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Therapeutic potential of video games for children with mild autism: systematic review of social, motor, and behavioral outcomes

Potencial terapêutico dos videogames para crianças com autismo leve: revisão sistemática de resultados sociais, motores e comportamentais

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ABSTRACT

Introduction: The prevalence of screen time among children has increased significantly, raising questions about its effects on children diagnosed with Autism Spectrum Disorder (ASD), especially those with mild or high-functioning autism. Video games and other digital platforms, often seen as recreational, may have therapeutic potential, engaging children in ways that traditional therapies may not reach.

Objective: To examine the current evidence on the use of video games as therapeutic tools for children with mild ASD, focusing on outcomes such as the development of social and motor skills, the reduction of repetitive behaviors, and the alleviation of anxiety.

Method: A systematic search of the Cochrane, PubMed, and Embase databases identified 7 studies that met the inclusion criteria, totaling 343 participants.

Result: The findings indicate that structured interventions with video games can improve social and motor skills, in addition to reducing repetitive behaviors. Despite the heterogeneity of interventions and outcome measures, the review reinforces the potential of video games as an adjunctive therapy for children with mild ASD.

Conclusion: Further research with standardized protocols and larger sample sizes is recommended to assess long-term efficacy and optimize their integration into therapeutic practices. This review contributes to the growing debate on digital therapies in the management of ASD, highlighting the need for more rigorous and targeted studies.

KEYWORDS: Autism spectrum disorder. Mild autism. Video games. Therapeutic intervention. Social skills. Motor skills. Repetitive behaviors. Screen time. Digital therapeutics.

RESUMO

Introdução: A prevalência do tempo de tela entre crianças tem aumentado, levantando questões sobre seus efeitos naquelas diagnosticadas com Transtorno do Espectro Autista (TEA), particularmente crianças com autismo leve ou de alto funcionamento. Os videogames e outras plataformas digitais, muitas vezes vistos como recreativos, podem ter potencial terapêutico, envolvendo as crianças de maneiras que as terapias tradicionais não podem.

Objetivo: Examinar as evidências atuais sobre videogames como ferramentas terapêuticas para crianças com TEA leve, com foco em desfechos como desenvolvimento de habilidades sociais e motoras, redução de comportamentos repetitivos e alívio da ansiedade.

Método: A busca sistemática nas bases de dados Cochrane, PubMed e Embase identificou 7 estudos que atenderam aos critérios de inclusão, com 343 participantes no total.

Resultado: Os resultados indicam que intervenções estruturadas em videogames podem melhorar as habilidades sociais, as habilidades motoras e reduzir comportamentos repetitivos. Apesar da heterogeneidade das intervenções e medições de resultados, a revisão apóia o papel potencial dos videogames como terapia adjuvante para crianças com TEA leve.

Conclusão: Recomenda-se mais pesquisas com protocolos padronizados e amostras maiores para avaliar a eficácia a longo prazo e otimizar a integração nas práticas terapêuticas. Esta revisão contribui para o crescente discurso sobre a terapêutica digital no gerenciamento de TEA, ressaltando a necessidade de estudos mais rigorosos e direcionados.

PALAVRAS-CHAVE: Transtorno do espectro autista. Autismo leve. Videogames. Intervenção terapêutica. Habilidades sociais. Habilidades motoras. Comportamentos repetitivos. Tempo de tela. Terapêutica digital.

Central Message

Video games can play a therapeutic role for children with mild autism, aiding in the development of social and motor skills, as well as reducing repetitive behaviors and anxiety. While the growing prevalence of screen time raises concerns, the review's findings suggest that structured video game interventions could be a promising complementary tool for managing Autism Spectrum Disorder (ASD).

Perspective

This article is exploratory and analytical, emphasizing the need for more rigorous research to standardize protocols, assess long-term efficacy, and integrate these digital approaches into traditional therapies. The study contributes to the ongoing discussion about digital therapeutics in the treatment of ASD, highlighting the potential of video games as an innovative and accessible resource.

