Published in final edited form as:

J Health Care Poor Underserved. 2021 ; 32(3): 1359–1371. doi:10.1353/hpu.2021.0137.

Achieving Diagnostic Resolution in Young Children with Social Communication Concerns in a Predominantly Low-Income Population

Hong-An T. Nguyen, MD, MSc,

The Children's Hospital at Montefiore/Albert Einstein College of Medicine

Jessica Rosenberg, MPH,

Boston Medical Center/Boston University School of Medicine

Caroline J. Kistin, MD, MSc,

Boston Medical Center/Boston University School of Medicine

Emily Feinberg, ScD,

Boston Medical Center/Boston University School of Medicine.

Sarabeth Broder-Fingert, MD, MPH

University of Massachusetts Medical School.

Abstract

Children in low-income families are at risk for delayed diagnosis of autism spectrum disorder (ASD). The cascade-of-care model, which examines steps of care for quality and efficacy, can identify lesions in the process for evaluation and diagnosis for children at risk for ASD. Little is known about predictors that influence key steps in this process. We performed a retrospective chart review of 110 children under age five years from an academic medical center with social communication concerns. We assessed predictors of age of referral for ASD diagnostic evaluation, time to diagnosis, and likelihood of diagnostic completion. Children with continuity of primary care were referred at an earlier age than those receiving primary care at multiple centers. Compared with children with missed visits, children attending all well-child visits had a shorter median time to diagnosis. These findings illustrate a need for primary medical homes to facilitate early and timely ASD evaluations

Keywords

Autism spectrum disorder; primary care; low income; children; diagnostic resolution

Social communication disorders, including autism spectrum disorder (ASD), have increased in prevalence over the last 20 years.^{1,2} Previous studies have demonstrated that children can reliably be diagnosed with ASD before age three,^{3–5} and early age of diagnosis and

initiation of intensive services is linked to improved outcomes.^{6–8} Because of this, the American Academy of Pediatrics (AAP) recommends universal screening for developmental delays during well-child visits in early childhood and standardized screening for ASD starting at 18 months.^{9,10} Some states mandate developmental screening at multiple visits between nine months and four years of age for Medicaid reimbursement.^{11–12} Despite this focus on early ASD diagnosis, many children continue to be diagnosed years later than the optimal time.¹³ Children in low-income families are especially at risk for a later age of diagnostic resolution.^{14–16}

The diagnostic process for children with social communication concerns involves several key steps: 1) identification of developmental concerns and referral for diagnostic evaluation by the primary care provider; 2) timely completion of evaluation visits performed by a diagnostic provider (usually a developmental behavioral pediatrician or a psychologist); 3) ascertainment of diagnosis. Because diagnosis requires synthesis of data from multiple sources (i.e., parent, provider), the ascertainment of diagnosis is a separate step from the clinical evaluation. After these steps are complete, a child becomes eligible for ASD-specific treatment services. Every step in this process directly affects the timing of the next step. Delays in any of the steps contribute to a later age of diagnosis in these young children, and therefore leads to delayed access to necessary developmental services.

Given the need for sequential steps to achieve diagnostic resolution and engagement in services, we applied the cascade-of-care model to assess these barriers in the evaluation and diagnostic process.¹⁷ The *cascade-of-care model* was initially used during the HIV/AIDS epidemic to understand the quality of HIV care delivery by carefully assessing each step of care, such as diagnosis, engagement, retention in care, adherence to therapy, and viral suppression. This model has been successfully adapted for hepatitis C and diabetes care.^{18,19} To our knowledge, no studies have applied the cascade-of-care model to ASD to assess for gaps in the process and identify specific modifiable factors that can reduce delays in the diagnostic process for a low-income population. Without these data, developing solutions to these delays can be challenging.

Therefore, our primary aims in this study were to assess, in a predominantly low-income population: 1) predictors of earlier versus later age of referral for ASD or other social communication disorders; 2) differences among groups in median time to diagnostic resolution; 3) and likelihood of completing the diagnostic process.

