

Rapid Evidence Synthesis: extended reality (XR) digital interventions for anxiety-based avoidance in children with autism and/or learning difficulties

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Rapid Evidence Synthesis:

Rapid Evidence Syntheses (RES) are produced by the National Institute for Health and Care Research (NIHR) Applied Research Collaboration Greater Manchester (ARC-GM). The methods used are based on a framework set out in Norman et al. 2022 and previously registered on the Open Science Framework (OSF).^{1,2}

RES use evidence synthesis approaches and draws on the GRADE Evidence to Decision framework³ to provide rapid assessments of the existing evidence and its relevance to specific decision problems. In the first instance, they focus on evidence from guidance and existing evidence syntheses. RES are undertaken in a real-time context of decision-making around adoption of innovative health technologies and are designed to provide a “good-enough” answer to inform decision problems in a short timescale. RES methods are flexible and adaptive. They have evolved in response to user feedback and differ depending on the nature of the assessment undertaken.

RES is not intended to serve as a substitute for a full systematic review.

We welcome feedback and are particularly interested to hear how you have used this Rapid Evidence Synthesis.

Please send any queries or comments to:

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Additional information:

This work was undertaken by the National Institute for Health and Care Research (NIHR) Applied Research Collaboration Greater Manchester (ARC-GM). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

¹ Norman, G. *Rapid evidence synthesis to support health system decision making*. OSF registration. 2020 [cited 2023]; Available from: osf.io/hsxk5

² Norman, G., et al., *Rapid Evidence Synthesis To Enable Innovation And Adoption in Health and Social Care*. Systematic Reviews, 2022. **11**: p. 250. <https://doi.org/10.1186/s13643-022-02106-z>

³ Alonso-Coello, P., et al., *GRADE Evidence to Decision (EtD) frameworks: a systematic and transparent approach to making well informed healthcare choices. 1: Introduction*. BMJ, 2016. **353**: p. i2016. <https://doi.org/10.1136/bmj.i2016>

1. Summary

There is **little** evidence on the effects of using extended reality (XR) digital interventions for anxiety-based avoidance in children with autism spectrum disorders. Where available, the evidence on whether XR digital interventions reduce anxiety in children with autism is **uncertain**.

There is **no** evidence regarding the effects of XR therapies with parental involvement, and **no** evidence regarding children with learning difficulties.

2. Methods

2.1 Description of the Intervention

Extended reality (XR), also known as cross reality, is an overarching term referring to a group of emerging technologies that use immersive platforms to give access to virtual worlds. Examples of XR include virtual reality (VR), augmented reality (AR), mixed reality (MR), and virtual worlds (VWs).

XR mental health exposure therapies ('XR therapies' hereafter) are available for children and young people with autism or learning difficulties to manage their symptoms of anxiety and the related avoidance behaviours. XR therapies project digital scenes for those affected to navigate through specific virtual situations that induce symptoms of anxiety in the real world e.g., crowded buses or classrooms. In virtual situations, users are supported to practice anxiety management strategies such as relaxation techniques. Following the treatment, the user will be followed up on their progress in managing anxieties in real-world situations. Often these therapies come with exercises and activities to do in the real world, outside of XR (sometimes called homework), which is considered an important element of the therapy and where, with children, parent or guardian support is considered crucial.

2.2 Search

We searched Medline (Ovid) and the Epistemonikos database in July 2024. Our searches were based on key terms related to cross reality, extended reality, virtual reality, augmented reality, mixed reality, virtual worlds, anxiety, autism and learning difficulties. We also searched the reference lists of the included reviews and used Google Scholar to identify further related articles.

2.3 Key Questions

Q1. What is the evidence for the clinical effectiveness and cost-effectiveness of XR therapies on anxiety-based avoidance in children and young people with autism spectrum disorders and/or learning difficulties?

Q2. What is the evidence for the clinical effectiveness and cost-effectiveness of XR therapies with parental involvement on anxiety-based avoidance in children and young people with autism spectrum disorders and/or learning difficulties?

2.4 Inclusion Criteria

2.4.1 Participants

We included evidence about the impact on anxiety-based avoidance behaviours in children and young people (≤ 18 years) who have autism spectrum disorders and/or learning difficulties. We excluded studies on people who did not have autism or learning difficulties.

We acknowledge that there are different types of anxiety disorders. We focused on generalised anxiety disorders but have also presented evidence of other types of anxiety such as social anxiety; healthcare-related anxieties; anxiety relating to work, school or home environments; and other situation-related anxieties and phobias such as public speaking, public transport, and heights. We accepted the definitions of anxiety and phobias given by the authors of the included studies.

We did not place limitations on the countries where the included studies were conducted, but we considered the evidence to be directly relevant to this RES if the studies were conducted in high-income countries, particularly the UK.

2.4.2 Interventions

We included evaluations of the impact of XR therapies that used any type of XR technologies as noted in 2.1. Description of the intervention. We accepted the definitions of specific XR technologies given by the authors of the included studies. We excluded studies on general digital technologies that could not generate virtual world scenarios to recreate in physical reality.

XR therapies may embed any type of mental health therapy, including but not limited to cognitive behavioural therapy, mindfulness therapy, and art-based therapy.

We acknowledge the debate about whether parental involvement could improve outcomes in children and young people. To summarise evidence on this topic for Q2, we looked at the subset of eligible studies that evaluated XR therapies with parental (or guardian) involvement as a clearly defined component.

2.4.3 Comparators

We considered reviews and studies with any comparator group, including no intervention, and alternative interventions.

