Postsecondary Education and Employment Among Youth With an Autism Spectrum Disorder

WHAT'S KNOWN ON THIS SUBJECT: Previous research has identified low rates of employment and postsecondary education for youth with autism, but generalizability has been limited by small samples.

WHAT THIS STUDY ADDS: Using national data, the authors of this study found that youth with autism are at high risk for no postsecondary education or employment, especially in the first 2 years after high school. Findings highlight the need for improved transition planning.

abstract

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OBJECTIVES: We examined the prevalence and correlates of postsecondary education and employment among youth with an autism spectrum disorder (ASD).

METHODS: Data were from a nationally representative survey of parents, guardians, and young adults with an ASD. Participation in postsecondary employment, college, or vocational education and lack of participation in any of these activities were examined. Rates were compared with those of youth in 3 other eligibility categories: speech/language impairment, learning disability, and mental retardation. Logistic regression was used to examine correlates of each outcome.

RESULTS: For youth with an ASD, 34.7% had attended college and 55.1% had held paid employment during the first 6 years after high school. More than 50% of youth who had left high school in the past 2 years had no participation in employment or education. Youth with an ASD had the lowest rates of participation in employment and the highest rates of no participation compared with youth in other disability categories. Higher income and higher functional ability were associated with higher adjusted odds of participation in postsecondary employment and education.

CONCLUSIONS: Youth with an ASD have poor postsecondary employment and education outcomes, especially in the first 2 years after high school. Those from lower-income families and those with greater functional impairments are at heightened risk for poor outcomes. Further research is needed to understand how transition planning before high school exit can facilitate a better connection to productive postsecondary activities. *Pediatrics* 2012;129:1042–1049

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KEY WORDS

autism, adolescent, young adult, employment, education

ABBREVIATIONS

ASD—autism spectrum disorder
LD—learning disability
MR—mental retardation
NLTS2—National Longitudinal Transition Study 2
SLI—speech/language impairment
USDE—US Department of Education

All authors have made substantial contributions to the conception and design and/or analysis and interpretation of the data; all authors have been involved in drafting and revising the article and have given final approval of the version submitted for publication: and all authors take public responsibility for the appropriateness of the content. Dr Shattuck contributed to conceptualization, design, analysis, interpretation, and drafting and revising the article; Ms Narendorf contributed to conceptualization, design, interpretation, and drafting and revising the article; Mr Cooper contributed to conceptualization, analysis, interpretation, and drafting and revising the article; Mr Sterzing contributed to conceptualization, analysis, interpretation, and drafting and revising the article; Dr Wagner contributed to conceptualization, design, interpretation, and revising the article; and Dr Taylor contributed to conceptualization, interpretation, and revising the article.

www.pediatrics.org/cgi/doi/10.1542/peds.2011-2864

doi:10.1542/peds.2011-2864

Accepted for publication Feb 16, 2012

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

FUNDING: This work was supported by funding to Dr Shattuck from the Organization for Autism Research, Autism Speaks, and the National Institute of Mental Health (R01 MH086489). Its contents are solely the responsibility of the authors and do not represent the official views of the National Institute of Mental Health or other funders. Funded by the National Institutes of Health (NIH).

"What will my child's life be like as an adult? Will college or employment be possible?" Pediatricians often are asked questions like these by parents of a child diagnosed with a lifelong condition. These questions can be especially difficult to answer for a child diagnosed with an autism spectrum disorder (ASD). Approximately 50 000 adolescents with an ASD will turn 18 years old this year in the United States[1]; however, there is little population-based evidence about the distribution of postsecondary educational and vocational outcomes among young adults with an ASD.

Two normative social role transitions for youth exiting high school are enrolling in postsecondary education and finding employment. Rates of postsecondary educational participation for youth with an ASD are substantially lower than the general population, with previous studies indicating 40% or fewer ever attend college and very few receive a degree.[2–7] Lower rates of postsecondary education participation have been found among individuals with more severe impairments, comorbid conditions, or lack of access to services.[8,9] Rates of employment for adults with an ASD are also low across studies, with 25% to 50% of adults with an ASD participating in any type of paid employment.[10] Those who are employed often are employed below their level of education and have difficulty maintaining stable employment.[10,11] Lower cognitive and language functioning have been associated with lower rates of employment.[2,12] Some studies have found that 12% to 24% of youth are not engaged in any productive activities in young adulthood.[2,9] A total lack of participation in the years after high school has been associated with poorer behavioral outcomes, especially among youth with low incomes.[13]

The external validity of studies on adult outcomes for youth with an ASD has been limited, however, by small sample sizes, volunteer bias, and samples that lack racial or socioeconomic diversity.[1,14] Our aims were to report population-based prevalence estimates and correlates of postsecondary education and employment among young adults with an ASD. We used data from the fourth wave of a national cohort study of young adults who previously had received special education services. To contextualize findings, we compared youth with an ASD with those from 3 other special education eligibility categories who are likely to share some degree of impairment in areas commonly affected by ASD: those with a learning disability (LD), mental retardation (MR), or speech/language impairment (SLI).