Methods

Participants and procedures.

We conducted a retrospective cohort study of children referred for social communication concerns to an academic medical center's developmental-behavioral pediatric (DBP) clinic located in an urban, safety-net hospital in Massachusetts. A safety-net hospital is defined as a hospital that delivers health care regardless of insurance status and ability to pay and thus serves a predominantly low-income population²⁰. The medical center's pediatric primary care practice is an academic faculty practice with pediatric residents. These children were

referred by the practice's providers because of elicited concern from the providers and/or the parents during clinic visits. The authors' institutional review board approved this study.

Children were included in the cohort if they 1) received primary care at the center's pediatric practice; 2) were under age five years; and 3) were referred during the period of February 9, 2015 to December 31, 2017. There were 158 children available for initial review. Children who had a prior diagnosis of ASD (16 children) or had been referred to research studies that aimed to improve access to diagnostic services at the medical center (32 children) were excluded. Ultimately, 110 children were eligible for the study.

The evaluation process at the DBP clinic consisted of three visits: 1) initial intake of the patient and primary caregivers, including pertinent history and exam; 2) evaluation of the patient, including administration of a developmental assessment, 3) discussion of diagnosis with the patient's caregivers and recommended next steps. The time between visits 2 and 3 was typically one week. If the child completed the evaluation and received a diagnosis at the conclusion of the evaluation, this was defined as diagnostic resolution. Examples of the diagnoses included ASD, developmental delay, language delay, and typical development.

Data extraction.

We reviewed data from the children's medical records from age 18 months through the completion of their diagnostic evaluation, when diagnostic resolution was achieved. We reviewed through February 28, 2019 the records of children who did not achieve diagnostic resolution in order to confirm their status. Although the chosen date meant that some children had longer follow-up times than others, the date ensured that all children who did not achieve diagnostic resolution had their records reviewed for a minimum of 15 months after their referral date. This timeframe allowed our study team to account for delayed documentation in the medical record.

We collected patient-level (date of birth, sex, race/ethnicity, insurance type at referral, diagnosis as recorded by DBP providers), provider-level (referring primary care provider's credentials, such as resident physician, nurse practitioner, attending physician), and system-level (well-child visit attendance prior to referral, care at more than one health center prior to referral) characteristics. We used public insurance enrollment as a proxy for low-income status; in Massachusetts, Medicaid eligibility is 138% of the federal poverty level. We used unique age-ranges for each well-child visit and provider documentation of well-child care to determine well-child visit attendance (Table 1). We reviewed provider notes to determine if, prior to referral, a child had previously received primary care at clinics other than the medical center. We collected date of referral and date of diagnostic resolution to determine age of referral and time to diagnosis. We also collected information on whether a child was enrolled in Part C Early Intervention (EI) services, and if not, whether they were referred for enrollment at the time of the DBP referral.

All data were recorded using a chart review abstraction tool developed in Research Electronic Data Capture (REDCap version 8.6.1).²¹ Two reviewers independently tested the initial tool with 10 randomly selected medical records and came to a consensus on the

categories. Two independent reviewers then extracted information from a second set of 20 randomly selected medical records and reconciled differences to finalize the tool.

Data analysis.

Predictors of age of referral.—Our outcome was early referral versus late referral. We defined *early referral* as receiving a referral for evaluation by a DBP provider at younger than 30 months and *late referral* at 30 months or older. Early and late referral definitions were selected based on clinical significance. Screening that is ASD-specific is often performed between 18–30 months of age depending on primary care practice preferences, and there are no ASD-specific validated screening measures after 30 months of age.¹⁰ Additionally, children referred at older than 30 months are less likely to access EI services, given the time to complete assessment and connection with an EI provider, and that eligibility ends at 36 months.²² Using chi-square tests of independence or Fisher's exact test, we compared the patient-level, provider-level, and system-level factors between children with early versus late referral. Any factors that differed significantly between the two groups were identified as possible predictors. Predictors were fit separately into simple and multivariable logistic regression models with early versus late referral as the outcome. We used a 10% change-in-estimates method to select covariates for multivariable models. We reported adjusted odds ratios (aORs), 95% confidence intervals (CIs), and p-values for all models.

