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Empowering Caregivers in the Digital Age: The Influence of Digital Literacy on Tele Health-Based Parent-Mediated Interventions for Children with Autism

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ABSTRACT

Parent training programs may enhance the social behaviour and communication skills of children with autism spectrum disorder (ASD), especially for families dealing with them as caregivers. Unfortunately, these activities have not been assessed. This study sought to consolidate available data from research on parent-mediated intervention training for families with children diagnosed with autism spectrum disorder (ASD) and to assess the efficiency of such home interventions based on the results. In accordance with the PRISMA declaration, a search of the following electronic databases (ERIC, PsycINFO, PubMed, Google Scholar) for studies examining parent-mediated intervention training for families with a child diagnosed with autism spectrum disorder (ASD) was performed. The results revealed that eleven studies satisfied the qualifying requirements. Remote parent-mediated intervention training may improve parents' understanding, intervention fidelity, and children's social behaviour and communication abilities. Future study should include standardised outcome measures to reduce bias, as well as evaluations of the therapy's applicability and practicality.

Introduction

According to the American Psychiatric Association (APA), Autism Spectrum disorder (ASD) is a neuro-developmental disease, marked by impairments in social communication and the manifestation of repetitive or restricted behavioral patterns. Described by impairments in social communication and behaviour, such as challenges in interpreting nonverbal cues, forming age-appropriate friendships, adhering to strict routines, and adjusting to environmental changes, autism spectrum disorders (ASD) (Happé, & Ronald, 2008). The upsurge in the prevalence of Autism Spectrum Disorder (ASD) among children in recent years can be ascribed to (1) advancements in diagnostic methodologies, (2) expansion of diagnostic criteria, (3) heightened awareness of ASD, (4) historical diagnoses, and (5) acknowledgement that ASD is a lifelong condition (Salari et al.,

2022). Currently, ASD affects anywhere from 20 to 110 per 10,000 people in the global population (Talantseva et al., 2023). The growing prevalence of ASD puts great pressure on educational institutions and early intervention programs, hence driving calls for new service delivery systems and approaches (Dahiya et al., 2022).

Inadequate access to suitable health services and a lack of appropriately competent early intervention health and education professionals, especially in remote areas (Drapalik, Grodberg, & Ventola, 2022). Families of children with Autism Spectrum Disorder (ASD) living in regional and remote areas often face many challenges improving their child's outcomes (Montiel-Nava et al., 2022), including (1) long travel distances to reach suitably qualified doctors for efficient therapeutic services, (2) delayed diagnoses caused by reduced screening programs, and (3) problems resulting from the inconsistency of healthcare professionals caused by high attrition rates and major workforce turnover (Ismail & Baker, 2024). These challenges pinpoint the necessity of advanced and alternative timely mediation approaches by parents for children with ASD.

Effective timely mediation for treatment calls for skilled health and education professionals, which means families must bear more financial and time pressure to get services (Gentile et al., 2022). Therefore, parents or careers might have to play a more active part in providing treatment services for their ASD children (Montiel-Nava et al., 2022). Parents may participate actively in the treatment process by means of proper education and ongoing support, so enabling these interventions to their children more often and so reducing these challenges (Gentile et al., 2022).

