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What happens after a positive primary care autism screen among historically underserved families? Predictors of evaluation and autism diagnosis

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Abstract

Objective: Families, pediatric providers, and service systems would benefit from expanded knowledge regarding: 1) who is most likely to receive a recommended diagnostic evaluation after a positive primary-care administered autism screen; and, 2) of those who screen positive, who is most likely to be diagnosed with autism?

Method: Participants included 309 predominantly low-income, racial/ethnic minority parents and their child, aged 15 to 27 months, who screened positive on the M-CHAT-R/F. Generalized estimating equations were used to fit models of predictors for each binary outcome: receiving a diagnostic evaluation and receiving an autism diagnosis upon evaluation.

Results: Significant predictors of diagnostic evaluation receipt included the parent being older or non-Hispanic, and the child having private insurance, lower child communication functioning or receiving Early Intervention services. Significant predictors of an autism diagnosis upon evaluation included: male child, lower child communication functioning, screening directly in the parent's preferred language, White/non-Hispanic parent, and no parent history of mood disorder.

Conclusion: Children with younger parents, Hispanic ethnicity, relatively higher communication skills, public insurance, and no Early Intervention services were less likely to receive recommended diagnostic care. Reduced likelihood of autism diagnosis after a positive screen in non-White/non-Hispanic subgroups supports prior research indicating issues with M-CHAT-R/F positive predictive power for racial/ethnic minorities. The use of telephonic interpreters to

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administer screens, as opposed to directly screening in families' preferred languages, may lead to identification of fewer true autism cases. Thus, multi-lingual clinical staff capacity may improve positive predictive power of autism screening.

Keywords

Autism screening; engagement in care; developmental/behavioral pediatrics access; ethnic and racial minorities; multi-lingual populations

Primary care pediatricians often make difficult decisions about how to best support children with positive autism spectrum disorder (ASD)-specific screens. Although current guidelines recommend referral for a diagnostic evaluation after a positive screen,[1] a referral may not always be not be justified,[2] and pediatricians do not always refer.[3,4] Pediatricians might consider various factors including their knowledge of the screening tool's accuracy, the level of risk indicated, parent concerns, parental willingness to pursue an evaluation, whether the child is already supported through Early Intervention services, and the capacity of local clinics to conduct timely ASD-specific evaluations.[2,5] Pediatricians may feel uncertain about whether a family needs extra support to understand the meaning of a positive screen and referral or to attend the recommended diagnostic evaluation visits.[6] Indeed, family-level factors have been shown to impact parental ASD concerns and the likelihood that a child receives a diagnostic evaluation after a positive screen. Parental knowledge about ASD and subsequent engagement in services may vary based on parent race and ethnicity. For example, African American families in a prior study were less likely to keep an initial diagnostic appointment and were more likely to express doubt in the diagnosis.[7] Other data show that Latinx and non-Latinx families first recognize ASD-related symptoms when their children are similar ages, yet Latinx families reach diagnostic ascertainment later.[8]

Further complicating decision-making after a positive screen, extensive research on the M-CHAT-R,[9] the most commonly used ASD-specific screen in pediatric primary care,[10] indicates that a positive screen may predict general developmental delay more accurately than ASD specifically.[5,9] Universal ASD screening has led to increased demand for ASD diagnostic evaluations, yet literature shows that only 14.6% to 61% of children who screen positive receive an ASD diagnosis upon evaluation.[5,9,11] Although the initial M-CHAT-R/F validation study of 16,071 children screened in primary care showed high sensitivity (85%) and specificity (99%), and a moderate positive predictive value (PPV) for ASD (48%),[9] more recent population-based accuracy studies bring to question the generalizability of these findings. Notably, Guthrie and colleagues found M-CHAT/F sensitivity of 38.8% and PPV of 14.6%, which was lower yet for females and children from low-income households and minority groups.[11] In another recent population-based study across 20 clinics with predominantly non-Hispanic White children, the M-CHAT, usually administered without the follow-up interviews, had a sensitivity of 33.1% and PPV of 17.8%.[12]

As described by the U.S. Preventive Services task force, there is an outstanding need to develop efficient screening and referral systems that accurately identify ASD risk in diverse populations and engage the families who will benefit most from these services.[13] To date, most studies have examined either the factors associated with accessing an evaluation or

the factors associated with receiving an accurate screening outcome, but no study to our knowledge has done both in a majority-minority sample of young children suspected of having ASD. Prior research in this area has drawn from electronic medical records,[11,12] and thus been limited in the consideration of parent and child characteristics that are not tracked in medical records. In addressing this gap, the current study examined additional child and family factors that predict receiving a diagnostic evaluation and a confirmed ASD diagnosis in a large, majority-minority sample of children who screened positive on the M-CHAT-R/F from three large urban healthcare systems.