Two recent studies examined postsecondary outcomes by using the same data set used here; however, 1 study was based on an earlier wave of data collection, when fewer participants had left high school and very few had been out of high school for >2 years.[15] The other study used the same wave of data as our study but examined only a single outcome and appears not to have used the sample weights in analyses, meaning the estimates are not nationally representative.[16] Our study reports on a wider range of postsecondary outcomes than any previous study, includes participants ranging in age up to 23 years old, and uses appropriate and preferred methods for weighting and variance estimation.

Nationally representative estimates of postsecondary education and employment outcomes can help clinicians talk with parents about the range of potential young adult outcomes for children with an ASD. Examining correlates of these outcomes can help identify subsets of youth who are at particularly high risk for disengagement from education and employment and inform policies currently being formulated to serve this expanding population.

METHODS

We used data from the National Longitudinal Transition Study 2 (NLTS2), a 10-year prospective study of youth receiving special education services conducted by SRI International for the US Department of Education (USDE). The study evaluated youth from each of 12 federal special education disability categories as they left high school and aged into young adulthood.

We used data from wave 4, collected in 2007–2008, which included 680 youth in the autism category, 500 of whom were no longer in high school. We also used NLTS2 data on youth from 3 other special education categories to contextualize the ASD findings: SLI (n = 470), LD (n = 460), and MR (n = 430). We use the outdated term "mental retardation" to be consistent with the federal special education category definitions and how the data were collected. Use of NLTS2 data are governed by a data use agreement with USDE and was approved by the Washington University institutional review board. All unweighted sample counts have been rounded to the nearest 10, in accordance with the USDE data use license.

The sampling and weighting design for NLTS2 yields estimates that generalize to special education students who were aged 13 through 16 and in seventh through 12th grades or in ungraded programs on December 1, 2000. School districts were sampled first, then students within districts. Detailed information about the sampling strategy and questionnaire design have been published previously.[17] Determination of eligibility for special education services under each category was made by each student's school district. The 680 youth in the autism category at wave 4 represented a 74% retention rate from the original sample of 920 at

wave 1. Weights include adjustment for nonresponse at each wave.[17]

To determine eligibility for each special education category, schools do not necessarily use *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* diagnostic criteria.[18] The USDE provides a broad definition for each category. States and districts decide how to operationalize eligibility criteria. The USDE definition for autism is consistent with *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria but is not as detailed. Surveillance in the United States has revealed that nearly all children reported in the school autism category also meet case criteria for an ASD.[19,20] The probability that youth in this category do not have an ASD is very low; however, not all youth with an ASD are identified in the autism category. Some may be served in other disability categories, may not be in special education, or may not attend school.

Data Collection Procedures

Data come from surveys of 500 parents or guardians and youth who were capable of participating. Telephone interviews began with identifying the adult who was most knowledgeable about the youth. At the end of the interview, this adult identified whether the youth was capable of answering survey questions. Youth identified as capable of participation were interviewed by telephone or mailed a questionnaire.

Measures

Outcome Measures

Respondents were asked questions about participation in postsecondary education and paid employment. Estimates reflect prevalence during the period since leaving high school. Types of postsecondary education included vocational and technical training, 2-year and community college, or 4-year college or university. Employment was coded affirmatively if a young adult had any work for pay since leaving high school, other than work around the house. Indicators were created for any involvement in each of these activities and for different combinations thereof. We also created an indicator for no participation in any of these activities.

Correlates

Demographic variables included gender, age, ethnicity, race, and parents' or guardian's household income. We included measures of whether a youth stayed in high school until age 21 and for the number of years elapsed since exiting high school. Overall health was assessed by using a 5-point scale from excellent to poor. How well the youth could use their arms and legs was rated on a 4-point scale (normal usage, some trouble, a lot of trouble, or no use of $\geq$1 appendage). Parents rated how well youth conversed on a 4-point scale (youth had no trouble, a little trouble, a lot of trouble, or could not converse at all). We created a scale to measure functional independence by summing 8 4-category (not at all well, not very well, pretty well, very well) questions that asked how well each youth could do the following: tell time on an analog clock, read and understand common signs, count change, look up telephone numbers and use a telephone, get to places outside the home, use public transportation, buy clothes at a store, and arrange travel to go out of town (Cronbach's α = 0.93 for the ASD group). The scale ranged from 8 to 32, and we quartiled the scale for Table 1 at the following cut points: 16, 22, and 28.

Data Analysis

Rates of missing data per variable in the ASD group ranged from 0% to 22%. Missing data were imputed by using sequential regression in IVEware (version 0.1; Survey Methodology Program, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI) to create 50 implicates.[21,22] Variables in the imputation model included all those reported in the study plus the following auxiliary variables: youth's speaking ability, an indicator for each sampling stratum, whether English is the primary language, and wave 1 household income. We used Stata 11 (StataCorp, College Station, TX to analyze the imputed data, pooling implicate estimates by using established procedures.[23] All estimates were weighted to the population level, and variances were adjusted in accordance with the complex sampling design.

