# Child Age at Time of First Maternal Concern and Time to Services among Children with Autism Spectrum Disorder

**Julia Van Dyke, MS**[a], **Steven A. Rosenberg, PhD**[b], **Tessa Crume, PHD, MSPH**[a], **Nuri Reyes, PhD**[c], **Aimee Anido Alexander, MS, CGC**[d], **Brian Barger, PhD**[e], **Robert Fitzgerald, PhD, MPH**[f], **Kristina Hightshoe, MSPH**[a], **Eric J. Moody, PhD**[g], **Karen Pazol, PhD, MPH**[d], **Cordelia R. Rosenberg, PhD, RN**[c], **Eric Rubenstein, PhD**[h], **Lisa Wiggins, PhD**[d], **Carolyn DiGuiseppi, MD, PhD, MPH**[a]

[a]Department of Epidemiology, Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO

[b]Department of Psychiatry, School of Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO

[c]Department of Pediatrics, School of Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO

[d]Division of Human Development and Disability, National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, Atlanta, GA

[e]Center for Leadership in Disability, School of Public Health, Georgia State University, Atlanta, GA

[f]Department of Psychiatry, Washington University in St. Louis, St. Louis, MO

[g]Wyoming Institute for Disabilities, University of Wyoming, Laramie, WY

[h]Department of Epidemiology, Boston University School of Public Health, Boston, MA

## Abstract

**Objective**—Early treatment of autism spectrum disorder (ASD) can improve developmental outcomes. Children with ASD from minority families often receive services later. We explored factors related to child's age at time of mother's first concerns about child's development and subsequent time to service initiation among children with ASD.

**Methods**—Analysis included 759 preschool-age children classified with ASD based on comprehensive evaluations. Factors associated with retrospectively-reported child age at time of first maternal concern and subsequent time to service initiation were investigated using multiple linear regression and Cox proportional-hazards.

**Results**—Earlier maternal concern was associated with multiparity, ≥1 child chronic condition, externalizing behaviors, and younger gestational age, but not race/ethnicity. Time to service initiation was longer for children of non-Latino Black or other than Black or White race and

Address correspondence to: Carolyn DiGuiseppi, MD, PhD, MPH, University of Colorado Anschutz Medical Campus, 13001 East 17th Place, Campus Box B-119, Aurora, CO 80045, Carolyn.DiGuiseppi@cuanschutz.edu, FAX: 303-724-4489.

higher developmental level, and shorter for children with   1 chronic condition and older child age at first maternal concern.

**Conclusion—**Parity, gestational age, and child health and behavior were associated with child age at first maternal concern. Knowledge of child development in multiparous mothers may allow them to recognize potential concerns earlier, suggesting that first time parents may benefit from enhanced education about normal development. Race/ethnicity was not associated with child's age when mothers recognized potential developmental problems, hence it is unlikely that awareness of ASD symptoms causes racial/ethnic disparities in initiation of services. Delays in time to service initiation among children from racial/ethnic minority groups highlight the need to improve their access to services as soon as developmental concerns are recognized.

### Keywords

autism spectrum disorder; access to services; early intervention; health disparities

## INTRODUCTION

Autism spectrum disorder (ASD) is a developmental disability associated with social and behavioral deficits emerging in early childhood. Because early intervention can improve developmental outcomes for children with ASD, the American Academy of Pediatrics recommends screening and developmental surveillance to detect ASD symptoms as early as possible.[1] However, despite efforts to improve identification, children from racial and ethnic minority groups, from families of lower socioeconomic status or born to non-US-born mothers are often diagnosed later than other children.[2,3,4] These children also have less access to services, receive less intensive services and have more unmet service needs than more advantaged peers.[5]

The child age at which parents first become concerned about developmental problems is a key contributor to earlier diagnosis of ASD,[2] as parental concerns increase the likelihood that they will discuss potential problems with providers, pursue diagnosis of ASD and initiate treatment.[6] Research has demonstrated that younger child age at time of first parental concern about child development is associated with higher maternal parity,[6,7] prematurity,[8,9] child chronic health conditions,[7,8,10,11] learning difficulties or cognitive delay,[6,8,10,11] and ASD symptom severity.[7,10] The literature is inconsistent, however, in demonstrating associations with demographic characteristics. Two studies reported younger child age at time of first parental concern for girls than boys,[8,12] while others found no child gender-based differences.[6,7,10] In Rosenberg et al. (2011),[8] initial parental concerns were later for African-American, Asian-American, and Hispanic children, whereas others found no difference by parent race or ethnicity.[6,7,13] Donohue et al. (2019)[14] found Black parents reported fewer ASD-related concerns compared to white parents, and Blacher et al. (2019)[15] that Hispanic mothers reported fewer ASD-related concerns compared with non-Hispanic mothers. Establishing relationships between sociodemographic factors and age of first parental concern is important for guiding targeted interventions to reduce racial, ethnic and gender disparities in diagnosing and treating ASD.

