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## Bridging the Autism Diagnosis Gap through Digital Inclusion in Underserved Communities

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### Abstract

Disparities in autism diagnosis persist across racial, socioeconomic, and geographic lines, disproportionately affecting underserved communities. Historically, marginalized populations have been excluded from autism research and healthcare access, leading to delayed diagnoses, misdiagnoses, and limited early intervention opportunities. Factors such as implicit bias in traditional diagnostic methods, socioeconomic barriers, and lack of culturally competent healthcare services have further widened the autism diagnosis gap. Addressing these inequities requires innovative solutions that leverage digital health tools and AI-driven diagnostics to improve early detection and intervention in historically excluded populations. Emerging technologies, including machine learning-based autism screening, telehealth consultations, and mobile health applications, offer promising pathways to overcome structural barriers in autism diagnosis. AI-powered screening tools can enhance accuracy, efficiency, and accessibility, allowing for remote and cost-effective early detection in communities with limited access to specialized healthcare providers. Additionally, culturally tailored digital platforms can reduce bias in autism assessments and provide caregiver education and support, empowering families to seek timely interventions. However, challenges remain, including the digital divide, data privacy concerns, and the need for clinician training in AI-assisted diagnostics. This explores the intersection of historical healthcare exclusion and modern digital solutions, proposing a framework for equitable autism diagnosis and intervention. It highlights the potential of public-private partnerships, policy reforms, and community-based digital health initiatives to expand access to AI-driven autism screening. By integrating technology, policy, and culturally responsive care, digital inclusion can help close the autism diagnosis gap, ensuring that all children regardless of racial, economic, or geographic background receive timely and appropriate support. Future research should focus on refining AI models for diverse populations and scaling digital health interventions to bridge longstanding healthcare disparities in autism diagnosis and treatment.

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### 1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by challenges in social communication, repetitive behaviors, and sensory sensitivities (Matthew *et al.*, 2021) <sup>[33]</sup>. Early diagnosis and intervention are critical for improving developmental outcomes, yet disparities in autism diagnosis persist, disproportionately affecting underserved communities. Studies show that children from racial, ethnic, and socioeconomically disadvantaged backgrounds are diagnosed with autism later than their white and affluent counterparts (Cruz and Rodl, 2018; Adegoke *et al.*, 2022) <sup>[12]</sup>. Factors contributing

to this diagnosis gap include limited access to specialized healthcare providers, implicit bias in clinical assessments, and a lack of culturally competent screening tools. As a result, many children in marginalized communities miss the crucial early intervention window, which can significantly impact their cognitive, social, and emotional development (Colizzi *et al.*, 2020) <sup>[10]</sup>.

Historically, autism research and healthcare access have been exclusionary, with racial and ethnic minorities underrepresented in clinical studies. Traditional diagnostic criteria have largely been developed based on data from predominantly white, middle-class populations, leading to misdiagnosis or underdiagnosis in diverse communities. Additionally, healthcare infrastructure disparities, including limited availability of developmental specialists in rural and low-income areas, have restricted access to early screening and intervention (Spencer *et al.*, 2019) <sup>[46]</sup>. The intersection of systemic racism, economic inequality, and healthcare inaccessibility has perpetuated a cycle of delayed autism identification, placing children from underserved communities at a long-term disadvantage. Addressing these barriers requires innovative, technology-driven approaches that can expand equitable access to autism diagnostics. Digital health tools and AI-driven diagnostics have the potential to close the autism diagnosis gap by providing accessible, efficient, and cost-effective screening methods. AI-powered diagnostic models can analyze behavioral patterns, facial expressions, and speech characteristics, offering objective and scalable autism assessments (Washington *et al.*, 2020) <sup>[48]</sup>. Additionally, telehealth platforms and mobile health applications can facilitate remote screenings, allowing families in healthcare deserts to access early evaluation and intervention services. Culturally tailored digital screening tools can also help mitigate implicit bias by incorporating diverse population data into machine learning algorithms, ensuring more accurate diagnoses across racial and ethnic groups (Rajkomar *et al.*, 2018) <sup>[39]</sup>.

This explores how emerging digital health solutions can rectify historical disparities in autism diagnosis and promote equitable early intervention. By examining the intersection of healthcare exclusion and technological advancements, it proposes a comprehensive framework that integrates AI-assisted screening, telehealth services, and community-driven digital inclusion initiatives. In doing so, this study highlights the transformative potential of digital innovation in autism diagnosis and the urgent need for interdisciplinary collaboration among healthcare providers, policymakers, and technology developers. Ultimately, bridging the autism diagnosis gap requires a multifaceted approach that combines policy reform, culturally competent digital tools, and expanded access to telehealth services, ensuring that all children regardless of their racial, economic, or geographic background receive timely and appropriate autism support.

## 2. Methodology

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was employed to systematically analyze literature on autism diagnosis disparities and the role of digital health tools in improving access to early screening and intervention in underserved communities. A comprehensive search strategy was developed using electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar. Keywords such as "autism diagnosis disparities," "underserved communities," "digital health tools," "AI-driven autism screening," and "telehealth for autism" were used in combination with Boolean operators to refine the search

results.

