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The Use of Telehealth Evaluations For Diagnosis of Autism Spectrum Disorder in Children Aged 0-7: A Literature Review

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THE USE OF TELEHEALTH EVALUATIONS FOR DIAGNOSIS OF AUTISM SPECTRUM DISORDER IN CHILDREN AGED 0-7: A LITERATURE REVIEW

by

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ABSTRACT

The following literature review was intended to review current research studies related to diagnostic evaluation using Telehealth for young children aged 0-7 seeking a diagnosis of autism spectrum disorder (ASD). The analyzed research created a comprehensive guide on the quality, quantity, and state of Telehealth research for ASD evaluation will result. Through the synthesis of available literature, the strengths, and weaknesses of different models of Telehealth ASD evaluation were assessed. The results of this literature review found that there is evidence to support Telehealth's use in some aspects of evaluation, but not as a stand-alone methodology. Further research is required to show that Telehealth methods of evaluation withhold the same reliability, quality, and validity as traditional ASD evaluation methods.

Keywords: Autism, early childhood, Telehealth, evaluation, early intervention, young children

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Acronyms

1. ASD: Autism Spectrum Disorder
2. ADHD: Attention Deficit Hyperactivity Disorder
3. HIPAA: Health Insurance Portability and Accountability Act
4. COVID-19: Coronavirus Disease of 2019
5. DSM-5: The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
6. ADOS-2: Autism Diagnostic Observation Schedule, Second Edition
7. CASP: Critical Assessment Skills Programme
8. NODA: Naturalistic Observation Diagnostic Assessment
9. TAP: Tele-ASD-Peds
10. ADEC-V: Autism Detection in Early Childhood-Virtual
11. TEDI: Telehealth Assessment of Social Communication
12. AOSI: Autism Observation Scale for Infants
13. BOSA: Brief Observation of Symptoms of Autism
14. ADI-R: Autism Diagnostic Interview Revised
15. MSEL: Mullen Scales of Early Learning
16. VABS-III: Vineland Adaptive Behavior Scales Third Edition
17. SORF: Systematic Observation of Red Flags of ASD
18. M-CHAT: Modified Checklist for Autism in Toddlers
19. CARS-2: Childhood Autism Rating Scale Second Edition

INTRODUCTION

In 2020, the Coronavirus pandemic (Covid-19) posed new challenges for families with young children seeking an autism spectrum disorder (ASD) evaluation. Clinicians were faced with public safety concerns when asked to conduct traditional in-person assessments to diagnose ASD. With this challenge in hand, researchers were tasked with developing procedures to evaluate children for ASD using virtual methods that compared to the gold standard traditional process. The purpose of this thesis is to evaluate literature that supports and challenges the feasibility, reliability, and integration of telehealth in the autism spectrum disorder (ASD) diagnosis process for young children ages 0-7. The existing information from the studies included in the literature review will be synthesized and assessed for quality. Through analysis of the research on the subject matter, data will be collected to determine the quality and scope of health professionals' research on the current state of autism spectrum disorder evaluation conducted via Telehealth for young children.

The purpose of this thesis is to summarize and analyze the scope of what current research has suggested regarding the use of Telehealth to diagnose ASD for young children. Through synthesis of the limited amount of literature, the feasibility, reliability, and integration of telehealth in the ASD diagnosis process for young children ages 0-7 will be considered from a post-global pandemic perspective. The information from the studies within the literature review will be synthesized and assessed for quality. The information collected from each piece of analyzed literature will allow for a more in-depth review of the strengths, limitations, and quality of the current research on the subject. By including both qualitative and quantitative data from clinicians and caregivers, professionals reading the completed literature review will gain

background knowledge essential for understanding and furthering research within the realm of study.

Statement of Problem

Because the concept of Telehealth evaluation of ASD has recently emerged in development, there are a myriad of techniques clinicians have been implementing in order to establish a standardized procedure. The development of the new evaluation administration method was incited by a global health crisis, making research on the subject more difficult to conduct. As of 2024, there are several methods of Telehealth administration that have been implemented for diagnostic evaluation that have resulted in ASD diagnosis. However, the lack of a large body of high-quality supporting evidence has made it difficult for professionals to advocate for the use of Telehealth in diagnostic procedures (Meimei & Zenghui, 2022). in clinical settings. Full diagnostic assessment for ASD via Telehealth presents potential barriers to clinicians in comparison to traditional methods due to the nature of the method. The lack of standardized procedures is a large aspect of the current resistance to implementing Telehealth into the diagnostic process for ASD (Meimei & Zenghui, 2022).

BACKGROUND INFORMATION

Telehealth

Telehealth (sometimes referred as Telemedicine) is the practice of receiving services from medical professionals without in person face-to-face interaction between the patient and the health service provider (Health Resources and Services Administration [HRSA], 2022). Both the patient and healthcare provider must have internet access and a device such as a laptop,

smartphone, or tablet with a webcam to participate in the virtual appointment (HRSA, 2022). Telehealth communication may also be performed via phone-call or text messages between the patient and health service provider at the provider's discretion (HRSA, 2022). The most common uses for Telehealth include monitoring, diagnosis, patient education, administration of medical advice, counseling, and intervention (Gogia, 2020). Telehealth benefits the patient by eliminating travel time to clinician's offices, shortened wait times to obtain appointments, and virtual access to specialists otherwise inaccessible to the patient (HRSA, 2022).

Although Telehealth has seen an exponential increase in use within the 21st century, the first account of a Telehealth procedure being performed dates to 1879 (Gogia, 2020). *The Lancet,* a medical journal established in 1823, described the first documented account of a medical professional providing diagnosis of illness and care plan via phone call (Gogia, 2020). Further development of the concept of Telehealth was seen in the 1920's, when clinicians developed a way for a two-way television system to facilitate medical instruction (Gogia, 2020). Almost 40 years later in 1959, the first real-time telemedicine appointment was conducted by the University of Nebraska using interactive television (Gogia, 2020). Since these events, telehealth has only continued to gain public interest with the introduction and integration of the internet into modern day society. In early 2020, the sudden impact of the quarantine imposed by the Coronavirus (Covid-19) pandemic was the unfortunate catalyst to expanding Telehealth's usage amongst all medical professionals. To minimize the risk of spreading Coronavirus, professionals worldwide made a quick shift to Telehealth. The fast-paced change made both benefits and barriers of Telehealth visible to health care providers, patients, and others receiving health services (Bryne, 2020). Insurance covering virtual visits, cybersecurity, and ethics concerning

the Health Insurance Portability and Accountability Act (HIPAA), were all issues that required attention to maintain the quality of services being provided to patients worldwide (Bryne, 2020).

Ethics & Telehealth

The sudden integration of Telehealth usage into providers' practice due to Covid-19 created ethical concerns among healthcare professionals and patients alike. Prior to the pandemic, "44 states had over 200 telehealth-related pieces of legislation, many of which addressed remuneration, with no two states having concurrence" (Mars, 2020, p. 297). These laws included reinforcement of HIPAA's role in Telehealth confidentiality procedures, among other ethical considerations related to cybersecurity of patients, and clinician-patient relationships (Mars, 2020).

Telehealth & Diagnosing Other Developmental Disabilities

ASD, ADHD, intellectual disability, communication disorders, specific learning disorder, motor disorders, stereotypical movement disorder, and tic disorder are all conditions that qualify as a developmental disability in the DSM-5 (Valentine et al., 2021). In a systematic review conducted by Valentine et al., (2021) clinicians reported that overall, Telehealth was viewed as a favorable method for facilitating both diagnosis and treatment of conditions such as ADHD and other developmental disorders by 85% of clinicians (Valentine et al., 2021). Despite these findings, tools developed for ADHD virtual diagnostic use were determined to be clinically unreliable and require further development (Valentine et al., 2021). Development of virtual assessments for other developmental disorders at the time of Valentine et al. (2021) were not found within the study.

Autism Spectrum Disorder

According to the DSM-5, ASD is characterized by deficits in social communication and interaction in multiple contexts and repetitive or restrictive routines, interests, behavioral patterns, or activities (American Psychiatric Association [APA], 2013). For one to be diagnosed with autism spectrum disorder, symptoms must be prevalent from early childhood and cause noticeable impairment in an occupational, educational, or social setting (APA, 2013). Autism Spectrum Disorder (ASD) is often further specified using a level system to identify severity. Level 1 severity indicates support is needed, level 2 severity indicates that substantial support is needed, and level 3 severity indicates that very substantial support is needed (APA, 2013).

The causes of autism spectrum disorder are often attributed to a combination of environmental and genetic factors (APA, 2013). There is no cause of ASD that is universal amongst all autistic people. Environmental factors that may contribute to the diagnosis of ASD include "advanced parental age, low birth weight, or fetal exposure to valproate." (APA, 2013, p.56). Genetic and physiological factors that may contribute to the prevalence of ASD are heritability and genetic mutation (APA, 2013). According to the DSM-5 "Heritability estimates for autism spectrum disorder have ranged from 37% to higher than 90%, based on twin concordance rates." (APA, 2013, p.57). Additionally, the DSM-5 states that 15% of diagnoses can be attributed to "a known genetic mutation, with different de novo copy number variants or de novo mutations in specific genes associated with the disorder in different families." (APA, 2013, p.57). Despite these two findings, the causes of ASD have yet to be found, and differ between each individual diagnosed.

In 1943, Leo Kanner published seminal literature on autism, recognizing it as a neurodevelopmental disorder (Wolff, 2004). Kanner stressed the prevalence of symptoms from

birth including, “abnormal speech with echolalia, pronominal reversal, literalness and inability to use language for communication; and monotonous, repetitive behaviors with an anxiously obsessive desire for the maintenance of sameness” (Wolff, 2004, p. 202). Despite Kanner’s original definition being narrow and identifying autistic symptoms as rare, it provided a basis for decades of research to come (Wolff, 2004).