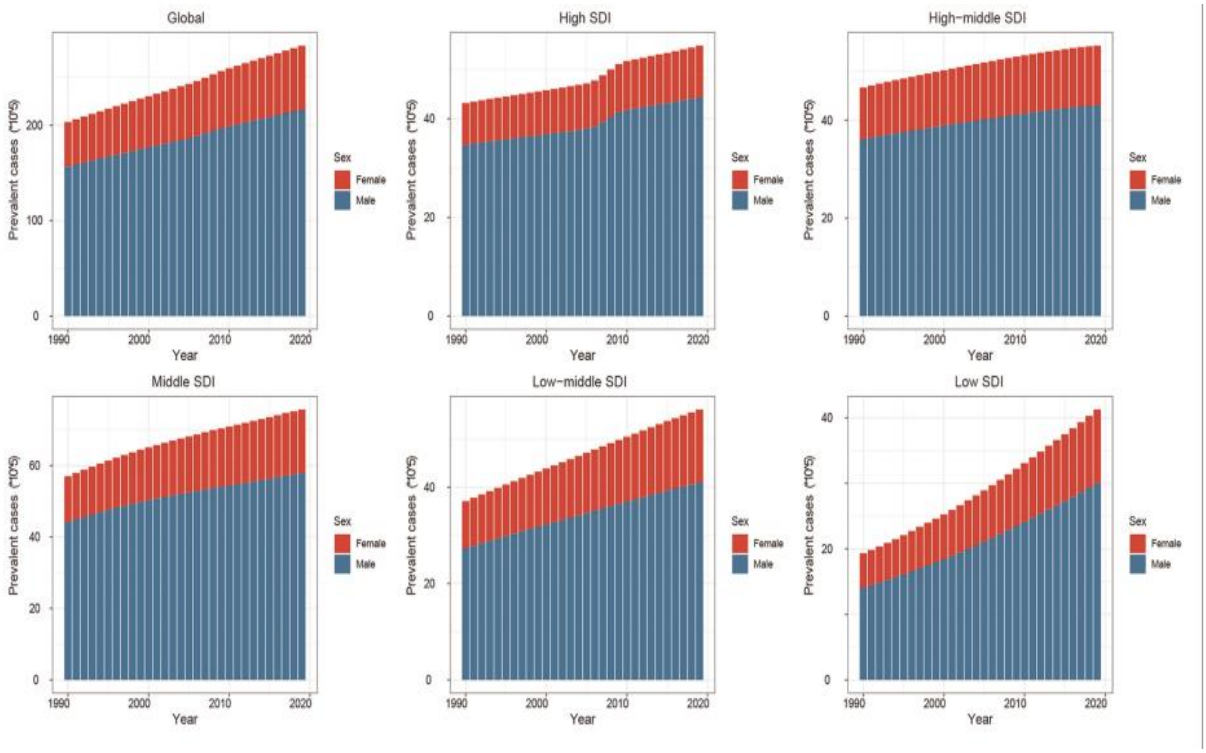

Figure 1: Showing From 1990 to 2019, the prevalence of autism spectrum disorders (ASD) worldwide was broken down by quintiles of the sociodemographic index (SDI) and by demographic, sourced from (Li et al., 2022).

Caregiver Involvement in Intervention of ASD

People with autism spectrum disorder (ASD), a neurodevelopmental condition that lasts a lifetime, have trouble interacting and communicating with others. They may also have repetitive behaviors

and limited interests (Faras et al. (2010). Behavioral patterns, social interaction, and reciprocal communication are all impacted by autism spectrum disorder (ASD) in children (Bekhet, 2017b). Children with ASD have difficulties establishing and sustaining social relationships, which impacts their imminent social engagement (Duvall et al., 2021; Faras et al., 2010)

50% to 90% of autistic children display at least one problem behavior, either aggressiveness, damage, self-injury, tantrums, or stereotyped behavior, as reported by Turgeon et al. (2021). Such behaviors have the potential to limit a child's social opportunities for social interaction, as reported by Lindgren et al. (2020). Function-based treatment to reduce the frequency and intensity of disruptive behavior in Autism Spectrum Disorder (ASD) was implemented by Turgeon et al. (2021). The majority of caregivers (92%) of those with ASD help with daily activities, according to Bekhet (2017). Parental participation in their children's treatments produces benefits include lower parental stress and There are significant improvements in the children's joint attention, joint engagement, cognitive functioning, adaptive behavior, compliance, and dyadic parent-child communication. Parents as the initial and primary teachers of the children can readily recognize the development of skill deficits and maladaptive child behaviors in children with autism (Ministry of Health & Welfare, 2017). Consequently, the therapeutic process relies on parents, who serve as the primary providers and educators for autistic children. Their involvement in their child's treatment yields several advantages, such as less stress and enhancements in collaborative focus, cognitive growth, and interpersonal interaction.

Rise of Digital literacy and Telehealth Parent Mediated Interventions

Technical developments in information communication technology (ICT) have opened up more ways to provide health care. Studies show that health treatments provided by professionals utilizing ICT are very helpful in treating anxiety and depression (Pacione, 2022). Moreover, growing studies show that telehealth and ICT could have benefits in the diagnosis and intervention delivery for teenagers and children with ASD (Wagner et al., 2025). A cost-effective model that enhances some of the child's areas of social development, like social communication, is the parent-mediated intervention (PMI) (Li et al., 2022). Parents, typically the main caregivers of their child, might enhance the effectiveness of the treatment by using it in various situations (Dai et al., 2018; Turgeon et al., 2021). Parent training enhances their knowledge and, at the same time, lessens their stress (Hao et al., 2021). Klein et al. (2021) report that video feedback (VF) greatly enhances the efficacy of parent-mediated interventions (PMI) for young infants with heterogeneous developmental disabilities. VF supports remote feedback and support for parents, thereby maximizing program satisfaction and adherence to implementation. PMIs encourage parents to enhance their child's developmental abilities and facilitate the interaction between the caregiver and the child. Parents who receive training in mutually agreed goals may decrease their stress levels and enhance the general relations of the family. According to Ibañez et al. (2018), telehealth-based teaching for parents of autistic children offers a secure teaching environment, standardized training, tailored treatment, and round-the-clock accessibility.

Telemedicine has also emerged as a powerful instrument in most recent research studies, with immense benefits in training caregivers of children with autism. For instance, parents' perception of treatment concepts was transformed dramatically after participating in self-managed online courses (Vismara et al., 2013). VF facilitates remote assistance and feedback for parents, hence improving program satisfaction and fidelity of implementation. PMIs recommend that parents improve their child's age-related skills and support the caregiver-child relationship, according to Corona et al.(2021). Moreover, it tackles issues related to in-person parent training including costs, time limits, and regional accessibility (Sadeghi et al., 2021). Autistic children have been treated

with various telehealth-based PMIs. Vismara et al. (2018) found higher compliance with the parent implementation and higher program satisfaction in the P-ESDM group when they compared the effectiveness of telehealth-delivered parent-implemented Early Start Denver Model (P-ESDM) versus a standard community-based treatment protocol. Liu (2021) also suggest moderate to large positive effects on parental anxiety, depression, stress, and hope in parents who took the Joint Attention, Symbolic Play, Engagement, and Regulation (JASPER) online course. Mothers' stress and sadness were shown by Hemdi and Daley (2017) to be lowered by a psychoeducational intervention (Double ABCX Model). Telehealth therapies might overcome geographic obstacles to accessing early intervention programs, hence allowing families to interact with professionals from the comfort of their homes. Examining the effectiveness of telehealth-only services, Corona et al. (2021) establish higher levels of caregiver contentment with these services. Telehealth training enables parents to use digital resources to acquire intervention knowledge at their own speed, followed by virtual engagement with a professional for feedback on planning and problem-solving. When treatment outcomes are inconsistent and when assessing the cost-benefit ratio between intervention intensity and service delivery, adaptive therapies may be especially suitable (Wainer et al., 2021).