Inclusion criteria consisted of peer-reviewed studies, systematic reviews, and policy reports published in English within the last two decades that examined autism diagnosis barriers, digital health interventions, and healthcare access inequalities. Studies focusing on non-digital autism screening methods, populations outside underserved communities, and articles lacking empirical data were excluded. The initial search yielded a total of 3,200 articles, which were screened for relevance based on titles and abstracts. After removing duplicates and non-relevant studies, 250 full-text articles were assessed for eligibility. Of these, 85 studies met the final inclusion criteria.

Data extraction focused on identifying key themes related to historical exclusion from autism research, challenges in traditional diagnostic pathways, and the implementation of AI-driven and digital screening tools. Information regarding study design, population demographics, intervention methods, and reported outcomes was systematically categorized. Bias assessment was conducted using the Cochrane Risk of Bias tool for randomized studies and the Newcastle-Ottawa Scale for observational studies.

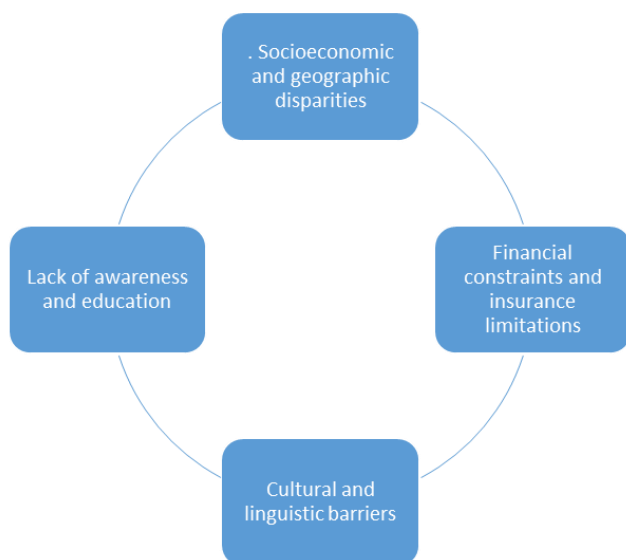
The synthesis of findings highlights significant barriers in autism diagnosis within underserved communities, including systemic healthcare inequities, implicit bias, and limited access to specialists. Studies demonstrate that digital health interventions, particularly AI-assisted diagnostic models and telehealth platforms, can enhance early autism detection by improving accessibility, reducing bias, and expediting intervention processes. However, challenges such as the digital divide, data privacy concerns, and the need for clinician training in AI-assisted diagnosis were also identified. The systematic review underscores the potential of digital inclusion strategies to address long-standing disparities in autism diagnosis. Findings support the development of policy frameworks integrating AI-driven screening tools with community-based healthcare models to enhance early autism intervention in marginalized populations. The study also highlights the necessity for further research on the scalability, ethical considerations, and cultural adaptation of digital diagnostic tools to ensure equitable implementation.

### 2.1 Historical exclusion and systemic barriers

Autism spectrum disorder (ASD) affects individuals of all racial, ethnic, and socioeconomic backgrounds, yet significant disparities exist in diagnosis, intervention, and research representation. Historically, marginalized communities particularly racial and ethnic minorities and low-income populations have been systematically excluded from autism studies, leading to a lack of culturally competent diagnostic criteria and healthcare interventions (Morgan and Stahmer, 2020; Mascayano *et al.*, 2020) <sup>[35]</sup>. Additionally, socioeconomic and geographic barriers limit access to early screening and specialized care, further exacerbating disparities. Implicit bias within the healthcare system also plays a role, contributing to delayed diagnoses, misdiagnoses, and reduced access to intervention services for underserved populations. Understanding the historical exclusion and systemic barriers in autism diagnosis is critical to addressing existing inequities and developing inclusive, effective digital health solutions.

Historically, autism research has been predominantly based on white, middle- to upper-class populations, leading to a narrow understanding of how ASD manifests across different racial and ethnic groups. Many foundational studies that established diagnostic criteria and intervention strategies

relied on homogeneous study samples, failing to account for cultural variations in autism presentation and caregiver reporting (Sandbank *et al.*, 2020) [42]. As a result, the current diagnostic frameworks and assessment tools may not accurately reflect neurodevelopmental differences in diverse populations, contributing to the underdiagnosis and misdiagnosis of autism in non-white children. Studies have shown that Black, Hispanic, and Indigenous children are diagnosed with autism later than their white counterparts, reducing their chances of receiving early intervention services that are critical for developmental outcomes. Moreover, research has indicated that healthcare professionals are more likely to misdiagnose children from minority backgrounds with behavioral disorders such as attention-deficit/hyperactivity disorder (ADHD) or oppositional defiant disorder (ODD) instead of autism, due to culturally ingrained biases and differences in symptom expression. The lack of diverse representation in autism research has contributed to a self-reinforcing cycle of exclusion, where minority populations are less likely to be studied, leading to diagnostic tools and interventions that do not adequately serve them.