We estimated univariate percentage distributions for all correlates for the ASD group (Table 1). We stratified rates of outcomes by the correlates (Table 1) and compared the prevalence of outcomes across the 4 disability groups (Table 2). Because tabular tests (eg, χ^2) are not available in Stata for imputed data, we used logistic regression with dummy variables for groups to test for significant differences between the ASD group and each other group. We estimated logistic regression models to measure the adjusted association between correlates and outcomes for the ASD group (Table 3). We then re-ran these regression models with all groups and included dummy indicators for the non-ASD groups to test for group differences while adjusting for covariates. These findings are discussed but not presented in a table. For the bar chart in Fig 1, we ran a logistic regression of no postsecondary education or employment on quartiles of income and the functional skills scale.

RESULTS

Ages ranged from 19 to 23 (Table 1). About one-fourth had left high school during the school year immediately

TABLE 1 Univariate Percentage Distributions of Correlates and Stratified Rates of Outcomes Among Youth With an ASD

Correlate	Univariate Distribution (95% CI)	Percentage Rates of Outcomes (95% CI)				
		Any Vocational or Technical Education	Any 2- or 4-y College	Any Paid Employment	Both Education/ Employment	No Participation
Overall	—	9.3 (6.3–13.4)	34.7 (27.9–42.3)	55.1 (46.5–63.4)	26.8 (20.7–34.0)	34.9 (27.2–43.5)
Gender						
Male	86.9 (81.1–91.1)	9.9 (6.4–14.9)	32.4 (25.5–40.2)	54.5 (45.3–63.4)	24.6 (18.8–31.5)	35.6 (27.0–45.3)
Female	13.1 (8.9–18.9)	5.3 (2.2–12.0)	50.1 (29.2–70.9)	59.1 (39.6–76.1)	41.9 (21.2–65.9)	30.3 (16.9–48.2)
Age						
19	8.0 (4.8–13.2)	7.3 (1.8–24.7)	60.9 (37.3–80.4)	45.7 (22.9–70.4)	33.4 (15.2–58.3)	21.4 (8.5–44.0)
20	16.9 (12.8–21.9)	13.7 (7.3–24.4)	32.3 (20.8–46.4)	60.1 (47.6–71.4)	27.4 (17.1–40.9)	32.3 (21.5–45.3)
21	20.3 (15.8–25.6)	12.2 (7.2–20.1)	32.0 (21.7–44.5)	48.1 (35.1–61.3)	20.2 (12.3–31.2)	38.5 (26.9–51.5)
22	33.0 (25.8–41.2)	8.3 (3.7–17.6)	24.2 (15.6–35.6)	43.9 (29.3–59.6)	17.8 (10.7–28.1)	47.0 (31.9–62.6)
23	21.9 (15.6–29.8)	5.4 (1.5–17.1)	45.3 (25.7–66.4)	78.2 (63.4–88.1)	43.8 (24.5–65.2)	20.4 (10.9–35.0)
Hispanic						
No	90.6 (84.7–94.4)	9.9 (6.8–14.2)	36.1 (29.0–43.8)	57.2 (48.5–65.4)	28.4 (22.0–35.8)	32.8 (25.5–41.1)
Yes	9.4 (5.6–15.3)	[a]	21.5 (8.5–44.4)	35.2 (14.7–63.0)	11.9 (3.7–31.4)	55.2 (28.9–78.9)
Race						
White	73.5 (65.8–80.0)	9.8 (6.4–14.7)	37.9 (29.8–46.8)	61.0 (51.8–69.5)	30.5 (23.1–39.0)	28.9 (21.4–37.9)
African American	17.8 (12.1–25.3)	5.4 (2.5–11.2)	19.9 (10.4–34.6)	35.4 (16.7–59.2)	13.0 (5.6–26.9)	57.1 (34.5–77.2)
Mixed/other	8.7 (5.4–13.8)	13.4 (3.8–37.7)	37.8 (18.0–62.7)	45.1 (22.2–70.3)	24.3 (8.0–54.0)	40.2 (20.3–63.8)
Income						
≤$25 000	16.5 (11.1–23.6)	3.7 (1.3–10.2)	23.4 (10.2–44.3)	36.6 (18.4–59.1)	15.0 (5.3–34.7)	54.6 (33.3–74.5)
$25 001–$50 000	30.5 (22.4–39.9)	7.2 (3.4–14.8)	27.9 (15.1–45.2)	48.5 (30.9–66.6)	18.6 (8.6–35.1)	40.7 (25.2–58.2)
$50 001–$75 000	34.6 (27.2–42.7)	9.3 (5.0–16.5)	40.9 (27.9–55.3)	61.4 (48.4–73.0)	32.9 (20.7–47.7)	29.6 (19.4–42.4)
Over $75 000	18.4 (13.3–25.0)	17.8 (9.0–32.3)	44.2 (29.7–59.6)	70.4 (56.5–81.4)	39.5 (26.2–54.6)	17.8 (8.9–32.2)
In high school until age 21						
No	91.8 (86.5–95.2)	10.0 (6.8–14.5)	36.9 (30.0–44–4)	60.0 (51.6–67.8)	28.8 (22.5–36.1)	29.6 (22.9–37.4)
Yes	8.2 (4.8–13.5)	[a]	[a]	6.8 (2.2–17.9)	[a]	92.2 (81.9–97.0)
Years since high school						
<1	25.4 (19.2–32.8)	4.4 (2.0–9.2)	24.2 (12.3–42.1)	30.0 (18.8–44.1)	14.6 (5.8–32.1)	58.5 (44.4–71.4)
1–2	18.3 (13.2–24.8)	8.3 (2.7–22.8)	21.7 (11.4–37.1)	40.1 (25.0–57.3)	15.1 (6.9–29.6)	51.9 (34.4–68.9)
2–3	20.6 (16.0–26.2)	11.1 (4.9–23.1)	32.3 (21.1–45.9)	61.3 (46.9–74.1)	23.3 (13.9–36.4)	28.9 (17.8–43.3)
3–4	19.8 (13.2–28.5)	16.0 (7.1–32.2)	35.7 (20.2–54.8)	70.1 (44.0–88.0)	25.8 (13.9–42.9)	14.3 (2.5–45.7)
4–7	15.9 (10.9–22.4)	7.6 (2.2–23.2)	68.6 (49.1–83.1)	85.9 (74.2–92.8)	65.9 (46.7–81.0)	11.1 (5.1–22.7)
Overall health						
Excellent	36.2 (28.0–45.3)	12.8 (7.6–20.8)	40.3 (28.6–53.1)	62.5 (50.8–72.9)	31.5 (21.4–43.6)	27.5 (17.9–39.5)
Very good	37.3 (28.4–47.1)	8.5 (4.2–16.1)	34.4 (21.3–50.2)	57.7 (43.3–71.0)	25.8 (14.7–41.3)	29.5 (18.3–43.7)
Good	20.2 (14.1–27.8)	7.0 (2.3–19.0)	25.8 (12.4–45.3)	41.0 (25.2–58.7)	20.3 (9.0–38.9)	53.0 (35.5–69.9)
Fair/poor	6.3 (3.4–11.2)	[a]	31.2 (11.0–61.1)	42.0 (18.8–69.1)	26.2 (9.2–54.0)	52.9 (26.5–77.8)
Trouble using appendages						
Normal use	74.8 (66.5–81.6)	8.9 (5.7–13.8)	37.5 (29.7–46.0)	58.0 (48.7–66.9)	30.0 (22.9–38.2)	32.1 (24.0–41.4)
Some trouble	19.1 (12.8–27.5)	11.7 (5.2–24.0)	26.4 (12.5–46.9)	50.7 (30.3–70.8)	16.8 (7.7–32.5)	38.0 (20.5–59.2)
Lots of trouble/ no use at all	6.1 (3.5–10.2)	6.1 (1.3–22.0)	26.4 (8.8–56.0)	33.1 (14.5–58.8)	20.1 (6.4–47.3)	60.4 (34.1–82.0)
How well youth converses						
No trouble	17.6 (11.8–25.4)	8.0 (4.0–15.2)	41.4 (23.6–61.8)	72.3 (52.3–86.2)	34.6 (18.5–55.1)	20.3 (8.6–40.6)
Little trouble	43.4 (36.2–50.9)	8.5 (4.2–16.5)	44.9 (33.9–56.3)	68.4 (58.7–76.7)	38.5 (27.9–50.3)	21.7 (14.8–30.5)