Methods

Study Design and Population

The current study involved a secondary analysis of data collected as part of a multi-site randomized controlled trial examining the effects of Family Navigation[14] on access to ASD-related diagnostic services among low-income, racially and ethnically diverse families. The study was conducted across large, urban integrated care networks in Boston, Massachusetts; New Haven, Connecticut; and Philadelphia Pennsylvania, in partnership with their Developmental and Behavioral Pediatrics specialty clinics and a total of 11 pediatric primary care clinics which referred parent/child dyads to the study.

Upon referral to the study, which occurred simultaneously with referral from primary care for a developmental/behavioral evaluation, parents were administered the M-CHAT-R/F to confirm their child's risk for ASD. Due to this study's focus on positive screens, 13 children who screened negative on the M-CHAT-R/F were excluded. The study included 15-to 27-month-old children. There were no exclusions based on language or comorbid conditions.

As part of the larger study, families were assigned either Family Navigation or a Conventional Care Management control condition.[15] Family Navigation is a structured intervention that provides a navigator who proactively contacts and meets with the family, connects them to service agencies, and reminds them about upcoming appointments.[14] Conventional Care Management was a form of enhanced usual care that exceeded standard care at all study sites. Families receiving Conventional Care Management were assigned a care manager who reached out to families to introduce themselves and to remind families about DBP clinic appointments. They provided their contact information to families and were available to answer families' questions about the child's services, needs, and diagnosis. Families received Family Navigation or control condition care throughout their child's developmental evaluation and for 100 days post-diagnostic resolution.

Measures

Primary outcomes.—The primary study outcomes were two major steps of the diagnostic process which were determined via electronic medical record review for a follow-up period of 365 days post-screening. The first, receiving a diagnostic evaluation, was analyzed within the larger study's control condition only, because Family Navigation was designed to increase diagnostic ascertainment and would thus confound predictors of this outcome.[15]

The second, receiving a diagnosis of ASD, was analyzed among study participants who received an evaluation, regardless of study arm.

M-CHAT-R/F.—Given possible inconsistent administration of the clinical M-CHAT-R/F at the primary care sites, research staff systematically re-administered the M-CHAT-R/F by telephone to every family within one week of study referral. Standard administration and scoring procedures including the follow-up interview for "medium risk" range scores were used (see Robins et al., 2014).[9] Interpreters were employed as needed; three staff who administered the M-CHAT-R/F used a phone interpreter for all non-English languages; one conducted Spanish administrations using a previously translated version.

Patient and family-level characteristics.—Parents completed a study baseline interview in which they were asked to provide information about themselves, their child, and other family members. Relevant baseline interview variables are listed in Table 1. "Sibling with ASD" refers to whether the child had any siblings with DSM-V ASD, DSM-IV Asperger's Disorder or DSM-IV Pervasive Developmental Disorder-Not Otherwise Specified. Child and parent ages were calculated from birth dates and M-CHAT-R/F screening dates. Racial and ethnic categories were collapsed because many Hispanic families did not report a racial identity, likely due to differing racialized social structures in Latin America and the US.[16]

Adaptive functioning.: Child adaptive functioning was measured with select subscales (Communication, Self-Direction, and Social) of the ABAS-2,[17] which is a parent rating scale of child adaptive functioning. The ABAS-2 was validated for capturing adaptive function impairments with good reliability and validity using a national sample.[17] Higher scores correspond to higher functioning levels.

Perceived Stress Scale.: Parents were administered the 14-item version Perceived Stress Scale (PSS).[18] The PSS is a self-report measure of global perceived stress; it has shown moderate to strong psychometric properties in various samples.[19]

Parent level of worry.: Parents were asked: "On a scale of 0–10, how worried are you about how your child is developing?" The anchors were set at 0 for "not at all" worried and 10 for "very" worried.