**Fig 1:** Barriers to autism diagnosis in underserved communities

Families from low-income backgrounds often face significant challenges in accessing autism diagnosis and intervention services, leading to delayed or missed diagnoses. One of the primary barriers is the high cost of specialized autism evaluations and therapy. Many families lack adequate health insurance coverage or face long waitlists for public healthcare programs, delaying crucial assessments and interventions. Geographic disparities also play a role in autism diagnosis inequities. Rural communities and healthcare deserts often lack developmental specialists, child psychologists, and autism clinics, forcing families to travel long distances for evaluations (Dakota *et al.*, 2020) [16]. For many low-income families, transportation barriers, work constraints, and financial instability make it difficult to access these services, leading to disproportionate delays in diagnosis and intervention. Additionally, the lack of autism-related resources in public schools, particularly in underfunded districts, limits the availability of early childhood screenings and school-based interventions for at-risk children.

Implicit bias within the healthcare system further exacerbates disparities in autism diagnosis and treatment. Healthcare providers often interpret symptoms differently based on a child's race or ethnicity, leading to misdiagnoses or

dismissals of parental concerns (Najdowski *et al.*, 2020) [36]. Studies have shown that Black and Hispanic children are less likely to receive formal autism evaluations when caregivers first express developmental concerns. Instead, their behaviors may be misattributed to poor parenting, behavioral issues, or environmental factors, delaying formal diagnoses and reducing access to autism-specific interventions. Language barriers also contribute to disparities in autism diagnosis. Many standardized diagnostic tools and parent questionnaires are designed primarily for English-speaking families, making it difficult for non-English-speaking caregivers to effectively communicate concerns or navigate the diagnostic process. The absence of culturally and linguistically appropriate screening tools results in underreporting of autism symptoms in non-English-speaking households, further reinforcing disparities in early detection and support. Additionally, there is a deep-rooted mistrust of the medical system among historically marginalized communities, stemming from past experiences of discrimination, medical neglect, and unethical research practices. This mistrust can lead families to hesitate in seeking medical evaluations for developmental concerns, further widening the diagnosis gap (Hafting *et al.*, 2019) [20]. Without proactive efforts to increase cultural competency, reduce bias, and build trust between healthcare providers and underserved communities, disparities in autism diagnosis will continue to persist.

The historical exclusion of racial and ethnic minorities from autism research, coupled with socioeconomic and geographic barriers and implicit bias in healthcare, has significantly contributed to disparities in autism diagnosis and intervention. These systemic challenges result in delayed diagnoses, reduced access to specialized care, and poorer developmental outcomes for children in underserved communities. Addressing these barriers requires intentional efforts to diversify autism research populations, increase access to affordable and geographically accessible diagnostic services, and implement culturally responsive screening tools. Emerging digital health technologies, including AI-driven diagnostic models and telehealth services, offer promising solutions to mitigate these longstanding disparities. By leveraging technology to create more inclusive, accessible, and equitable autism screening and intervention pathways, policymakers and healthcare providers can take meaningful steps toward closing the autism diagnosis gap and ensuring that all children, regardless of their racial, economic, or geographic background, receive the support they need (Krzeminska and Hawse, 2020; Klin *et al.*, 2020) [29].

## 2.2 The role of digital health tools in autism diagnosis

Advancements in digital health technologies are transforming the landscape of autism diagnosis, particularly in underserved communities where traditional diagnostic pathways are often inaccessible. Digital tools, including AI-driven diagnostics, telehealth services, and mobile applications, offer innovative solutions to improve early detection, intervention, and caregiver education (Almatrafi *et al.*, 2019) [4]. These technologies help bridge gaps in healthcare access by reducing barriers related to geographic location, cost, and availability of specialists. By leveraging digital solutions, autism diagnosis can become more efficient, accessible, and equitable, ensuring that all children receive the support they need at an early stage.

Artificial intelligence (AI) has emerged as a powerful tool for early autism screening and diagnosis, enabling healthcare providers to analyze behavioral and neurological patterns with greater accuracy and efficiency. Traditional autism

diagnosis often involves long waitlists, subjective clinical assessments, and limited access to specialists, particularly in low-resource communities. AI-driven diagnostic models offer a data-driven approach to screening, reducing human error and bias while accelerating the diagnostic process. AI-based tools use machine learning algorithms to analyze speech patterns, facial expressions, eye-tracking data, and movement behaviors, which are key indicators of autism (Das *et al.*, 2020) [17]. Some AI models process videos of children's interactions, identifying subtle behavioral markers that might be overlooked in traditional clinical evaluations. Additionally, AI-powered natural language processing (NLP) tools can assess the speech patterns and social communication abilities of children, providing early indicators of autism spectrum disorder (ASD). One of the most significant benefits of AI-driven diagnostics is their ability to increase accessibility for families who may not have direct access to autism specialists. Mobile applications and web-based platforms equipped with AI can enable caregivers and primary care providers to conduct preliminary screenings remotely, ensuring that children at risk of ASD are identified sooner and referred for further evaluation. While AI is not meant to replace clinical assessments, it serves as a valuable complementary tool to streamline the diagnostic process and improve early detection rates.