Although studies have examined the relationship between child age at time of first parental concern and time to diagnosis,[2] previous research has not studied time between first concern about development and initiation of services. This has potential implications for decisions about offering services to children whose parents have raised concerns about development while awaiting diagnosis. As noted by McNally Keehn et al (2021), long wait times and limited availability of diagnosticians contribute to delayed ASD diagnosis, in turn delaying entry into services.[16] White children are more likely than Black or Asian children to have already begun early intervention services at the time of a positive developmental screen,[17] suggesting that delaying intervention until after diagnosis contributes to disparities in receiving services. Zablotsky et al. (2017)[6] observed differences in associations of gender and ethnicity with age at diagnosis versus age at first services, with male and Hispanic children receiving later services, but not later ASD diagnosis, than female and non-Hispanic children. Understanding factors that influence when children first receive developmental services, including the potential impact of delayed parental recognition of developmental problems, sociodemographic and other factors, is essential to understanding and addressing disparities in access to treatment.

Some studies that examined time of first concern and diagnosis have important limitations. Some used less rigorous criteria for ASD such as parent report of having been told by a health care provider their child had ASD,[e.g., 6] or a screener rather than widely accepted evaluation tools to identify children with ASD.[e.g., 13] Others used small samples.[e.g., 4] Studies are needed that examine the relationship between parental concerns and initiation of services utilizing larger, more diverse samples of young children whose ASD diagnosis has been confirmed by high quality, comprehensive diagnostic evaluation.

This analysis sought to answer the following research questions using a large, diverse sample of children with verified ASD: are sociodemographic factors, as well as parity and child health and development, associated with (1) child age at time of first maternal concern about their development and (2) time from first maternal concern about child's development to initiation of services? We hypothesized that sociodemographic factors would be associated with both child age at time of first maternal concern and subsequent time to initiation of services.

## METHODS

This case-only analysis examined data collected at one timepoint from participants enrolled in the Study to Explore Early Development (SEED), a multisite case-control study exploring ASD phenotypes and risk factors, during Phase 2 (SEEDII, which included children born between 2008 and 2011 and assessed between 2012 and 2016), who met SEED research criteria for ASD.

SEED recruited children with ASD or other developmental delays and disorders from clinical and educational settings, and children from the general population from vital records.[18] Eligible children were born and currently resided in one of six catchment areas in California, Colorado, Georgia, Maryland, North Carolina, and Pennsylvania; were aged 30-68 months at the study clinic visit; and lived with their biological mother. CDC and

site institutional review boards approved the study. Potentially eligible families were mailed an invitation, then called to determine eligibility. Participating families provided written informed consent.

The Social Communication Questionnaire (SCQ)[19] was administered to mothers of every enrolled child to screen for possible undiagnosed ASD. At the clinic visit, children with SCQ score 11 or prior ASD diagnosis or educational eligibility received a comprehensive developmental assessment including standardized ASD-specific diagnostic instruments: Autism Diagnostic Observation Scale, 2nd ed. (ADOS-2)[20] and Autism Diagnostic Interview-Revised (ADI-R).[21] Results determined whether children met the study ASD case definition.[22] At the time of the clinic visit, we collected data about child and family demographics, pregnancy experiences, child diagnosed medical conditions and, for children who were SCQ-positive or had a prior ASD diagnosis or eligibility, child age at initiation, types, and frequency of services and treatments. The Child Behavior Checklist for Ages 1½–5 (CBCL/1½–5; Achenbach & Rescorla, 2000) assessed emotional and behavioral problems;[23] higher scores indicate greater problem severity. Mullen Scales of Early Learning (MSEL) assessed early learning abilities;[24] higher scores indicate higher developmental level.

