

Comparisons Between Individuals With Autism Spectrum Disorders and Individuals With Down Syndrome in Adulthood

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Abstract

Differences between 70 adults with autism spectrum disorders and intellectual disability and 70 age-matched adults with Down syndrome were examined on variables indicative of independence in adult life. Adults with autism spectrum disorder had less residential independence and social contact with friends, had more limited functional abilities and literacy, exhibited more behavior problems, had more unmet service needs, and received fewer services as compared to adults with Down syndrome. Reflecting these differences, adults with autism spectrum disorder were less likely to be classified as having high or moderate levels of independence in adult life as compared to adults with Down syndrome. Predictors of independence in adult life differed for adults with autism spectrum disorder as compared with adults who have Down syndrome. Implications for service delivery are discussed.

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As larger numbers of children with the diagnosis of autism spectrum disorders exit the educational system and enter adulthood, it has become increasingly important to understand the course of this lifelong disorder. Information about the outcomes of adults with autism spectrum disorders and the challenges that they face in their transition to adulthood is central to service provision and policy planning. However, limited research has been conducted in this area, with the few studies in which researchers have examined adults with autism spectrum disorders generally reporting poor outcomes (Billstedt, Gillberg, & Gillberg, 2005; Howlin, Goode, Hutton, & Rutter,

2004; Piven, Harper, Palmer, & Arndt, 1996). Despite evidence that autism spectrum disorders symptoms abate to some extent over time (Seltzer, Krauss, Shattuck, Orsmond, Swe, & Lord, 2003; Shattuck et al., 2007), the majority of adults with these disorders continue to exhibit significant impairments and difficulties with typical tasks of adulthood, for example, employment, social relationships, and residential independence (Howlin et al., 2004).

Previous descriptions of adults with autism spectrum disorders highlight their wide range of outcomes across different areas of adult functioning (e.g., Ballaban-Gil, Rapin, Tuchman, &

Shinnar, 1996; Eaves & Ho, 2008; Howlin et al., 2004). This work has also been influential in pointing out that these individuals continue to experience significant difficulties as adults, which has underscored the need for intervention and public service programs aimed at improving adult outcomes. However, because studies of adults with autism spectrum disorders have been focused primarily on within-group analyses (Billstedt et al., 2005; Seltzer et al., 2003), they are limited as far as the extent to which they can provide a relevant basis for comparison. To date, examinations of independence in adult life have presented outcomes in terms of what would be expected of a typical adult (Howlin et al., 2004), and little is known about how adults with autism spectrum disorders fare in comparison to their peers with other types of developmental disabilities. Independence in adult life is subjective, although several common goals are promoted by various government agencies and organizations (Luckason et al., 2002; U.S. Department of Health, 2000). These goals include vocational and residential independence, having friends, and engaging in leisure activities. To be consistent with previous literature on outcomes in adults with autism spectrum disorders (Ballaban-Gil et al., 1996; Eaves & Ho, 2008; Howlin et al., 2004), for the purpose of this paper, we defined *independence in adult life* by residential independence, social contact with friends, and vocational independence. Although it would be ideal if individuals with autism spectrum disorders could achieve the same independence as their typically developing peers, it is also important to know how adults with autism spectrum disorders compare to adults with other developmental disabilities.

Information about the specific areas in which adults with autism spectrum disorders differ relative to their peers with other developmental disabilities is useful both in terms of knowing how they currently fare as well as in guiding future service provision efforts. Earlier researchers have suggested that there may be a significant discrepancy between what many adults with autism spectrum disorders are capable of and how they perform or function (Gerhardt & Holmes, 1997; Howlin et al., 2004). Details about the strengths and weaknesses of adults with autism spectrum disorders in comparison to adults with other developmental disabilities would be beneficial in setting intervention goals and designing programs to reduce this discrepancy.

Similarly, there is a dearth of research on adult outcomes for individuals with Down syndrome (Carr, 2008). Although much is known about the aging of these adults in regard to their health concerns, cognitive declines later in life, and life expectancy, there is little research on what predicts outcomes for these individuals earlier in adulthood (Bittles, Bower, Hussain, & Glasson, 2007; Bittles & Glasson, 2004; Esbensen, Seltzer, & Krauss, 2008; Holland, 1999). Details about how adults with Down syndrome succeed in meeting the milestones of adulthood and what leads to better outcomes will be informative for transition planning and the provision of ongoing adult supports.