Telehealth has revolutionized autism diagnostics by providing virtual access to specialists, reducing the need for in-person visits, and expanding healthcare reach to remote and underserved communities. Telehealth consultations allow families to connect with developmental pediatricians, psychologists, and speech therapists, making early assessments more accessible (Dahiya *et al.*, 2020) [15]. For families in rural areas or low-income communities, telehealth mitigates geographic and financial barriers that often prevent timely autism diagnosis. Many families face long travel distances and high costs associated with specialist visits, leading to delayed or missed diagnoses. Through video conferencing and remote behavioral assessments, telehealth provides a cost-effective and convenient alternative for early autism screening and follow-up care. Mobile applications also play a significant role in improving autism diagnosis and intervention. Many apps are designed to assist parents and caregivers in tracking developmental milestones, recording behavioral patterns, and completing validated autism screening questionnaires. These apps provide structured, evidence-based tools that guide caregivers in recognizing early signs of autism and seeking professional support when necessary. Some mobile applications integrate AI-powered analytics to evaluate uploaded videos of a child's social interactions, providing automated preliminary assessments. Other apps offer interactive exercises for children, which help assess cognitive and motor functions while simultaneously engaging them in learning activities. By utilizing mobile technology, families can actively participate in the early screening process without relying solely on traditional healthcare systems, making autism assessment more accessible and proactive (Stahmer *et al.*, 2019) [47].

Beyond screening and diagnosis, digital health tools also serve as educational platforms for caregivers, equipping them with the knowledge and resources needed to support their children effectively. Many parents, especially in underserved communities, lack access to autism specialists and support groups, leaving them feeling isolated and unprepared to navigate their child's diagnosis (Crais *et al.*, 2020) [11]. Digital platforms address this gap by providing online resources, training modules, and virtual support networks. Web-based platforms offer comprehensive educational materials on

autism spectrum disorder, including early intervention techniques, communication strategies, and behavioral management approaches. Caregivers can access step-by-step guidance on how to support their child's development, fostering an informed and proactive approach to autism care. Some platforms also provide virtual coaching and teletherapy sessions, allowing caregivers to receive direct guidance from autism professionals without the need for in-person visits. Additionally, online support communities and social media groups have become valuable spaces for caregivers to connect, share experiences, and seek advice. Many families, particularly in underserved and minority communities, face cultural stigma and social barriers when discussing autism. Digital platforms help break down these barriers by fostering a sense of community and empowerment, ensuring that caregivers do not feel alone in their journey. Furthermore, digital tools can support culturally tailored autism resources that address the unique challenges faced by diverse populations. Many underserved communities encounter linguistic and cultural barriers in traditional healthcare settings, making it difficult for caregivers to access and understand autism-related information (Smith *et al.*, 2020) [6]. Digital health platforms can offer multilingual content and culturally sensitive educational materials, ensuring that families from all backgrounds have access to the necessary resources for early autism intervention.

The integration of AI-driven diagnostic tools, telehealth services, and digital caregiver education platforms has the potential to revolutionize autism diagnosis and intervention, particularly in underserved communities. By reducing barriers related to cost, geography, and specialist availability, digital health solutions create more equitable pathways to early autism detection and support (Beresford *et al.*, 2020) [7]. AI-powered screening tools enhance diagnostic accuracy and accessibility, while telehealth services enable families to connect with specialists remotely, minimizing delays in diagnosis. Mobile applications empower caregivers with real-time screening tools and interactive learning resources, allowing them to take an active role in their child's developmental assessment. Additionally, digital platforms for caregiver education and peer support help reduce stigma, provide culturally relevant information, and build strong support networks. While digital health tools are not a substitute for in-person evaluations and therapeutic interventions, they serve as critical complementary solutions in expanding autism diagnosis accessibility. To maximize their impact, it is essential for policymakers, healthcare providers, and technology developers to collaborate in designing ethical, inclusive, and user-friendly digital autism assessment tools. Moving forward, continued research and innovation in AI-driven diagnostics and telehealth services will play a crucial role in closing the autism diagnosis gap and promoting early intervention for all children, regardless of socioeconomic or geographic barriers.

### 2.3 Addressing healthcare disparities through digital inclusion

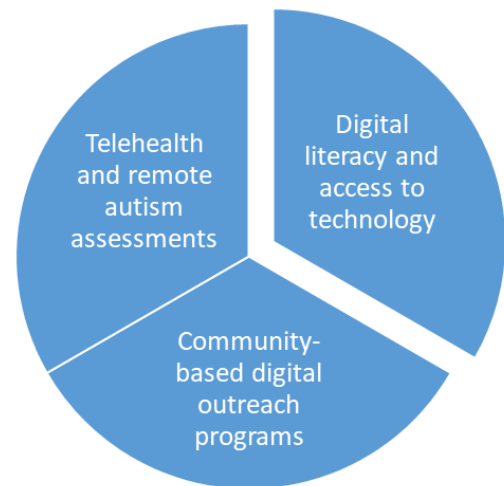
Healthcare disparities continue to hinder early autism diagnosis and intervention, particularly in underserved communities where access to specialists and diagnostic tools is limited. The growing field of digital health presents an opportunity to bridge these gaps by leveraging AI-assisted autism screening, culturally competent digital tools, and public-private partnerships that expand access to technology and internet-based care (Raso *et al.*, 2018) [40]. By integrating these digital solutions into the healthcare system, it is possible to create a more equitable landscape for autism

diagnosis and early intervention, ensuring that all children regardless of socioeconomic status or geographic location receive timely and appropriate care.