### Outcomes

Outcome data were collected at the clinic visit (Figure 1). Child age at time of first maternal concern came from the ADI-R, which asks "How old was [child] when you first wondered if there might be something not quite right with her/his development?" To assess time to initiation of services, we asked, "Has your child ever used the following services or therapies?" and if YES, child age at initiation of services. The outcome was calculated as the difference in months between child age at time of first maternal concern and age at service initiation, defined as the youngest age, in months, the parent reported their child beginning any services recommended for children with ASD[1]: applied behavior analysis behavior modification, speech language therapy, occupational therapy, physical therapy, social skills training, classroom aide, para-educator or shadow, special needs preschool program or other, specified in free text. Three SEED researchers determined by consensus whether free text answers qualified as relevant services, excluding complementary or alternative treatment.

### Independent Variables

We assessed child sex, gestational age at birth, chronic medical conditions, insurance status, and older siblings' ASD diagnosis; maternal race/ethnicity, education at child's birth, language typically spoken at home, birth country, and parity; and total household income during 12 months before pregnancy, categorized as shown in Table 1. Parity was defined as the number of times the mother had given birth, up to and including the index child's birth, regardless of multiple gestation or pregnancy outcome. Mothers were asked if their child had any chronic medical condition(s) from a list provided (e.g., asthma) or any other unlisted chronic medical condition. Children with at least one specified condition, or a free text answer indicating a complex chronic condition as defined by Feudtner et al. (2000),[25] were coded "Yes." The interview did not collect onset dates of chronic conditions.

Child behavior and development test scores obtained at the clinic visit were investigated as independent variables: ADOS-2 severity summary score, representing ASD symptom severity,[20,26] CBCL internalizing (e.g., withdrawn, fearful) and externalizing (e.g., aggressive) behaviors t-scores,[23] and MSEL Early Learning Composite (ELC) standard score.[24]

### Data Analysis

For analyses of child age at time of first maternal concern, we excluded three children whose mothers could not recall the child's age at time of first concern and 11 whose mothers were never concerned. We investigated univariate relationships using simple linear regressions between each independent variable with this outcome. As several prior studies found that parents from racial and ethnic minority groups had later or fewer concerns about their child's development or autism symptoms than White or non-Hispanic parents,[8,14,15] we used non-Hispanic White race/ethnicity as the reference group when modeling race/ethnicity in relation to this outcome. Variables with p<0.2 were added to an initial multiple linear regression model, after excluding variables with evidence of multicollinearity based on correlation coefficient >=0.7 and variance inflation factor >=4 (none identified). Model selection used manual backwards selection with Akaike information criterion (AIC), removing the independent variable with the highest p-value at each step and selecting the model with the lowest AIC. Alpha=0.05 was used to assess statistical significance in the final model. A residuals plot and QQ-plot were created to assess normality. After selecting the final model, a sensitivity analysis examined the same model restricted to children with a previous community ASD diagnosis, as these children may have been more likely to receive services or to receive them earlier.

We analyzed time from child age at first maternal concern to initiation of services using Cox proportional-hazards models. Child age at time of first maternal concern was included as an independent variable in these models. We excluded 42 children who received services before their age at first maternal concern and seven missing age at initiation of services. Children who never received services were included in the analyses but their time to service initiation was right censored at the study clinic visit date, accounting for the fact that these children had not yet experienced any services by the date of outcome assessment. The proportional hazards assumption was confirmed by plotting potential independent variables in Kaplan Meier curves. Assessment of collinearity and model selection were as described above. Given existing literature that children from racial and ethnic minority groups have delayed or less access to services compared to White or non-Hispanic children,[5, 6, 17] we used non-Hispanic White race/ethnicity as the reference group when modeling race/ethnicity in relation to this outcome. Hazard Ratios (HR) are interpreted as the 'risk' of initiating services at any point in time compared to the reference group: HR >1 indicates shorter time to initiation of services compared to the reference group and HR<1 indicates a longer time. To examine potential modification by child age at time of first maternal concern, we tested interaction terms between this variable and any independent variables included in the final model.

## RESULTS

Of 773 SEEDII children with an ASD classification, we included 759 (98.2%) children with data on child age at time of first maternal concern; 710 (91.8%) also had data on initiation of services. Participant characteristics are shown in Table 1. Mean child age at first maternal concern was 15.1 months. Mean time from child age at first maternal concern to initiation of services was 11.7 months. Characteristics of the 49 participants excluded from analysis of time to initiation of services were similar to those included, except mean child age at time of first maternal concern was about 4 months later.

