Comparison of the Remote NODA Assessment Method to the In-Person Gold Standard Assessment Method for ASD

Keywords: ASD diagnosis, telehealth, remote NODA assessment

ABSTRACT

An autism spectrum diagnostic (ASD) study was conducted comparing a remote Naturalistic Observation Diagnostic Assessment (NODA) method to the traditional in-person "gold-standard" diagnostic method. The study included 40 children who were referred for an ASD evaluation and 11 non-ASD children who served as "controls". NODA agreed with the in-person assessment in 88.2% of cases, kappa = 0.75, sensitivity = 84.9% and specificity = 94.4%. The data show that the NODA assessment method can offer an effective approach to the early diagnosis of ASD remotely.

Background

Studies have shown that early intensive therapeutic behavioral interventions can result in significant improvement for children with ASD (1, 2). Obtaining a diagnosis is a critical first step. However, there are often significant time delays between a parent's first concerns about a child's delayed development and obtaining an ASD diagnosis from a qualified professional (3). Compounding this challenge is the variability that is inherent in how a child may present in a new environment on a select day, his/her parents' ability to communicate helpful background to assist a diagnostician, and the variability of how two independent diagnosticians frequently assess the same child due to a variety of factors.

The current diagnostic process for ASD is counterintuitive in relation to the growing knowledge about the benefits of early intervention (4). It is clear that the current system needs to change if children with ASD are to benefit from early intensive behavioral interventions. Waitlists and waiting times to consult diagnosticians need to be shortened so that children with developmental delays can be assessed at earlier ages. An effective way to promote such a change is to improve accessibility. Rather than lose time with referrals and long wait lists, NODA can now connect a family with diagnostic experts who will be able to provide important information regarding a child's development and get them started with an early intervention program.

Previous Studies

Remote behavior data collection and data sharing has been reported in numerous studies (5-15). Behavior Imaging® has been successfully deployed for health and education purposes, including remotely assessing functional behaviors, supervision of uncertified tutors administering behavior therapy, medication management, and progress monitoring for special education students (16-19).

In 2009, the Southwest Autism Research & Resource Center (SARRC) evaluated the issues associated with delayed ASD diagnosis using the Behavior Imaging technology. The store-and-forward approach used in collecting and sharing videos included a tagging capability to support parents who were implementing intervention techniques at home. While reviewing the video clips, clinicians were able to identify and classify behaviors that supported a diagnosis of ASD. To further determine if a diagnosis could be made based on evidence seen in a video clip, a pilot study was conducted that included five children who were previously diagnosed with ASD at SARRC (20). In this study, families recorded videos at home, which were then reviewed by diagnosticians who tagged the behaviors and entered the descriptions of the symptoms. In parallel, in-person observations of the children

by other independent diagnosticians were conducted using the standard DSM-IV diagnostic criteria for ASD. There was a one-to-one agreement between the video assessment and the in-person assessment. The video review was completed in less than an hour while the in-person assessment required approximately 4 to 5 hours.

Methods and Procedures

Two participant groups were recruited for this study. Group 1 included 40 families who were either seeking a diagnosis of ASD or were already diagnosed during the previous four months. Group 2 included 11 families of children who were developing "normally". All children were between the ages of 18 months and 7 years old and had no known genetic condition.

In-person Assessments

The following diagnostic assessments were completed for each participant:

o Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) - The ADOS-2 is a direct observation assessment of behaviors associated with ASD.
o Autism Diagnostic Interview-Revised (ADI-R). The ADI-R is a parent interview regarding the individual's developmental history, which is used to document symptoms associated with ASD. The ADI-R assesses impairments in three core behavioral domains of autism: 1) reciprocal social interaction; 2) communication; and 3) restricted, repetitive interests and behaviors.
o Vineland Adaptive Behavior Scales, Second Edition (Vineland-II). The Vineland-II, Survey Interview Form is a parent interview designed to measure adaptive behavior, with eleven subdomains grouped into four domain composites in the areas of: Communication, Daily Living Skills, Socialization, and Motor Skills.

o Mullen Scales of Early Learning. The Mullen Scales of Early Learning provides a comprehensive measure of cognitive functioning for infants and preschool children from birth through 68 months.

NODA Remote Assessments

NODA is a remote-based assessment service developed to accelerate the diagnosis of ASD in children. Parents concerned about their child's developmental progress can download a mobile application (app) on their smart phone that records responses to a development history interview and guides the collection of video clips in four different scenarios in the home including: 1) Mealtime, 2) Playtime with Others, 3) Playtime Alone, and 4) Parent comments and concerns. The first three scenarios reflect typical social communication and play based behaviors. The fourth scenario, parental comments and concerns, provides an opportunity for parents to record additional behaviors by their child that cause concern, regardless of the scenario. The app captures the parent's video per chosen scenario and then gives the parent the choice to save the video, or delete it and record again. If the parent saves the video, it automatically uploads to a web based platform for subsequent clinical review.

When all video scenarios are complete, the case is assigned to a NODA rater who logs into a HIPAA compliant and secure web-portal. The rater reviews the developmental history for each video and identifies behaviors of atypical or typical development by "tagging". The tagging procedure includes identifying a notable behavior and selecting an appropriate descriptor from a list of pre-defined "tags. These tags are mapped to criteria and displayed on NODA's specially prepared DSM 5 checklist to help a rater assess if evidence of ASD criterion was observed.