Artificial intelligence (AI) has the potential to revolutionize autism screening, particularly in regions where access to developmental specialists is scarce. Traditional autism diagnosis is resource-intensive, often requiring multiple in-person assessments, leading to delays, misdiagnoses, and exclusion of marginalized groups (Clark, 2018) <sup>[9]</sup>. AI-driven screening tools reduce these barriers by offering cost-effective, scalable, and accessible alternatives to traditional diagnostic pathways. AI-powered tools analyze speech patterns, facial expressions, eye-tracking data, and behavioral indicators to detect autism-related traits. These tools can be integrated into mobile applications and telehealth platforms, allowing caregivers, educators, and primary care providers to conduct preliminary screenings remotely. For rural and low-income communities, where autism specialists are often unavailable, AI-assisted screening serves as a first step in identifying children who require further assessment and intervention. Additionally, AI-based autism screening tools reduce subjectivity and implicit bias in traditional diagnostic methods by relying on data-driven analysis rather than human judgment alone. This is particularly beneficial for minority communities, who have historically been underdiagnosed or misdiagnosed due to cultural differences in the presentation of autism symptoms. AI-driven diagnostics offer a more standardized and equitable approach, ensuring that all children receive an accurate assessment regardless of their background. Despite the potential of AI in autism screening, barriers to implementation remain, including limited access to digital devices, lack of internet connectivity, and disparities in digital literacy (Sable *et al.*, 2020) <sup>[41]</sup>. Expanding access to AI-assisted screening in underserved communities requires investment in telehealth infrastructure, mobile-friendly screening tools, and community outreach programs that educate caregivers on how to use these technologies effectively.

A key challenge in autism diagnosis is the cultural bias embedded in traditional screening methods, which are often designed based on neurotypical behaviors observed in Western populations. Many autism assessment tools fail to account for cultural variations in social interaction, communication styles, and family dynamics, leading to underdiagnosis or misinterpretation of autism symptoms in diverse communities. Digital tools offer an opportunity to reduce these biases by incorporating culturally competent frameworks into autism screening and intervention programs (Baker *et al.*, 2020) <sup>[6]</sup>. AI models can be trained using diverse datasets that include behavioral patterns from children of different ethnic, linguistic, and socioeconomic backgrounds, ensuring greater accuracy and inclusivity in autism detection. Additionally, community-led digital health initiatives can provide educational resources tailored to specific cultural groups, helping caregivers and educators better understand autism within their own socio-cultural contexts. Digital platforms can also facilitate virtual support groups where families from similar backgrounds can share experiences, access culturally relevant guidance, and connect with healthcare professionals who understand their unique challenges. To ensure that digital autism screening tools do not perpetuate existing biases, it is critical for policymakers, researchers, and technology developers to collaborate with communities in designing and testing these tools. Engaging culturally diverse stakeholders, including healthcare providers, educators, and autism advocacy groups, will help create more equitable and representative digital health

solutions that improve autism diagnosis for all children.



**Fig 2:** Digital inclusion as a solution

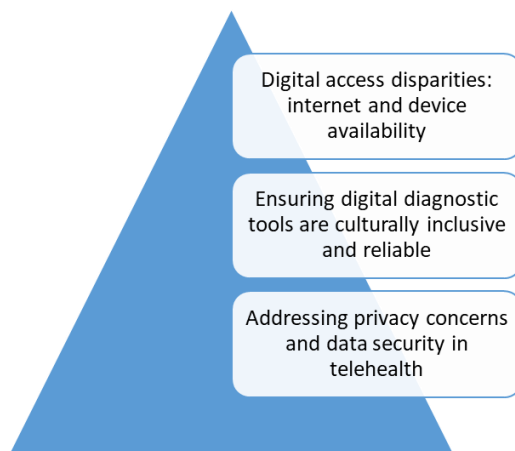
One of the biggest barriers to digital health adoption in underserved communities is the lack of technology access and reliable internet connectivity. Many low-income families do not own smartphones, tablets, or computers, making it difficult to utilize AI-assisted autism screening tools and telehealth services. Addressing these disparities requires collaboration between public institutions, private companies, and nonprofit organizations to provide affordable or subsidized digital resources for families in need (Siliunas *et al.*, 2019) <sup>[44]</sup>. Public-private partnerships can help bridge the digital divide by providing free or low-cost internet access to underserved households, particularly in rural and inner-city areas where broadband infrastructure is limited. Distributing mobile devices preloaded with autism screening apps to families enrolled in Medicaid or other public assistance programs. Expanding telehealth services in community health centers and schools, allowing caregivers to access remote autism evaluations and interventions without needing personal internet access. Partnering with local organizations to offer digital literacy training, ensuring that caregivers know how to navigate and use autism-related digital tools effectively. In addition to improving access to technology, public-private collaborations can also support the development of open-source, low-cost digital health solutions tailored for underserved communities. Large technology firms, government agencies, and autism advocacy groups can work together to fund research, develop culturally competent AI models, and deploy scalable digital interventions in low-resource settings.