### Child age at time of first maternal concern

In univariate analyses, U.S. born mother, higher parity, younger child gestational age, at least one child chronic condition, and higher internalizing and externalizing behavior scores were associated with younger child age at time of first maternal concern at p <0.2 (Table 2). Race/ethnicity overall was not statistically significantly associated with this outcome and therefore was excluded from the final model. In univariate analysis, mothers of non-Latino other race children first had concerns about development at older child age compared to non-Latino White mothers, but confidence intervals were wide due to the small number represented by this diverse group of participants (see footnote, Table 1). Internalizing behavior t-score was not retained in the adjusted model based on best model fit. All other variables significant at p<0.2 in univariate analyses were retained.

Six hundred sixty-four children (87.5%) had previously been diagnosed with ASD at enrollment. Analyzes limited to these children had similar results, except the associations of CBCL externalizing T-score and chronic conditions with child age at time of first maternal concern were no longer statistically significant.

### Time to initiation of services

Many children began receiving multiple types of services at the time of service initiation. The most common services first received were speech/language therapy (64.6%) and occupational therapy (42.7%), with 74.6% of children receiving one or both of these services first. Also commonly received first were special needs preschool (22.5%) and physical therapy (16.5%). In univariate analyses, older child age at time of first maternal concern was associated with shorter time to services, while non-Latino Black and non-Latino other race/ethnicity, lower maternal educational attainment, older gestational age, at least one child chronic condition, higher developmental level, and more internalizing and externalizing behaviors were associated with longer time to initiation of services at p <0.2 (Table 3). To illustrate the absolute impact on this outcome, we calculated the unadjusted mean difference in time to initiation of services from child age at time of first maternal concern about development by race/ethnicity: time to services was nearly two months longer for children of non-Latino Black mothers (1.60 months [95%CI: 0.18, 3.38] and non-Latino other race mothers (1.97 months [−0.34, 4.29] compared to children of non-Latino White mothers. Interactions were not statistically significant. Internalizing behavior t-score was not retained based on best model fit. In our adjusted model, children with older age at time of first maternal concern or at least one chronic condition had significantly shorter time

to initiation of services, while children with higher developmental level or whose mothers were non-Latino Black or non-Latino other race had significantly longer time to services initiation compared to children without these characteristics (Table 3). Approximately 1% of participants had not reported receiving any services at the clinic visit date and were right censored (see Data Analysis above). The sensitivity analysis restricted to children with previously diagnosed ASD had similar results, except the association with maternal race/ethnicity was no longer significant.

## DISCUSSION

Factors influencing child age at time of first maternal concern and time to initiation of services may guide improvements in access to early intervention and service programs to maximize developmental potential for children with ASD. Higher maternal parity, younger gestational age, at least one child chronic condition, and more externalizing behavior problems, but not race/ethnicity, were associated with younger child age at time of first maternal concern. Having a chronic condition and older child age at time of first maternal concern were associated with shorter time to service initiation, while higher developmental level and maternal non-Latino Black or non-Latino race other than Black or White were associated with increased time to initiation of services.

Current literature supports several of our findings. Younger gestational age and presence of chronic conditions were also associated with younger age of first maternal concern in other studies.[7-11] This is likely due to children born prematurely or with chronic health conditions being observed more closely by parents and providers compared to other children, which supports the potential benefits of developmental surveillance for all children. Our finding that multiparous mothers identify developmental concerns at younger child ages than primiparous mothers is consistent with several prior studies that found mothers with an older child had a younger child age at time of first maternal concern.[6,8] Mothers with an older child may have greater awareness of typical development, and therefore identify potential problems earlier than less experienced mothers. Previous research has found younger child age at time of first parental concern when older siblings had an ASD diagnosis.[27] Only 43 children in our sample had an older sibling diagnosed with ASD, precluding investigation of this factor. Children with increased behavioral problems may present challenges that attract notice earlier; for example, hyperactivity, oppositional behaviors, and temper problems have been associated with both younger child age at time of first maternal concern and ASD diagnosis.[28]