Where there is a discrepancy in treatment outcomes and in assessment of the cost-benefit trade-off between intensity of intervention and service delivery, adaptive therapies are particularly well suited. Telemedicine increases the efficacy of emerging treatment technologies mainly by supplying (i) remote diagnostic services minimizing delay in ASD diagnosis, (ii) support to autistic children's families, and (iii) a chance for family members to participate in therapy with successful PMI (Marino et al., 2020). By allowing interaction with local clinicians and improving interdisciplinary cooperation, the telehealth delivery system overcomes geographic obstacles (Marino et al., 2020). Face-to-face and telemedicine therapy modes showed no significant differences in effectiveness (Hao et al., 2021Sadeghi et al. (2021) asserted that telemedicine was equal to face-to-face intervention in reducing parental stress and enhancing ASD-like symptoms in children. Numerous large-scale studies have been published since 2017 using telehealth for evaluating, identifying, and treating children with autism. Telehealth treatment for children aged 0–12 years has been shown to improve treatment accessibility, reduce waiting times for diagnostic appointments, facilitate early symptom monitoring, and relax pandemic-related screening constraints (Dahiya et al., 2022). Telehealth treatment is effective in diagnosing, evaluating, and monitoring diseases using video, phone, mobile apps, or the Internet (Dahiya et al., 2022; Ellison et al., 2021).

Telemedicine enhanced treatment access; telemedicine-delivered therapy benefited autistic children since they are very acceptable. Therefore, they are effective in conveying the knowledge on implementer–child interactions, child participation, implementation fidelity in parents, satisfaction/acceptability, feasibility, self-efficacy, stress, and child outcomes (e.g., verbal and social communication, adaptive behaviors, reduction in frequency or severity of problem behaviors, play skills, and Individualized Education Program [IEP] goal achievement) (de Nocker and Toolan, 2023). Telemedicine services provided were equivalent to face-to-face treatment and benefited autistic children, families, and teachers (Sutherland et al., 2018).

A number of studies have evaluated intervention effectiveness across a variety of topics, such as social communication, emotion recognition, and language. A variety of methodologies across a number of countries were used by the present study, including RCTs, cohort studies, multiple baseline studies, and pre-post studies. Outcomes, such as participant satisfaction, intervention fidelity, and social behavior and communication change, have been quantified. Ellison et al. (2021) provided the geographical distribution of the study, reporting the number of studies carried out per

country. Reporting detailed impact sizes and confidence intervals, Parsons et al. (2019) evaluated therapy efficacy in social communication, emotion recognition, and language.

Pi et al. (2021) focused on multiple delivery methods and examined outcomes for children and parents with regard to parent, child, and teacher program effectiveness in their study. Pi et al. (2021) meta-analysis of technology-enabled parenting therapy for autistic children identified heterogeneity with regard to intervention effectiveness on various parameters. Outcomes in the social communication field were not unanimous; no advantages over the control groups were seen in some studies. Nevertheless, outcomes in the field of emotion recognition were positive. In the field of emotion recognition, the intervention significantly exceeded the control group, according to three separate studies. Furthermore, the study focusing on the influence of telehealth therapy among autistic children revealed constraints, and the benefits of such interventions to parents using them yet need to be determined.

A number of studies have been done to evaluate the application of technology-based diagnostic and screening devices for Autism Spectrum Disorder (ASD). The studies used various technological approaches, including camera observation, live video examination, internet-based devices, and telephone interview. The forms of evaluation that were used include the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R), as well as screening measures such as the Parents' Evaluation of Developmental Status (PEDS) and the Modified Checklist for Autism in Toddlers (M-CHAT). Diagnostic accuracy, agreement, specificity, and sensitivity all improved consistently across the studies, thereby indicating their potential utility for the assessment of children suspected to have ASD (Dahiya et al., 2022; Ellison et al., 2021).

Ellison et al. (2021) analyzed 55 research on the evaluation and intervention for Autism Spectrum Disorder (ASD), including autistic children and various interventionists or staff members, completed between January 2010 and March 2021. All investigations indicated perfect satisfaction levels (100%) and accuracy after feedback using video conferencing as the evaluation method. The telehealth platform interventions specifically addressed ASD. The execution of treatments shown substantial enhancement. Parents of children with ASD, indicated significant fulfilment with interventions that enhanced daily living skills, reduced parent-reported stress, and elevated parental competence. Parents doing functional evaluations with their autistic children via telehealth coaching found it beneficial. Parsons et al. (2017) mostly used self-directed websites, with or without the support of a therapist. Supplementary elements were video conferencing, written directives, and instructional films. Post-intervention, significant enhancements were seen in parental knowledge, parental intervention faithfulness, and children's social conduct and communication abilities .In all groups, parent self-efficacy shown a significant enhancement .