In the present investigation, we compared adults with autism spectrum disorders with adults who had Down syndrome. In one of the few previous comparative studies of these individuals, Loveland and Kelley (1988) reported no differences in adaptive behavior between adolescents and young adults with autism spectrum disorders and peers with Down syndrome (ages 10 to 29). However, they did find age-related differences as well as group differences in adaptive behavior relative to intellectual functioning (Loveland & Kelley, 1988). Adaptive behavior was better among the older than younger individuals with Down syndrome and was consistent with their intellectual functioning. In contrast, for individuals with autism spectrum disorders, level of adaptive behavior was not found to be associated with age and was more delayed relative to their level of intellectual functioning. This pattern of discrepancy between intellectual functioning and certain aspects of adult adaptive behavior for adults with autism spectrum disorders was also reported by Gerhardt and Holmes (1997) and may be an important impediment to achieving adult milestones (e.g., residential independence) for which adaptive behavior is important.

Although few investigators have compared autism spectrum disorders and Down syndrome in adulthood, many have explored the differences between children with autism spectrum disorders and children with Down syndrome. Results have been overwhelmingly consistent in indicating that children with autism spectrum disorders tend to function more poorly than those with Down syndrome. Children with autism spectrum disorders have been found to have fewer adaptive skills (Rodrigue, Morgan, & Geffken, 1991), fewer social and communication skills (Bierberich & Morgan,

1998; Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998; O'Neill & Happé, 2000; Sigman & Ruskin, 1999), more behavior problems (Eisenhower, Baker, & Blacher, 2005), more sleep problems (Cotton & Richdale, 2006), and less behavioral flexibility (Didden et al., 2008) compared with children who have Down syndrome. Children with autism spectrum disorders have also been found to exhibit more impaired interactions with their parents and siblings than have children with Down syndrome (Hopkes & Harris, 1990; Kasari & Sigman, 1997).

Because most comparative work in this area has been limited to children, it is not known whether a similar pattern of poorer outcomes persists into adulthood for individuals with autism spectrum disorders as compared with individuals who have Down syndrome. As individuals with autism spectrum disorders and Down syndrome age beyond childhood and young adulthood, divergent life course trajectories are suggested by within-group studies. Among adults with autism spectrum disorders, the severity of symptoms tends to abate to some extent with age and skills improve (Seltzer et al., 2003; Shattuck et al., 2007), whereas the acquisition of skills among adults with Down syndrome begins to level off and functional abilities decline in midlife (Esbensen et al., 2008; Zigman et al., 1987, 1995, 2002). Thus, it is possible that the gap evidenced in studies of children with autism spectrum disorders compared with children who have Down syndrome may narrow in adulthood. Alternatively, it is possible that adults with autism spectrum disorders continue to exhibit a profile of relative poorer outcomes compared to adults with Down syndrome and that the difficulties they experience in adulthood are above and beyond what would generally be expected given their intellectual functioning and symptoms.

In this paper we build on previous research by examining the relative skill profiles of adults with autism spectrum disorders and adults with Down syndrome. For this analysis we addressed three primary research aims. First, we examined whether adults with autism spectrum disorders differ from adults with Down syndrome with respect to three core domains of independence in adult life as defined by previous research: residential independence, social contact with friends, and vocational independence (Ballaban-Gil et al., 1996; Eaves & Ho, 2008; Howlin et al., 2004) and on an overall composite measure of independence in adult life

based on these three core domains. To increase the comparability of the two groups of adults in intellectual functioning, we only included adults with autism spectrum disorders who also had intellectual disability. Second, we addressed whether adults with autism spectrum disorders differ from those with Down syndrome with respect to other variables that may facilitate adult functioning. We examined variables that are known to differ between children with autism spectrum disorders and children with Down syndrome, including functional abilities, literacy, and behavior problems, as well as variables that are pertinent to adulthood, such as health and service usage. Finally, we assessed the extent to which these other variables (health, functional abilities, literacy, behavior problems, and service use) differentially predict the overall composite measure of independence in adult life for adults with autism spectrum disorders versus adults with Down syndrome.