TABLE 1 Continued

Correlate	Univariate Distribution (95% CI)	Percentage Rates of Outcomes (95% CI)				
		Any Vocational or Technical Education	Any 2- or 4-y College	Any Paid Employment	Both Education/ Employment	No Participation
Lots of trouble	25.9 (20.0–32.8)	11.5 (5.6–22.0)	27.9 (16.1–43.7)	40.2 (24.0–58.6)	10.4 (5.7–18.0)	45.7 (28.5–63.9)
Not at all	13.1 (8.7–19.2)	9.2 (2.7–26.8)	5.6 (1.4–19.5)	17.4 (7.1–36.0)	[a]	77.2 (59.4–88.8)
Functional skills scale (quartiles)						
High ability (28–32)	24.6 (17.4–33.3)	17.9 (9.2–31.9)	59.1 (40.3–75.7)	82.2 (68.9–90.8)	52.3 (34.7–69.4)	6.3 (2.0–16.9)
3 (22–27)	24.2 (17.6–32.3)	8.2 (4.6–14.1)	43.9 (29.1–59.9)	66.9 (50.8–80.0)	35.2 (21.7–51.4)	23.1 (12.0–39.1)
2 (16–21)	25.7 (18.3–34.6)	4.7 (1.8–11.3)	25.7 (13.0–43.9)	49.6 (33.4–66.0)	18.3 (8.0–35.5)	42.4 (27.3–58.8)
Lowest ability (8–15)	25.5 (18.5–33.9)	6.8 (2.7–16.2)	11.2 (3.1–30.5)	23.2 (10.6–42.7)	[a]	66.3 (47.4–81.3)

Source: NLTS2, wave 4. No. of multiply-imputed data sets = 50. Weighted to population levels. Variances adjusted for sampling method. CI indicates confidence interval.

