Screening for Autism Spectrum Disorder Using the Language ENvironmental Analysis Device

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"Meadow at Chautauqua" by Anne Gifford (http://www.annegifford.com)

Introduction

There has been an increased awareness of multiple disabilities in the Deaf and Hard-of-Hearing (DHH) pediatric population. Autism Spectrum Disorder (ASD) is classified as: (i) deficits in social interaction such as eye gaze or sharing interests and emotions; (ii) impairments in communication such as problems and initiating conversations; (iii) repetitive interests, behaviors, and activities (Xu, Richards, Gilkerson, Yapanel, Gray, & Hansen, 2009). However, little is known about ASD in the DHH population. Current data shows that the prevalence of ASD in the general population is one is 91, and upwards to one and 53 for the DHH population (Szymanski, Brice, Lam, & Hotto, 2012). ASD is most often diagnosed around the age of three, but can be much later for the DHH population, sometimes as late as five to six years of age (Worley, Matson, & Kozlowski, 2011). However, there are no screening tools to assess the DHH population for ASD. The Language Environmental Analysis (LENA) is such a tool that has been proven effective for screening for ASD in the general population (Yoder, Oller, Richards, Gray, & Gilkerson, 2013). The question remains if LENA can also be used for the DHH population.

The purposes of the current study are to:

- Assess the accuracy of the LENA Language and Autism Screen (LLAS) for children who are DHH.

- Develop a screening protocol that incorporates a double screen using the social quotient on the Minnesota Child Development Inventory (M-CDI).

Methods

PARTICIPANTS

•Colorado Home Intervention Program N=97 children Age: 0-72 months
•At least one ear with pure-tone averages (PTA) below 20 dB HL.
•LENA device was worn by the children for 10 =16 hours
•Exclusion criteria: missing audiometric data or developmental assessments

•N=83 subjects
•HF (N=6), UHL (N=9), ANSD (N=5), Mild (N=14), Mod (N=19), Mod-Sev (N=9), Sev-Pro (N=21)

•LENA Language and Autism Screen (LLAS)
•During the analysis each child is given a numerical score of 1-7, which correlates to probability of having ASD.

•Three algorithms were used during the analysis that resulted in three numerical values, n_12ft, Method 1, and Method 2/3.
•Algorithms varied in the number of variables that were analyzed.

•Three different criteria to determine an accurate referral protocol.
- Criteria 1: A score from 3-7 on any algorithm used.
- Criteria 2: A score from 4-7 on Method 1
- Criteria 3: A score from 4-7 on Method 2/3

Once determined if a child flagged on the LENA, the social subscale on the MINN-CDI was analyzed to determine if there were concerns regarding social development. A quotient score below 0.8 resulted in a flagged response.
If a child flagged on both the LENA and the M-CDI there were categorized as high risk and would meet criteria for referral. If they flagged on either screen they were assessed further based on CHIP Provider concerns.

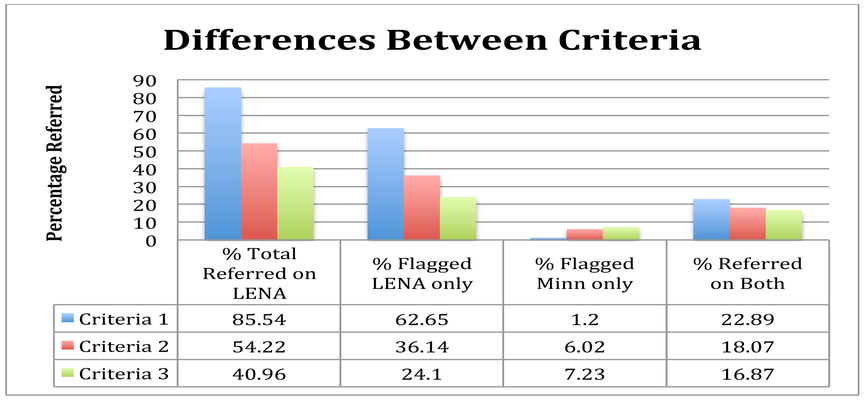

Figure 2: Graph depicting the differences between the three criteria used. Percent total referred is the total number of children in each criteria that flagged using the LLAS. Percent total that flagged on LLAS, but not on the social subscale on the Minnesota CDI. Percentage flagged on the social subscale on the Minnesota CDI only is shown in column three. This number could represent the percentage of children missed by the LLAS. The final column is the total percentage of children that referred using a double screen of both the LLAS and the social subscale of the Minnesota CDI.

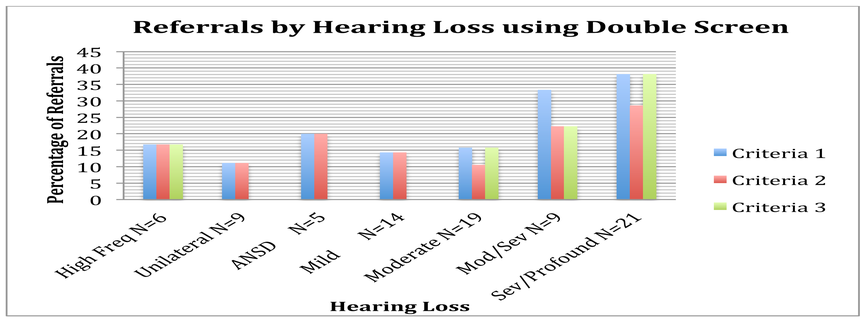

Figure 3: Referral rates divided by hearing loss using the double screen in all three criteria. Criteria 3 had the most robust analysis for unilateral, auditory neuropathy, and mild hearing losses. Those that flagged on criteria 1 and 2 for those three types of hearing loss had no CHIP provider concerns, therefore criteria 3 is a more sensitive measure for hearing loss.