As time passed, researchers such as Rutter and Kolvin conducted research that widened the criteria of what symptoms and behavioral patterns could be used to identify autistic symptoms in the 1970’s and 1980’s (Wolff, 2004). These strides in research helped develop the notion of autism being recognized as a spectrum, differing within everyone that is diagnosed. Additionally, the United States introduced the Developmental Disability Act of 1975 within this period (Wolff, 2004). This act increased the general population's awareness of developmental disabilities and advocated for financial support and accessible education for these identified individuals (Wolff, 2004).

Over time, several assumptions about the root causes of autistic symptoms have been disproven. Poor parenting, relation to schizophrenia, associations with being secondary symptoms to unspecified receptive language disorders, and rumors of MMR vaccination causing autism have been scientifically disproven (Wolff, 2004). These notions, although false, were all instrumental in the research process that has brought us to where health care professionals, educators, and the general public stand today in their understanding and knowledge of ASD (Wolff, 2004).

Although once thought of as a rare condition, the prevalence of diagnosis of autism spectrum disorder in young children has exponentially increased within the past two decades alone. According to a study conducted by Maenner et. al. and recognized by the Center for

Disease Control, "ASD prevalence estimates of children aged 8 years from the ADDM Network have increased markedly, from 6.7 (one in 150) per 1,000 in 2000 to 23.0 (one in 44) in 2018 (3,12)" (Maenner et. al., 2020). In a study by DeVilbiss and Lee (2014), the increased use of the internet over the past four decades proves to be a contributing factor to public awareness and acceptance of ASD. After the month of April was declared Autism Awareness month in 1970, there has been a steady increase in internet searches relating to autism in April annually, peaking in 2008 (DeVilbiss & Lee, 2014). As of 2024, Autism Awareness month is more commonly referred to as Autism Acceptance Month.

Early Identification and Intervention of Autism Spectrum Disorder

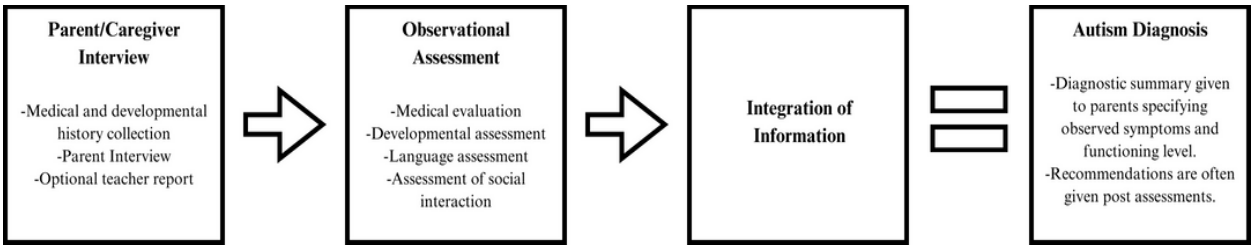
Because of the developmental nature of ASD, diagnosis and intervention at a young age is essential for the success of both children and families who are affected. Prior research reported that children's age at the start of intervention showed significant relation to the cognitive gains achieved in response to intervention (Ben Itzchak & Zachor, 2011). This could be linked to the plasticity that the brain has within the critical period of development (Ben Itzchak & Zachor, 2011). A later diagnosis due to any of the limitations above tend to cause later introduction of intervention for children with ASD.

Diagnosing Autism

As of the 1990's and early 2000's, efforts to standardize the process for diagnosing ASD and children became more important than ever. Professionals began to emphasize a multidisciplinary or team-based approach to diagnosis, incorporating a combination of parents, educators, developmental pediatricians, developmental neuropsychologists, and speech-language pathologists (Huerta & Lord, 2012). Age, comorbidities of other disabilities and conditions, and cognitive functioning, are all factors that can be challenges presented throughout the diagnostic

process. (Huerta & Lord, 2012). The diagnostic process can be broken down into several components, typically consisting of parent/caregiver interview, observational assessment, integration of information, and diagnosis (Figure 1) (Huerta & Lord, 2012). According to Talbott et al. (2022) Traditional face-to-face assessments may take a full day or longer to conduct.

Figure 1



Flow chart of the steps in the Face-to-face evaluation process based on a flow chart by Huerta & Lord (2012).

Parent-Based Interviews and Screeners

Parent based interviews and screeners are an integral portion of the diagnostic process of autism spectrum disorder for young children (Huerta & Lord, 2012). These assessments are purposefully conducted for clinicians to gain a developmental history, familial medical history, and current report of abilities regarding the child being assessed (Huerta & Lord, 2012). See *Appendix A* for a list of commonly used parent-based interviews and screeners within the diagnostic process of ASD for young children.

Language Assessments

Language assessments are often used to assess social communicative deficits presented within children suspected of having ASD (Huerta & Lord, 2012). A speech-language pathologist may be asked to assess a young child presenting with symptoms of ASD as an attempt to

complete a multidisciplinary approach to diagnosis. See *Appendix B* for a list of commonly used language assessments typically used within the diagnostic process of ASD for young children.

Developmental Assessments

Developmental assessments are used within the realm of diagnosis of ASD, specifically within young children. Developmental assessments may be conducted by educators, school intervention specialists, or developmental pediatricians to identify delays within young children in comparison to typically developing peers. Results of developmental assessments can be shared with evaluators and used as a means for referral for further testing. See *Appendix C* for a list of commonly used developmental assessments typically used within the diagnostic process of ASD for young children.

Rating Scales

Rating Scales are often used to identify whether children present with typical behaviors and symptoms associated with ASD. Rating scales are completed by primary caregivers and others who know the child well and are typically used to systematize, categorize, and quantify (scale) observations found within empirical observation and strengthen the validity of these findings. See *Appendix D* for a list of commonly used rating scales typically used within the diagnostic process of ASD for young children.

Behavioral Assessments

Behavioral assessments are typically conducted during the observational assessment of young children to indicate if they present with symptoms commonly associated with ASD. These assessments may take place in clinical observational settings with prompts from clinicians, classroom settings, or at the child's home (Huerta & Lord, 2012). The data collected in behavioral assessments are used to reinforce the findings within standardized assessments and

identify areas a child may need intervention within. See Appendix E for a list of commonly used Behavioral assessments typically used within the diagnostic process of ASD for young children.

ADOS-2

The Autism Diagnostic Observation Schedule- Second Edition (ADOS-2) is often referred to as the gold standard for clinicians in regard to diagnosis of ASD (Falkmer et al., 2013). Through its semi-structured nature, this assessment helps clinicians code and analyze communication, social interaction, play, and behaviors associated with ASD (Lord & Rutter, 2012). The ADOS-2 can be administered at the age of one and used throughout adulthood because of its separation into modules based on age and language level (Lord & Rutter, 2012). Only one module is required for each participant to complete, taking about 40-60 minutes for the administrator to complete using the ADOS-2 scoring book and manual and the toys within the ADOS-2 administration kit (Lord & Rutter, 2012). The completion of the ADOS-2 can be used to support the diagnosis of ASD, identify areas where intervention may be necessary, and assist children in receiving accommodations necessary for educational success (Lord & Rutter, 2012).

Current Limitations of Face-to-Face Diagnostic Evaluations

The rapid increase in rates of diagnosis indicates the current demand for assessment of autism spectrum disorder globally (Meimei & Zenghui, 2022). Due to lack of professionals with adequate training to diagnose ASD, this has caused added stress on existing professionals to service the increased demand for the already time-intensive assessment and provide valid and reliable results (Meimei & Zenghui, 2022). The demand results in children and families being placed on long waitlists to be assessed for ASD. This delays the child's access to therapies, intervention, and educational assistance as well.

The same lack of professionals equipped with the correct tools to diagnose autism spectrum disorder is even more detrimental to families living in rural or low-income areas. (Panos et al., 2023). Families seeking diagnosis within these areas are subject to travel long distances for face-to-face evaluations in order to receive diagnosis and later support for their children (Panos et al., 2023). Travel costs may include but are not limited to transportation, living accommodations and meals while traveling on top of the fees associated with obtaining the diagnosis in these situations. Families in rural, low-income areas may also struggle with obtaining funds to fulfill both the diagnostic assessment and these added fees (Panos et al., 2023).

` Language barriers must also be considered when evaluating the limitations of Face-to-face diagnostic evaluations. The lack of providers that contribute to long waitlists for families is increased when adding the factor of parents who communicate in a language other than English. Although many face-to-face assessments have been translated into different languages, there is a lack of bilingual providers that can keep up with the demand for families of differing lingual backgrounds. In a study conducted by Liptak (2008), Hispanic children are within the group least likely to be diagnosed with ASD in comparison to members of other ethnic groups (Dallman et al., 2020).

Even with insurance, lower-income families tend to lack adequate financial resources to seek developmental consultations prior to starting school (Dallman et al., 2020). Despite studies showing that in 2008, about 98% of children in the United States had access to health insurance, low-income families are still at a disadvantage (Dallman et al., 2020). Due to this factor alone, a child's socio-economic status may contribute to the delay of identification of symptoms of ASD (Dallman et al., 2020).

When observing children with ASD in a new setting, such as a clinician's office, there is a chance that the new environment or unfamiliar medical professional may impact the child's performance on assessments. (Hodge et al., 2023) Observation of a child in a natural setting such as one's home or the classroom may be a better setting for behavioral observation (Hodge et al., 2023). Although empirical data may be more accurate in naturalistic settings, completing these observations in a naturalistic environment for each assessment may further extend the evaluation process.

Autism Spectrum Disorder Diagnosis & Coronavirus

The fast-paced switch to providing services via Telehealth left health professionals questioning what direction to proceed in when approaching diagnostic evaluation of ASD during the Coronavirus pandemic. Because the world was focused on survival during this time period, face-to-face diagnostic assessment was put at a halt for the foreseeable future. As a result, the diagnostic process was further delayed for many children and families while clinicians attempted to develop a plan of action (Posar et al., 2021). Due to lack of research on developing a standardized procedure amongst professionals, the search for reliable tools for Telehealth diagnosis commenced (Posar et al., 2021).