Method

Sample and Procedures

Participants were selected from an ongoing study of 406 individuals with autism spectrum disorders (Seltzer et al., 2003) and a completed study of 169 individuals with Down syndrome (Krauss & Seltzer, 1999). In both studies, the maternal respondent was interviewed at 18-month intervals regarding the health, behavior problems, functional abilities, and daily activities of her son or daughter. In both studies, about half of the families lived in Massachusetts and the other half in Wisconsin. The criteria for inclusion in the Down syndrome study were that the mother was between the ages of 55 and 85 and the son or daughter lived at home with her at the beginning of the study. The criteria for inclusion in the autism spectrum disorders study were that the son or daughter with autism spectrum disorders was age 10 or older, had received an independent diagnosis of autism spectrum disorders (autistic disorder, Asperger disorder, or pervasive developmental disorder-not otherwise specified) from an educational or health professional and had a research-administered Autism Diagnostic Interview-Revised—ADI-R (Lord, Rutter, & Le Couteur, 1994) profile consistent with the diagnosis. Unlike the inclusion criteria for the Down syndrome study, individuals with autism spectrum disorders

were selected for the autism spectrum disorders study either if they lived with their families or in non-family settings. Families in both studies volunteered to participate.

The analyses reported here are based on data collected at the second round of data collection (in 2000–2001) from the autism spectrum disorders study and at the seventh round of data collection (in 1997–1998) from the Down syndrome study. These points of data collection were selected because they were close to each other in time, which was intended to minimize the influence of the economic, policy, and other contextual factors that may differ over time. Participants from both studies who were selected for the present analysis were age 22 and older and also had a diagnosis of intellectual disability.

We confirmed intellectual disability status for adults with Down syndrome by a review of state and agency records and results of intelligence testing using the Stanford-Binet Intelligence Scales–SB-IV (Thorndike, Hagen, & Sattler, 1986). We determined intellectual disability status for adults with autism spectrum disorders using a variety of sources of information (as described in Smith, Greenberg, Seltzer, & Hong, 2008), including intelligence testing with the Wide Range Intelligence Test (Glutting, Adams, & Sheslow, 2000), adaptive behavior assessment with the Vineland Screener (Sparrow, Carter, & Cicchetti, 1993), and a review of available records (standardized assessments; parent report of prior diagnoses, intellectual functioning, and adaptive behavior; and clinical and school records).

To select the sample for the present analysis, we matched adults with autism spectrum disorders on age within 4-year age intervals with adults who had Down syndrome. Age matching resulted in a final sample of 70 in each group. Adults in both groups averaged about 37 years of age and were primarily male and Caucasian (see Table 1). About half of the adults with autism spectrum disorders had mild or moderate intellectual disability (52.8%), whereas the majority of adults with Down syndrome had mild or moderate intellectual disability (72.8%). There were no differences between adults with autism spectrum disorders and adults with Down syndrome with respect to age ($M = 37.7$, $SD = 7.5$, range = 22 to 53 and $M = 37.6$, $SD = 7.0$, range = 24 to 52, respectively), $t(138) = .02$, $p = .98$, gender, $\chi^2(1, N = 140) = 0.13$, $p = .72$, or ethnicity, $\chi^2(4, N = 140) = 3.39$, $p = .49$. Compared with adults who

Table 1. Demographics of Adults With Down Syndrome and Adults With Autism Spectrum Disorders and Their Mothers (in %)

Variable	Down syndrome ($n=70$)	Autism spectrum disorder ($n=70$)
Age		
22–30	14.3	18.6
31–40	48.6	48.6
40 and older	37.1	32.9
Gender (% male)	65.7	68.6
Ethnicity (%)		
Caucasian)	97.1	94.2
Level of intellectual disability		
Mild	28.6	25.7
Moderate	50.0	27.1
Severe	17.1	35.7
Profound	2.9	8.6
Unknown	1.4	2.9
Residence (%)		
outside family home)	21.4	71.4
Maternal education		
Less than high school	22.9	4.3
High school	37.1	37.1
Some college	21.4	24.3
College graduate or more	18.6	34.3

have Down syndrome, adults with autism spectrum disorders were significantly more likely to live away from the family home, $\chi^2(1, N = 140) = 35.18$, $p < .001$, to have a lower level of intellectual disability, $\chi^2(3, N = 140) = 11.41$, $p < .01$, and their mothers had higher levels of education, $\chi^2(3, N = 140) = 12.29$, $p < .01$. Therefore, maternal education, residential status, and level of intellectual disability of the son or daughter were controlled in the analyses.