Time to and likelihood of diagnostic resolution.—Time to diagnostic resolution was measured from date of referral to DBP clinic to date of diagnostic resolution. We calculated the median time to diagnostic resolution on variables that were found to be significant in our early referral versus late referral models. We also used the Kaplan-Meier method to estimate the likelihood of diagnostic resolution on the same significant variables. All children were followed for 365 days after their referral date. Children who achieved diagnostic resolution after the 365-day follow-up period or did not complete diagnostic evaluation were censored at 365 days. We performed Cox proportional hazards regression to assess the association between our selected predictors and achievement of diagnostic resolution and reported hazard ratios (HRs), 95% CIs, and p-values for models when appropriate.

Children without diagnostic resolution.—We assessed whether there were inherent patient-level, provider-level, and system-level differences between children who achieved diagnostic resolution and those who did not by using chi-square test of independence or Fisher's exact test.

All analyses used a p-value of .05 for hypothesis testing. All analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NC).

Results

Descriptive characteristics.

Among 110 children in this study, 72 achieved diagnostic resolution. Among children who completed the diagnostic process, the majority were male (72%) and had public insurance

(86.1%). Over half were non-Hispanic Black. Forty-two children (58.3%) were referred before 30 months of age and 30 (41.7%) were referred after 30 months of age. The mean age of referral was 28.0 months, with a standard deviation of 9.4 months. Of the children who completed the diagnostic process, 29 (40.3%) received an ASD diagnosis. The median age of diagnostic resolution for males was 34.6 months (interquartile range [IQR] 27.6–42.3 months); for females, it was 36.9 months (IQR 30.9–44.0 months). Thirty-eight (52.8%) children had one or a combination of non-ASD developmental diagnoses such as developmental delay or language delay; five (6.9%) of the children were typically developing. There was no difference in the proportion of children diagnosed with ASD by referral age (Table 2).

Predictors of early versus late age of referral.

Based on bivariate analyses, receiving primary care at more than one health center ($p = .005$) and attending all well-child visits prior to DBP referral ($p = .01$) were identified as possible predictors and included in the logistic regression models. Because there were no significant differences in sex, caregiver's primary language, insurance, and level of provider training, these variables were not included. Adjusted for race/ethnicity, children receiving care at a single health center had significantly higher odds (aOR 11.22; 95% CI 1.98, 63.65) of having an early age of referral compared with those who had received care at more than one health center. Adjusted for insurance, children who attended all well-child visits prior to referral also had higher odds (aOR 3.76; 95% CI 1.00, 14.13) of having an early age of referral compared with those who missed well-child visits, but these findings were borderline statistically significant.

Time to diagnostic resolution.

Children who received care at one health center had a similar time to diagnostic resolution compared with children who received care at more than one health center (216 days; IQR 148–295 days versus 213 days; IQR 130–446 days, respectively). Children who attended all their well-child visits prior to DBP referral had a shorter time to diagnostic resolution than children who had missed well-child visits (183 days; IQR 144–265 days versus 286 days; IQR 246–531 days, respectively).

Likelihood of diagnostic resolution.

Of 110 children, 102 children (92.7%) had more than one well-child visit at the medical center prior to referral. Eight children did not have recorded well-child visits prior to referral because the referral date was their first well-child visit at the pediatric practice, which resulted in a violation of the proportional hazards assumption of Cox proportional hazards regression.²³ Therefore, we limited Kaplan-Meier method and Cox regression analyses to the 102 children who had at least one recorded well-child visit at the medical center prior to referral (Figures 1 and 2). There was no difference in the rate of achieving diagnostic resolution between children who received care at one health center compared with children who received care at more than one health center. Children who attended all well-child visits prior to referral were more likely to achieve diagnostic resolution compared with children who missed visits (HR 2.00, 95% CI 0.94, 4.24), but these findings were not statistically significant ($p = .07$).