Once face-to-face doctors' visits began to be integrated back into society, clinician and patient safety was put at risk when considering the impact that facial coverings may have on the results of empirical observation, and patient-clinician interactions (Posar et al., 2021). Presence of facial masks on clinicians were determined to increase the possibility of false-positive diagnosis. (Posar et al., 2021). Additionally, children with sensory processing issues also showed difficulty keeping masks on their faces during the facial covering mandates (Posar et al., 2021).

These limitations further reinforced the need for a standardized method of Telehealth diagnostic procedure to be developed to help further assist children during this time of crisis.

THE CURRENT STUDY

The purpose of the conducted literature review was to provide a summary and analysis the scope of what current research has suggested regarding the use of Telehealth to diagnose ASD for young children. The following research questions were addressed:

Research Question 1: What are the current methods of Telehealth diagnostic evaluations?

Research Question 2: What forms of Telehealth diagnostic evaluations existed prior to Covid-19, and how were they conducted?

Research Question 3: What is the quality of research on the use of Telehealth in the ASD diagnostic evaluation process?

Research Question 4: What are the advantages and disadvantages of diagnosis of ASD via Telehealth?

Research Question 4a. Are there specific limitations stated in research results that are related to Telehealth administration solely due to the age of young children?

METHODS

Hypothesis

It is hypothesized that research to date (January 31st, 2024) will support some components of the diagnostic process of ASD via Telehealth but fail to demonstrate support for Telehealth as a stand-alone data collection method in the evaluation process. Potential limitations

are hypothesized to be a lack of trial on a large number of participants from varying backgrounds to fully determine whether the Telehealth ASD diagnostic evaluations is a plausible, reliable, and feasible method. Lack of available data characteristics, small data pools, and unequal distribution of race, social status, and gender within the data pool is also hypothesized to be an overarching limitation of the current scope of literature available.

Procedures

Identifying Sources

The databases that were used to conduct review of studies on telehealth ASD diagnostic testing are the EBSCO, ProQuest, Wiley Online Library, Sage Research Methods, Google Scholar, and Sage Journals. Sources were limited to peer-reviewed, open-access articles. "autism", "ASD", "autism spectrum disorder", "Telehealth", "Telemedicine", "virtual", "toddler" "early childhood", "evaluation", "diagnostic" and "diagnosis" were the primary descriptors used to identify sources for the literature review within databases.

Rationale for Selecting Sources

Once the identification of research in a database was completed, all source materials that did not focus on children aged 0-7 were excluded from the literature review. Additional sources were excluded if they focused on interventions, familial support groups, and therapy administered via Telehealth. Sources in languages other than English that had not been professionally translated were also eliminated.

Procedures for Analyzing Sources

Following the elimination of research unrelated to the topic of study and duplicated articles, the PRISMA diagram was used to summarize the screening process. Following this step,

notes were taken summarizing each article with citations in order to make selecting the articles used within the thesis a fluid process.

Once sources were chosen, the final procedure was to conduct a quality assessment. Using the Critical Appraisal Skills Programme (CASP) Diagnostic Study Checklist, the articles were given a score out of twelve (one point per checklist box marked indicating the research was of quality). The CASP checklist allows researchers to be able to critically assess research articles for relevance, trustworthiness, and quality in an organized fashion (Critical Appraisal Skills Programme, 2015). The scores of each included study are summarized within the results of the literature review and fully included in Appendix F.

Criterion for Integration in Thesis

When selected literature for use within the thesis several factors contribute to whether the text will be of viable importance for the intended audience. With professionals in mind, articles selected for incorporation and citation within the thesis must be credible, from other established professionals. Additionally, text must be current, within the past ten years. Due to this thesis' indication of Covid-19 as a catalyst for the implication of Telehealth's surge into the ASD diagnostic process, it is likely that most sources will be from 2020, 2021, 2022, or 2023 with few exceptions.

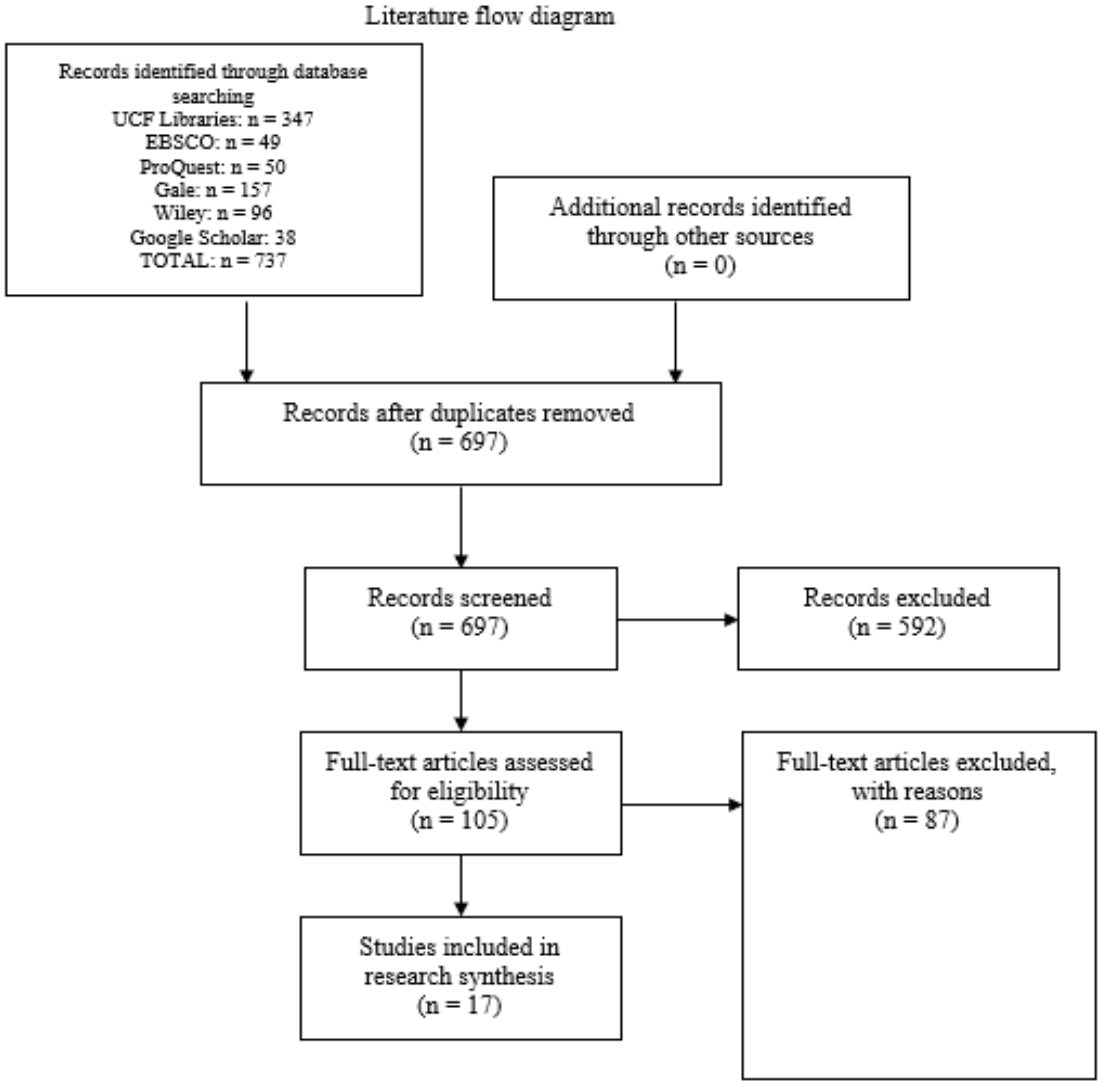
RESULTS

There were eighteen articles from 697 unique search results from various databases identified that fit the sufficient criteria for inclusion in the literature review. Below is the PRISMA diagram that organizes the screening process for identifying articles that could be used for inclusion in the literature review. Many articles were excluded due to their lack of focus

toward the evaluation of young children. Other reasons that studies may have been excluded are lack of focus on diagnosis, lack of inclusion of participant data, and lack of text availability in English.

Table 1.1

PRISMA Diagram



Research Question One

Summary of Evaluations Created for Telehealth

Of the articles synthesized for this literature review (n=17) The methods that have been researched by professionals can be categorized into two main methods: Store-and-forward and real time video conferencing. The following information summarizes each assessment that has been recently developed to assist the understanding of the research completed before and after the global pandemic.

Store & Forward Method

Store-and-forward methods of data collection do not require the family and health care provider to be virtually available at the same time for data to be collected and assessed (Lui & Ma, 2022). Of the articles included 24% (n=4) used store-and-forward methodology to collect data used to diagnose young children with ASD.

The Naturalistic Observation Diagnostic Assessment (NODA) is a method of diagnostic assessment that includes collection of data from caregivers via downloading of the application on a smart device (Nazneen et. al., 2017). Through the direction of the NODA, caregivers record three different scenarios when prompted (Nazneen et. al., 2017). These scenarios included the child at mealtime with family, playing with others, and playing alone (Nazneen et. al., 2017). Lastly, the caregivers are instructed to create a video of themselves stating their own concerns and submit each video within the app for professional assessment (Nazneen et. al., 2017). The NODA was developed as a tool to assist diagnosis digitally, not as a replacement for in-person evaluation.

The TELE-NIDA is a novel store-and-forward method of data collection developed to capture videos of toddlers suspected to have ASD in their natural environments (Riva et. al.,

2023). The assessment provides prompts for guides parent and caregivers s to capture four videos that are five minutes in length of the toddler participating in everyday activities (Riva et. al., 2023). These videos can be assessed by professionals to identify key behaviors associated with children that have ASD (Riva et. al., 2023).

Real Time Video Conferencing

Real-time video conferencing is a method of Telehealth evaluation that requires virtual participation from the patient and clinician. The clinician and caregiver are both required to use smart devices with cameras (laptop with webcam, tablet, smartphone) to participate in a video call that allows clinicians to collect observational data. Clinicians coach the parents and caregivers of through a series of prompts that help identify social delays typically seen in autistic children. Below are summaries of the main assessments developed specifically for video-conferencing evaluations.