Statistical Analyses

Bivariate analyses including cross-tabulations with chi-square tests and simple logistic regressions were used to detect the strength of associations between the individual predictor variables of interest and the two binary outcomes. Variables meeting our association criteria ($P<0.20$) were considered as candidate covariates in our multivariable statistical models. Generalized estimating equations (GEE) with the logit link function and independent working correlation structure were used to fit models of predictors for each of the two binary primary diagnostic outcomes. The GEE approach was selected to allow for nesting by research site, thus accounting for dependence of data within sites. This iterative process to build multivariable models balanced the inclusion of predictors based on theory and prior

literature, along with the need to attain the lowest possible goodness of fit value. Statistical analyses were conducted across SPSS (Version 25).

Results

Our total sample consisted of 309 unique parent-child dyads (Table 1). Of these 309, 156 were assigned to the larger study's control arm thus included in the first model, which predicted receiving a diagnostic evaluation. Many of these control arm participants received a diagnostic evaluation within one year (76.9%). Across both larger study arms, 253 (81.9%) received a diagnostic evaluation in the same time period and were included in the second model that analyzed ASD diagnosis predictors. Of the 253 children evaluated, 59.7% were diagnosed with ASD and the remaining 40.3% were diagnosed with another developmental/behavioral disorder or delay. Similar rates of ASD diagnosis were found between the larger trial's study conditions (62.7% with ASD in Family Navigation treatment arm and 56.3% in the control arm).

Participating families were primarily from a minority racial/ethnic background (only 6.3% White, non-Hispanic), and 16.5% preferred to speak a language other than English. Most of the children were publicly insured (92.2%), and most parents graduated high school (83.8%). Just under half of the children (44.3%) were receiving Early Intervention services. Some reported another child in the family with an ASD, PDD-NOS, or Asperger's diagnosis (10%). On average, parents were 30 years old and children were 21 months old.

Outcome 1: Receiving an ASD Diagnostic Evaluation

The child and family-level variables meeting our criteria to be candidate covariates for the GEE model are presented in Table 4 and final models are presented in Table 2. In adjusted models, families receiving Early Intervention were 5.01-times more likely to receive a diagnostic evaluation (95% confidence interval, CI of the adjusted Odds Ratio, aOR: 2.05, 12.24, $P<.001$). When children had private insurance, they were 4.52-times more likely to receive a diagnostic evaluation (95% confidence interval, CI: 2.48, 8.23, $P<.001$). Relative to Hispanic families, those in all other racial/ethnic groups were significantly more likely to receive the diagnostic evaluation (White, non-Hispanic aOR = 1.91, 95% CI: 1.68, 2.26, $P<.001$; Black, non-Hispanic aOR = 3.77, 95% CI: 2.45, 5.79, $P<.001$; Other, non-Hispanic aOR = 3.05, 95% CI: 1.03, 9.00, $P=.04$). For each additional month of child age, likelihood of receiving the diagnostic evaluation decreased 14% (aOR = 0.86, 95% CI: 0.82, 0.91], $P<.001$). For each additional year in parent age, likelihood of evaluation receipt increased 10% (aOR = 1.10, 95% CI: 1.05, 1.16, $P<.001$). For each one scaled score decrease in communication functioning, likelihood of evaluation receipt increased 11% (aOR = 0.89, 95% CI: 0.80, 0.98, $P=.02$).

Outcome 2: Receiving an ASD Diagnosis

Among those who received a diagnostic evaluation within the study period (n = 253), baseline variables meeting and not meeting our criteria for candidate model covariates are shown in Table 4. An ASD diagnosis was significantly more likely among males (aOR = 1.69, 95% CI: 1.57, 1.82, $P<.001$; Table 3) and White, non-Hispanic families (Relative

to White, non-Hispanic: Black, Non-Hispanic aOR = 0.16, 95% CI: 0.04–0.59, *P*=.006; Hispanic, any race aOR = 0.16, 95% CI: 0.03– 0.72, *P*=.02; other, non-Hispanic aOR = 0.19, 95% CI: 0.07–0.51, *P*=.001). Children who were screened *without* an interpreter (i.e., screening directly in the parent's preferred language) due to varying language capacities of staff administering the screeners were 3.57-times more likely to receive an ASD diagnosis (95% CI: 2.33– 5.49, *P*<.001), and those whose parents had no history of a mood disorder were 1.95-times more likely (95% CI: 1.08–3.51, *P*=.03). For each one-unit decrease in ABAS-2 communication scaled score, children were 22% more likely to be diagnosed with ASD (aOR = 0.78, 95% CI: 0.69–0.89, *P*<.001). Children who had a sibling with ASD were not significantly more likely to receive an ASD diagnosis.