Although some studies of children with ASD found non-Latino Black[14] and Latino mothers[15] reported fewer developmental concerns compared to non-Latino White parents, others found, as we did, that race/ethnicity and other sociodemographic variables were not associated with child age at time of first maternal concern.[10,13] However, we found children of mothers of non-Latino Black race and non-Latino race other than Black or White had significantly longer time to initiation of services from child age at first maternal concern, a finding supported in existing literature showing children from racial/ethnic minority groups have later access to services than White children.[29,30] Mothers from racial/ethnic minority groups may experience more barriers to care,[30] such as lack of knowledge about ASD and

healthcare systems, difficulty scheduling services,[31] lack of trust in providers,[32] implicit provider bias,[33] reliance on social networks to inform help-seeking,[34] social and financial stressors,[34] and culturally different views of child behavior,[14] which may lead to later service initiation.

We found that mothers who first become concerned about development at older child age have a shorter time to services, and conversely, earlier concerns were associated with a longer time to services. We suspect this is due to some services, e.g., special needs preschool programs, only becoming available at 36 months of age.

### Limitations and Strengths

This study has several limitations. Most data were collected retrospectively by maternal recall. Reporting could be biased if parents of children with more severe disability recalled earlier concerns than those with less severe disability. SEED did not collect age at ASD diagnosis in those with an existing community ASD diagnosis, hence we were unable to evaluate how child age at ASD diagnosis may have mediated the relationship between child age at time of first maternal concern and time to initiation of services. We did not collect data on age of diagnosis for child chronic conditions. A condition diagnosed after initiating services for ASD is unlikely to have influenced child age at time of first maternal concern or time to initiation of services, which may have biased the association toward the null. The ADOS-2 and MSEL scores measured current ASD severity and developmental level, which does not necessarily represent severity or development at child age at time of first concern or initiation of services. We assessed income during the 12 months prior to pregnancy and insurance status during the 12 months prior to the clinic visit, which may not represent the family's status during the periods of interest. Since we did not have data from multiple time periods, we could not add time-varying covariates. The Cox proportional-hazards model required assuming these values stayed consistent over time, although some may have changed. Our sample included families consenting to research participation, who may have had earlier or greater concerns compared to families who did not participate.

Strengths of this study include identification and inclusion of children not previously diagnosed with autism (potentially increasing inclusion of families lacking access to health care or diagnostic services, or children with milder symptoms), research-reliable administration of standardized instruments to classify children with ASD and to evaluate behavior and cognitive development, ability to examine simultaneously multiple factors potentially associated with the outcomes of interest, and the large, diverse sample included.

## CONCLUSION

The finding that child age at time of first maternal concern about development was unrelated to race/ethnicity indicates that maternal awareness of child development is unlikely to be an important contributor to racial/ethnic disparities in accessing services. Mothers from racial/ethnic minority groups nevertheless reported longer time to initiation of services from the time of their first concern about their child's development. The relationship between race/ethnicity and later service initiation suggests other factors are responsible for disparities in time to services, such as failure of providers to refer children from racial and ethnic

minority groups for evaluation and treatment, or a lack of insurance or financial resources, parent knowledge about potential benefits of early intervention, or availability of specialized services in the community. Efforts to improve access to services could include expanded screening and improved surveillance,[1] outreach to communities with less access,[33] and providing navigation to facilitate service access.[35] First-time mothers became concerned at older child age than multiparous mothers, suggesting first-time mothers may need help recognizing normal development.

While past research has focused on time from initial concern to diagnosis, we investigated time from initial concern to service initiation. Given our finding of longer time before initiation of services for children of mothers from racial/ethnic minorities, we recommend monitoring and supporting families expressing concerns about their child's development and considering developmental interventions prior to a formal diagnosis to avoid delays and reduce racial/ethnic service disparities, especially where access to diagnostic services is limited. For example, Healthy Steps (www.healthysteps.org/) introduces child development experts into pediatric settings to work with families to support child development, while offering additional guidance and resources to families with concerns.

Our research focused on time from first maternal concern about child development to initiation of any services as a key marker for disparities. Future research to examine potential variability in time to services for different types of services would be a valuable contribution. Similarly, we suggest future research aiming to address barriers at each step from time of first parental concern about child development to discussion with their primary care provider, subsequent diagnostic assessment and initiation of services.