[a] Point estimate not reported because of low cell count for this category.

preceding data collection (2006–2007). There was a diverse range of health and impairment severity. The overall rate of paid employment since high school among youth with an ASD was 55.1%. Twenty-eight percent had attended a 2-year college, 12.1% had attended a 4-year college, the combined rate of attendance at either a 2- or 4-year college was 34.7%, and 9.3% had attended a vocational or technical education program. Approximately one-third (34.9%) had not participated in any postsecondary employment or school. Rates of involvement in all employment and educational activities were lower for Hispanic individuals, African-American individuals, and those with lower income. Participation rates on all indicators were higher among youth with an ASD who had been out of school longer. More than half of youth who had left high school in the preceding 2 years were not participating in any paid work or school, compared with only 11% among those who had been out for ≥4 years.

Compared with youth in the 3 other disability categories, those with an ASD had significantly lower rates of employment and the highest overall rates of no participation (Table 2). Rates of any college attendance for youth with an ASD were significantly lower than for youth in the SLI category and higher than those in the MR category. We stratified the rate of no participation by the number of years since leaving high school to see whether it was common across groups to observe an initially high rate in the first few years after high school followed by a decline as time passed. The pattern of very low rates of participation in these early years after high school was particularly pronounced for youth with an ASD.

Most employment and education outcomes were best for youth with an ASD who had been out of school longest (Table 3). Odds of participation in college, paid work, or both were significantly lower among youth who had been out of high school for <3 years, compared with youth who had been out of high school for ≥4 years. Odds of no participation were significantly higher for youth who had left high school in the preceding 2 years. Higher family income was associated with higher odds of participation in paid employment and college and with lower odds of no participation. Youth with higher functional skills had higher odds of being involved in education and employment and lower odds of no participation. The marginal estimates for no participation showed a clear gradient, with the highest rates of no participation in the lowest-income/lowest-skill group and the lowest rates of no participation in the highest-income/highest-skill group (Fig 1).

Regression models with dummy indicators for comparison groups tested whether the significant group differences in Table 2 persisted after adjusting for covariates. Four group differences were no longer significant after adjustment: the LD rate of any vocational education, the SLI rate of any 2- or 4-year college attendance, and the LD and MR rates of both education and employment.

DISCUSSION

We examined rates of postsecondary education and employment participation by using a large national sample. Youth with an ASD had a lower rate of employment relative to those in the SLI, LD, or MR categories. The rate of postsecondary education among those with an ASD was lower than for those in the SLI or LD categories but higher than for those in the MR category.

Young people with an ASD had the highest risk of being completely disengaged from any kind of postsecondary education or employment. This risk

TABLE 2 Prevalence of Participation in Postsecondary Education and Employment Compared Among Groups and Stratified by Years Since High School Exit

	ASD, % (95% CI)	SLI, % (95% CI)	LD, % (95% CI)	MR, % (95% CI)
Any vocational or technical education	9.3 (6.3–13.4)	11.2 (7.7–15.9)	19.1** (14.5–24.7)	6.1 (3.9–9.5)
Any 2-y college	28.0 (21.5–35.5)	35.3 (30.3–40.6)	33.6 (28.1–39.5)	17.1* (11.8–24.0)
Any 4-y college	12.1 (8.1–17.6)	23.3** (17.9–29.8)	13.1 (9.8–17.4)	4.3* (2.1–8.3)
Any 2- or 4-y college	34.7 (27.9–42.2)	51.0** (45.3–56.8)	39.9 (34.5–45.5)	18.2** (12.8–25.1)
Any paid employment	55.1 (46.5–63.4)	86.0*** (75.3–92.6)	93.8*** (89.2–96.6)	68.9* (62.8–74.5)
Both education/employment	26.8 (20.8–33.9)	45.2*** (38.3–52.4)	37.2* (31.8–43.0)	14.0** (9.5–20.1)
No participation	34.9 (27.2–43.5)	7.4*** (3.7–14.3)	3.0*** (1.2–6.8)	25.6 (20.2–31.8)
Stratified by years since high school				
<1	58.5 (44.4–71.4)	19.5 (9.6–35.3)	5.1* (1.1–20.2)	26.2 (15.3–40.5)
1–2	51.9 (34.4–68.9)	12.2 (5.2–25.7)	2.5** (0.7–8.2)	38.3 (25.0–53.6)
2–3	28.9 (17.8–43.3)	4.6 (1.5–13.3)	[a]	19.6 (11.2–32.0)
3–4	14.3 (2.5–45.7)	[a]	4.9 (1.6–13.7)	20.4 (11.5–33.3)
4–7	11.1 (5.1–22.7)	2.8* (0.8–9.0)	[a]	26.1 (15.7–40.0)

Tests are for significance of difference between each comparison group and the ASD group.