The TELE-ASD-PEEDS (TAP) is an evaluation tool developed in the midst of the Covid-19 pandemic to facilitate parent-mediated assessment for ASD with children under 36 months (about 3 years) of age (Corona et. al., 2020). Using a video conferencing platform, like Zoom, parents and caregivers are coached in real-time to prompt eight different activities that can be used to identify traits of ASD within their child (Corona et. al., 2020). The TAP uses toys found within the child's home environment and reduces assessment time to about 15-20 minutes (Corona et. al., 2020).

The ADEC-V is a virtual adaptation of the Autism Detection in Early Childhood test (Young, 2007). It is a 16-question behavioral screener for children under the age of three (Kryszak, 2022). The test was modified to be able to be conducted with toys found in the child's

home (Kryszak, 2022). There is a validated scoring system used to evaluate the data collected from the ADEC-V and it can typically be conducted in 10-15 minutes (Kryszak, 2022).

The Telehealth Assessment of Social Communication (TEDI) is a method of virtual data collection used to support the diagnosis of ASD in children under 24 months (about 2 years) of age (Talbott, 2020). The TEDI allows evaluators to observe ten different parent-child interactions ("scenes") through a video conferencing platform (Talbott, 2020) The TEDI also includes a set of cue cards similar to that of Adamson and Bakeman's (2016) parent–child Communication Play Protocol (Talbott, 2020).

The Autism Observation Scale for Infants (AOSI) (Bryson et. al., 2008) was a tool initially created for in person observation of traits found within infants (6-18 months) that are later diagnosed with ASD. (Talbott, 2023) Later adapted for Telehealth, AOSI has 19 different tasks that are conducted by a child's caregiver (Talbott, 2023). The evaluator observes the caregiver and child via Telehealth and coaches the parent on various tasks throughout the evaluation (Talbott, 2023).

The Brief Observation of Symptoms of Autism (BOSA) is a virtual method of ASD diagnostic assessment heavily influenced by the ADOS-2 (Dow, 2021). The BOSA has two sections that could be used to cater to young children (Dow, 2021). The BOSA-MV is for children who are non-verbal or minimally verbal and the BOSA-PSYF is for children under the age of 8 with more flexible speech (Dow, 2021). The BOSA requires specific toys and tools similar to the ADOS-2 diagnostic assessment (Dow, 2021). These tools can be mailed to families prior to the diagnostic assessment date in order for them to be able to conduct the assessment remotely (Dow, 2021). Additionally, a caregiver interview is conducted by the evaluator to

collect concerns, developmental history, and other important data that may influence diagnosis results (Dow, 2021).

Research Question Two

Studies Conducted Pre-2019

Before the Covid-19 pandemic, little research had been conducted regarding Telehealth and evaluation for diagnosis of ASD using virtual methods. Of the studies included in this literature review 23% (n=4) articles were written before this global health crisis. These studies use store-and forward methods and videoconferencing methods to adapt standardized evaluations typically used in face-to-face settings for a virtual platform. Below are summaries of the word conducted by Nanzeen (2015, 2017), Reese (2015), and Juarez (2018).

Nanzeen et. al. (2015, 2017) developed some of the first research in regard to the diagnosis of ASD in young children via store-and-forward methods. The participant metrics are sparse in both studies and ranked lower in quality on the CASP quality assessment in comparison to other research from this time period. (See Table 1.1) In 2015, the results found that novel use of the NODA method of data collection provides reliable metrics in 91% of patients (Nanzeen et, at 2015). In 2017, the results found that after evaluation of kappa coefficients, there was a 85%-90% agreement between in-person and NODA evaluators (Nanzeen et, at 2017).

Reese et. al. (2015) conducted some of the first research regarding the diagnosis of ASD in young children via real-time video conferencing. The research teams consisted of four evaluators for each child. An in-person and virtual assessment was conducted for each child to compare results from each method of assessment (Reese et. al., 2015). Each evaluation in this study consisted of a 20-minute observation of play, coaching from evaluator/caregiver for modified ADOS-2 activities, Autism Diagnostic Interview (ADI-R), collection of patient and

family medical history, feedback session, and post-survey for parent evaluators (Reese et. al., 2015). The results found that there was an 86% accuracy, 88% specificity, and 83% sensitivity for diagnosis via video conferencing (Reese et. al., 2015). Parent fidelity was 91% when assisting in the administration of the evaluation (Reese et. al., 2015).

Juarez et. al. (2018) conducted research in regard to real-time evaluation via video conferencing as well. Juarez and team administered the Screening tool for Autism in Toddlers and Young Children (STAT) via a video conferencing platform (Juarez et. al., 2018). Afterwards, each child participated in an in-person evaluation consisting of MSEL, VABS-II, ADOS-2, and DSM-5 clinical interview (Juarez et. al., 2018). The results were then compared on an individual and participant-wide level and found that in 86.67% of cases, clinicians had adequate confidence intervals in the diagnosis of children virtually, using the STAT (Juarez et. al., 2018).

Studies Conducted After 2019

During and after the peak of the Covid-19 pandemic, research began to expand due to the need for individuals and families to stay socially distant. During this period, researchers began to expand on the pre-existing research by Nazneen, Juarez, and Reese to further develop methodology for ASD Telehealth evaluations. Of the studies included in this literature review about 76% (n=13) articles were written after 2019. These studies also used store-and forward methods and videoconferencing methods to adapt standardized evaluations typically used in face-to-face settings for a virtual platform. Below are summaries of the work conducted by the research times of Talbott (2020, 2022, 2023), Corona & Wagner (2021-2023), Dow (2020), Kryszak (2022), Holtman (2022), Riva (2023), Stavropoulos (2022), Reisinger (2022) and Sutherland (2023).

Talbott and her team of researchers have participated in several different research projects during and the height of the Coronavirus pandemic. Her focus of research was on the virtual identification of ASD symptoms in infants. Talbott et. al. (2020, 2023) validated parent coaching methods through methods like TEDI and AOSI over several years. In 2020, the results found that 90% of participants met codability qualifications. Participants that did not meet these qualifications (n=2) were excluded due to video errors (Talbott et al., 2020). In 2022, Talbott found that on average caregivers received an 82% score on an assessment fidelity checklist after assisting the administration on the AOSI via Telehealth (Talbott et al., 2022). In 2023, the study found that on average caregivers received an 82% score on an assessment fidelity checklist after assisting the administration on the AOSI via Telehealth. =

Corona et. al. created the TELE-ASD-PEDS in 2020 in response to the halt of in person evaluations due to nation-wide quarantine procedures. Of the articles included in this literature review 41% (n=7) primarily used TAP as the primary method of assessment. In 2021, Corona & Wagner found that 89% of evaluations were completed with adequate clinician confidence intervals (Corona & Wagner et. al, 2021). In 2023, the results found that in 14% of cases, there was uncertainty of diagnosis between evaluators. 15% of all families had technology barriers that affected their experience with the TAP (Corona & Wagner et. al, 2023). Holtman (2022), Stavropoulos (2022), Reisinger (2022), and Sutherland (2023) all have provided additional research validating the TAP's feasibility, reliability, and validity for ASD diagnosis in young children.

Dow et. al. (2020) provided research supporting the Brief Observation of Symptoms of Autism (BOSA)'s use for supporting the ASD diagnosis of children virtually (Dow et. al., 2020). Dow and her team developed a system to code the BOSA data in comparison with the ADOS-2

scoring system (Dow et. al., 2020). The main goal of the study was to examine the psychometric properties of the BOSA through evaluation and identify any limitations within the current administration methods (Dow et. al., 2020). The results found that in the Toddler module of the BOSA, there was a 74% correlation between BOSA and ADOS-2 scores for each child. Results of this study were divided into module groups to separate data between age groups of the BOSA (Dow et. al., 2020).

Kryszak et. al. (2022) studied the virtual implications of the Autism Detection in Early Childhood assessment for young children specifically in hospital settings (Kryszak et. al., 2022). The creator of the ADEC, Robyn Young, collaborated with Kryszak to modify the test for virtual settings (Kryszak et. al., 2022). Then, Kryszak and her team evaluated patients to validate the ADEC-V's use in clinical settings with acceptable results (Kryszak et. al., 2022). The results found that ADEC-V scores has a strong correlation with scores from the CARS-2 ($r = 0.70$, $p < 0.001$) and slightly correlated with scores from the ADI-R scores ($r = 0.26$, $p < 0.01$) (Kryszak et. al., 2022).

Riva et. al. (2023) developed a novel tool known as the TeleNIDA to be another store-and-forward method of assessment for young children seeking an ASD diagnosis in Italy (Riva et. al. 2023). The TeleNIDA was based primarily off of the Systematic Observation of Red Flags of ASD (SORF) (Riva et. al. 2023). Through parent coaching, Riva and her team developed an assessment method that collects five-minute videos in a child's home environment (Riva et. al. 2023). The results revealed that the TELE-NIDA had a 78% correlation with ADOS-2 scores for all its participants.

Morrier et. al. (2023) reinforced the pre-existing data supporting the NODA's use in supporting the diagnosis of ASD in young children (Morrier et. al. 2023). Morrier and team

validated previous research by collecting data through the established store-and-forward method and comparing the data to an in-person assessment completed afterwards (Morrier et. al. 2023). The in-person assessment consisted of the MSEL, ADOS-2, Toddler ADI-R, M-CHAT-R/F, CARS-2, and a DSM-5 checklist (Morrier et. al. 2023). The results found that the NODA and in-person assessment results agreed 93.9% of the time (Morrier et. al. 2023).

Research Question Three

Assessment Summary

Using the Critical Appraisal Skills Programme to analyze the quality of studies included in this literature review provided analysis of the results, relevance, and overall reliability of each data source. By recording the results of each article's response to the diagnostic study checklist, the overall quality of each article can easily be assessed and compared for researchers' knowledge. The median & mode score of all CASP assessments was 10/12. In Appendix E and F, the full CASP checklist can be viewed. Below (Table 2.1) provides a quick summary of the CASP results for each individual study included in this review.