Governments can play a crucial role in regulating and funding these initiatives, ensuring that digital health programs for autism diagnosis align with public health priorities and equity goals. Incentives such as grants for telehealth expansion, tax benefits for companies investing in autism-related technology, and policy frameworks supporting equitable digital inclusion can drive the widespread adoption of digital health solutions for autism care. Digital inclusion is essential for addressing autism healthcare disparities, ensuring that all children regardless of their background have access to timely and accurate diagnosis (Bird *et al.*, 2019) <sup>[8]</sup>. By expanding AI-assisted autism screening, developing culturally competent digital tools, and fostering public-private partnerships, it is possible to reduce systemic barriers and promote equitable healthcare solutions for underserved communities. AI-driven diagnostic tools provide a cost-effective and scalable approach to autism screening, reducing

human bias and increasing accessibility. Culturally competent digital platforms ensure that screening methods reflect the diverse experiences of minority populations, preventing underdiagnosis and misinterpretation of autism symptoms (Henderson and Majors, 2020; Lester and O'Reilly, 2021) <sup>[22]</sup>. Additionally, public-private partnerships help bridge the digital divide by expanding technology and internet access, making remote autism care a viable option for low-income families. To maximize the impact of digital inclusion, it is crucial for governments, healthcare providers, technology developers, and community organizations to collaborate in designing ethical, inclusive, and accessible digital health solutions. Future research and policy efforts should continue to prioritize equity-driven innovation, ensuring that digital tools empower caregivers, reduce diagnostic disparities, and improve long-term outcomes for autistic children worldwide (Harrington *et al.*, 2019; Kozleski *et al.*, 2020) <sup>[21]</sup>.

#### 2.4 Challenges and ethical considerations

As digital health technologies and AI-driven autism diagnostics gain momentum, several challenges and ethical considerations must be addressed to ensure their equitable, secure, and effective implementation. While these innovations have the potential to bridge long-standing disparities in autism diagnosis, they also introduce new risks related to data privacy, digital accessibility, and provider readiness (Shahidullah *et al.*, 2020) <sup>[43]</sup>. This explores three key challenges: ensuring data privacy and security, bridging the digital divide, and training healthcare providers to integrate digital tools effectively.



**Fig 3:** Challenges and limitations

AI-driven autism diagnostics rely on large-scale data collection, including facial recognition, speech patterns, and behavioral analysis, raising significant concerns about data privacy and security (Guo *et al.*, 2021; Ismail and Kumar, 2021) <sup>[19]</sup>. Given the sensitive nature of autism-related health data, protecting the rights and confidentiality of individuals must be a priority. One of the main privacy concerns is the risk of unauthorized access or misuse of personal health data. Many AI-powered diagnostic tools operate on cloud-based platforms, making them vulnerable to cybersecurity threats, hacking, and data breaches. If improperly secured, sensitive health information such as a child's developmental profile or biometric data could be exposed to third parties without consent, leading to stigmatization or discrimination in educational, medical, or employment settings. To mitigate these risks, strict data encryption protocols, anonymization techniques, and consent-based data sharing agreements must