Children without diagnostic resolution.

Based on bivariate analysis, there were no significant differences in the patient-level, provider-level, and system-level characteristics between children who achieved diagnostic resolution and those who did not (Table 3). Of the 38 children who did not achieve diagnostic resolution, 20 (52.6%) did not attend the intake visit, and 18 (47.4%) attended the intake visit but did not attend the assessment visit.

Discussion

In this retrospective cohort study of children in a predominantly low-income population aged five years or younger referred for evaluation of social communication concerns, we found that continuity of care was a predictor of earlier age of referral for diagnostic evaluation. We also identified attendance at all well-child visits prior to referral as a probable predictor of early age of referral. There were no differences in these children's likelihood to complete the evaluation process compared with those who had missed well-child visits, but they had a shorter median time to diagnostic resolution by more than three months.

Our findings of earlier age of referral corresponding with care at a single health center complement prior studies, which found that having multiple physicians before diagnosis or switching pediatricians before age five^{14,24,25} was associated with a later age of diagnosis. Switching health centers leaves a child at risk of missing necessary routine screening for developmental concerns as recommended by the AAP^{9–10} and may contribute to a later age of identification and referral by primary care providers. Another possible reason is that clinicians may be less likely to address developmental concerns in-depth with families that they are meeting for the first time, though this merits further study.

Our analyses of well-child visit attendance as a predictor of age of referral or likelihood of completing the diagnostic process were not statistically significant. However, we found that the median time to completing the diagnostic process differed by 3.4 months. This highlights a possible role that well-child visit attendance can play in facilitating shorter wait times between referral to diagnostic resolution in low-income populations.

However, low-income families face additional challenges to attend all well-child visits. Although families agree with the importance of these visits to address growth and development, they also experience barriers that lead to missed visits, such as issues with transportation (for example, inconvenient public transit, expensive paid parking spaces), difficulty taking time off from work, and child care for other children during the visits.²⁶ We hypothesize that by having interval follow-up appointments during the evaluation, where attendance barriers are reduced by measures such as transportation assistance, care coordination, and flexible appointment settings (telemedicine versus in-person visits), pediatricians can further reinforce the importance of attending upcoming DBP clinic appointments. These efforts would help close gaps in achieving each step in the cascade-of-care model for ASD diagnosis for children in low-income families. Future investigation could be placed on further understanding these barriers and assisting children and their families, as well as considering whether these findings may differ among children in low-income families in rural medical settings as compared to urban settings.

Time from referral to diagnostic resolution for social communication concerns may be center-and resource-dependent. In our study, among those who achieved diagnostic resolution, the majority of children received their diagnosis within one year after referral, with 14 children after one year. The median time ranged from six months to 9.5 months. These numbers are comparable to a range of previously published median times, which were estimated to be from seven months in Canada²⁷ to 10–14 months in Scotland and the United States.^{28,29} There are likely a variety of factors that influence time to diagnostic resolution, including the variability in the supply of DBP and other trained clinicians.³⁰ In our case, our DBP providers are co-located within the same medical center, likely facilitating an easier evaluation process for these children in low-income settings who may face transportation challenges and/or limited access to other providers who may not accept public insurance.

Limitations.