Discussion

In the current study of 309 children from three large health systems, 23.1% of families in the control condition did not receive their diagnostic evaluation within one year of screening positive on the M-CHAT-R/F and being referred for a diagnostic evaluation. Of those who received an evaluation, 59.7% received an ASD diagnosis and the remaining 40.3% went on to receive a clinical developmental/behavioral diagnosis other than ASD.

Some findings in this study provide further evidence of previous research findings, while others represent novel contributions to the literature. Overall, the findings related to predictors of accessing diagnostic services can help providers identify for whom the service system is not working as well. Our findings revealed the following characteristics associated with lower likelihood of receiving a diagnostic evaluation: publicly insured, higher child communication functioning, older toddlers, younger parents, Hispanic families, and no prior Early Intervention services. Examples of novel programs and approaches that can improve systems and supports for families with these characteristics include Family Navigation, accessibility promotion, support networking, and rapport building.[14,20]

One may anticipate that among children with positive ASD screens, those already enrolled in EI are more developmentally delayed and therefore more likely to complete the diagnostic process. However, our findings suggest that independent of child communication functioning level or age, families involved with EI were 5-times more likely follow through with a diagnostic evaluation in a DBP specialty clinic. We suspect that ongoing interactions with EI providers specifically may lead to increased feelings of support and motivation to follow through with the recommended diagnostic evaluation; furthermore, families enrolled in EI may generally have a higher level of engagement and trust in the service system. This finding builds upon a recent study which found that children who participated in EI reached diagnostic ascertainment two years earlier than children who did not participate in EI, while controlling for sociodemographic, clinical, and geographic characteristics.[21] This highlights how important it is for primary care pediatricians to make EI referrals as soon as early signs of ASD or other developmental delays are noticed, with strong encouragement for families to follow through on this referral. In addition to benefits of EI on child development, accessing this service may help to destigmatize future use of developmental/behavioral specialty services.

The substantially decreased likelihood of receiving a developmental evaluation among Hispanic families in our study reflects an extensive body of research indicating disparities in ASD-related services for Hispanic families.[8,22,23] Our finding suggests the period between screening positive and attending diagnostic evaluation appointments is an important time for intervention to address these disparities. During this time, Hispanic families may especially benefit from culturally relevant care coordination strategies and interventions. Countering the increased levels of ASD-related stigma, decreased ASD and child development knowledge, and poorer communication with healthcare providers reported among Hispanic parents may be particularly beneficial.[24,25]

Parents of older children and those with higher communication functioning may have been less likely to receive diagnostic care because such parents feel less activated about their child's developmental concerns, which may be relatively mild given the relatively higher communication score and additional time to develop. Considering that parents of children with lower communication skills tend to report increased parenting stress,[26] these parents may conversely seek to relieve this stress through a diagnostic evaluation. However, our null findings that parent level of worry and stress did not predict evaluation receipt provide some evidence against the above hypothesis; further research is needed to determine the extent to which worry, stress, and behavioral activation are linked in this health service context. Lastly, given that all of the medical centers in this study accepted public insurance, our finding that those with public insurance were less likely to access care may be best explained when considering public insurance as a proxy for a low level of financial resources in general. Poverty has indeed been identified in previous research as a barrier to ASD diagnostic care.[27]

Our findings from the second model include a mix of predictors that point to problems with screening accuracy in some subgroups, and predictors with known links based on the symptoms and prevalence rates of ASD in various populations. First, we found a higher likelihood of a true-positive ASD screens among males. At face value, this finding reflects the well-established higher prevalence of ASD among males.[28] Given that our sample was limited to children with positive M-CHAT-R/F screens, however, these results may also relate to ASD presenting differently in females, likely resulting in poorer sensitivity of current screens for females.[28,29] Although there is increased ASD risk for siblings of children with ASD,[30] this factor was not a significant predictor in our study, possibly due to the relatively small number of families who fit into this category.