Measures

Residential arrangements. Mothers reported on the current living situation of their adult son or daughter. Categories of living situations were living independently, living semi-independently,

co-residence with family or other relatives, living in a community residence, and living in a hospital or institution.

Social contact with friends. Mothers reported on their son's or daughter's social and recreational activities on a modified version of a measure developed for the National Survey of Families and Households (Bumpass & Sweet, 1987). In both studies, mothers rated the frequency of participation of the son or daughter in socializing with friends or neighbors as 0 (less than yearly or never), 1 (about 1 to 10 times per year), 2 (about once per month), 3 (about once per week), and 4 (several times a week).

Vocational activities. Mothers reported on whether (1) or not (0) the adult son or daughter participated in any of the following vocational activities on a regular basis: day activity or day habilitation program, sheltered workshop, supported employment, competitive employment, or volunteer work. Participants were also categorized as having any vocational activity (1) or no vocational activity (0). Participants who only did volunteer work were categorized as having no vocational activity.

Overall composite of independence in adult life. A composite measure of independence in adult life was modified from one developed by Howlin and colleagues (2004). This composite was a sum of ratings in the core domains of residential independence, social contact with friends, and vocational independence. *Residential independence* ratings were living in a hospital or institution (0), living in a community residence (1), living with family or other relatives (2), living semi-independently (3), and living independently (4). *Social contact with friends* ratings were extracted from maternal reports of social and recreational activities. It was rated as 0 (never visiting with friends or seeing them less than yearly), 1 (seeing friends less than once per month), seeing friends at least once per month (2), seeing friends at least once per week (3), and seeing friends more than once per week (4). *Vocational independence* ratings were volunteer work or no formal day activity (0), day habilitation program (1), sheltered employment (2), supported employment (3), and competitive employment (4). To create a composite measure, we summed and categorized ratings on these three core domains: 0 to 2 (very low), 3 to 5 (low), 6 to 8 (moderate), 9 to 11 (high), and 12 (very high) levels of independence in adult life.

Health. In both studies, health was measured using a maternal rating of the current health status

of her son or daughter (1 = poor, 2 = fair, 3 = good, 4 = excellent). In a meta-analysis of 27 studies, Idler and Benyamini (1997) found that such global ratings of health are valid measures of morbidity, net of sociodemographic factors known to affect health.

Functional abilities. Functional abilities were measured in both studies using an 18-item scale that covered skills in the areas of housework, personal care, and meal-related activities. This measure of functional skills was based on a revised version of the Barthel Index (Mahoney & Barthel, 1965) to measure personal and instrumental activities of daily living appropriate for adults with intellectual disability (Seltzer, Ivry, & Litchfield, 1987). Each item was rated on a 3-point scale of independence (0 = does not do task at all, 1 = does task with help, 2 = does task independently), and averaged for a total score. Our measure of functional abilities correlates .82 with the Vineland Screener Scale composite in the sample of adults with autism spectrum disorders, the group for whom Vineland Screener results were available.

Literacy. Mothers in both studies reported on the ability of their son or daughter to read and write. Reading skills were rated as cannot read (0), reads a few words (1), reads simple sentences (2), and reads paragraphs (3). Writing skills were rated as cannot write (0), writes a few words including name (1), writes simple sentences (2), and writes paragraphs (3). These measures of reading and writing skills correlate significantly with the Verbal IQ measure of the Wide Range Intelligence Test, $r_s = .57$ and $.67$, respectively, both $p_s < .001$, with the Communication domain of Vineland Screener, $r_s = .81$ and $.81$, respectively, both $p_s < .001$, and with each other, $r = .80$, $p < .001$. As reading and writing were strongly intercorrelated, we created a literacy variable based on the summed score of reading and writing skills.