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INTRODUCTION

The increasing prevalence of screen time among children has raised concerns about its impact, particularly for those diagnosed with Autism Spectrum Disorder (ASD). Among individuals with mild forms of autism, also referred to as high-functioning autism, there is growing interest in the potential of video games and digital platforms to serve as therapeutic tools. These games can engage children in a way that traditional therapeutic methods may not, making them a subject of increasing research attention. With a significant number of children with ASD spending considerable time on screens, understanding whether video games can provide more than mere entertainment is essential.[1,2]

Despite the concerns regarding excessive screen time, the potential for therapeutic video games to enhance the developmental trajectories of children with mild ASD presents a unique opportunity. Video games, especially those designed with therapeutic intent, offer a structured, immersive environment where social and motor skills can be honed, and repetitive behaviors, characteristic of ASD, might be reduced. Given the complexity of ASD and the variety of interventions available, it is crucial to evaluate the effectiveness of such targeted interventions, ensuring that this growing screen time is beneficial rather than detrimental.[3,4]

The objective of this article is systematically review the current evidence on the use of video games as a therapeutic tool for children with mild ASD. This review aims to determine whether video games can improve social skills, enhance motor skills, reduce repetitive behaviors, and alleviate associated anxiety. The paper seeks to contribute to the ongoing conversation about therapeutic strategies in ASD care providing a comprehensive analysis of the role of video games as a therapeutic intervention for children with mild ASD, with a focus on key developmental outcomes.

METHOD

This study is a systematic review conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The research question follows the PICOT framework (Population, Intervention, Comparison, Outcome, Time)[5] were: 1) Population (P) refers to children diagnosed with mild ASD, including high-functioning autism and mild autism, were the primary population of interest; keywords for this population included "autism spectrum disorder", "ASD", "mild autism", and "gigh-functioning autism"; 2) Intervention (I): the intervention evaluated was the use of video games and other forms of screen-based stimulation as therapeutic tools and included traditional video games, serious games, therapeutic video games, gaming therapy, and computer-based games, all aimed at improving skills and behaviors in children with mild ASD; 3) Comparison (C): consisted of children with ASD who did not receive video game-based interventions and this group either had no intervention or received standard care, which could include behavioral therapy without the use of video games or screen-based stimulation; 4) Outcome (O): the primary outcomes evaluated were the improvement of social and motor skills, the reduction of repetitive behaviors, and the alleviation of anxiety, and additional outcomes included overall behavioral therapy success and cognitive enhancement in the children receiving video game-based therapy; 5) Time (T): the studies selected for inclusion varied in follow-up duration, with no specific time limit enforced for the analysis due to the indeterminate follow-up periods across the trials. The focus was placed on randomized controlled trials (RCTs), providing high-quality evidence on the efficacy of video game-based interventions.

Search strategy

The databases searched included Cochrane, PubMed, and Embase, using a broad range of terms related to ASD and video game interventions. Search terms combined both MeSH headings and free-text words such as "Autism Spectrum Disorder", "ASD", "Video games", "Screen time", and "Therapeutic video games". Boolean operators and truncation were employed to maximize the retrieval of relevant studies.

Inclusion criteria

The inclusion criteria required that studies involve children with mild ASD, and report on outcomes related to social and motor skill development, repetitive behaviors, or anxiety. No time or language restrictions were applied. Data extraction was performed by two independent reviewers, and any discrepancies were resolved through discussion and consultation with a third reviewer. The quality of the included studies was assessed using the Cochrane Risk of Bias tool (Figure).

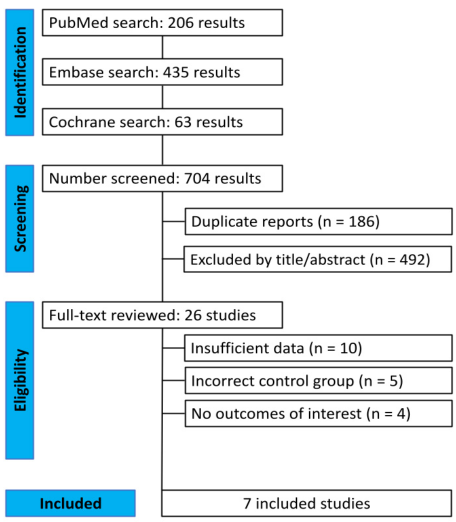

FIGURE — PRISMA flow diagram of study screening and selection

DISCUSSION

The search yielded 704 records: 63 from Cochrane, 206 from PubMed, and 435 from Embase. After the removal of 186 duplicates, 518 records were screened for eligibility using a double-blind process. Of these, 26 studies were read in full, but 5 were excluded due to incorrect control group criteria, 10 to insufficient data and 4 due to no outcomes of interest, leaving 7 studies for final inclusion in the systematic review. Total of the 7 studies included 343 patients from 294 RCTs, and 49 non-randomized cohorts (Table). The included articles were: Shamir 2022[6], Jouen 2017[7], Kirst 2022[8], Scherf 2021[9], Serret 2017[10], Milajerdi 2021[11], and Dickinson 2016[12.]