be implemented (Olteanu *et al.*, 2018) <sup>[37]</sup>. Developers of AI-driven diagnostic tools should adhere to health data protection regulations such as HIPAA (Health Insurance Portability and Accountability Act) in the U.S. and GDPR (General Data Protection Regulation) in Europe. Additionally, transparent policies regarding data collection, storage, and sharing must be communicated to caregivers and individuals undergoing screening. Another ethical issue involves bias in AI algorithms, which can arise if the training datasets are not diverse enough to accurately reflect different racial, ethnic, or socioeconomic backgrounds. If AI models are trained predominantly on data from high-income, Western populations, they may fail to recognize autism traits in children from marginalized communities, reinforcing diagnostic disparities rather than reducing them (Alami *et al.*, 2020; Yu, 2020) <sup>[2]</sup>. To ensure fair and accurate autism assessments, AI models must be trained on inclusive, diverse datasets, and undergo continuous validation to prevent bias. Despite the promise of AI-driven diagnostics and telehealth-based autism assessments, many underserved communities lack access to digital health technologies due to economic, geographic, and infrastructural barriers (Hewitt *et al.*, 2020) <sup>[23]</sup>. This "digital divide" disproportionately affects low-income families, rural populations, and historically marginalized groups, making it difficult to leverage digital autism diagnostic tools effectively. One of the biggest challenges is limited internet connectivity and access to smart devices. Many families in rural and inner-city areas have poor broadband infrastructure or cannot afford smartphones, tablets, or computers, which are necessary for telehealth consultations and digital autism screenings (Cueto and Sanders, 2020) <sup>[13]</sup>. Even when technology is available, digital literacy gaps may prevent caregivers from navigating online health platforms or utilizing AI-based screening tools effectively. To bridge this gap, governments and private-sector organizations must invest in expanding broadband infrastructure, providing subsidized smart devices, and offering digital literacy training programs. Public-private partnerships can facilitate technology donations for low-income families, ensuring that access to digital autism diagnostics is not restricted by financial or technological constraints. Additionally, community-based healthcare facilities such as clinics, schools, and libraries can serve as access points for digital autism screenings, allowing caregivers to use AI-powered tools in publicly available, internet-enabled spaces. By integrating digital health services into community settings, access barriers can be significantly reduced, ensuring that early autism detection tools reach those who need them most (Zervogianni *et al.*, 2020) <sup>[50]</sup>. Another critical challenge in implementing AI-driven autism diagnostics is ensuring that healthcare providers are adequately trained to use these tools (Ienca and Ignatiadis, 2020) <sup>[24]</sup>. Many clinicians, pediatricians, and early childhood specialists have limited experience with digital health platforms, which can lead to hesitancy or resistance in adopting AI-assisted screening tools. Without proper training, healthcare professionals may lack confidence in interpreting AI-generated diagnostic insights, leading to misuse or skepticism regarding digital assessments (Lucieri *et al.*, 2020) <sup>[31]</sup>. To successfully integrate digital autism diagnostics into clinical practice, medical education programs must incorporate digital health literacy and AI training. Healthcare providers should receive specialized training on how to use AI-assisted tools, interpret machine-learning-based screening results, and effectively communicate findings to caregivers. Additionally, interdisciplinary collaboration between clinicians, data

scientists, and AI developers can help refine digital diagnostic tools, ensuring that they are designed with clinician feedback and practical usability in mind. Another ethical concern is the risk of over-reliance on AI at the expense of human clinical judgment. While AI-based autism screening tools offer valuable insights, they should be used as complementary tools rather than replacements for in-depth clinical evaluations (Miao *et al.*, 2021) <sup>[34]</sup>. Digital diagnostics must be integrated into a holistic, multi-disciplinary approach, where AI findings are validated by experienced clinicians, behavioral specialists, and developmental psychologists. Healthcare providers also play a crucial role in addressing caregiver concerns about digital autism diagnostics, particularly in communities with historical distrust in medical institutions. Many families may be skeptical of AI-based tools due to fears of misdiagnosis, privacy violations, or lack of human oversight (Atkinson, 2018) <sup>[5]</sup>. Providers must educate caregivers on the benefits, limitations, and ethical safeguards of digital screening, fostering trust and engagement in the diagnostic process.

While AI-driven diagnostics and digital health tools have the potential to revolutionize autism detection, several challenges and ethical considerations must be addressed to ensure equitable, secure, and effective implementation (Parimi *et al.*, 2020; Fanelli *et al.*, 2020) <sup>[38]</sup>. Data privacy and security remain major concerns, requiring strong encryption, transparent consent policies, and diverse AI training datasets to prevent bias and unauthorized data misuse (Khanna and Srivastava, 2020) <sup>[26]</sup>. Bridging the digital divide is another pressing issue, as many underserved communities lack access to smart devices, reliable internet, and digital literacy resources. Expanding broadband infrastructure, subsidizing technology access, and integrating AI-based screenings into community healthcare settings can help ensure equitable diagnostic opportunities. Finally, training healthcare providers to effectively integrate digital tools into clinical practice is essential. Medical professionals must be equipped with digital health literacy, understand AI-assisted diagnostic methodologies, and maintain a balanced approach that combines AI insights with human clinical expertise. As digital health continues to evolve, addressing these challenges through ethical policies, equitable access strategies, and provider training programs will be key to ensuring that all children, regardless of their background, have access to timely and accurate autism diagnosis (Dababnah *et al.*, 2018; Alfuraydan *et al.*, 2002) <sup>[14]</sup>.

## 2.5 Policy recommendations and future directions

Advancements in AI-driven diagnostics and digital health tools have the potential to bridge the autism diagnosis gap in underserved communities. However, to ensure equitable and effective implementation, comprehensive policy strategies must be developed. This explores three key policy recommendations: investing in community-based digital autism screening programs, standardizing AI-driven diagnostics for equitable implementation, and expanding future research to include diverse populations.

One of the most effective ways to increase early autism detection in underserved communities is by integrating digital screening programs into existing community healthcare infrastructures. Many families in low-income, rural, and historically marginalized populations face barriers to traditional autism diagnostic services, including long wait times, financial constraints, and geographic inaccessibility. Community-based digital screening programs offer a cost-effective and scalable solution to these challenges.