Our study was limited to one medical center and our results may not be generalizable to other urban, safety-net hospitals with different patient populations. Our sample size was small, which resulted in wide confidence intervals for the aORs. However, our findings still signaled that modifiable factors may play a role in the cascade-of-care model related to ASD diagnosis and can help providers identify children at highest risk for a late age of referral and eventual diagnosis. This study was based on data from a retrospective chart review from a single electronic health record (EHR). There may be more complex factors in the diagnostic process such as parental and/or provider concerns, severity of presenting symptoms, or social determinants of health that were not assessed in this study that may play a role in age of referral and likelihood of completing the diagnostic process. We attempted to collect information about specific parental and provider concerns regarding development and severity of symptoms expressed during the index visit; however, the EHR documentation of these concerns was inconsistent or missing for many of the children. Because we were limited to the EHR at our site, we were unable to review all records regarding well-child visit attendance for eight children in our study sample. Additionally, children whose follow-up periods exceeded 365 days were censored, so conclusions for our calculated median times cannot be applied for children who exceeded the follow-up period. We also specifically assessed children under five years of age, and thus our findings may not be generalizable to older children who present with social communication concerns.

Conclusion.

This study contributes to a limited number of studies focused on predominantly low-income populations of children with social communication concerns. Future steps include further evaluating these predictors and outcomes at multiple centers in various geographic locations in order to increase generalizability to other children in low-income families. We have highlighted a need for continued efforts to improve primary care continuity for low-income children and the importance of facilitating expedient care and necessary referrals for new pediatric patients. Efficient diagnostic resolution times are feasible but rely upon a robust clinical referral infrastructure and co-located clinics to facilitate a streamlined evaluation process for children in low-income families.

Acknowledgments

Dr. Nguyen was supported by a National Research Service Award T32HP10028 from the Health Resources and Services Administration (HRSA) and BU-cTSI grant 1UL1TR0011430 from the National Center for Advancing Translational Sciences, National Institutes of Health (NIH). Drs. Feinberg and Broder-Fingert were supported by grant R01MH104355 from the National Institute of Mental Health (NIMH), NIH, which is part of NIMH's national ASD PEDS research network and supported by the HRSA-funded Developmental and Behavioral Pediatrics Research Network (DBPNet). DBPNet is supported by the cooperative agreement UA3MC20218 from the Maternal and Child Health Bureau, HRSA. Dr. Broder-Fingert is also supported by grant K23MH109673 from the NIMH. The funders had no role in study design, data analysis, or preparation of the manuscript. All authors otherwise declare no conflicts of interest.

We thank Andrea Chu, MPH, Nicole Melita, MS, and Julia Goupil for their contributions to the study.