A deeper analysis of the studies included in the systematic review reveals several important insights regarding the use of video games as a therapeutic intervention for children with mild ASD.

The studies generally involved children diagnosed with mild ASD or high-functioning autism, but the homogeneity of the samples may limit the generalizability of findings to the broader spectrum of ASD. Additionally, the predominance of male participants (e.g., Shamir et al. and Jouen et al. had 100% male participants[6,7]) reflects the higher prevalence of ASD in males but raises concerns about the applicability of findings to female children, who may exhibit different social and behavioral patterns in response to video game interventions.

Interventions varied significantly across studies, from more structured, therapeutic video games designed specifically to improve social and cognitive functions[8] to less structured screen time exposures or digital games.[9] The structured games often involved metacognitive guidance, meaning they were explicitly designed to engage the participants in self-reflective thinking about their social behaviors. These guided interventions are more likely to yield improvements in targeted outcomes, such as eye-contact duration or total gazing time.[6]

The level of engagement required by the participants also varied. More interactive games, especially those incorporating serious games with therapeutic components, tend to actively involve participants in scenarios where they practice social skills in a simulated environment. Passive screen time, or games lacking a social component, are less likely to produce meaningful social improvements. Studies like Jouen et al. in 2017[7], which used both a control and a game intervention,7 (Goliah combined with TAU), highlight the benefits of coupling game-based therapy with traditional therapeutic interventions. This suggests that video games should be seen as adjunct rather than a standalone treatment.

Several studies focused on social skills improvement, which is a core challenge for individuals with ASD. Shamir et al.[6] reported significant improvements in eye-contact duration and total gazing time, indicating enhanced social engagement. Other studies, such as Kirst et al.[8,] measured broader social skills improvements using standardized tools like ADOS (Autism Diagnostic Observation Schedule), confirming that targeted video games can lead to measurable social enhancements. However, the clinical significance of these improvements remains unclear, as none of the studies examined the long-term retention of these skills beyond the intervention period.

Studies like Griffin et al.[9] emphasized motor skills improvements, particularly hand-eye coordination, and fine motor abilities, which are often delayed in children with ASD. These findings align with previous research on the motor benefits of video games, suggesting that certain types of games can be used to promote motor development in this population.

Repetitive behaviors, another hallmark of ASD, were less frequently measured across the studies. However, Kirst et al.[8] included measures of repetitive behavior reduction, which, while not as prominent an outcome as social skills, still highlights the potential for video games to modulate ASD symptoms beyond the social domain. This could have significant implications for the development of therapeutic interventions targeting the broader spectrum of ASD behaviors.

The heterogeneity of video game interventions presents a challenge when synthesizing the findings. The studies used different types of video games, ranging from serious therapeutic games to more general commercial video games, which limits the ability to draw firm conclusions about which specific game characteristics (e.[g.,] interactivity, feedback, narrative structure) are most beneficial for children with ASD. For instance, some games involved significant social interaction components, while others focused solely on motor or cognitive stimulation.

The tools used to measure outcomes varied, with

TABLE — Seven studies were included for final evaluation in this systematic review

Characteristic	Design	nº Patients	Intervention (IT)	Control (CT)	Sex	Age
Study		(n)	(n ; %)	(n ; %)	(n ; %)	M (SD)
Shamir 2022	RCT	18	with metacognitive guidance (9 ; 50%)	without metacognitive guidance (9 ; 50%)	M (18 ; 100%)	91.66 (14.26) (months)
Jouen 2017	non-RCT	24	GOLIAH + TAU (14 ; 58.3%)	TAU (10 ; 41.7%)	M (24 ; 100%)	IT: 6.85 (1.34) CT: 7.17 (1.62) (probably years)
Kirst 2022	RCT	82	Zirkus Empathico (42 ; 51.22%)	Condition (40 ; 48.78%)	IT: M (32 ; 76.2%) CT: M (37 ; 92.5%)	IT: 8.1 (1.6) CT: 7.6 (1.3) (years)
Griffin 2021	RCT	34	Serious Game (14 ; 41.2%)	Standard Care (20 ; 58.8%)	IT: M (12 ; 85.7%) CT: M (17 ; 85%)	IT: 163.8 (31.9) CT: 168.4 (36.9) (months)
Serret 2017	non-RCT	25	with SEMA-TIC (12 ; 50%)	without SEMA-TIC (13 ; 50%)	IT: M (11 ; 91.7%) CT: M (9 ; 69.2%)	IT: 8.7 (1.0) CT: 8.5 (1.8) (years)
Milajerdi 2021	RCT	60	Kinect (20 ; 33%)	SPARK (20 ; 33%); Control (20 ; 33%)	IT: M (19 ; 95%) CT: M (19 ; 95%) S (19 ; 95%)	IT: 8.45 (1.50) CT: 8.15 (1.45) S: 7.95 (1.60)
Dickinson 2016	RCT	100	Nintendo (50 ; 50%)	without Nintendo (50 ; 50%)	IT: M (39 ; 78.0%) CT: M (40 ; 80.0%)	7 – 16 yo