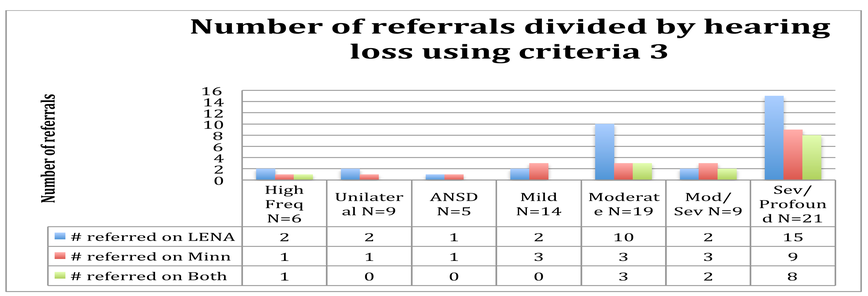

Figure 4: Criteria 3 divided by hearing loss and the number of children that referred on the LENA, M-CDI, or both. When a child referred on the M-CDI, but not the LENA it could result in a false negative. Care was taken to assess these children further and it was determined that they had global delays (cerebral palsy, down syndrome, etc.) and that all scores on the M-CDI subscales were significantly delayed.

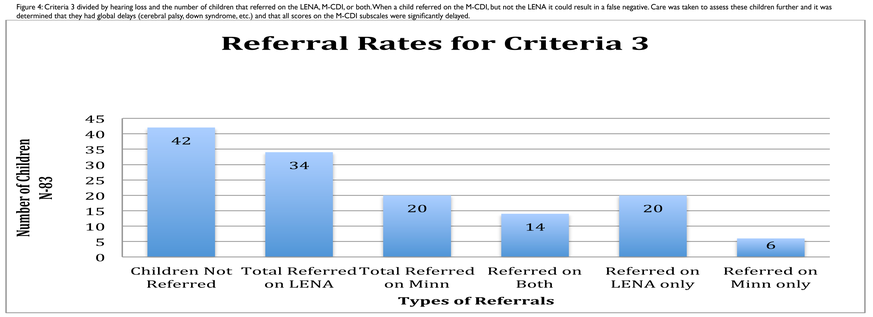

Figure 5: Data collected on the referral rates for the LENA and the M-CDI. 42 children did not refer on any measure, 34 children flagged on LENA, where 20 of them only referred on the LENA screen, 20 children referred on the M-CDI, where 6 of them did not refer on the LENA screen. The final 14 who referred on the LENA screen and the M-CDI should be referred to diagnostic evaluation. Two children of those 14 have been diagnosed with a form of ASD.

Results

Based on this data, we suggest using a double screen with criteria 3 being the most appropriate option for referral. Using the other two criteria results in a high false positive rate. However, if there are any concerns a diagnostic evaluation is warranted.

- Criteria 3 is the most robust measure with more variables analyzed, resulting in few referrals.
- Using a double screen the refer rate for the LLAS and M-CDI is 16.87%
- Those that referred on LLAS but not the M-CDI was 24.10%, which could be indicative of a "false positive."
- Those that referred on the MINN-CDI Social but not the LLAS were 7.23%, which could be at risk for a "false negative," which can only be verified by a diagnostic evaluation for autism
- Thus far, three children in the study have been diagnosed with a form of ASD, one of which was a false negative and the other two were accurately caught by criteria 3.
- The sensitivity for referral is robust for all types of hearing loss, except for bilateral severe/profound hearing losses.

Discussion

Special caution should be taken when referring children who are suspected of having any form on ASD. While it is suggested that a double screen is the most appropriate protocol to follow when making decisions regarding if and when to refer, not all children who do not flag will not need further diagnostic evaluation. Based on the current research, 20 children in the study flagged on the LLAS, but not the social subscale on the MINN-CDI Social. According to CHIP provider concerns, none of these children are suspected of having ASD, therefore it is safe to assume that further diagnostic evaluation is not needed. However, six children were not caught by the LLAS, yet had scores below the required 0.8 social quotient. One of these children is a true false negative; however, this child has a mild form of ASD. The LLAS may not be sensitive enough to pick out minute vocal qualities of children with milder forms of ASD.

Of the 14 children who were flagged with LLAS, two have gone on to further diagnosis and both have been diagnosed with ASD. Both of these children had hearing loss in the severe to profound range, and one was a cochlear implant recipient. This suggests that although more children will flag when hearing loss is more severe, all children who flag should be considered at-risk and further investigation is warranted.

Further research in this area is needed. It would be most interesting to get a full diagnostic evaluation for autism spectrum disorder in order to determine specific sensitivity/specificity rates.

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