Governments, healthcare organizations, and private stakeholders should invest in telehealth initiatives, mobile clinics, and digital screening stations within local schools, community centers, and primary care facilities. By providing AI-powered autism screening tools in trusted, accessible locations, early detection rates can improve, reducing long-term disparities in autism diagnosis and intervention. Additionally, public-private partnerships should be developed to ensure affordable or subsidized access to digital diagnostic tools. Funding models can include grants, insurance reimbursements, and government subsidies to support free or low-cost screening programs for families with limited financial resources. Finally, community outreach and education programs should accompany these screening initiatives. Caregivers, educators, and healthcare providers must be trained to understand and utilize digital diagnostic tools effectively. Digital literacy training can empower families to engage with telehealth platforms, ensuring that technology-based autism assessments reach those who need them most.

AI-driven autism diagnostics have the potential to revolutionize early detection, but standardization is necessary to ensure accuracy, fairness, and ethical implementation. Current AI-based screening tools vary widely in design, training datasets, and diagnostic criteria, leading to potential inconsistencies and biases in autism assessments. To address these challenges, policymakers must establish standardized guidelines for AI-based autism diagnostics. These guidelines should include, AI-driven diagnostic tools should undergo rigorous clinical validation before being integrated into healthcare systems. Regulatory agencies such as the FDA (U.S.), EMA (Europe), and WHO (global) should develop AI-specific approval frameworks for digital autism assessments. AI models should be trained on diverse, representative datasets to prevent racial, ethnic, and socioeconomic biases in autism detection. Standardization efforts must include diversity benchmarks and fairness testing protocols to ensure that AI-based screening tools work equitably across all populations. AI diagnostic tools should be designed to integrate seamlessly with electronic health records (EHRs), telehealth platforms, and existing autism intervention services. Policymakers must establish technical standards for interoperability, ensuring that digital screening results can be easily shared across healthcare networks for comprehensive care coordination.

One of the biggest limitations in current AI-driven autism diagnostics is the underrepresentation of diverse populations in training datasets. Many existing models are primarily trained on data from high-income, Western populations, leading to reduced accuracy and effectiveness in diagnosing autism in racially and culturally diverse groups. To ensure equitable and reliable AI diagnostics, future research must focus on expanding AI models to include diverse populations. Research institutions and healthcare organizations should prioritize collecting behavioral, linguistic, and neurodevelopmental data from diverse racial, ethnic, and socioeconomic backgrounds. This will help train AI models to recognize autism presentations across different demographic groups. Future research should explore how cultural differences in communication styles, social interactions, and behavioral expressions impact autism diagnosis. AI models should be adapted to account for culturally specific autism traits, ensuring that screening tools are sensitive to variations in autism presentation across different populations. Governments, universities, and

private-sector AI developers should establish international collaborations to create shared, anonymized datasets for autism research. By pooling data from diverse regions and communities, AI models can be refined and validated on a global scale, improving diagnostic accuracy and generalizability. Future research should not only focus on AI-based screening but also explore how digital diagnostics influence long-term intervention outcomes. Studies tracking children who receive AI-assisted autism diagnosis and early digital interventions will provide valuable insights into the effectiveness of these technologies in improving developmental outcomes.

To bridge the autism diagnosis gap in underserved communities, targeted policy interventions and future research efforts are essential. Investing in community-based digital autism screening programs will improve early detection and accessibility, particularly for historically marginalized groups. Standardizing AI-driven diagnostic tools will ensure accuracy, fairness, and interoperability in autism assessments. Additionally, future research must expand AI models to include diverse populations, reducing biases and enhancing the reliability of digital diagnostics worldwide. By adopting a comprehensive, equity-focused approach, policymakers, researchers, and healthcare providers can leverage digital health innovations to create a more inclusive, effective, and accessible autism diagnosis system.

### 3. Conclusion

The integration of digital health solutions into autism diagnosis presents a transformative opportunity to bridge longstanding disparities in underserved communities. AI-driven screening tools, telehealth services, and mobile applications have expanded access to early autism detection, particularly for populations historically excluded from autism research and healthcare. However, systemic barriers such as technological accessibility, implicit biases in AI models, and healthcare infrastructure gaps must be addressed to ensure equitable implementation. Standardizing AI-assisted diagnostic tools, investing in community-based screening programs, and fostering public-private partnerships are essential steps toward closing the autism diagnosis gap.

To achieve this goal, interdisciplinary collaboration is crucial. Healthcare professionals, AI researchers, policymakers, and community advocates must work together to develop culturally competent, evidence-based digital screening solutions. Expanding AI training datasets to include diverse populations, creating equitable telehealth policies, and promoting digital literacy among caregivers and healthcare providers will help ensure that emerging technologies serve all communities fairly. Additionally, healthcare institutions must integrate AI-driven diagnostic tools into existing autism care frameworks, enabling a holistic, patient-centered approach to early intervention.

Looking ahead, emerging technologies will continue to shape the future of autism diagnosis and care. Advances in machine learning, wearable biosensors, and natural language processing hold the potential to enhance early detection accuracy and personalize autism interventions. However, ethical considerations, including data privacy, security, and bias mitigation, must remain at the forefront of digital health innovations. With sustained policy efforts, inclusive research practices, and equitable technology deployment, digital health tools can serve as a powerful mechanism to eliminate autism diagnosis disparities and ensure accessible, high-quality autism care worldwide.

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