* $P < .05$; ** $P < .01$; *** $P < .001$.

Source: NLTS2, wave 4. Tests of significance versus the ASD group. No. of multiply-imputed data sets = 50. Weighted to population levels. Variances adjusted for sampling method. CI indicates confidence interval.

[a] Point estimate not reported because of low cell count for this category.

remained >50% for the first 2 years after high school. It appears that youth with an ASD are uniquely at high risk for a period of struggling to find ways to participate in work and school after leaving high school. These findings point to potential gaps in transition planning specifically for youth with autism and barriers to participation that may be specific to this population. Future research needs to examine how transition planning is conducted for youth with an ASD to ensure that services promote participation in education and employment in the first years after high school.

Youth from households with lower incomes also were significantly more likely to be disengaged, even after controlling for measures of impairment severity. This finding highlights the value of using population-based data relative to smaller clinical samples that often lack diversity. It also builds on previous findings in another examination of youth with an ASD after high school that found those with lower socioeconomic status had poorer behavioral outcomes after high school.[13] The association between a lack of financial resources and poorer postsecondary outcomes among youth with an ASD also mirrors previous findings that found African-American individuals and those from poorer households to be at increased risk for disengagement from therapeutic services after leaving high school.[24]

An emerging pattern of findings across a range of outcome measures suggests poorer youth with an ASD have very different life chances after leaving high school than more affluent peers. Income inequality and poverty rates have been increasing nationwide in recent years.[25] In 2009, 20% of US children lived below the federal poverty line.[25] Given current estimates of ASD prevalence and the poverty rate, ~163 000 children with an ASD were living below the poverty line in 2009. Future research needs to examine how financial resources influence developmental trajectories and what interventions are needed to help poorer youth overcome barriers to accessing services and achieving fuller participation in society.

Impairments in functional skills were associated consistently with worse outcomes, which is consistent with previous research that has revealed a strong association between developmental impairments and greater risk for disengagement in adulthood.[14,26]

This study has some limitations. The sampling frame was based on enrollment in the special education category of autism, which is specific but only moderately sensitive relative to the total population of youth with an ASD. It is impossible to quantify how well our findings generalize to all youth with an ASD and not just to those who also were enrolled in the autism special education category. Data were collected by using surveys that relied on respondent information with no clinical assessment. We did not have norm-referenced measures of symptoms or disability severity. In addition, our analyses were cross-sectional and cannot be used to definitively establish the causal ordering of statistical associations.

This study also has several strengths. The size and diversity of the sample allowed us to examine disparities in outcomes, a previously neglected direction of inquiry in research on ASDs. The recency of the data and the national sampling strategy make these findings highly relevant for policy and practice. Lastly, the range of postsecondary measures reported in our study is larger than other recent studies that have used the same data set.

The growing diagnosed prevalence of ASDs among children means a correspondingly large number of teenagers will be aging into adulthood in the

TABLE 3 Logistic Regression Models of Employment and Education Outcomes Among Youth With an ASD