References

1. Maenner MJ, Shaw KA, Baio J, et al. Prevalence of autism spectrum disorder among children aged 8 years—Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2016. *MMWR Surveill Summ.* 2020 3 27;69(4):1–12.
2. Kogan MD, Vladutiu CJ, Schieve LA, et al. The prevalence of parent-reported autism spectrum disorder among US children. *Pediatrics.* 2018 12 1;142(6):e20174161. 10.1542/peds.2017-4161
3. Lord C, Risi S, DiLavore PS, et al. Autism from 2 to 9 years of age. *Arch Gen Psychiatry.* 2006 6;63(6):694–701. 10.1001/archpsyc.63.6.694 [PubMed: 16754843]
4. Barbaro J, Dissanayake C. Developmental profiles of infants and toddlers with autism spectrum disorders identified prospectively in a community-based setting. *J Autism Dev Disord.* 2012 2 7;42(9):1939–48. 10.1007/s10803-012-1441-z [PubMed: 22310906]
5. Barbaro J, Dissanayake C. Diagnostic stability of autism spectrum disorder in toddlers prospectively identified in a community-based setting: behavioural characteristics and predictors of change over time. *Autism.* 2017 10;21(7):830–40. 10.1177/1362361316654084 [PubMed: 27474118]
6. Dawson G, Rodgers S, Munson J, et al. Randomized, controlled trial of an intervention for toddlers with autism: the Early Start Denver Model. *Pediatrics.* 2010 1;125(1):e17–e23. 10.1542/peds.2009-0958 [PubMed: 19948568]
7. Dawson G, Jones E, Merkle K, et al. Early behavioral intervention is associated with normalized brain activity in young children with autism. *J Am Acad Child Adolesc Psychiatry.* 2012 11;51(11):1150–9. 10.1016/j.jaac.2012.08.018 [PubMed: 23101741]
8. Clark MLE, Vinen Z, Barbaro J, et al. School age outcomes of children diagnosed early and later with autism spectrum disorder. *J Autism Dev Disord.* 2018 1;48(1):92–102. 10.1007/s10803-017-3279-x [PubMed: 28905160]
9. Simon GR, Baker CN, Barden GA, et al. 2015 recommendations for preventive pediatric health care committee on practice and ambulatory medicine and bright futures periodicity schedule workgroup. *Pediatrics.* 2015 9;136(3):e727. 10.1542/peds.2015-2009 [PubMed: 26324870]
10. Hyman SL, Levy SE, Myers SM. Identification, evaluation, and management of children with autism spectrum disorder. *Pediatrics.* 2020 1;145(1):e20193447. 10.1542/peds.2019-3447
11. National Academy for State Health Policy. Developmental screening Medicaid policy by state. Washington, DC: National Academy for State Health Policy, 2019 5. Available at: <https://healthychild.nashp.org/wp-content/uploads/2019/05/Developmental-Screening-Reimbursement-Table-5.21.19.pdf>.
12. Commonwealth of Massachusetts. MassHealth children's behavioral health initiative. [Mass.gov](https://www.mass.gov/service-details/learn-about-cbhi), 2019. Available at: <https://www.mass.gov/service-details/learn-about-cbhi>.
13. Sheldrick RC, Maye MP, Carter AS. Age at first identification of autism spectrum disorder: an analysis of two US surveys. *J Am Acad Child Adolesc Psychiatry.* 2017 4;56(4):313–20. 10.1016/j.jaac.2017.01.012 [PubMed: 28335875]
14. Mandell DS, Novak MM, Zubritsky CD. Factors associated with age of diagnosis among children with autism spectrum disorders. *Pediatrics.* 2005 12;116(6):1480–6. 10.1542/peds.2005-0185 [PubMed: 16322174]

15. Fountain C, King MD, Bearman PS. Age of diagnosis for autism: individual and community factors across 10 birth cohorts. *J Epidemiol Community Health*. 2011 6;65(6):503–10. 10.1136/jech.2009.104588 [PubMed: 20974836]
16. Durkin MS, Maenner MJ, Baio J, et al. Autism spectrum disorder among us children (2002–2010): socioeconomic, racial, and ethnic disparities. *Am J Public Health*. 2017 11;107(11):1818–26. 10.2105/AJPH.2017.304032 [PubMed: 28933930]
17. Gardner EM, McLees MP, Steiner JF, et al. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis*. 2011 3 15;52(6):793–800. 10.1093/cid/ciq243 [PubMed: 21367734]
18. Yehia BR, Schranz AJ, Umscheid CA, et al. The treatment cascade for chronic hepatitis C virus infection in the United States: a systematic review and meta-analysis. *PLoS One*. 2014 7 2;9(7):e101554. 10.1371/journal.pone.0101554
19. Ali MK, Bullard KMK, Gregg EW, et al. A cascade of care for diabetes in the United States: visualizing the gaps. *Ann Intern Med*. 2014 11 18;161(10):681–9. 10.7326/M14-0019 [PubMed: 25402511]
20. Lewin ME, Altman S, editors. America's health care safety net: intact but endangered. Washington, DC: The National Academies Press, 2000.
21. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)-a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009 4;42(2):377–81. 10.1016/j.jbi.2008.08.010 [PubMed: 18929686]
22. US Department of Education. Early intervention program for infants and toddlers with disabilities. Washington, DC: US Department of Education, 2016. Available at: <https://www2.ed.gov/programs/osepeip/index.html>.
23. Kleinbaum DG, Klein M. Evaluating the proportional hazards assumption. In: *Survival analysis: a self-learning text* (3rd ed). New York, NY: Springer, 2012:161–200. 10.1007/978-1-4419-6646-9_4
24. Emerson ND, Morrell HER, Neece C. Predictors of age of diagnosis for children with autism spectrum disorder: the role of a consistent source of medical care, race, and condition severity. *J Autism Dev Disord*. 2016 1;46(1):127–38. 10.1007/s10803-015-2555-x [PubMed: 26280401]
25. Adelman CR, Kubiszyn T. Factors that affect age of identification of children with an autism spectrum disorder. *J Early Interv*. 2016 11;39(1):18–32. 10.1177/1053815116675461
26. Wolf ER, O'Neil J, Pecsok J, et al. Caregiver and clinician perspectives on missed well-child visits. *Ann Fam Med*. 2020 1;18(1):30–4. 10.1370/afm.2466 [PubMed: 31937530]
27. Penner M, Anagnostou E, Ungar WJ. Practice patterns and determinants of wait time for autism spectrum disorder diagnosis in Canada. *Mol Autism*. 2018 3 6;9(1):1–13. 10.1186/s13229-018-0201-0 [PubMed: 29321841]
28. McKenzie K, Forsyth K, O'Hare A, et al. Factors influencing waiting times for diagnosis of autism spectrum disorder in children and adults. *Res Dev Disabil*. 2015 Oct-Nov;45–46:300–6. 10.1016/j.ridd.2015.07.033 [PubMed: 26280693]
29. Wiggins LD, Baio J, Rice C. Examination of the time between first evaluation and first autism spectrum diagnosis in a population-based sample. *J Dev Behav Pediatr*. 2006 4;27(2):S79–S87. 10.1097/00004703-200604002-00005 [PubMed: 16685189]
30. Bridgemohan C, Bauer NS, Nielsen BA, et al. A workforce survey on developmental-behavioral pediatrics. *Pediatrics*. 2018 3;141(3):e20172164. 10.1542/peds.2017-2164