Our finding that children of parents *without* history of a mood disorder were almost twice as likely to have ASD was also surprising. It indicates the opposite finding of prior large population-based studies showing associations between children's ASD diagnoses and maternal depression.[31] However, especially given the parent-reported symptom screening context of our study, our finding is consistent with the "depression-distortion hypothesis." This hypothesis suggests that depressed mothers report inflated internalizing and externalizing symptoms in their children.[32] Our study demonstrates that such a hypothesis may be relevant to parent-report of ASD-related symptoms as well. Supporting this notion, one prior study found that parents with depressive symptoms reported greater ASD symptoms in their children than what clinicians observed, pointing to the benefits of

using multiple informants for screening and assessment in cases with parental mood disorder history.[33]

The finding that ABAS-2 Communication scaled scores predicted ASD diagnosis, with 22% increase in likelihood per each lower scaled score unit, is consistent with the core symptoms of ASD. Yet, this is somewhat surprising given that many of the children who were not found to have ASD in our sample were given diagnoses related to language-specific and global developmental delays. Interestingly, the model of predictors of an ASD diagnosis had the best fit when including the ABAS-2 Communication subscale as opposed to other ABAS-2 subscales or the M-CHAT-R/F. This finding is consistent with a previous study showing that communication skills differentially predict ASD from global developmental delays or developmental language disorders after a positive screen.[34] However, the scope of our study is limited in that we did not compare these measures head-to-head, and we did not comprehensively measure every relevant developmental domain. It is possible that in some clinical systems, parent rating scales of children's communication functioning, such as the one used in this study, could be useful for initially scheduling families with ASD-specific teams versus more general developmental/behavioral teams for care. We would like to highlight that all children who received a DBP evaluation in this study were found to have a diagnosis that impacted their daily functioning, with implications for ongoing service needs.

The remaining predictors of ASD diagnosis likely relate to differentially inaccurate screening and referral systems. Children of White, non-Hispanic parents were more likely to have a child diagnosed with ASD, and their counterparts were more likely to be diagnosed with a different disorder; this corroborates prior research indicating problems with M-CHAT-R/F accuracy among minority populations, including inflated false-positive screens.[11] Finally, our findings suggest potential issues with the telephonic language interpretation process for parent checklist screening approaches, highlighting the importance of hiring and training native speakers of various languages to directly administer screening assessments in families' preferred languages. It is important to consider that telephonic interpreters are generally not able to utilize linguistically and culturally validated versions of screening tools, as they typically translate each item in the moment as it is read aloud. Without bilingual staff and validation of screening tools for many languages and cultures, greater reliance on word-for-word translation likely leads to increased confusion and misunderstanding of items, thus resulting in poorer positive predictive power of the screening process.[35,36]

Practical Implications

Our study findings bring up two important questions for clinicians and policy makers. First, how do we better support families to ensure that all children referred for developmental evaluations reach diagnostic ascertainment? The predictors of diagnostic evaluation receipt reveal two key types of barriers to reaching an ASD diagnosis: those relating to the service system and characteristics of parents and their children. Efforts to spread awareness about and destigmatize ASD as well as culturally responsive interventions targeting parent engagement and structural barriers, such as Family Navigation, are important to improve access to recommended diagnostic services. Hispanic navigators may be especially

needed to help destigmatize ASD-related concerns and engage Hispanic families in the developmental/behavioral care system. There is a need for future research that examines whether the use of interactive screening instruments, rather than parent checklists, might lead to improved levels of parent engagement in care, especially for those who are younger, Hispanic, publicly insured, or have not yet been connected with EI services.

Second, it is important to ask: how can systems of screening, referral, and DBP diagnostic evaluation provide diagnostic ascertainment and ongoing care in a more timely, efficient, and equitable manner? Challenges related to diagnostic accuracy of screening for low-income, minority groups are well-documented and further substantiated in this study. Continued adaptation and development of screening tools with the goal of high accuracy rates across sociodemographic subgroups, especially females and racial, ethnic, and linguistic minorities would support equity in ASD identification.

Strengths and Limitations

This study presumes that the results of the clinical diagnostic evaluations are 100% accurate, which may not be true given the potential for error and bias of diagnostic providers. Due to re-administration of the full M-CHAT-R/F by study staff, this study may lack in generalizability to real world contexts in which repeated screening is unlikely to be feasible and the follow-up portion of the M-CHAT-R/F is often omitted.[4,12] The larger study drew from integrated care networks that primarily serve low-income, racially and ethnically diverse populations, and thus lacks comparison groups with higher socioeconomic status.[15] The findings may not be generalizable to broader clinical populations. This also represents a strength of this study, given that ASD research often lacks representation of families with low socioeconomic status as well as racial and ethnic minority groups. Research with diverse samples across multiple large clinical care networks, such as this study, may help guide practice transformations that reduce health service disparities. Given that participants from both arms of the larger study received care management support beyond standard usual care,[15] our findings may conservatively under-estimate real-world disparities in accessing diagnostic care or receiving a true-positive screen.