Research indicates that there was a difference between the quality and quantity of studies for this age group before the coronavirus pandemic and during/after the pandemic. Articles published prior to 2019 (n=4), had an average of ~80% of marked positive quality indicators on the CASP checklist. Articles published after 2019 (n=13) had an average of ~86% of marked positive quality indicators on the CASP checklist. Store-and-forward and real time videoconferencing were found to be the current methods of data collection that have been studied for use in Telehealth assessments. Studies based on store-and-forward assessment administration (n=4) had an average of ~86% of marked positive quality indicators on the CASP checklist.

Studies based on video conferencing assessment administration (n=13) had an average of ~84% of marked positive quality indicators on the CASP checklist.

Consistently across all studies analyzed, the participants mainly consisted of white, male children. Studies that collected data on the caregiver (n=5) scored higher on the CASP assessment than studies that did not display said information (n=12). Some studies (n=3) relied on post surveys from both clinicians and caregivers to assess them as a primary method of evaluating the quality and feasibility of the Telehealth assessments performed.

The results of the quality assessment indicate that the quality of research before and after the coronavirus pandemic are not statistically significant. While the assessment was conducted based on the The quality of available literature was often impacted by all outcomes important to the population not being considered. Race, gender, ethnicity, and socio-economic status were not equally represented within the current literature, which creates the risk of bias in the study. In other cases, the methodology and procedures of the study lacked in-depth explanations.

Table 2.1

Summary of CASP Checklist for Each Included Study

Study	CASP Score
Nanzeen (2015)	10/12 (~84%)
Reese (2015)	9/12 (75%)
Nanzeen (2017)	10/12 (~84%)
Juarez (2018)	9/12 (75%)
Talbott (2020)	9/12 (75%)
Dow (2021)	11/12 (~92%)
Corona & Wagner (2021)	10/12 (~84%)
Kryszak (2022)	10/12 (~84%)
Holtman (2022)	9/12 (75%)
Stavropoulos (2022)	9/12 (75%)
Reisinger (2022)	12/12 (100%)
Talbott (2022)	11/12 (~92%)
Sutherland (2023)	11/12 (~92%)
Riva (2023)	10/12 (~84%)
Morrier (2023)	11/12 (~92%)
Talbott (2023)	10/12 (~84%)
Corona & Wagner (2023)	10/12 (~84%)

The percentage is derived from the number of positive indicators of a quality assessment from the CASP checklist.

Research Question Four

Advantages of Telehealth Evaluations

The use of Telehealth has the potential to shorten waitlists for ASD evaluations. This is because the time spent completing evaluations is shortened through Telehealth procedures. Methods like the NODA and BOSA allow clinicians to observe children in various settings via pre-recorded video submissions. Access to remote evaluation also eliminates travel time for all families and clinicians, which can also contribute to shorter waitlists.

The traditional face-to-face administration length of the ADOS-2 takes 40-60 minutes per module (Lord & Rutter, 2012). The TELE-ASD-PEDS takes approximately 15-20 minutes to administer via Telehealth (Sutherland et al., 2023). Store-and-forward methods can be recorded and completed by caregivers on their own time, for durations up to five minutes. The lack of coinciding availability from the clinician, child, and caregiver in store-and-forward methods, save can also contribute to a lower overall assessment rate.

Telehealth diagnostic evaluations for ASD have the potential to eliminate expenses in several areas. Travel costs to clinicians during traditional in-person assessments can sometimes prove to be financially challenging for certain families. Remote assessments would reduce travel costs for families seeking an ASD diagnosis. Currently, the cost of an ADOS-2 Hand-scored Kit is $2,695 (WPS, n.d.). With evaluations like the TELE-ASD-PEDS, parents and caregivers use toys that they have at home, which could reduce the evaluation cost for both the clinician and the family if continued to be practiced.

Remote evaluations allow families in rural settings to have increased access to evaluators. In rural and low-income communities, there is a common lack of professionals trained to work with autistic children and administer "gold-standard" assessments (Franz et al.,

2017; Olusanya et al., 2018; Gallego et al., 2017, as cited in Katakis et al. 2023). Assuming the families in these rural areas have access to a device (computer with adequate web camera, smartphone, tablet, etc.) The normalization of Telehealth assessments in the diagnostic process has the potential to significantly benefit members of these communities by providing more time-efficient solutions.

Many studies reported that reduction of travel time was an advantage from a client perspective. In a study by Talbott et al., (2022), one parent stated that elimination of travel time was "ideal" for parents of children with sensory issues. Another parent from a study by Kellom et al. (2023) highlighted the timely advantage of Telehealth's absence of required travel. "I don't have to get everybody ready an hour before our appointment to leave, because I don't have to worry about parking or getting lost or getting stuck in traffic or my kids having a total meltdown in the car." (Kellom et al. 2023, p 54). These parent perspectives were common amongst data from qualitative post-assessment interviews with parents and caregivers.

Clinicians facilitating assessments via Telehealth have the advantage of observing children in natural settings. During a traditional in-person assessment children on the spectrum may be more sensitive to unfamiliar environments and develop clinic-based anxiety that could impact data collection. (Kerns et al., 2014, as cited in Katakis et al. 2023). Through Telehealth assessments, clinicians have the advantage of viewing children in their everyday environments. Store-and-forward methods of assessment like the NODA and BOSA eliminate the variable of the clinician's office or presence affecting the data collected during empirical observation and assessment.

The store-and-forward method provides clinicians with the opportunity to review observation scenarios multiple times. Because the videos of these assessments are able to be

viewed more than once, clinicians have the opportunity to carefully assess each video. In turn, there are more opportunities to identify red flags of ASD and obtain a more accurate assessment of behavior overall. From an ethical standpoint, recording a video conference-based Telehealth assessment such as the TELE-ASD-PEDS is more challenging. Informed consent would be necessary to obtain from the caregiver of the child being assessed. Data leaks and privacy concerns may arise that have the capability to risk patient confidentiality and violate HIPAA (Mars, 2020). As medical web-based technology advances, there has been a struggle between lawmakers and health professionals to determine what is moral. (Mars, 2020). Despite this, there is not a large disadvantage to not having access to video-recordings of assessments because that is standard in traditional in-person assessment.

Disadvantages of Telehealth Evaluations

In video-conference Telehealth evaluations specifically, there is the potential of assessment quality being impacted by caregiver-education, language spoken by the caregiver, and caregiver fidelity that have the potential to impact data. Of the articles that assessed parent fidelity in assessment administration (n=3), the fidelity levels were universally described as adequate. It is important to consider that the majority of studies eliminated potential for the caregiver's language to impact results because proficiency in English was an outlined participant requirement.

Additionally, some studies mentioned that parents reported administering an assessment to their own child was emotionally challenging. In a study by Talbott et al. (2022) caregivers were interviewed post administration of the TEDI assessment. One parent that was interviewed stated "Seeing my baby not react to some of the scenarios or asks of the clinician [was challenging]. That was hard to see as a parent, but it is the reality." (Talbott et. al, 2022, p. 5269)

This study highlighted that a parent's emotional state must also be considered when coaching caregivers and parents throughout the evaluation process.

While a natural setting may be advantageous to clinicians when obtaining data, the environment must be conducive to clinical evaluation. Home environments may have variables such as pets, and other children that produce excess noise can be disruptive to the clinician's evaluation process (Kellom et al., 2023). In a study by Wagner et al. (2022), 21/202 professionals experienced home environment-related disruption during their Telehealth session that impacted the adequacy of the evaluation. Some studies mentioned that the failure of the clinician's informing the caregiver of the ideal home environment before the session may have contributed to the disruptions experienced.

When interviewed, both caregivers and healthcare professionals expressed some dissatisfaction with the establishment of client-clinician rapport through Telehealth. In a study by Kellom et al. (2023), rapport via Telehealth was analyzed with both clinician and caregiver interview. Emotional engagement with clinicians was described to be "difficult" specifically when technological malfunctions arose (Kellom et al. 2023).

Incorporating technology into the diagnostic evaluation process for ASD diagnosis introduces the variable of evaluation being affected by technological malfunction. Because both the clinician and family are dependent on technology for the data collection process, there is an increased risk of technology affecting the quality of assessment. Challenges that may arise include but are not limited to calls dropping, wireless connections failing, and inconsistent video audios (Wagner et al, 2022). In a study designed to gather caregiver perspectives on the TELE-ASD-PEDS by Wagner et al. (2022), 87 of 202 clinicians reported experiencing technological malfunction during one or more sessions with a client while administering the assessment. While

the degree of malfunction or the malfunction's impact on the assessments were not mentioned, Wagner et al., 2022 provides evidence that technological malfunctions are a disadvantageous element of Telehealth assessment of ASD.

General Limitations

The current available research using young children to assess whether ASD technology-based evaluations are feasible has expanded and grown in terms of quality as time has progressed. Despite these findings, current literature devoted to the subject of Telehealth diagnostic evaluation of ASD is agreed to be limited amongst most researchers and health professionals. This is due to the increased need for Telehealth evaluations due to the Covid-19 pandemic. As is the case with many diagnostic processes, repeated detailed and specific research is required to show the validity of new methodology. Limitations within research are expected due to the recent demand for virtual medical appointments. However, it is important to identify limitations within literature to identify areas where further research may be required.

Because Telehealth's role in the ASD diagnostic evaluation process is new, literature has primarily consisted of researchers testing different methods of virtual evaluation of ASD. While testing different methods of administration is essential to the development of the new web-based "gold-standard", there has been a noticeable lack of standardization in evaluation procedures. Without this standardization, there is less room for research to evaluate the true validity, feasibility, and accuracy of Telehealth based assessments. Additionally, assessments developed specifically for the evaluation of infants, toddlers, and young children are even more limited.

The studies included in this literature review often lack diversity in participant gender, race, linguistic background, and cultural background. A study by Williams et al. (2023) brings attention to how there is a desperate need within the autism research community to standardize a

practice for diversity inclusion in the field. As of 2018, a systematic review of interventions for autistic individuals found that only 62.3% of studies in the review included data on the participant's racial identity (Davenport et al., 2018, as cited in Williams et al., 2023). Although diagnosis statistics have reached an almost equal distribution between white and non-white individuals, racially diverse Autistic individuals tend to be diagnosed later than white Autistic individuals (Montes and Halterman, 2011; Tek and Landa, 2012; Tincani et al., 2009, as cited in Kandeh, et al., 2020). With this statistic in mind, the rate of early intervention between white and non-white children must also be considered.