Figure 1.

Achievement of diagnostic resolution according to care at a single health center versus care at multiple health centers (n=102).

Figure 2.
Achievement of diagnostic resolution according to well-child visit attendance, (n=102).

Table 1.

AGE RANGES USED TO DEFINE WELL-CHILD VISIT ATTENDANCE IN THE STUDY

Expected Visit Age	Earliest Acceptable Age	Latest Acceptable Age
18 months	17 months	21 months
24 months	22 months	27 months
30 months	28 months	33 months
36 months	34 months	45 months
48 months	46 months	56 months

Table 2.

DEMOGRAPHIC INFORMATION FOR CHILDREN WHO COMPLETED DIAGNOSTIC PROCESS^a

Characteristics	Total n = 72 N (%)	Referral age < 30 months n = 42 N (%)	Referral age ≥ 30 months n = 30 N (%)	p-value
Sex				
– Male	52 (72.2)	31 (73.8)	21 (70.0)	.72
– Female	20 (27.8)	11 (26.2)	9 (30.0)	
Race/Ethnicity				
– Non-Hispanic Black	42 (58.3)	23 (54.8)	19 (63.3)	.82
– Non-Hispanic White	9 (12.5)	5 (11.9)	4 (13.3)	
– Hispanic	11 (15.3)	7 (16.7)	4 (13.3)	
– Other ^b	10 (13.9)	7 (16.7)	3 (10.0)	
Language				
– English	51 (70.8)	26 (61.9)	25 (83.3)	.14
– Spanish	5 (6.9)	4 (9.5)	1 (3.3)	
– Haitian Creole/Cape Verdean/Port Creole/Other	16 (22.2)	12 (28.6)	4 (13.3)	
Insurance				
– Public	62 (86.1)	38 (90.5)	24 (80.0)	.30
– Private	10 (13.9)	4 (9.5)	6 (20.0)	
Referral provider				
– Attending physician	41 (56.9)	23 (54.8)	18 (60.0)	.88
– Resident physician	24 (33.3)	15 (35.7)	9 (30.0)	
– Nurse practitioner	7 (9.7)	4 (9.5)	3 (10.0)	
Received primary care at multiple health centers				
– Yes	11 (15.3)	2 (4.8)	9 (30.0)	.005
– No	61 (84.7)	40 (95.2)	21 (70.0)	
Attended all well-child visits prior to referral				
– Yes	53 (73.6)	36 (85.7)	17 (56.7)	.01
– No	12 (16.7)	5 (11.9)	7 (23.3)	
– Unknown	7 (9.7)	1 (2.4)	6 (20.0)	
Enrolled in early intervention at time of referral				
– Yes	32 (44.4)	21 (50.0)	11 (36.7)	<.001
– No, referred for enrollment	20 (27.8)	18 (42.9)	2 (6.7)	
– No, not referred for enrollment	19 (26.4)	3 (7.4)	16 (53.3)	
– Unknown	1 (1.4)	0 (0.0)	1 (3.3)	
Diagnosis given at resolution				
– ASD	29 (40.3)	17 (40.5)	12 (40.0)	.97
– Non-ASD ^c	43 (59.7)	25 (59.5)	18 (60.0)	