Covariate	Any Vocational/Technical Education, Odds Ratio (95% CI)	Any 2- or 4-y College, Odds Ratio (95% CI)	Any Paid Employment, Odds Ratio (95% CI)	Both Education/ Employment, Odds Ratio (95% CI)	No Participation, Odds Ratio (95% CI)
Gender					
Male	—	—	—	—	—
Female	0.6 (0.2–1.9)	3 (1.0–9.4)	1.2 (0.5–2.8)	3.2 (0.9–11.0)	0.6 (0.2–1.8)
Age	0.9 (0.6–1.3)	0.7 (0.5–1.1)	1.3 (1.0–1.8)	0.9 (0.6–1.3)	1 (0.7–1.5)
Hispanic					
No	—	—	—	—	—
Yes	0.2 (0.0–2.0)	0.5 (0.1–2.0)	0.5 (0.2–1.4)	0.3 (0.1–1.5)	2.7 (0.7–9.8)
Race					
White	—	—	—	—	—
African American	0.6 (0.2–2.0)	0.7 (0.2–2.0)	0.6 (0.2–1.5)	0.6 (0.2–2.2)	2.3 (0.8–6.3)
Other, mixed	2.8 (0.7–11.4)	2.1 (0.5–8.4)	0.8 (0.2–3.0)	1.1 (0.2–4.8)	0.7 (0.2–3.6)
Parent or guardian household income, $10 000 increments	1.1 (1.0–1.4)	1.1 (0.9–1.2)	1.2* (1.0–1.4)	1.2* (1.0–1.3)	0.8** (0.7–0.9)
In high school until age 21					
No	—	[a]	—	[a]	—
Yes	0.2 (0.0–1.8)	[a]	0.1** (0.0–0.4)	[a]	17.3** (3.1–96.8)
Years since high school					
<1	0.3 (0.1–2.0)	0.2** (0.0–0.5)	0.2** (0.1–0.5)	0.1** (0.0–0.4)	5.7** (1.6–20.3)
1–2	0.7 (0.1–4.3)	0.1*** (0.0–0.4)	0.3 (0.1–1.1)	0.1*** (0.0–0.3)	3.6 (0.8–15.3)
2–3	1 (0.2–4.3)	0.1*** (0.0–0.4)	0.4 (0.1–1.1)	0.1*** (0.0–0.3)	2.3 (0.7–8.3)
3–4	2.1 (0.4–10.1)	0.3* (0.1–0.9)	0.7 (0.2–2.7)	0.2** (0.0–0.6)	0.4 (0.0–2.5)
4–7	—	—	—	—	—
Overall health					
Excellent	—	—	—	—	—
Very good	0.5 (0.2–1.6)	0.8 (0.3–2.2)	0.8 (0.3–2.0)	0.8 (0.3–2.2)	1.1 (0.4–3.1)
Good	0.7 (0.2–2.3)	1.2 (0.3–5.1)	0.8 (0.3–2.4)	1.5 (0.3–7.3)	1.4 (0.3–5.4)
Fair/poor	0.1 (0.0–1.8)	1.2 (0.1–9.3)	0.8 (0.2–2.9)	1.6 (0.2–12.4)	1.6 (0.3–8.5)
Trouble using appendages					
Normal use	—	—	—	—	—
Some trouble	2 (0.6–6.9)	0.5 (0.2–1.6)	0.8 (0.3–2.0)	0.4 (0.1–1.2)	1.2 (0.4–4.0)
Lot of trouble/no use at all	0.9 (0.1–7.1)	1.8 (0.3–9.9)	0.9 (0.2–3.5)	2.7 (0.5–14.1)	1.5 (0.3–7.1)
How well youth converses					
No trouble	—	—	—	—	—
Little trouble	1.3 (0.4–4.5)	1.2 (0.4–3.4)	0.8 (0.3–2.0)	1.4 (0.5–4.4)	1.2 (0.4–3.7)
Lot of trouble	4.7* (1.0–21.6)	1.4 (0.4–4.2)	0.7 (0.2–2.2)	1 (0.3–3.8)	1.1 (0.3–5.1)
Not at all	16.3* (1.9142.3)	0.3 (0.0–2.7)	0.5 (0.1–2.4)	[b]	1.7 (0.3–9.0)
Functional skills scale	1.1* (1.0–1.2)	1.1** (1.0–1.3)	1.1** (1.0–1.2)	1.2*** (1.1–1.3)	0.9** (0.8–0.9)

*$P < .05$; **$P < .01$; ***$P < .001$.

Source: NLTS2, wave 4. No. of multiply-imputed data sets = 50. Weighted to population levels. Variances adjusted for sampling method. CI indicates confidence interval.

[a] This variable was deleted from these models because of 0 counts in the "yes" category.

[b] This level of this variable was dropped because low cell count prevented model from converging.

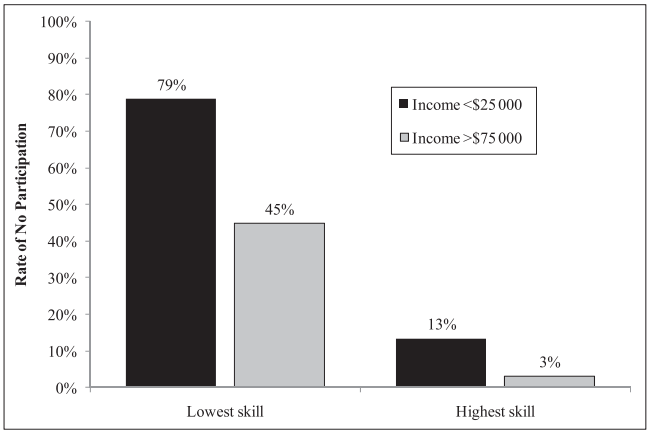

FIGURE 1
Marginal estimates of the rate of no participation in education or employment since high school by the highest and lowest income and functional skills quartiles among youth with an ASD.

coming years, which will increase demand for services. The evidence base informing strategies for helping this population is poorly developed, however.[1] As the demand increases for research into ways to help support positive outcomes among young adults with an ASD, it will be important for funding agencies to prioritize the simultaneous study of ways to reduce and prevent disparities in postsecondary education and employment. This study helps establish a baseline for measuring future progress toward improving outcomes for this rapidly growing population.