In other settings, including home, clinic, and home-based telemedicine, De Nocker and Toolan (2023) added to our understanding of telehealth treatment efficacy compared to face-to-face treatments and control groups. The study looked at the outcomes of treatments from the perspective of both the therapist and the kid, as well as the factors that make these interventions accessible to everyone. Youths' positive attitudes were significantly improved by both in-person and telehealth therapies; there were no noticeable differences between the two methods. The intervention programs to be reviewed are ABA, FYF, COMPASS, ImPACT Online, JASPER, Skills and Knowledge of Intervention for Language Learning Success, ESDM, and Applied Behaviour Analysis. Several factors were measured, including intervention knowledge, implementer-child interactions, implementation of the intervention, engagement, intervention fidelity, satisfaction and acceptability, feasibility, sense of competence or self-efficacy, stress, and

child outcomes, including social and language skills, adaptive skills, decrease in problematic behaviors, play skills, and Individualized Education Program goal progress. Additional research is needed to explore the long-term impact of telehealth treatments, compare certain intervention programs, and solve issues with equal access to these therapies (Pan, Kuo, & Kuo, 2023).

Research Philosophy

In light of the recent COVID-19 epidemic and the need for self-care therapies in the absence of medical professionals, this research seeks to assess the efficacy of parental telemedicine interventions. To delve more into this intervention strategy, want to do a quantitative research, particularly a meta-analysis. Telehealth treatments have the potential to overcome geographic obstacles and provide services to people with ASD; this research emphasizes its effectiveness, practicability, and acceptance. Academics, practitioners, and families seeking accessible and effective therapy for Autism Spectrum Disorder (ASD) may use research as a valuable resource (Leadbitter etal., 2025).

It is critical to empower and strengthen the self-efficacy of families with young children who have delays or impairments, since family-capacity building initiatives are important. It may be particularly crucial to start early on creating a setting that helps families enhance their children's learning for children who need more support in developing their public communication skills, such as autistic children. By incorporating successful teaching tactics into their daily lives, primary caregivers may enhance their children's chances of learning and help them generalize their social communication and behavioral abilities to other situations.

Aim of the Study

- To provide a comprehensive evaluation and synthesis of present studies on the relevance of digital literacy in parent-mediated autism treatments, stressing the training needs for carers and the accessibility of digital tools.

Main Research Question

- What is the impact of caregiver digital literacy on the efficacy of parent-mediated autism interventions administered, relative to caregivers with restricted digital competencies or access?

Objectives of the Study

- To comprehensively locate and evaluate peer-reviewed research investigating the correlation between caregiver digital literacy and results in parent-mediated autism therapies conducted using telehealth.
- To assess the quality and methodological rigor of current research using suitable assessment instruments (e.g., PRISMA).
- To extract and compare reported outcomes (e.g., caregiver involvement, intervention fidelity, stress levels, child developmental progress) concerning digital literacy levels.
- To evaluate the extent to which digital accessibility and literacy impact the usefulness and scalability of parent-mediated therapies for autism.
- To identify research deficiencies and provide evidence-based suggestions for digital training or support systems targeted at caregivers of children with ASD.

Study Protocol

The study used a secondary research strategy to assess the impact of carer digital literacy and telehealth on the efficacy of parent-mediated autism treatments. The following search string was used to do the inquiry: (("caregiver-implement*" OR "parent-implement*" OR "parent-mediat*") PLUS ("social skill*" OR "social communication" OR "social engagement") PLUS ("intervention" OR "instruct*") PLUS ("coach*" OR "train*") PLUS ("autism" OR "autism spectrum" OR "autistic" OR "Asperger" OR "ASD").). The following practical factors lent credence to the idea of doing a comprehensive literature analysis on the topic: At first, drawing on previous research would help avoid repeating efforts and make it easier to obtain current data. Second, the review was structured according to the PICO standard criteria. This systematic review followed the guidelines laid forth in the PRISMA declaration. Systematic assessments of parent-mediated therapy should adhere to the guidelines laid forth in this statement, which emphasis transparency.

PICO Statement

Refining a study subject for systematic reviews and other evidence-based research is the goal of the PICO, a systematic inquiry tool. Everything from the population to the intervention to the comparison to the outcome is part of this. An analysis of the impact of careers' digital literacy on parent-mediated interventions was conducted using the PICO framework, as shown in the table.

Table 1: Showing PICO Element and their description

PICO Element	Description
Population (P)	Parent-mediated therapy was used by caregivers of children identified with Autism Spectrum Disorder (ASD).
Intervention (I)	Accessibility resources, healthcare services, and courses in digital literacy
Comparison (C)	Caregivers who are either not proficient with modern technologies or who have limited access to them
Outcome (O)	Primary outcomes include: • Improved Caregiver Engagement • More Accurate Intervention • Less Stress, • Improved Child Development

Databases to Search

- PubMed / MEDLINE
- Scopus
- PsycINFO
- ERIC (for educational interventions)
- Google Scholar (for gray literature)

Inclusion Criteria (Example)

- Studies published between 2020–2025

- Peer-reviewed empirical studies
- English language
- Focus on parent-mediated interventions for ASD
- Include reference to digital literacy, technology access, or caregiver digital skills

Exclusion Criteria

- Editorials, commentaries, or conference abstracts
- Interventions not involving caregivers directly
- Studies unrelated to telehealth or digital platforms
- No mention of digital skills or technology use

Information Sources

The authors performed a thorough systematic search across electronic databases to find papers that met the eligibility criteria. For educational interventions, we scanned PubMed/MEDLINE, Scopus, PsycIN FO, Web of Science ERIC, and Google Scholar. For grey literature, we combed Google Scholar.