Behavior problems. Behavior problems were assessed in both studies with the Scales of Independent Behavior-Revised–SIB-R (Bruininks, Woodcock, Weatherman, & Hill, 1996). This measure captures the frequency and severity of eight types of behavior problems, providing a Generalized Maladaptive Index. Individual problem behaviors are scored as present or absent. Index scores provide ratings of the seriousness of the problem behavior as normal (90 to 110), marginally serious (111 to 120), moderately

serious (121 to 130), serious (131 to 140), or very serious (141 or above). Reliability and validity are excellent for the Maladaptive Behavior subscale (Bruininks, Hill, Weatherman, & Woodcock, 1986).

Service use. Mothers also reported on the following nine services available to the adult son or daughter at the time of the data collection: physical therapy, occupational therapy, speech and language therapy, psychological or psychiatric services, personal care assistance, agency sponsored recreational or social activities, transportation services, income support, and vocational services. Mothers in both studies rated whether each service was received and, if not, whether it was an area of unmet need. The sum of the number of services rated within each of these two categories was calculated.

Method of Data Analysis

To address the first research aim, which concerned differences between adults with autism spectrum disorders and Down syndrome in the core domains of independence in adult life, we employed multivariate analyses of covariance (MANCOVAs) to contrast the two groups with respect to residential independence, social contact with friends, and vocational independence. Maternal education and level of intellectual disability were controlled in all analyses. Residential placement (co-residing or living away from the family home) was controlled in the analyses of social contact with friends and vocational independence. Where the MANCOVAs indicated significant differences, we used subsequent analyses of covariance (ANCOVAs) to test for differences between adults with autism spectrum disorders and adults with Down syndrome on the individual measures within each domain. Because of the dichotomous nature of the outcome variables, logistic regression is the preferred statistical analysis. We ran these analyses using logistic regression, and the findings were identical to the findings from the ANCOVA approach (data available from the first author). However, we present the ANCOVA findings as they satisfactorily illustrate the group means. We used a two-tailed chi-square test to assess differences in the overall independence in adult life composite rankings between adults with autism spectrum disorders and adults with Down syndrome.

To address the second research aim, which concerned differences between adults with autism

spectrum disorders and adults with Down syndrome in health, functional abilities, literacy, behavior problems, and service usage, we again used MANCOVA. Residential status, level of intellectual disability, and maternal education were controlled in this analysis. Where a significant difference was found with the MANCOVA, we employed subsequent ANCOVAs to test for differences between adults with autism spectrum disorders and those with Down syndrome on the individual variables.

To address our third research aim, which concerned the factors that predicted the overall composite of independence in adult life, we used parallel multiple regressions for adults with autism spectrum disorders and again for adults with Down syndrome. These regressions tested whether the variables in our second aim (health, functional abilities, literacy, behavior problems, and service usage) predicted the composite of overall independence in adult life. Because the measures of receiving services and unmet service needs were not independent of each other, we excluded the unmet service needs from the regression analysis, including only the number of services received (Model 1). In addition, in an effort to explore whether specific services have a differential association with outcomes, we ran the regression models again, replacing the number of services received with the individual services as predictors (physical therapy, occupational therapy, speech and language therapy, psychological or psychiatric services, personal care assistance, agency sponsored recreational or social activities, transportation services, and income support). Vocational services were not included as a predictor variable because of its overlap with the outcome of independence in adult life. Each service was tested in a separate exploratory model to determine which significantly contributed to the prediction of independence in adult life. We entered individual services that significantly contributed to the prediction of independence in adult life into Model 2, along with health, functional abilities, literacy, and behavior problems. Residential status, level of intellectual disability, and maternal education were controlled in this analysis.

Results

Comparing Groups on Measures of Independence in Adult Life

With our first research aim, we addressed differences between adults with autism spectrum

disorders and adults with Down syndrome on three core domains of independence in adult life, namely, residential independence, social contact with friends, and vocational independence. Because of small sample sizes within cells, living independently ($n = 1$) or in a hospital or institution ($n = 3$) were excluded from the MANCOVA for residential independence. Analyses revealed significant group differences with respect to residential independence, $F(3,131) = 13.49, p < .001$, and social contact with friends, $F(4,116) = 4.21, p < .01$, but not with respect to vocational independence, $F(4,125) = 1.29, p = .28$.