Conclusions

In this study, we identified children who were least likely to receive a diagnostic evaluation after a confirmed positive M-CHAT-R/F screen among a sample of low-income, predominantly ethnic/racial minority families – a historically underserved group with elevated risk for delayed ASD diagnosis.[37] Younger parents, Hispanic families, those using public health insurance, and families not already engaged in Early Intervention may be less likely to receive a diagnostic evaluation after a positive ASD-specific screen. Given these findings, families with these characteristics may especially benefit from interventions aiming to enhance parent engagement and remove barriers to care. Study findings regarding predictors of receiving an ASD diagnosis suggest that the MCHAT-R/F screening process may have less positive predictive power for racial and ethnic minority families, females, and families who are administered the screener with a telephonic interpreter rather than directly in their preferred language. Future research and program development efforts must focus on

improving the validity of screening practices for diverse populations and engaging families who are most likely to be lost in the referral process from primary care.

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Abbreviations

M-CHAT-R/F	The Modified Checklist for Autism in Toddlers, Revised with Follow-Up
ABAS-2	Adaptive Behavior Assessment System, Second Edition
CI	Confidence interval
aOR	Adjusted odds ratio

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Table 1:

Characteristics of children and parents in sample

	Total Sample (n=309)	Model 1 Sample Control Arm Only (n=156)	Model 2 Sample Received Diagnostic Evaluation Only (n=253)
Variable	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Study site			
Philadelphia	144 (46.6)	74 (47.4)	123 (48.6)
Boston	110 (35.6)	54 (34.6)	94 (37.2)
New Haven	55 (17.8)	28 (17.9)	36 (14.2)
Diagnostic evaluation result			
Autism	152 (49.4)	68 (43.6)	151 (59.7)
Other disorder/delay	101 (32.7)	52 (33.3)	102 (40.3)
No evaluation	56 (18.1)	36 (23.1)	----
Sex of child (male)	215 (69.6)	106 (67.9)	178 (70.4)
Preferred language			
English	258 (83.5)	128 (82.1)	210 (83)
Spanish	40 (12.9)	23 (14.7)	32 (12.6)
Other	11 (3.6)	5 (3.2)	11 (4.3)
Screened with interpreter	33 (10.7)	16 (10.3)	28 (11.1)
Parent race/ethnicity			
Black, non-Hispanic	168 (55.8)	82 (54.7)	141 (57.3)
Hispanic, any race	88 (29.2)	43 (28.7)	65 (25.7)
Other, non-Hispanic	26 (8.6)	17 (11.3)	23 (9.1)
White, non-Hispanic	19 (6.3)	8 (5.3)	17 (6.9)
Parent Born in the United States	191 (62)	91 (58.7)	155 (61.3)
Parent graduated high school	259 (83.8)	131 (84.0)	218 (86.2)
Child insurance type			
Public insurance (Medicaid)	285 (92.2)	142 (91.0)	231 (91.3)
Private or other	24 (7.8)	14 (9.0)	22 (8.7)
Receiving Early Intervention	137 (44.3)	74 (47.4)	123 (48.6)
Child gestational age <37 weeks	43 (13.9)	22 (14.1)	35 (13.8)
Sibling with autism	31 (10)	16 (10.3)	27 (10.7)
Parent history of mood disorder	60 (19.4)	28 (17.9)	50 (19.8)
	Median (Q1, Q3)	**Median (Q1, Q3)**	**Median (Q1, Q3)**
Child age at screening (months)	21 (18, 24)	20 (18, 24)	20 (18, 24)
Parent age at screening (years)	30 (25, 34)	30 (25, 34)	31 (26, 35)
ABAS-2: Communication scaled score	5 (3, 6)	5 (3, 6)	4.5 (3, 6)
ABAS-2: Self-Direction scaled score	5 (3, 7)	5 (3, 7)	5 (3, 7)
ABAS-2: Social scaled score	5 (3, 7)	5 (3.25, 7)	5 (3, 7)
M-CHAT-R/F score	9 (4, 11)	8 (4, 10)	9 (5, 11)