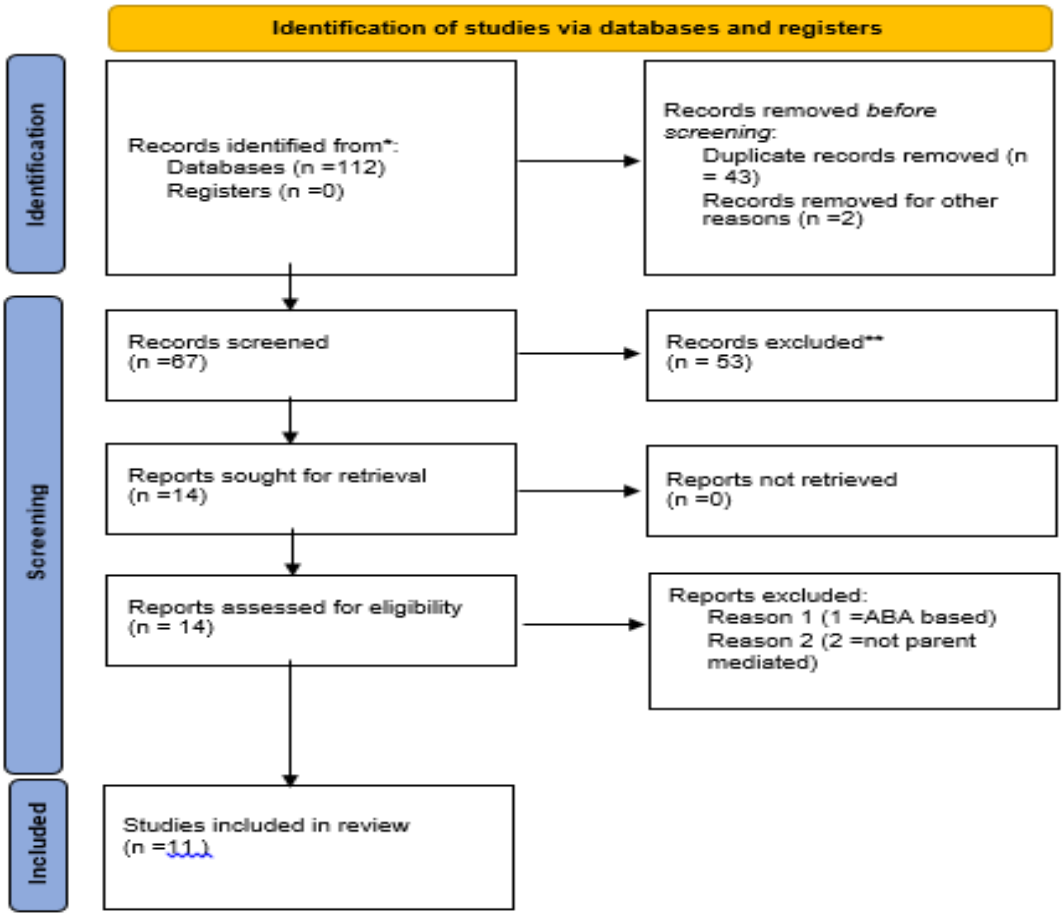

Figure 2: PRISMA flowchart of studies selection

Table 2: Extraction data for included studies

S/N	Author(s) and Year	Purpose/ Focus of Study	Publication Origin/Country	Research Plan /Sample	Parent/ Child outcomes
1	Pan et al. (2023)	The research investigates the influence of telehealth on parental loyalty and the negative behaviors shown by children with autism.	Taiwan	A thorough search was performed using PubMed, EMBASE, and the Cochrane Library. The analysis included comparing variations in implementation fidelity, self-efficacy, parental stress, and behavioural issues in autistic children with a quality evaluation.	After engaging in telemedicine treatment, parents of autistic children reported a decrease in stress levels as well as an improvement in self-efficacy and implementation fidelity.
2	de Nocker, and Toolan. (2023).	As per this review, which is a synthesis and summary of the latest evidence for group designs, Children with Autism Spectrum Disorder (ASD) are helped by telehealth therapy.	Los Angeles	This systematic review is a general summary and review of the literature on telehealth interventions in Autism Spectrum Disorder (ASD).The study is based on group designs. The sixteen publications that were reviewed focused on the results of interventions at the implementer and child levels, as well as the variables that encourage equal access to interventions.	Study has shown that telehealth programs are well-received, just as effective as in-person therapies, and have the potential to educate intervention implementers effectively.
3	Gentile et al. (2022)	The objective of this study is to examine how the ATHENA telehealth program affects parents who have children who have been diagnosed with Autism Spectrum Disorder (ASD). For children diagnosed with ASD, ATHENA is an online telemedicine system that makes therapist-conducted and parent-facilitated interventions available to them. What this six-month program seeks to do is promote early intervention by parents via distant monitoring.	Italy	The aim of this research is to determine if a six-month parent-guided telehealth intervention can be effective in helping children with autism spectrum disorder. The participant sample consisted of approximately twenty-seven parents.	Parents' ability to empower themselves, reduce stress, and improve their children's learning were all shown to increase when they participated in the program. There is a correlation between parental age and the interaction of parental capacity, stress, and empowerment levels, according to the study. The results suggest that a telehealth program for early intervention might help parents feel more empowered, reduce stress, and increase their awareness of positive interactions with their children.