## Acknowledgements:

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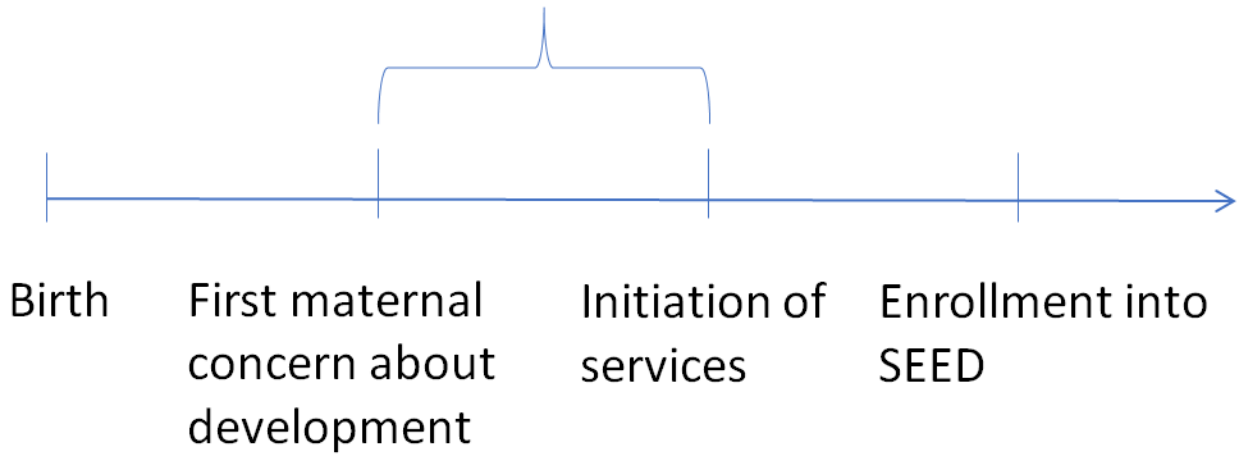
**Figure 1.**
Study Timeline

**Table 1.**

Characteristics of preschool children with autism spectrum disorder and their biological mothers in the Study to Explore Early Development (SEED) phase II; N = 759

| Variables | |
| --- | --- |
| **Outcomes** | **Mean (SD)** |
| Age at first maternal concern (months) | 15.1 (8.9) |
| Age at initiation of services (months) | 26.7 (11.4) |
| Time to initiation of services from age at maternal concern (months) | 11.7 (10.5) |
| **Maternal Characteristics** | **N (%)** |
| Race/ethnicity | |
| Non-Latino White | 346 (46.3) |
| Non-Latino Black | 195 (26.1) |
| Non-Latino other [*] | 88 (11.8) |
| Latino any race | 118 (15.8) |
| Mother's highest education at child's birth | |
| High school or less | 126 (16.6) |
| Some college | 235 (31.0) |
| Bachelor's degree | 246 (32.5) |
| Master's degree or greater | 151 (19.9) |
| Total household income for 12 months prior to pregnancy | |
| < $30,000 | 175 (23.7) |
| $30,000 - < $70,000 | 242 (32.8) |
| $70,000 - $110,000 | 169 (22.9) |
| > $110,000 | 153 (20.7) |
| Mother's primary language spoken at home | |
| English | 669 (88.4) |
| Spanish | 42 (5.6) |
| Other | 46 (6.0) |
| Mother's country of birth | |
| U.S. | 577 (76.1) |
| Outside the U.S., living in U.S. for 9 years or longer | 92 (12.1) |
| Outside the U.S., living in U.S. for less than 9 years | 89 (11.7) |
| Parity at time of child's birth | |
| First birth | 389 (51.3) |
| Second or later birth | 370 (48.8) |
| **Child characteristics** | **N (%)** |
| Child sex - male | 616 (81.3) |
| Child has at least one chronic condition | 298 (39.5) |
| Child uninsured in past 12 months | 40 (5.3) |

| Variables | |
|---|---|
| Child has older sibling diagnosed with autism spectrum disorder | 43 (5.7) |
| | **Mean (SD)** |
| Gestational age (weeks) | 38.4 (4.6) |
| ADOS Severity score | 7.4 (1.7) |
| MSEL ELC Standard Score | 66.1 (19.1) |
| CBCL Internalizing T-score | 62.6 (9.6) |
| CBCL Externalizing T-score | 59.3 (11.3) |

Continuous variables are presented as means and standard deviations (SD) and categorical variables are presented as Ns and percentages. ADOS = Autism Diagnostic Observation Schedule; MSEL = Mullen Scales of Early Learning; ELC = Early Learning Composite; CBCL = Child Behavior Checklist.