2.4.4 Outcomes

For both questions, we focused on the following outcomes:

- **Anxiety symptoms.** This could be self-reported, parent-reported, or health professional-reported anxiety measures, via the use of any measurement instrument. For example, the Revised Child Anxiety and Depression Scale (RCADS, a youth self-report questionnaire), or the Revised Child Anxiety and Depression Scale – Parent Version (RCADS-P) are commonly used in children and young people with autism or learning difficulties. We looked in particular at anxiety-based avoidance behaviour outcomes.
- **(Health-related) quality of life.** Quality of life is *“a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”*.^[1] Whereas, health-related quality of life is specific to characteristics of particular illnesses or disorders and reflects the state of functioning and well-being of the individual. We considered (health-related) quality of life measured using any instruments.

- **Cost effectiveness.** We only considered evidence of cost-effectiveness analysis comparing mean differences in effects with mean cost differences between study groups. Relevant data could be reported as incremental mean cost per incremental gain in benefit (incremental cost-effectiveness ratio (ICER)); net monetary benefit.

2.4.5 Study design

In the first instance we considered existing evidence syntheses, including overviews of reviews, systematic and scoping reviews of any primary study design. Given the nature of the questions to address, we included quantitative research evidence. We used a broad definition of systematic reviews as having a systematic search and clear inclusion criteria.

Where we were unable to identify relevant evidence syntheses, or where the relevant review evidence was limited, we considered primary studies, looking first at the most robust primary study designs. For both questions, this was randomised trials or well-designed alternative quantitative research that evaluates the clinical effectiveness and cost-effectiveness of XR therapy, compared with alternative or no intervention, on symptoms of anxiety in children and young people with autism or learning difficulties. Such research should follow up with clearly defined participants for some time and adjust for confounding in the analysis or by study design. These include controlled before-after studies, interrupted time series studies, and studies with regression discontinuity designs. Studies using other designs were considered only in the absence of well-designed quantitative research.

In summarising the evidence identified, we followed the GRADE approach to categorising the certainty of evidence into four levels:

- **high** certainty, i.e., we are confident that the research findings reflect a true effect;
- **moderate** certainty, i.e., we are fairly confident that the finding reflects a true effect;
- **low** certainty, i.e., we have limited confidence in the findings, and more research is likely to change them;
- **very low** certainty, i.e., there are no clear findings.

We followed general GRADE criteria in assessing the certainty of evidence without performing a full GRADE assessment of the evidence.

3. Results

3.1 Results of search

We identified 68 records from the database searches. After screening, we considered two randomised controlled trials to be eligible for inclusion in this RES.[2, 3]

3.2 The impact of XR therapies (Q1)

The two trials report evidence on this topic. However, in both trials, XR therapies were delivered in experimental environments in which parents observed the treatment sessions. This meant that the XR therapies did not involve therapeutic activities outside of XR in the real world (where parents would be needed to deliver treatments). Neither of the trials reported quality of life and cost-effectiveness outcomes. In terms of reducing anxiety in children with autism, there is a small amount of uncertain evidence. See the trial results below:

Maskey et al. (2019) conducted a small, UK-based randomised controlled feasibility trial (n = 32).[3] The trial evaluated the impact of using immersive VR alongside cognitive behaviour therapy for treating specific phobias in young people with autism spectrum disorder. The control group used a waiting list design, i.e., providing VR treatment for control participants when the trial was completed. Maskey and colleagues suggested that one-third of children using VR showed improvements in their phobia whilst no children in the control group showed improvement in their specific phobia. However, there were no differences between groups in the average scores of the other anxiety measures including the Spence Children's Anxiety Scale-parent version and child version, and the Fear Survey Schedule for Children. The design of the feasibility trial was methodologically robust. Because of the small sample size, we considered the evidence to be of **low certainty**, but it is **directly relevant** to this RES and the UK context.

Crowell et al. (2020) conducted a randomised controlled trial comparing two strategies of promoting social initiation for children with autism in Spain.[2] This trial included 18 pairs of children aged 8 to 12 years old. Each child with autism was matched with a child without autism. The intervention group involved children playing in the MR full-body interactive environment. The control group used the LEGO play blocks as a standard naturalistic therapy for autism. Crowell et al. suggested that the MR interactive environment generated on average the same number of social initiations as the control condition, and there was no difference in the anxiety levels in the children playing in the two groups. The evidence is **very low certainty** due to methodological limitations and the small sample size of the study. The evidence is **indirectly relevant** to this RES as the MR intervention targeted the promotion of social initiation in children with autism rather than focusing on their anxiety treatment.

3.3 The impact of XR therapies with parental involvement (Q2)

We did not identify any evidence on this topic.

4. References

1. World Health Organization, *A state of complete physical mental and social well-being and not merely the absence of disease or infirmity*. Constitution of the World Health Organization basic documents, 2006. **45**: p. 1-20.
2. Crowell, C., et al., *Mixed Reality, Full-Body Interactive Experience to Encourage Social Initiation for Autism: Comparison with a Control Nondigital Intervention*. *Cyberpsychology, behavior and social networking*, 2020. **23**(1): p. 5-9.
3. Maskey, M., et al., *A Randomised Controlled Feasibility Trial of Immersive Virtual Reality Treatment with Cognitive Behaviour Therapy for Specific Phobias in Young People with Autism Spectrum Disorder*. *Journal of Autism & Developmental Disorders*, 2019. **49**(5): p. 1912-1927.

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