DSM-5 Criteria Used for Comparison

For in-person assessments, a DSM-5 checklist was completed for the observed behaviors, developmental history, and clinical judgment of the diagnostician. All cases were reviewed by the principal investigator who is experienced in diagnosing ASD. In cases where the ADI-R and ADOS-2 were discordant, a best estimate review meeting was conducted including the raters for each protocol and the principal investigator.

For NODA assessments, the evidence to support each diagnostic criterion was critically reviewed and a final diagnostic category was determined. The overall diagnostic category (ASD/Not ASD) was then compared to the diagnostic category determined by the NODA rater.

Results

The results of this study show good agreement between the NODA assessment method and the in-person gold standard assessment method (i.e., Cohen's Kappa of 0.75). While the NODA sensitivity was 0.84, the specificity was 0.94. This indicates that in 94% of the non-ASD cases, the remote NODA method agreed with the gold standard method. For ASD cases, the remote NODA agreed with the gold standard method in 88.2% of the cases.

Conclusions

NODA method yielded an accurate diagnosis of ASD in 88.2% of the cases while correctly excluding an ASD diagnosis correctly in 94% of the non-ASD cases. This outcome suggests that the remote NODA assessment method may provide a more timely ASD diagnosis by allowing families and pediatricians to access diagnostic services remotely. This represents an important step in promoting early intervention programs for children with ASD.

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Diagram A

Illustration of research work-flow used in comparing the remote NODA assessment method to the in-person "Gold Standard" (ADOS) assessment method.
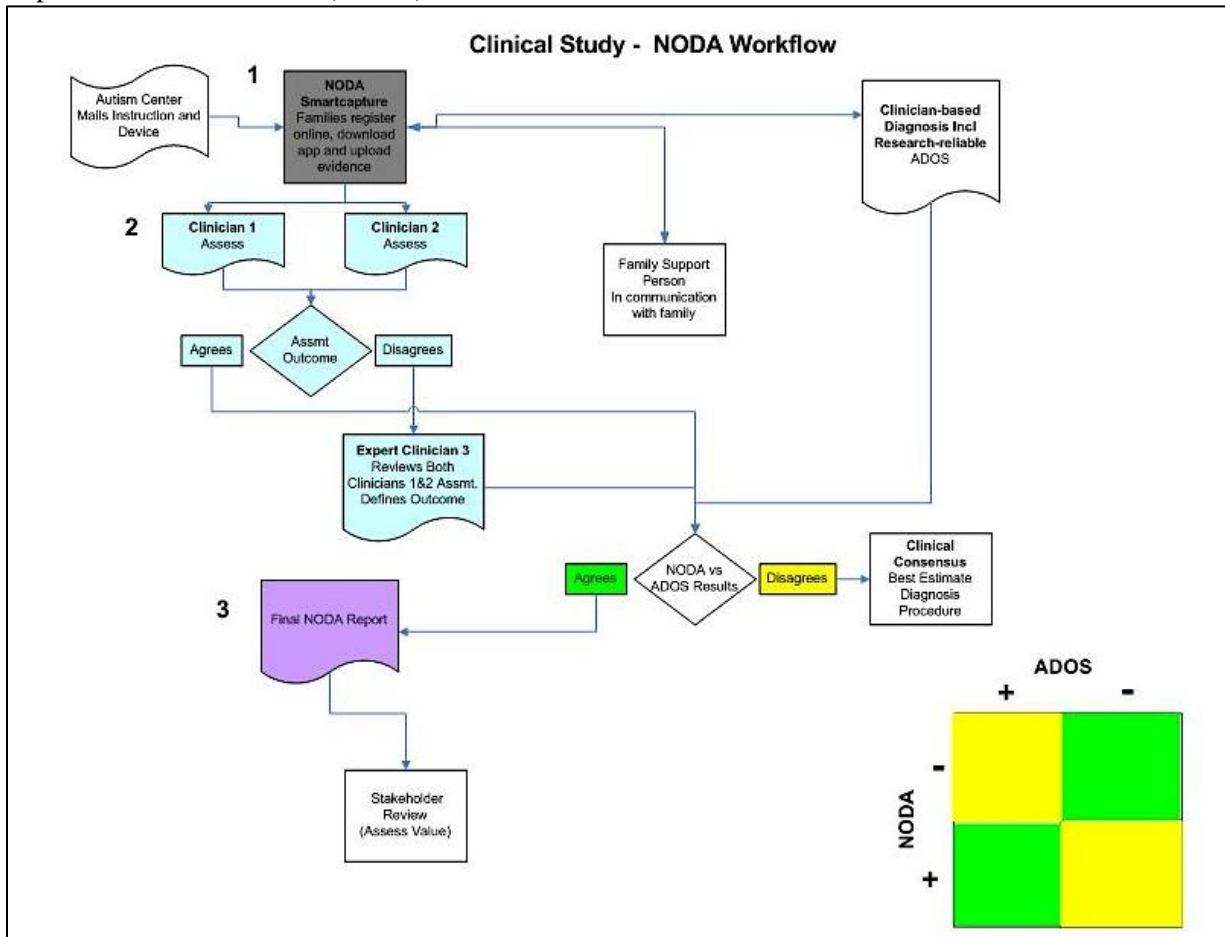
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Questions / Comments

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