REFERENCES

1. Shattuck PT, Roux AM, Hudson LE, Taylor JL, Maenner M, Trani J. Services for adults with an autism spectrum disorder. *Can J Psychiatry*. 2012, In press.
2. Cederlund M, Hagberg B, Billstedt E, Gillberg IC, Gillberg C. Asperger syndrome and autism: a comparative longitudinal follow-up study more than 5 years after original diagnosis. *J Autism Dev Disord*. 2008;38(1):72–85
3. Eaves LC, Ho HH. Young adult outcome of autism spectrum disorders. *J Autism Dev Disord*. 2008;38(4):739–747
4. Howlin P, Alcock J, Burkin C. An 8 year follow-up of a specialist supported employment service for high-ability adults with autism or Asperger syndrome. *Autism*. 2005;9(5):533–549
5. Kobayashi R, Murata T, Yoshinaga K. A follow-up study of 201 children with autism in Kyushu and Yamaguchi areas, Japan. *J Autism Dev Disord*. 1992;22(3):395–411
6. Szatmari P, Bartolucci G, Bremner R, Bond S, Rich S. A follow-up study of high-functioning autistic children. *J Autism Dev Disord*. 1989;19(2):213–225
7. Howlin P, Mawhood L, Rutter M. Autism and developmental receptive language disorder—a follow-up comparison in early adult life. II: Social, behavioural, and psychiatric outcomes. *J Child Psychol Psychiatry*. 2000;41(5):561–578
8. Levy A, Perry A. Outcomes in adolescents and adults with autism: A review of the literature. *Res Autism Spectr Disord*. 2011;5(4):1271–1282
9. Taylor JL, Seltzer MM. Employment and post-secondary educational activities for young adults with autism spectrum disorders during the transition to adulthood. *J Autism Dev Disord*. 2011;41(5):566–574
10. Hendricks D. Employment and adults with autism spectrum disorders: challenges and strategies for success. *J Vocat Rehabil*. 2010;32(2):125–134
11. Hurlbutt KK. Employment and adults with Asperger syndrome. *Focus Autism Other Dev Disabl*. 2004;19(4):215–222
12. Graetz JE. Autism grows up: opportunities for adults with autism. *Disabil Soc*. 2010;25(1):33–47
13. Taylor JL, Seltzer MM. Changes in the autism behavioral phenotype during the transition to adulthood. *J Autism Dev Disord*. 2010;40(12):1431–1446
14. Howlin P, Moss P. Adults with autism spectrum disorders. *Can J Psychiatry*. 2012, In press.
15. Liptak GS, Kennedy JA, Dosa NP. Social participation in a nationally representative sample of older youth and young adults with autism. *J Dev Behav Pediatr*. 2011;32(4):277–283
16. Chiang H, Cheung YK, Hickson L, Xiang R, Tsai LY. Predictive factors of participation in postsecondary education for high school leavers with autism [published online ahead of print May 27, 2011]. *J Autism Dev Disord*. doi: 10.1007/s10803-011-1297-7
17. Wagner M, Kutash K, Duchnowski AJ, Epstein MH. The special education elementary longitudinal study and the national longitudinal transition study: study designs and implications for children and youth with emotional disturbance. *J Emot Behav Disord*. 2005;13(1):25–41
18. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) 4th edition, text revision*. Washington, DC: American Psychiatric Association; 2000
19. Yeargin-Allsopp M, Rice C, Karapurkar T, Doernberg N, Boyle C, Murphy C. Prevalence of autism in a US metropolitan area. *JAMA*. 2003;289(1):49–55
20. Bertrand J, Mars A, Boyle C, Bove F, Yeargin-Allsopp M, Decoufle P. Prevalence of autism in a United States population: the Brick Township, New Jersey, investigation. *Pediatrics*. 2001;108(5):1155–1161
21. Raghunathan TE, Solenberger PW, Hoewyk JV. *IVEware: imputation and variance estimation software* [computer program]. Version 0.1. Ann Arbor, MI: Survey Methodology Program, Survey Research Center, Institute for Social Research, University of Michigan; 2002
22. Raghunathan TE, Lepkowski JM, Van Hoewyk J, Solenberger PW. A multivariate technique for multiply imputing missing values using a sequence of regression models. *Surv Methodol*. 2001;27(1):85–95
23. Rubin DB. *Multiple Imputation for Nonresponse in Surveys*. New York, NY: John Wiley & Sons; 1987
24. Shattuck PT, Wagner M, Narendorf S, Sterzing P, Hensley M. Post-high school service use among young adults with an autism spectrum disorder. *Arch Pediatr Adolesc Med*. 2011;165(2):141–146
25. US Census Bureau. *Current Population Reports, P60-239; Income, Poverty, and Health Insurance Coverage in the United States; 2010*. Washington, DC: US Government Printing Office, 2011
26. Seltzer MM, Shattuck P, Abbeduto L, Greenberg JS. Trajectory of development in adolescents and adults with autism. *Ment Retard Dev Disabil Res Rev*. 2004;10(4):234–247

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Pediatrics 2012;129;1042
DOI: 10.1542/peds.2011-2864 originally published online May 14, 2012;

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