Within the domain of residential independence, follow-up ANCOVAs revealed that adults with autism spectrum disorders were less likely to live with family, $F(1,133) = 39.89, p < .001$, and more likely to live in a community residence, $F(1,133) = 30.02, p < .001$, than adults with Down syndrome.

Within the domain of social contact with friends, follow-up ANCOVAs revealed that adults with autism spectrum disorders had less frequent social contact with friends than did adults with Down syndrome. A significantly smaller percentage of adults with autism spectrum disorders spent time with their friends and neighbors several times a week, $F(1,119) = 15.80, p < .001$, as compared with adults who have Down syndrome. Only 8% of the adults with autism spectrum disorders visited with friends and neighbors several times a week as compared to a quarter of adults with Down syndrome. Table 2 contains means on core domains of independence for both groups.

Adults with autism spectrum disorders significantly differed from adults with Down syndrome with respect to the composite measure of overall independence in adult life, $\chi^2(4, N = 128) = 9.79, p < .05$ (see Table 3). Whereas 62.3% of adults with Down syndrome were rated as having a “moderate” or “high” level of independence in

Table 2. Means for Adults by Group on the Core Domains of Independence in Adult Life

Variable	Down syndrome		Autism spectrum disorder		F
	Mean	SD	Mean	SD	
Residential independence ^a					13.49***
Independent ^b	.00	.00	.01	.12	-
Semi-independent	.06	.24	.09	.29	0.86
With family or other relatives	.78	.42	.29	.46	39.89***
Community residence	.14	.35	.57	.50	30.02***
Hospital or institution ^b	.01	.12	.03	.17	-
Social contact with friends ^{a,c}					4.21**
Several times a week	.25	.44	.08	.27	15.80***
About once per week	.22	.42	.19	.39	0.04
About once per month	.13	.34	.14	.35	0.57
About 1 to 10 times per year	.10	.30	.16	.37	0.77
Less than yearly or never	.30	.46	.44	.50	3.36
Vocational independence ^{a,c}					1.29
Competitive employment	.13	.34	.06	.24	-
Supported employment	.19	.40	.29	.46	-
Sheltered workshop	.40	.49	.25	.43	-
Day habilitation	.13	.34	.32	.47	-
Volunteer work or no vocational activity	.15	.36	.08	.27	-

^aAnalysis controlled for maternal education and level of intellectual disability. ^bThese variables were not entered in the MANCOVA or ANCOVAs due to small cell sizes. ^cAnalyses controlled for residential status (coresiding or living away from the family home).

** $p < .01$. *** $p < .001$.

Table 3. Percentage of Adults by Group and Level of Functioning on Composite Measure of Independence in Adult Life

Level of overall independence in adult life	Down syndrome	Autism spectrum disorder
Very high	0.0	1.5
High	9.8	9.0
Moderate	52.5	28.4
Low	31.1	44.8
Very low	6.6	16.4

adult life, only 37.4% of adults with autism spectrum disorders were rated comparably. It is noteworthy that none of the adults with Down syndrome and only one adult with autism spectrum disorders had a “very high” level of independence in adult life (lived independently, had a competitive job, and visited with friends and neighbors several times a week).

Comparing Groups on Factors Facilitative of Independence in Adult Life

For our second research aim, we addressed differences between adults with autism spectrum disorders and adults with Down syndrome on key variables that might facilitate independence in adult life: health, functional abilities, literacy, behavior problems, and service use. The overall MANCOVA revealed significant group differenc-

es between the two groups, $F(6,115) = 4.72, p < .001$ (see Table 4). Follow-up ANCOVAs revealed significant group differences in functional abilities, $F(1,120) = 7.97, p < .01$, literacy, $F(1,120) = 4.39, p < .05$, behavior problems $F(1,120) = 10.21, p < .01$, the number of unmet service needs, $F(1,120) = 12.21, p < .001$, and the number of services received, $F(1,120) = 4.01, p < .05$. Adults with autism spectrum disorders were more impaired in their total functional abilities, had poorer literacy skills, exhibited more behavior problems, had more unmet service needs, and received more services than adults with Down syndrome. However, the two groups did not differ with regard to health, $F(1,120) = 0.02, p = .88$. Both groups of adults were in similarly good health.