Additionally, unequal distribution in participants' gender were identified in included studies in this literature review. Some studies like Sutherland (2023) and Nanzeen (2017) did not have any female participants in their studies at all. As of 2011, ASD diagnosis is diagnosed four times less, and later in life in girls than in boys (Rivet & Matson, 2011, Begeer et al., 2012; as cited in Rabbitte et al., 2017). The unequal distribution of gender in the current literature supporting the use of Telehealth to diagnose ASD presents the risk of a tool used to diagnose characteristics of ASD in male populations exclusively.

Cultural consideration and diversity inclusion in autism research are essential to maintain an equal benefit from research in marginalized communities and most people diagnosed. When research fails to cater to marginalized communities, the risk of an unethical bias towards the majority increases. While research on Telehealth's use in the ASD diagnostic process is new, the bias towards white males in autism research continues to be a prevalent limitation within the field.

Many studies included in this literature review also fail to include important data from the parents and caregivers of the child being assessed. In early childhood settings, parent

involvement is a key aspect of a child's rate of success. Because parents are a key factor in the Telehealth evaluation process, factors like their education experience, linguistic background, cultural background, and socio-economic status become important for determining the demographic of people that Telehealth ASD assessments can benefit. Obtaining more information about a child's cultural and family background provides more insight to researchers on where disparities in their methods reside.

DISCUSSION

Overall, the information gathered from the research included in the literature review gave insight to the strengths and weaknesses of Telehealth as an evaluation tool. Strengths of the research to date include assessment of parent fidelity, comparison to gold-standard evaluations like ADOS-2, and collection qualitative data from clinician/caregiver feedback. Although each research study included measurement of results in differing ways, the advantage to this is a wide assortment of data that can be used to assess various aspects of the new evaluation process.

Despite the findings providing helpful insight, the research itself and this literature review both contain limitations that require attention to further understand the scope of the research. Additionally, further research is required to provide results that will improve the quality, standardization, reliability, and validity of ASD evaluations conducted via Telehealth. Through additional research, there may be an opportunity for additional information to be collected to support the common usage of Telehealth in the ASD diagnostic process for young children.

Limitations of This Study

The findings in this literature review synthesized important findings from recent research on the subject. The collection of data from seventeen different studies allows for a consolidated

opportunity to compare research on Telehealth evaluations to best support autistic individuals and their families. However, there were some limitations that may have impacted analysis of the current research available.

The focus of gathering research on young children resulted in the exclusion of some studies that provided diverse and high-quality research. While this remains true, diagnosis earlier in life provides the opportunity of early intervention that can significantly improve Autistic individuals' quality of life. There were several studies that were excluded from the literature review due to the age of the participants exceeding seven years of age. Because research on the subject of Telehealth ASD evaluation is so limited, the literature review dedicated to research on the subject for young children may have been more appropriate to conduct at a later date.

Due to the inclusion criteria requiring the research articles being in English, some articles that may have provided supplementary data were excluded from this review due to not having an English translation. As a result, most of the studies (n=15) synthesized results are from research teams in the United States. It is important to include literature from diverse topographical locations to avoid bias within the synthesis of data. When the majority of data is from a specific country, this may limit the number of perspectives obtained from clinicians and caregivers of diverse backgrounds or create unintentional bias.

The criteria for inclusion in the literature review was that research must be from a database with open-access articles and journals. This study did not receive any funding and some of the identified articles that may have supported the literature review were excluded due to access relying on monetary reimbursement. Due to the nature of the research conditions, this may have impacted the results of the study by eliminating research studies that may have qualified for inclusion. Because research on the subject is limited, inclusion of more studies

would have been able to further support or advocate against the integration of Telehealth in the diagnosis process of ASD for young children.

Additionally, the quality ratings of the included articles were not cross validated between researchers. Because of the independent nature of the research conducted, there was a lack of access to indiviudals familiar with the scope of the literature review. With lack of inter-raters, the possibility of bias or inaccurate results is a possibility. This should be taken into account when reviewing the results of the Critical Appraisal Scale Programme checklist.

Recommendations for Follow-up Research Studies

As seen with the beginning testing stages of the TELE-ASD-PEDS, repeated research of standardized assessments, procedures for test administration, and parent coaching protocols is the only way to statistically compare results to gold-standard, face-to-face testing methods. Repetition of these new assessments among a diverse testing population will allow more families and health professionals a chance to benefit from a well-rounded, virtual assessment process in the future.

To eliminate the possibility of research exclusively benefiting specific communities and neglecting to include equal data from members of marginalized communities, expansion of diversity within participants is essential. Within autism research, there is a proven unequal distribution between people of color and female participants in comparison with white male participants. It is especially important to emphasize the inclusion of diverse participants within studies surrounding Telehealth's role in ASD diagnosis to avoid creating a new "gold standard" that benefits some individuals more than others.

Within various scoping and systematic reviews about Telehealth's integration into the ASD diagnostic process, the notion of how Telehealth can support individuals in rural locations

is often used to support the practice. Despite this, most of the reviewed research fails to include what type of geographic location individuals reside in. Failure to include participants from rural communities contradicts professional's advocacy for the integration of Telehealth in ASD diagnostic procedures' ability to support these individuals.

Similarly, if the potential reduction of evaluation cost is a main point to support the use of Telehealth for diagnosis of ASD for low-income families, the studies must include more participants from lower-income communities. Access to quiet spaces conducive to Telehealth, presence of Wi-Fi with adequate speeds for video conferencing, and a family's access to compatible smart technology may be examples of possible limitations of the virtual evaluation method.

Due to parents and caregivers playing a vital role in children's lives, especially from an early childhood perspective, including more information on the parent plays a critical role in understanding data from research studies. Parents also play a bigger role in Telehealth ASD evaluations than traditional face to face methods. A parent's job, race, ethnicity, gender identity, income, marital status, location in the United States, education level, primary language spoken, emotional state of being, and number of other children are all factors that may all impact the quality and fidelity of a Telehealth assessment. By collecting detailed parent data in studies, there is a lesser risk for bias in research and more opportunities to identify gaps in research.

Further research may benefit from focusing on the preparation of parents and caregivers for the assessment via parent coaching. If parent coaching procedures are solidified and adapted to accommodate different languages, this may improve assessment fidelity and increase parent confidence levels during assessments. A study by Talbott et al. (2022) emphasizes the importance of parent coaching in relation to ASD telehealth evaluations for infants by stating

"effective parent coaching leads to improved caregiver engagement, responsiveness, and reflection and reduced parental stress" (Talbott et al., 2022, p. 2). By focusing on methods of effective parent coaching, the quality of assessment may see additional improvement.

Additionally, further research may benefit from focusing on the codability of results with traditional gold-standard assessments like the ADOS-2. Some of the research included in the literature review assessed validity by coding results with well-known assessments. In the future, research may benefit from determining a codability rate or percentage that can fully support the use of the assessments developed for Telehealth for clinical usage. This may allow health professionals to obtain increased confidence with new assessments that lack the notability of traditional face-to-face assessments.

By conducting research on Telehealth evaluations with scheduled longitudinal follow ups, assessment via newer methods such as the NODA or TELE-ASD-PEDS will be able to be truly evaluated for accuracy. Because virtual evaluations for ASD are a fairly new method of assessment, longitudinal follow-up has yet to be tested for any method. Following up with a series of participants from diverse backgrounds over time will allow research to identify false positives, increase method credibility, and increase the overall quality of research on the subject. Longitudinal insight may take years to achieve, but it will increase the overall validity of the method as a whole.

CONCLUSION

The results of the study conclude that the current path of research has the potential to integrate Telehealth into the ASD diagnostic process within the near future. Synthesis of seventeen different studies has shown both the strengths and weaknesses of existing literature on the subject of Telehealth use in the ASD diagnosis process for young children. Both store-and-

forward and video conferencing methods show promising results in theory of practice, with research catalyzed by the Coronavirus pandemic in 2020. While the research to-date presents limitations, the identification of gaps within research can be used to expand upon research and refine methodology to benefit young children and families from a wide range of backgrounds.

Appendix A

Table 3.1
Common Face-to-face Parent-Based Screeners and Interviews

Name of Assessment:	Description of Assessment:
Parents' Evaluation of Developmental Status Revised (PEDS-R)	1.Evidence-based surveillance tool & screening test for ages 0-7 years and 11 months. 2. Addresses parents concerns about children's language, motor, self-help, early academic skills, behavior and social-emotional/mental health. 3. Parents complete the screener and then professionals (paraprofessionals can administer as well) observe the child for two minutes, and then compare observations with the results of the screener. 4.PEDStest Online offers a virtual, protected, way to administer the screeners and report results directly to professionals online. 5. PEDS test uses an autism-specific screen at 18 and 24 months (about 2 years).
Modified Checklist for Autism in Toddlers Revised (M-CHAT-R)	1.2-Stage parent screening tool for ages 16-30 months to detect ASD specifically. 2.Asks parents to respond with yes/no to questions regarding behaviors and mannerisms typically associated with ASD. It is then evaluated by a professional. 3.Requires a follow-up assessment to be complete. 4. The goal of the MCHAT-R is to maximize sensitivity and detection of ASD, so there are often false-positives, or children that receive a high risk-score that are never diagnosed with ASD. 5. The Scoring algorithm is divided into three levels, 1.Low Risk (0-2 Total Score), 2.Medium Risk (3-7 Total Score), and High-Risk (8-20 Total Score)
Screening Tool for Autism in Toddlers and Young Children (STAT)	1.Screening tool specifically for ASD for children between 24-36 months. 2.Empirical based test that is designed for community service providers to detect need for intervention or further testing. 3. Activities assess key behaviors like imitation, play, requesting, and directing attention. 4.Takes around 20 minutes to administer in a school setting. It should not be administered by parents/people without experience in intervention settings or experience with children with ASD. 5.Consists of twelve physical items (toys) that are optimized for detecting ASD and not other developmental disabilities.
Autism Diagnostic Interview-Revised	1.Two 15-item rating scales completed by the clinician (each designed for a different population); and an unscored Parent/Caregiver Questionnaire for