4	Montiel-Nava et al. (2022)	This research sought to assess the acceptability and feasibility of implementing the World Health Organization-Caregivers Skills Training program (WHO-CST) in an online, synchronous group setting.	rural Missouri	Employed a combination of quantitative and qualitative methodologies to gather data from caregivers and program administrators at the study's inception and at the final home visit. In rural Missouri, 14 autistic children aged 3 to 7 and their caregivers participated in nine video classes and four virtual home visits.	The findings confirm the viability of executing the WHO-CST program via telehealth in a remote area of the United States. Caregivers like group programs that promote connection with other families, provide readily applicable skills, and incorporate the curriculum into their daily routines. To overcome treatment barriers and empower parents of autistic children, a Patient Management Intervention (PMI) similar to the WHO-CST is required, including cultural and language adjustments, as well as improved accessibility via telemedicine.
5	Martin et al. (2024)	A feasibility study to investigate BPT using telehealth was carried out among fourteen parents of autistic children.	USA	A feasibility experiment of BPT using telehealth was done with fourteen parents of children with autism.	Families may have challenges in accessing behavioral parent training (BPT) due to issues with transportation, scheduling, and community availability, as it was successful in reducing disruptive behavior among such children. Consistent with and building upon prior studies, the results show that telemedicine has promise for BPT.

6	Camilleri et al., (2024)	In order to determine how successful digitally-mediated social stories (SS) are, this research uses a two-sample pre-post design. The SS in question are: (1) created and delivered by adults taking care of children with autism and young people (CYP), and (2) independently generated and offered by autistic CYP.	USA	The aim of the study was to evaluate the efficacy of parents' development and dissemination of story structures (SS) with researchers (n = 17, sample 1), and to determine the responsible variables for the effectiveness. Furthermore, the study was to examine the efficacy of digitally-mediated storytelling in enabling the development and articulation of narratives of autistic children and adolescents, and thereby involving them in the program for the sake of self-support and self-care. Sample size: 2 (n = 5).	The study indicates that tele mediation might facilitate parent-led social skills interventions. Research indicates that receptive and expressive language abilities, systemizing, and engaging autistic children and young people (CYP) in goal identification and narrative building are individual and procedural characteristics that enhance parent-led therapies. The research furthermore shown that autistic youngsters and adolescents may use digitally-mediated social support for self-assistance.
7	Leadbitter et al. (2025)	This research sought to gauge the therapeutic efficacy of the Empower-Autism program combined with standard therapy compared to the conventional local post-diagnostic psychoeducation with standard treatment and digital literacy on caregiver's mental wellness at the 52-week follow-up.	United Kingdom	Empower-Autism was tested in a randomized controlled experiment with two parallel groups at many centers to determine its superiority. For caregivers dealing with the emotional fallout of a child's autism diagnosis. Online video conferencing allows for the delivery of psychotherapy. Participants were adults who have recently been diagnosed with autism and are either parents or primary caretakers of children with a developmental delay ranging from 2 to 15 years old. Centers served as randomizers for the intervention or standard therapy groups.	In the long run, everyone in the family—the child, the parents, and their parenting styles and service utilization—will gain from an enhancement in caregiver psychological well-being and health. The results of the trial provide more convincing evidence than before to support the use of therapy along with digital literacy with caregivers.

8	Dahake et al., (2025)	A research examined the efficacy of treatment programs for autistic children that are conducted in the home via the use of virtual reality and parent mediation.	India	This qualitative study is descriptive. Disability specialists led online interactive workshops with 10 autism parents. Customized home programs were created .Teleconsultation provides ongoing program implementation support. Parent-mediated therapies were evaluated six months later. Qualitative data analysis assessed usefulness.	The majority of parents reported an uptick in their children's linguistic and recreational skills. Confidently administering the program was able by 88% of parents. All of the parents had positive things to say about the teaching approach as a whole. Nearly eighty-five percent of parents think it would be easy to execute the program at home. In the free-form section, parents voiced their desire for further teleconsultation follow-up sessions.
9	Salman et al. (2022)	Focusing on parent-mediated intervention (PMI) programs, this study aimed to get insight into parents' perceptions on telehealth for children with autism spectrum disorder (ASD).	Malaysia	The Interpretative Phenomenological Analysis (IPA) methodology was applied in this qualitative study. Seven parents, of children with autism spectrum disorder (ASD) who had engaged their children in PMI programs through telehealth in Malaysia during the COVID-19 pandemic, were interviewed in-depth via online, semi-structured interviews. The interviews ranged from thirty to forty minutes. All the interviews were completely transcribed verbatim. A dyad of analysts coded, structured, and synthesized the transcripts.	Parents of children with autism spectrum disorder (ASD) are largely in agreement that telemedicine can assist them treat their children. All panellists emphasised the importance of PMI in meeting the intervention needs of children with ASD. These findings illustrate the real-life challenges parents faced during the pandemic while implementing the PMI program at home with children with autism spectrum disorder (ASD) and call for more research to improve care for these children.

10	Rao et al. (2024)	The main impetus for this qualitative study was to enhance understanding of Parent Mediated Interventions.	India	Two phases of study were done. The initial phase was interviewing specialists from multiple Indian institutes to understand their methods. To learn more about the difficulties and demands of parents with autism in establishing relationships with their children, the second stage was to conduct focus groups with these parents. These two rounds' data were validated by certified specialists.	Educating parents from the moment of diagnosis will enhance adult outcomes for those with autism spectrum disorders.
11	Zhai et al. (2023)	This article's goal is to assess the effectiveness of Human-Centered Design (HCD) methodologies and provide a modern evaluation of therapies that make use of digital health technology to aid family caregivers.	china	Researched family caregiver treatments that made use of contemporary technology from 2014 to 2021 by searching various information sources from July 2019 to January 2021. Evaluation, Development, and Assessment of Recommendations Grading System and Mixed Methods Appraisal Tool were used to assess the papers. Research Electronic Data Capture and Rayyan gathered and evaluated information.	This study found that digitally enhanced health treatments increased carer mental health, self-efficacy, caregiving competencies, quality of life, social support, and coping methods.