Notes:

^aChi-square test of independence or Fisher's exact test performed for all characteristics.

^b Other race/ethnicity includes Asian and not reported.

^c Non-ASD diagnoses include developmental delay, language delay (including mixed receptive-expressive and expressive), or typical development.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 3.

DEMOGRAPHIC CHARACTERISTICS OF ALL CHILDREN BY ACHIEVEMENT OF DIAGNOSTIC RESOLUTION^A

Characteristics	Total n = 110 N (%)	Received diagnosis n = 72 N (%)	Never received diagnosis n = 38 N (%)	p-value
Sex				
– Male	75 (68.2)	52 (72.2)	23 (60.5)	.21
– Female	35 (31.8)	20 (27.8)	15 (39.5)	
Race/Ethnicity				
– Non-Hispanic Black	62 (56.4)	42 (58.3)	20 (52.6)	.92
– Non-Hispanic White	14 (12.7)	9 (12.5)	5 (13.2)	
– Hispanic	17 (15.5)	11 (15.3)	6 (15.8)	
– Other ^b	17 (15.5)	10 (13.9)	7 (18.4)	
Language				
– English	82 (74.5)	51 (70.8)	31 (81.6)	.41
– Spanish	6 (5.5)	5 (6.9)	1 (2.6)	
– Haitian Creole/Cape Verdean/Port Creole/Other	22 (20.0)	16 (22.2)	6 (15.8)	
Insurance				
– Public	92 (83.6)	62 (86.1)	30 (79.0)	.33
– Private	18 (16.4)	10 (13.9)	8 (21.0)	
Referral provider				
– Attending physician	66 (60.0)	41 (56.9)	25 (65.8)	.67
– Resident physician	34 (30.9)	24 (33.3)	10 (26.3)	
– Nurse practitioner	10 (9.1)	7 (9.7)	3 (7.9)	
Received primary care at multiple health centers				
– Yes	15 (13.6)	11 (15.3)	4 (10.5)	.49
– No	95 (86.4)	61 (84.7)	34 (89.5)	
Attended all well-child visits prior to referral				
– Yes	81 (73.6)	53 (73.6)	28 (73.7)	.31
– No	21 (19.1)	12 (16.7)	9 (23.7)	
– Unknown	8 (7.3)	7 (9.7)	1 (2.6)	
Enrolled in early intervention at time of referral				
– Yes	42 (38.2)	32 (44.4)	10 (26.3)	.11
– No, referred for enrollment	35 (31.8)	20 (27.8)	15 (39.5)	
– No, not referred for enrollment	29 (26.4)	19 (26.4)	10 (26.3)	
– Unknown	4 (3.6)	1 (1.4)	3 (7.9)	

Notes:

^a Chi-square test of independence or Fisher's exact test performed for all categorical variables.

^b Other race/ethnicity includes Asian and not reported.