(ADI-R)	ages 2 and up. 2.Assesses the following Relating to People Imitation (ST); Social-Emotional Understanding (HF), Emotional Response (ST); Emotional Expression and Regulation of Emotions (HF) Body Use, Object Use (ST); Object Use in Play (HF),Adaptation to Change (ST); Adaptation to Change/Restricted Interests (HF),Visual Response, Listening Response,Taste, Smell, and Touch Response and Use, Fear or Nervousness (ST); Fear or Anxiety (HF), Verbal Communication, Nonverbal Communication Activity Level (ST); Thinking/Cognitive, Integration Skills (HF), Level and Consistency of Intellectual Response, General Impressions 3. Comes with three forms: 1- Standard Version Rating Booklet (CARS2-ST) Equivalent to the original CARS; for use with individuals younger than 6 years of age and those with communication difficulties or below-average estimated IQs 2-High-Functioning Version Rating Booklet (CARS2-HF) An alternative for assessing verbally fluent individuals, 6 years of age and older, with IQ scores above 80 3- Questionnaire for Parents or Caregivers (CARS2-QPC) An unscored scale that gathers information for use in making CARS2-ST and CARS2-HF ratings. Packets 1 and 2 are assessed by a Level C qualified professional and packet 3 is filled out by parents. 4. It typically takes 5–10 minutes (after the information needed to make the ratings has been collected) to administer.

Appendix B

Table 3.2
Common Face-to-face Language Evaluations

Name of Assessment:	Description of Assessment:
Peabody Picture Vocabulary Test 4th Ed (PPVT-4)	1.Vocabulary Assessment for ages 2-6. 2. Measures receptive language skills without requiring the child to read or write. 3. To purchase you must have a "B Qualification", it would not be suitable for parents to administer on their own. 4.Takes about 10-15 minutes to administer 5. Pearson has a digital stimulus Book for administration on desktop or laptop. 6.Pearson has guidelines on how to use the PPVT-4 via telehealth. 7.Available in English only.
Clinical Evaluation of Language Fundamentals, Preschool, Third Edition (CELF Preschool - 3)	1.Language Assessment for ages 3-6 that assesses language skills that are important for the classroom 2. Measures core language, receptive and expressive language skills, language content, and language structure through verbal response to a stimulus picture. 3.Scoring for the CLEF Preschool-3 includes scores within the following subsets: Sentence Comprehension, Word Structure, Expressive Vocabulary, Following Directions, Recalling Sentences, Basic Concepts, Word Classes, Phonological Awareness, Descriptive Pragmatics Profile, and Emerging Literacy Rating Scale. 4.To purchase you must have a "B Qualification", it would not be suitable for parents to administer on their own. 5.Pearson has guidelines on how to use the CLEF Preschool-3 via Telehealth.
Expressive Vocabulary Test | Third Edition (EVT-3)	1.EVT-3 is a norm-referenced and individually administered test of expressive vocabulary and word retrieval based on words in Standard American English and is typically paired with the PPVT. This is commonly used in 2-6 year olds but other forms of the test can assess people through adulthood. 2.The EVT-3 measures expressive vocabulary acquisition, contributes useful information when assessing expressive vocabulary, as part of a language evaluation, across the lifespan, contributes useful information when assessing strengths /weaknesses in word knowledge and language development. It also directly compares receptive and expressive vocabulary. 3.The EVT-3 requires administration from a level 3 clinician and takes about 10-15 minutes to administer. 4. The manufacturer provides guidelines on evaluation via Telehealth on their website.

Preschool Language Scales 5th Ed (PLS-5)	1. Developmental Language Assessment for ages 0-7. 2.Measures total language, auditory comprehension and expressive communication skills. 3. To purchase you must have a "B Qualification", it would not be suitable for parents to administer on their own. 4. Takes around 45-60 minutes to administer and requires children to point or verbally respond to pictures and objects(physical toys). 5. The assessment addresses play behaviors that could be used to detect ASD. 7. Test is available in Spanish. 8. Pearson has guidelines on how to use the PLS-5 via Telehealth.[10]

Appendix C

Table 3.3
Common Face-to-face Developmental Evaluations

Name of Assessment:	Description of Assessment:
Mullen Scales of Early Learning	1.The Mullen Scales of Early Learning are used in conjunction with the Vineland Adaptive Behavior Scales Third Edition (VABS-3). It is a developmentally integrated system that assesses language, motor, and perceptual abilities, measures cognitive ability and motor development quickly and reliability for children ages 0-68 months (about 5 and a half years). 2. Requires level B certification to administer. 3. The completion time varies from age to age, 15 minutes (1 year); 25-35 minutes (3 years); 40-60 minutes (5 years).
Developmental Profile (DP-4)	1.Developmental Profile (DP-3) is a developmental evaluation for ages birth-21 years old. 2.Measures development across five scales Physical, Social-Emotional, Adaptive behavior, Cognitive, & Communication. 3. It takes around 20-40 minutes to conduct by a level B qualified professional and has a parent questionnaire. 4. There are 190 yes/no questions and an intervention activity for each one of them and three forms: Parent/Caregiver Interview, Parent/Caregiver Checklist, and Teacher Checklist[19]
Bayley Scales of Infant and Toddler Development | Fourth Edition (Bayley IV)	1.The Bayley IV is a comprehensive assessment tool to detect developmental delay in infants and toddlers from 16 days (about 2 and a half weeks) to 42 months (about 3 and a half years) of age. 2.It assesses domains of cognitive, language, motor, social-emotional, and adaptive behavior (in three separate domains: cognitive, motor, and and language). This takes about 30-60 minutes to administer depending on a child's age. 3.The cognitive section consists of empirical observation of how a child reacts to a series of objects, language which measures both expressive and receptive skills, and the motor section empirically assesses fine and gross motor skills. 4.The parent report helps the level B or above evaluator assess a child's social-emotional development as well. 5.The test is available in english. 6.Pearson has guidelines for Telehealth conductions on their website.
Ages and Stages Questionnaire 3rd	1.Screening tool for ages 0-5.5 years 2.Pinpoints developmental milestones across five categories. (gross motor,

Edition (ASQ-3)	fine motor, communication, personal-social, and problem solving) 3. Typically filled out by parents, then scored by professionals 4. There are 21 different ASQ-3 tests. 5. The screener is scored across the 5 outlined categories individually to assess risk in each category on a scale of 0-50. 6. After scoring, there is opportunity for professionals to provide feedback to parents and recommend activities that follow up with concerns accordingly.

Appendix D

Table 3.4
Common Face-to-face Rating Scales

Name of Assessment:	Description of Assessment:
Social Responsiveness Scale, Second Edition (SRS-2)	1.Parent and/or teacher rating scale for 2 years, 6 months through 18 years that identifies the presence and severity of social impairment within the autism spectrum and differentiates it from that which occurs in other disorders. 2.It takes about 15-20 minutes to complete 65 questions on a 4-point scale and assesses 5 different domains: Social Awareness; Social Cognition; Social Communication; Social Motivation; and Restricted Interests and Repetitive Behavior. 3.Parents can complete, but scores should be interpreted by a level B qualified individual. 4.The rating scale is available in english and spanish.
Adaptive Behavior Assessment System, Third Edition (ABAS-III)	1.This behavior rating scale measures daily living skills—what people actually do, or can do, without assistance from others and is used from age 2 through adulthood. 2.The ABAS-3 is a useful tool in evaluating those with developmental delays, autism spectrum disorder (ASD), intellectual disability, learning disabilities, neuropsychological disorders, and sensory or physical impairments. 3.The ABAS-3 has been used via Telehealth and has manufacturer's guidelines for administration from a level C clinician or professional. It takes about 15 to 20 minutes to administer.

Appendix E

Table 3.5
Common Full-Length Face-to-face Assessments

Name of Assessment:	Description of Assessment:
NEPSY-II	1.NEPSY-II is used for general, diagnostic and selective, or full assessments — from a basic overview of a child's neurological status to a full comprehensive neuropsychological evaluation for children ages 3-16. 2.Assess executive functioning/attention, language, memory/learning, sensorimotor functioning, visuospatial processing, social perception. There is a form for 3–4-year-olds and one for children ages 5+ 3.The completion times for the NEPSY–II vary. General Assessment: Preschool ages - 45 minutes; School ages - 1 hour. Diagnostic & Selective Assessment: Varies. Full Assessment: Preschool ages - 90 minutes; School ages - 2 to 3 hours. 4. It must be completed by a professional with level C certification due to its complex nature.
ADOS-2	1.ADOS-2 is standardized behavior observation for diagnosis of ASD in ages 12 months-adulthood. 2.The ADOS-2 Assesses communication, social interaction, play, and restricted and repetitive behaviors through observational assessment. 3.Each individual is assessed in one module that correlates to the age that they are. There are 5 modules: Toddler Module—for children between 12 and 30 months (about 2 and a half years) of age who do not consistently use phrase speech. Module 1—for children 31 months (about 2 and a half years) and older who do not consistently use phrase speech. Module 2—for children of any age who use phrase speech but are not verbally fluent. Module 3—for verbally fluent children and young adolescents. Module 4—for verbally fluent older adolescents and adults. 4. It takes about 40-60 minutes to conduct and requires level C qualification to administer.
(VABS-3)	1.Vineland Adaptive Behavior Scales Third Edition (VABS-3) is a Standardized Assessment Tool for people ages birth-90 that helps diagnose ASD, among other developmental and cognitive disabilities. [16] 2.Assesses adaptive functioning in three categories: Communication, Daily Living Skills, and Socialization. [16] 3. Qualification level B is needed to administer, however there are already telemedicine adaptations being conducted of the VABS-3 through Q-global Video Proctoring. [16] 4. The assessment requires the completion of three forms Birth-90 years old:

	Interview and Parent/Caregiver Form. 3-21 years old: Teacher Form. [16]