Findings, Presentation and Synthesis

The findings revealed the main outcome for both parents and children after a parent-mediated intervention for autism. The results obtained from the examination of the selected studies are listed below.

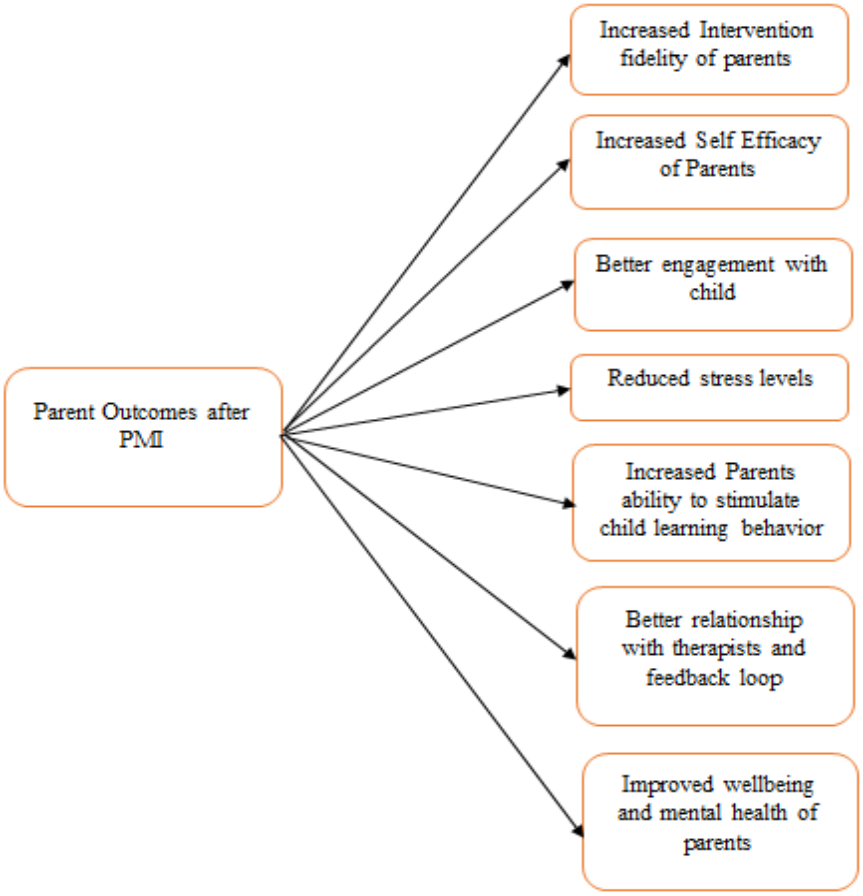

Figure 3: Showing Parent outcomes after PMI

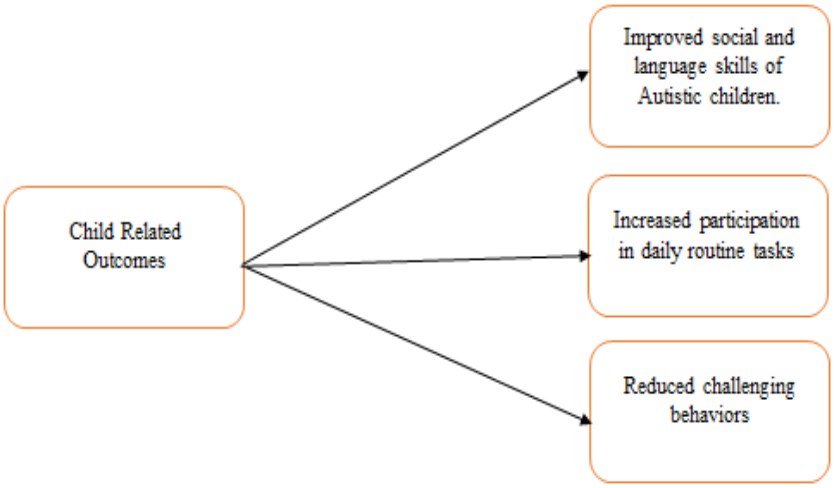

Figure 4: Showing Child Related outcomes after PMI

Discussion

The Impact of Digital Literacy on Parent-Mediated Interventions

There is an increasing body of work about digital literacy and parent-mediated therapies for autism. This research sought to enhance the comprehension of the efficacy of digital literacy in educating parents of young autistic children to implement naturalistic home treatments for social communication and to ameliorate the problematic behaviours of these children. This data from a meta-analysis of eleven studies suggests that telemedicine may help parents of young autistic children use naturalistic developmental therapy in the comfort of their own homes. Supporting the application of communication and social skills throughout daily activities and making the most of learning opportunities, main caregivers participating in the child's intervention should include effective teaching tactics into their household.

Moreover, after the implementation of treatments, family members serving as careers may have a significant sense of parental value, better-quality parent-child dynamics, and a deeper comprehension of autism together with practical resources (Zwaigenbaum et al., 2015). Caregiver-executed techniques, are among the most often used strategies to include families in interventions aimed at enhancing the social interaction growth of children with, or at high risk for autism.