*
"Non-Latino other" combines American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, and Multiple Races, where ethnicity was not Latino.

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**Table 2.**

Relationships between demographic and clinical characteristics of children ages 3-5 years with autism spectrum disorder and age at first maternal concern about their development, Study to Explore Early Development

| Variable | Crude model | | | Adjusted model[1] | | |
|---|---|---|---|---|---|---|
| | Beta estimate for relationship with age at first concern (months) | 95% Confidence Interval | P-Value | Beta estimate for relationship with age at first concern (months) | 95% Confidence Interval | P-Value |
| Race/ethnicity | | | 0.21 | | | |
| Non-Latino White | Ref | Ref | | | | |
| Non-Latino Black | 0.95 | (−0.59, 2.49) | | | | |
| Non-Latino other | 2.08 | (0.02, 4.13) | | | | |
| Latino any race | 0.85 | (−0.99, 2.68) | | | | |
| Mother's highest education at child's birth | | | 0.37 | | | |
| High school or less | −0.26 | (−2.15, 1.62) | | | | |
| Some college/trade | −1.16 | (−2.74, 0.42) | | | | |
| Bachelor's degree | Ref | Ref | | | | |
| Advanced degree | −1.27 | (−3.05, 0.51) | | | | |
| Total household income for 12 months prior to pregnancy | | | 0.73 | | | |
| Less than $30,000 | 0.10 | (−1.60, 1.80) | | | | |
| $30,000 - $70,000 | Ref | Ref | | | | |
| $70,000-$110,000 | 0.73 | (−0.98, 2.45) | | | | |
| More than $110,000 | 0.82 | (−0.95, 2.59) | | | | |
| Mother's primary language spoken at home | | | 0.21 | | | |
| English | Ref | Ref | | | | |
| Spanish | −0.42 | (−3.16, 2.32) | | | | |
| Other | 2.32 | (−0.31, 4.94) | | | | |
| Mother's country of birth | | | **0.10** | | | 0.09 |
| U.S. | Ref | Ref | | Ref | Ref | |
| Outside the U.S., living in U.S. for 9 years or longer | 0.74 | (−1.19, 2.67) | | 0.87 | (−1.03, 2.77) | |

| Variable | Beta estimate for relationship with age at first concern (months) | 95% Confidence Interval | P-Value | Beta estimate for relationship with age at first concern (months) | 95% Confidence Interval[1] | P-Value |
|---|---|---|---|---|---|---|
| | Crude model | | | Adjusted model[1] | | |
| Outside the U.S., living in U.S. for less than 9 years | 2.10 | (0.14, 4.06) | | 2.27 | (0.32, 4.21) | |
| Parity at time of child's birth - second or later birth | −1.64 | (−2.89, −0.40) | **0.01** | −1.54 | (−2.79, −0.30) | **0.02** |
| Child sex - female | 0.26 | (−1.34, 1.86) | 0.75 | | | |
| Gestational age (weeks) | 0.18 | (0.05, 0.32) | **0.01** | 0.19 | (0.06, 0.33) | **0.01** |
| Child has at least one chronic condition | −1.89 | (−3.16, −0.62) | **<0.00** | −1.35 | (−2.63, −0.08) | **0.04** |
| Child uninsured in past 12 months | 1.41 | (−1.37, 4.19) | 0.32 | | | |
| ADOS Severity score | 0.15 | (−0.22, 0.52) | 0.43 | | | |
| MSEL ELC Standard Score | −0.00 | (−0.04, 0.03) | 0.88 | | | |
| CBCL Internalizing T-score | −0.07 | (−0.14, −0.01) | **0.03** | | | |
| CBCL Externalizing T-score | −0.07 | (−0.13, −0.02) | **0.01** | −0.06 | (−0.12, −0.01) | **0.02** |

[1]. Adjusted model includes variables shown.