Appendix F

Table 4.1 CASP Checklist (Questions 1,2,3,4,5,6,9,10.11)

	Q1: Are the results of the trial valid?	Q2: Was there a compariso n with an appropriate reference standard?	Q3: Did all patients get the diagnostic test and reference standard?	Q4: Could the results of the test have been influenced by the results of the reference standard?	Q5: Is the disease status of the tested population clearly described?	Q6: Were the methods for performing the test described in sufficient detail?	Q7: What are the results?	Q8: How sure are we about the results? Consequences and cost of alternatives performed?	Q9: Can the results be applied to your patients /the population of interest?	Q10: Can the test be applied to your patient or population of interest?	Q11: Were all outcomes important to the individual or population considered?	Q12: What would be the impact of using this test on your patients/ population?
Nanzeen (2015)	Yes	Yes	Yes	*Yes*	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Reese (2015)	Yes	Yes	Yes	*Yes*	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Nanzeen (2017)	Yes	Yes	Yes	No	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Juarez (2018)	Yes	Yes	Yes	No	*No*	*No*	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Talbott (2020)	Yes	*No*	*No*	No	Yes	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Dow (2021)	Yes	Yes	Yes	No	Yes	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Corona & Wagner (2021)	Yes	Yes	Yes	No	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Kryszak (2022)	Yes	Yes	Yes	No	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Holtman (2022)	Yes	Yes	Yes	*Yes*	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2

Stavropoulos (2022)	Yes	Yes	Yes	*Yes*	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Reisinger (2022)	Yes	Yes	Yes	No	Yes	Yes	See 4.2	See 4.2	Yes	Yes	Yes	See 4.2
Talbott (2022)	Yes	Yes	Yes	No	Yes	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Sutherland (2023)	Yes	Yes	Yes	No	Yes	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Riva (2023)	Yes	Yes	Yes	No	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Morrier (2023)	Yes	Yes	Yes	No	Yes	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Talbott (2023)	Yes	Yes	Yes	No	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2
Corona & Wagner (2023)	Yes	Yes	Yes	No	*No*	Yes	See 4.2	See 4.2	Yes	Yes	*No*	See 4.2

Table 4.2
CASP Checklist (Questions 7, 8, 12)

	Q7: What are the results?	Q8: How sure are we about the results? Consequences and cost of alternatives performed?	Q12: What would be the impact of using this test on your patients/population?
Nanzeen (2015)	Found that novel use of the NODA method of data collection provides reliable metrics in 91% of patients.	Participants in this study already had ASD diagnoses. There was a team of three diagnosticians who worked together to achieve inter-rater reliability in almost all cases.	The impact of using the NODA on young children seeking an ASD diagnosis would be the opportunity for the evaluator to see the child in a naturalistic observation setting.
Reese (2015)	Found that there was an 86% accuracy, 88% specificity, and 83% sensitivity for diagnosis via video conferencing. Parent fidelity was 91% when assisting in the administration of the evaluation.	Participants in this study were also given an in-person evaluation to compare findings of research. In this study, results were similar and differences in data were not proven to be statistically significant. Inter-rater reliability was achieved by using two separate teams of clinicians to complete virtual or in-person evaluations, and collaboration between teams happened post-testing.	The impact of completing evaluations used to diagnose ASD on a videoconferencing platform could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Nanzeen (2017)	Found that after evaluation of kappa coefficients, there was a 85%-90% agreement between in-person and NODA evaluators.	Different teams worked together to complete in-person and virtual assessments for each participant. Each evaluator was also asked to rate their diagnosis on a confidence interval 1-5.	The impact of using the NODA on young children seeking an ASD diagnosis would be the opportunity for the evaluator to see the child in a naturalistic observation setting.
Juarez (2018)	Found that in 86.67% of cases, clinicians had adequate confidence intervals in the diagnosis of children virtually, using the STAT.	After the virtual assessment was completed, the evaluator gave a high or low risk rating of diagnosis to each participant. Then, an in-person assessment was completed to compare virtual results to.	The impact of completing evaluations used to diagnose ASD on a videoconferencing platform could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Talbott (2020)	Found that 90% of participants met codability qualifications. Participants that did not meet these qualifications (n=2) were excluded due to video errors.	The clinicians measured their findings via inter-rater reliability and test–retest reliability. Reliability of the tool used for evaluation (AOSI) produced low reliability rates due to the ages of infants that participated in the study. Infants that were older often showed more symptoms of ASD than younger infants.	The impact of completing evaluations used to diagnose ASD could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Dow (2021)	Found that in the Toddler module of the BOSA, there was a 74% correlation between BOSA and ADOS-2 scores for	Data from the BOSA was compared to ADOS-2 scores, which is the "gold-standard" of ASD diagnostic evaluation. Inter-rater reliability was 94% for the Toddler Module and 93% for Module 1.	The impact of completing evaluations used to diagnose ASD with the BOSA could help children get diagnosed younger and increase the opportunity for early

	each child. Results of this study were divided into module groups to separate data between age groups of the BOSA.	Because two sites were used during this study, cross-site reliability was also calculated (84%).	intervention to assist the child and family.
Corona & Wagner (2021)	Found that 89% of evaluations were completed with adequate clinician confidence intervals.	The clinicians confidence was rated on an interval scale that was later coded on an ANOVA to measure the diagnostic certainty. All clinicians that participated in the scoring and administration of these assessments were professionals trained in ADOS-2 with multiple years of experience.	The impact of completing evaluations used to diagnose ASD with the TELE-ASD-PEDS could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Kryszak (2022)	Found that ADEC-V scores has a strong correlation with scores from the CARS-2 ($r = 0.70$, $p < 0.001$) and slightly correlated with scores from the ADI-R scores ($r = 0.26$, $p < 0.01$).	The ACDE is an already established method of assessment used for ASD diagnosis in traditional evaluation settings. The comparison of data obtained from administering the ACDE-V with scores from the CARS-2 and ADI-R provide an adequate reference standard. Additionally, internal consistency reliability and predictive validity were analyzed after data collection to further advocate for the reliability of the ADEC-V.	The impact of completing evaluations used to diagnose ASD with the ADEC-V could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Holtman (2022)	Found that coronavirus diagnosis rates for ASD using the TAP (77.6%) were higher than rates of diagnosis pre-pandemic (70%).	Results of the TAP were compared to checklists like the Higher Child Behavior Checklist (CBCL) and the Autism Spectrum Rating Scale (ASRS) for both in-person and virtual evaluations. During the analysis of data, 50% was randomly checked for reliability.	The impact of completing evaluations used to diagnose ASD with the TELE-ASD-PEDS could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Stavropoulos (2022)	Found that 80% of caregivers said that the Telehealth evaluation process using TAP worked for their child and that 93.3% of caregivers were satisfied with the overall process. Eleven of the total number of children assessed (n=23) in this study were not diagnosed with ASD or any ID.	Results synthesize qualitative data from the caregivers of the participants. Inter-rater reliability was established by having 2-5 clinicians on each video conference to collect data.	The impact of completing evaluations used to diagnose ASD with the TELE-ASD-PEDS could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Reisinger (2022)	Results indicated overall satisfaction of the TAP's use to assist the diagnosis of ASD in young children from both caregivers and professionals. In	The TAP evaluations completed in the Riley Hospital for Children were all cross-validated with scores from the VABS-3. Additionally, obtaining caregiver and clinician perspectives assisted the validation of the TAP by providing a written record	The impact of completing evaluations used to diagnose ASD with the TELE-ASD-PEDS could help children get diagnosed younger and increase the opportunity for

	this study 10 participants of the total (n=141) had an "unsure" result of diagnosis from the clinicians. 70.92% of caregivers strongly agreed that the TAP was a functional tool for ASD diagnosis for their child.	of it's strengths and weaknesses. The checklist format of data collection also makes it easier for researchers to quantify data.	early intervention to assist the child and family.
Talbott (2022)	Found that there was an average of 56% score on the parent-completed Telehealth Usability Questionnaire in regard to using the AOSI virtually to detect signs of ASD in infants.	Inter-rater and test–retest reliability were assessed with positive scores among evaluators. Caregiver feedback using the TUQ also helped support the hypothesis.	The impact of completing evaluations used to diagnose ASD with the AOSI could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Sutherland (2023)	Found that 100% of participants (n=18) were diagnosed with ASD with the TAP.	The TAP evaluations were cross-validated with scores from the VABS-3. A post-assessment caregiver interview was also completed to identify weaknesses of the TAP.	The impact of completing evaluations used to diagnose ASD with the TELE-ASD-PEDS could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Riva (2023)	Found that the TELE-NIDA had a 78% correlation with ADOS-2 scores for all of its participants.	The results were validated by comparing results of scores from the ADOS-2. Inter-rater reliability was also calculated at a 96% agreement rate.	The impact of completing evaluations used to diagnose ASD with the TELENIDA could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Morrier (2023)	Found that the NODA and in-person assessment results agreed 93.9% of the time.	The results of the NODA were validated by completion of an in-person assessment. Additionally, inter-rater reliability and test randomization was completed to further support use of the NODA.	The impact of using the NODA on young children seeking an ASD diagnosis would be the opportunity for the evaluator to see the child in a naturalistic observation setting.
Talbott (2023)	Found that on average caregivers received an 82% score on an assessment fidelity checklist after assisting the administration on the AOSI via Telehealth.	Inter-rater reliability of the AOSI was used and calculated to be at a 95% agreeance rate. Additionally, the caregiver fidelity assessment helps researchers identify gaps in the testing protocols.	The impact of completing evaluations used to diagnose ASD with the AOSI could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.
Corona & Wagner (2023)	Found that in 14% of cases, there was an uncertainty of diagnosis between evaluators. 15% of all families had technology barriers that affected their experience with the TAP.	The TAP evaluations were cross-validated with scores from the VABS-3. Caregiver and clinician surveys were also collected post-assessment to identify and troubleshoot gaps in the testing protocols.	The impact of completing evaluations used to diagnose ASD with the TELE-ASD-PEDS could help children get diagnosed younger and increase the opportunity for early intervention to assist the child and family.

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