	Total Sample (n=309)	**Model 1 Sample Control Arm Only (n=156)**	**Model 2 Sample Received Diagnostic Evaluation Only (n=253)**
PSS total score	24 (19, 30)	25 (17, 31)	25 (18, 30)
Parent level of worry about child's development	7 (5, 10)	7 (5, 10)	7 (5, 10)

Note. Q1 = 1st quartile, Q3 = 3rd quartile. Due to missing data, sample sizes of some variables are slightly reduced: parent race/ethnicity (n = 301), parent born in the United States (n = 308), parent age at screening (n = 306), ABAS-2 Communication (n = 301), ABAS-2 Self-Direction (n = 304) and Social (n = 302), PSS Total score (n =307). All other variables describe data from the total sample size (n = 309).

Table 2.

Best-fit model of predictors of receiving a diagnostic evaluation

	X^2	*p*	aOR	aOR 95% CI
Child age at screen (months)	31.53	<.001	0.86	[0.82, 0.91]
Parent age at screen (years)	16.01	<.001	1.10	[1.05, 1.16]
ABAS-2 communication	5.52	.02	0.89	[0.80, 0.98]
Private child health insurance	24.20	<.001	4.52	[2.48, 8.23]
Receiving Early Intervention	12.54	<.001	5.01	[2.05, 12.24]
Parent race/ethnicity	46.76	<.001		
White, non-Hispanic	55.17	<.001	1.91	[1.61, 2.26]
Black, non-Hispanic	36.70	<.001	3.77	[2.45, 5.79]
Other, non-Hispanic	4.06	.04	3.05	[1.03, 9.00]
Hispanic, any race [reference group]				

Note. aOR = Exp(B)

Table 3.

Best-fit model of predictors of receiving an autism diagnosis

	χ^2	*p*	aOR	aOR 95% CI
Sex of child (male)	199.22	<.001	1.69	[1.57, 1.82]
Screened without interpreter	33.90	<.001	3.57	[2.33, 5.49]
Parent race/ethnicity	33.08	<.001		
Black, non-Hispanic	7.68	0.006	0.16	[0.04, 0.59]
Hispanic, any race	5.72	0.02	0.16	[0.03, 0.72]
Other, non-Hispanic	10.58	0.001	0.19	[0.07, 0.51]
White, non-Hispanic [Reference group]				
Parent without mood disorder history	4.97	0.03	1.95	[1.08, 3.51]
ABAS-2 Communication	14.36	<.001	0.78	[0.69, 0.89]
Sibling with autism	2.75	0.10	0.33	[0.09, 1.22]

Note. aOR = Exp(B).

Table 4.

Bivariate associations of child and family-level variables with receiving a diagnostic evaluation and receiving an ASD diagnosis

	Received Diagnostic Evaluation		***Received Autism Diagnosis***	
Child/Family-Level Variable	χ^2	***p-value***	χ^2	***p-value***
Parent graduated high school	6.77	.009*	.49	.95
Receiving Early Intervention	10.39	.001*	.01	.91
Parent race/ethnicity	10.88	.01*	5.91	.12*
Child insurance type	2.34	.13*	.00	.96
Sibling with autism	1.24	.27	1.67	.196*
Sex of child	0.21	.65	4.75	.03*
Screened with interpreter	0.56	.46	3.82	.05*
Parent born in United States	0.44	.51	.11	.74
Child gestational age <37 weeks	0.43	.51	1.15	.28
Parent history of mood disorder	0.24	.63	2.15	.14*
	β (S.E.)	***p-value***	***β (S.E.)***	***p-value***
Child age at screen (months)	−.08 (.06)	.16*	.05 (.04)	.195*
Parent age at screen (years)	.10 (.04)	.003*	−.01 (.02)	.44
M-CHAT-R/F score	.13 (.05)	.02*	.05 (.03)	.14*
Parent level of worry about child's development	.08 (.06)	.22	.00 (.05)	.99
ABAS-2 Communication scaled score	−.13 (.07)	.07*	−.20(.06)	.001*
ABAS-2: Self-Direction scaled score	−.06 (.06)	.28	−.04 (.04)	.41
ABAS-2: Social scaled score	−.04 (.08)	.64	−.10 (.05)	.07*
PSS total score	.007 (.02)	.72	−.02 (.01)	.26

Note.

* = Predictor meeting criteria (P<.20) to consider for inclusion in the GEE model.