[2]. ADOS= Autism Diagnostic Observation Schedule; MSEL = Mullen Scales of Early Learning; ELC=Early Learning Composite; CBCL = Child Behavior Checklist; Ref = reference group

[3]. Univariate relationships that were significant at p < 0.2 and adjusted relationships that were significant at p < 0.05 are bolded

**Table 3.**

Relationships between demographic and clinical characteristics of children age 3–5 years with autism spectrum disorder and time to initiation of treatment after first maternal concern about development, Study to Explore Early Development

| Variables | Hazard ratio for relationship with time to treatment | 95% Confidence Interval | P-Value | Hazard ratio for relationship with time to treatment | 95% Confidence Interval | P-Value |
|---|---|---|---|---|---|---|
| | **Crude model** | | | **Adjusted model**[1] | | |
| Age of first maternal concern (months) | 1.030 | (1.022, 1.039) | **<0.00** | 1.036 | (1.026, 1.045) | **<0.00** |
| Race/ethnicity | | | **0.08** | | | **0.01** |
| Non-Latino White | Ref | Ref | | Ref | Ref | |
| Non-Latino Black | 0.809 | (0.674, 0.971) | | 0.748 | (0.617, 0.909) | |
| Non-Latino other | 0.797 | (0.623, 1.019) | | 0.749 | (0.582, 0.962) | |
| Latino any race | 0.923 | (0.742, 1.146) | | 0.969 | (0.774, 1.213) | |
| Mother's highest education at child's birth | | | **0.11** | | | 0.06 |
| High school or less | 0.856 | (0.682, 1.074) | | 0.863 | (0.677, 1.101) | |
| Some college/trade | 1.096 | (0.911, 1.317) | | 1.110 | (0.915, 1.346) | |
| Bachelor's degree | Ref | Ref | | Ref | Ref | |
| Advanced degree | 1.129 | (0.914, 1.395) | | 1.213 | (0.975, 1.509) | |
| Total household income for 12 months prior to pregnancy | | | 0.33 | | | |
| Less than $30,000 | 0.859 | (0.701, 1.054) | | | | |
| $30,000 – $70,000 | Ref | Ref | | | | |
| $70,000-$110,000 | 1.045 | (0.853, 1.281) | | | | |
| More than $110,000 | 0.953 | (0.772, 1.177) | | | | |
| Mother's primary language | | | 0.31 | | | |
| English | Ref | Ref | | | | |
| Spanish | 1.140 | (0.818, 1.589) | | | | |
| Other | 0.818 | (0.600, 1.116) | | | | |
| Mother's country of birth | | | 0.21 | | | |
| U.S. | Ref | Ref | | | | |

| Variables | Hazard ratio for relationship with time to treatment | 95% Confidence Interval | P-Value | Hazard ratio for relationship with time to treatment | 95% Confidence Interval[1] | P-Value |
|---|---|---|---|---|---|---|
| | Crude model | | | Adjusted model[1] | | |
| Outside the U.S., living in U.S. for 9 years or longer | 1.050 | (0.833,1.324) | | | | |
| Outside the U.S., living in U.S. for less than 9 years | 0.824 | (0.654, 1.039) | | | | |
| Parity at time of child's birth second or later birth | 0.924 | (0.797, 1.072) | 0.30 | | | |
| Child sex - female | 1.058 | (0.872, 1.283) | 0.57 | | | |
| Gestational age (weeks) | 0.988 | (0.972, 1.005) | **0.17** | 0.989 | (0.971, 1.006) | 0.21 |
| Child has at least one chronic condition | 0.904 | (0.766, 1.052) | **0.12** | 1.287 | (1.096, 1.512) | **<0.00** |
| Child uninsured in past 12 months | 0.916 | (0.648, 1.293) | 0.62 | | | |
| ADOS Severity score | 1.022 | (0.979, 1.067) | 0.32 | | | |
| MSEL ELC Standard Score | 0.995 | (0.991, 0.999) | **0.02** | 0.992 | (0.988, 0.997) | **<0.00** |
| CBCL Internalizing T-score | 0.992 | (0.985, 0.999) | **0.03** | | | |
| CBCL Externalizing T-score | 0.993 | (0.987, 0.999) | **0.03** | 0.995 | (0.988, 1.001) | 0.08 |

[1.] Adjusted model includes variables shown.

[2.] ADOS= Autism Diagnostic Observation Schedule; MSEL = Mullen Scales of Early Learning; ELC=Early Learning Composite; CBCL = Child Behavior Checklist; Ref = reference group

[3.] Univariate relationships that were significant at p < 0.2 and adjusted relationships that were significant at p < 0.05 are bolded