some relying on parent-reported outcomes, which are subject to bias, while others used more objective behavioral assessments, such as eye-tracking for social gaze measurements.[6] The variability in measurement tools introduces inconsistency in how outcomes are defined and measured, making it difficult to compare results across studies.

The studies suggest that video games, particularly those designed with therapeutic goals, offer a promising avenue for enhancing social skills and motor development in children with mild ASD. However, their clinical relevance needs to be further substantiated with larger, more homogenous samples and standardized interventions. Additionally, future studies should explore how individual differences in game engagement, such as baseline cognitive abilities or interest in gaming, might moderate treatment outcomes. This would help tailor interventions more effectively to individual patient needs.

Further research should also investigate the integration of video games with traditional therapeutic modalities, as suggested by Jouen et al.[7,] maximizing therapeutic outcomes. Combining video games with cognitive-behavioral therapy or social skills training could yield synergistic effects that neither intervention can achieve on its own.

While the reviewed studies offer preliminary evidence supporting the use of video games as a therapeutic tool for children with mild ASD, further research is needed to standardize intervention protocols and assess long-term outcomes. The potential for video games to address core ASD challenges, such as social skills deficits and repetitive behaviors, is promising, but more rigorous trials with larger sample sizes and longer follow-up periods are essential to confirm these findings.

In the realm of therapeutic interventions for children with ASD, recent studies underscore the growing recognition of digital therapeutics (DTx) and serious games as promising strategies. These approaches aim to address social communication challenges and improve social skills among children diagnosed with ASD.

One notable review evaluated the effectiveness of serious games in enhancing social skills among children and adolescents with ASD. The findings highlighted a positive impact on various aspects of social functioning, including emotional recognition, joint attention, and behavioral skills.[13,14]

This aligns with the outcomes of this systematic review, which noted improvements in social skills, motor skills, and reductions in repetitive behaviors through gaming therapy. Additionally, emerging technologies such as virtual reality and artificial intelligence are gaining traction in the field of digital therapeutics. A bibliometric analysis revealed that these technologies are becoming increasingly integrated into interventions for ASD, allowing for more personalized and effective treatment options.[13]

Overall, the intersection of video games, digital therapeutics, and ASD treatment represents a dynamic area of research that holds promise for improving the quality of life for affected children and their families. As more studies emerge, they will further elucidate the efficacy and mechanisms behind these innovative therapeutic approaches. Future research should focus on larger, more homogenous samples, standardized intervention protocols, and extended follow-up to fully assess the enduring effects of video game interventions on children with ASD.

Despite these promising results, several limitations must be acknowledged. The heterogeneity of study designs, the variability in outcome measurement tools, and the short duration of follow-up periods hinder the generalizability and long-term applicability of the findings.

CONCLUSION

This systematic review highlights the emerging role of video games as a therapeutic intervention for children with ASD. The findings from the 7 included studies indicate that structured video game interventions can lead to significant improvements in social skills, motor skills, and reductions in repetitive behaviors. Moreover, the evidence suggests that video games not only provide an engaging platform for skill development but also hold promise for improving cognitive functions and reducing anxiety in children with ASD. While video games offer a novel and potentially effective approach for enhancing the therapeutic landscape for children with mild ASD, further rigorous studies are needed to validate these findings and explore the optimal integration of gaming into existing therapeutic frameworks. As digital technologies continue to evolve, they present exciting opportunities for improving the quality of life for children with autism and their families.

Authors' contributions:
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Vilson Rogerio Weige Marth: Project administration

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