Children's cognitive abilities, social functioning, behaviour, everyday living skills, and family self-efficacy have all shown notable gains in a number of randomised controlled trials (RCTs) including caregiver-implemented instructional tactics (Green et al., 2017). Professional coaching strategies for careers, such as those offered by early intervention service providers and behavioural therapists, are critical components of caregiver-implemented treatments. These tactics include specialists actively training caring ways to promote the child's growth. As a result, early teaching strategies for carers of young children with autism or at high risk for the disorder should focus on enabling parents to practice social communication techniques with their child in daily activities (Stahmer & Pellecchia, 2015). On the other hand, previous research on the effects of caregiver-implemented treatments on the social communication development of children with autism or at higher risk for it has produced conflicting findings (Nevill et al., 2018).

Early childhood education is dependent on the participation of families and caregivers in the children's educational experiences. Early learning experiences for young children should include family-centered practices, activities targeted at strengthening family capacity, and cooperation between families and professionals, as defined by the Division for Early Childhood (DEC) Recommended Practices (2014). These are the core components of early learning experiences. According to Trivette and Banerjee (2015), it is recommended that there be active participation from parents throughout the stages of evaluation, planning, and intervention. To be more specific, practitioners are able to provide caregivers with precise information to enable informed decision-making within the framework of 12 respectful relationships between careers and practitioners. It is crucial to include the concerns, priorities, strengths, and needs of both the caregiver and the child throughout the whole process of developing and implementing the intervention. It is important for practitioners to make use of family information in order to help parents in improving the functioning of their families. It is possible to do this by providing chances for parents to enhance their knowledge and abilities in parenting, as well as by working together with parents to attain the individualized goals and objectives that they have created for themselves. These models emphasize the active participation of caregivers in the services that are provided to their children.

Caretakers' interventions increase outcomes for young infants and their parents (Roberts and Kaiser, 2011). Research is increasingly indicating that caretakers are proficient in applying certain techniques and that their use has a good influence on child outcomes (e.g., Windsor et al., 2023). Furthermore, because the child may have more opportunities to acquire and practise new abilities, caregiver-implemented treatments are both time and cost-effective, as they improve the generalisation and retention of these skills (Koegel et al., 2020). Empowering parents to take on the role of educator enhances the child's acquisition and application of newly acquired abilities across varied situations, including household and community settings (Steiner et al., 2018).

Conclusion

The purpose of this research was to identify eleven studies that investigated the effectiveness of parent-mediated treatments and digital literacy programs for informal caregivers. With improved digital literacy, it is possible to cater to the requirements of both the people receiving care and the people providing it, therefore reducing the constraints that are associated with conventional human interactions. Clients who are in need of assistance may benefit from home treatments since they provide a medium for interactive communication and the quick distribution of information that is up to date. It is possible that these measures will also minimize the number of unnecessary healthcare visits and hospitalizations. The significance of using technology in the delivery of therapies to family caregivers is highlighted by this increased study on the topic. Carers who are burdened by their responsibilities may benefit from technology-based interventions that are taught to them. These interventions may facilitate greater access to self-care, reduce anxiety and depression, improve quality of life, enhance coping strategies, communication methods, and relationships with care recipients, and ultimately benefit the well-being of both patients and care givers. In the future, research on the creation and assessment of digital literacy and home treatments for family caregivers should be altered to accommodate caregivers from a variety of different backgrounds. Comprehensive human-centered design (HCD) approaches should be used to support this endeavor.

Implications and Limitations

The results of this extensive research demonstrate that parent-mediated intervention training that is conveyed remotely is most effective. For a child with autism spectrum disorder (ASD), further research is required to determine the optimum combination of parent-mediated intervention and therapist help via online or remote training. This is especially important when considering the proximity of the family to traditional treatments.In addition to parents' knowledge and skill development, parent-mediated intervention training should be evaluated for its effects on ASD children's social behaviour and communication abilities.

Experiments in the future studies that use parent-mediated therapies, like as training programs, have to incorporate larger sample sizes, randomised controlled trials, more stringent bias controls, and standardized outcome measures.. The lack of comparison groups hampered this review's meta-analysis. Standards should be employed wherever feasible, because they were seldom used in this review's studies. Researchers commonly generated non-validated measures to assess their own therapies. This might influence the investigations, reducing their importance. Next research may evaluate parent training programs, including their components, doses, and dissemination techniques, in order to discover an improved approach to raising parental consciousness and intervention faithfulness, as well as their children's social conduct and language abilities. We prioritized the parents' perception of the intervention's appropriateness and their overall happiness with it, although parental participation in parent-mediated treatments has been less studied. Further

study on parental involvement in the intervention may help doctors design content, parental engagement, and delivery training programs.

This comprehensive examination and evaluation of digital literacy and home interventions has ramifications for clinical practice. The study demonstrated that home treatments effectively supported informal carers, with the majority showing improvements in carer outcomes. Healthcare professionals must ensure that informal carers get necessary psychological assessments and support, since they play a crucial role in patient care. Physical health, mental health, and self-efficacy are all important factors to consider when evaluating caregivers. In order to effectively assist caregivers, health professionals, should increase their digital health literateness and learn to utilize various forms of technology.

Caregivers from low-income backgrounds should be the focus of future studies. Technology tools should be more easily accessible and useful, and intervention materials should be adapted to be more culturally and linguistically suitable. Numerous technologies may fail to achieve widespread adoption if they are not created with input from carers and care users, since they may lack acceptability and feasibility. The design and development of interventions need a comprehensive Human-Centered Design methodology.

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