Predictors of Overall Independence in Adult Life

Our third research aim concerned whether variables that might facilitate independence in adult life (health, functional abilities, literacy, behavior problems, and the number of services received) in fact predicted the composite of independence in adult life for adults with autism spectrum disorders and those with Down syndrome. We initially tested the models including age as a predictor variable because of the findings of Loveland and Kelley (1988). However, because it did not contribute to the models, we omitted age from our analyses.

Among adults with Down syndrome, 41% of the variance in the composite of independence in

Table 4. Means by Group on Other Variables Facilitating Independence in Adult Life

Variable	Down syndrome		Autism spectrum disorder		F
	Mean	SD	Mean	SD	
Variables facilitating independence in adult life					4.72***
Current health	3.29	0.64	3.20	0.68	.02
Total functional abilities	1.43	0.45	1.16	0.41	7.97**
Literacy	3.04	2.05	1.98	2.12	4.39*
Generalized maladaptive behaviors	103.29	4.88	108.21	6.84	10.21**
No. of unmet service needs	0.69	1.07	1.47	1.67	12.21***
No. of services received	3.61	1.53	3.58	1.89	4.01*

Note. Analyses controlled for maternal education, level of intellectual disability, and residential status (co-residing or living away from the family home).

* $p < .05$. ** $p < .01$. *** $p < .001$.

adult life was accounted for by the variables included in Model 1 (see Table 5, Down syndrome Model 1). Having better functional abilities, $\beta = .39, p < .01$, and receiving a greater number of services, $\beta = .31, p < .01$, were both significant predictors of better independence in adult life outcomes for adults with Down syndrome. As noted earlier, in preliminary analyses, we examined which individual services predicted independence in adult life. For adults with Down syndrome, three services were significant predictors: speech and language therapy, recreational services, and transportation services. When we replaced the total number of services received with these three individual services, we found that this model now accounted for 52% of the variance (see Table 5, Down syndrome Model 2). In addition to having better functional abilities, $\beta = .39, p < .05$, receiving speech and language therapy, $\beta = .22, p < .05$, recreational services, $\beta = .24, p < .05$, and transportation services, $\beta = .22, p < .05$, were all significant predictors of better independence in adult life outcomes for adults with Down syndrome.

Among adults with autism spectrum disorders, health, functional abilities, literacy, behavior problems, and the number of services received accounted for 21% of the variance in the composite of independence in adult life (see Table 5, autism spectrum disorders Model 1). The

only significant predictor was having better functional abilities, $\beta = .39, p < .05$. When we replaced the total number of services received with the individual service that, in preliminary analyses, had a significant contribution to independence in adult life for sample members with autism spectrum disorders, we found that this model now accounted for 30% of the variance (see Table 5, autism spectrum disorders Model 2). In Model 2, having better functional abilities, $\beta = .39, p < .05$ and *not* receiving psychological or psychiatric services, $\beta = -.34, p < .01$, significantly predicted better independence in adult life outcomes for adults with autism spectrum disorders.

Thus, for both groups of adults having better functional abilities was related to better adult outcomes. Receipt of services played a significant role in predicting better outcomes for adults with Down syndrome. Specifically, receiving particular services (speech/language, recreational services, and transportation) was predictive of better overall adult outcomes. On the other hand, receiving services was not related to better outcomes for adults with autism spectrum disorders. In fact, having a better outcome was related to *not* receiving (and by implication, not needing) psychological services.

For descriptive purposes, Table 6 presents the percentage of adults in both groups who received

Table 5. Regression Analysis Predicting the Composite Measure of Independence in Adult Life by Group

Predictor	Down syndrome		Autism spectrum disorders	
	Model 1	Model 2	Model 1	Model 2
Level of intellectual disability	.04	.06	.11	.12
Maternal education	-.06	-.04	-.04	-.06
Current health	.04	.04	.17	.22
Total functional abilities	.39**	.31*	.39*	.39*
Literacy	.26	.27	-.13	-.09
Generalized maladaptive behaviors	-.01	.01	-.05	-.02
No. of services received	.31**	-	-.12	-
Speech and language therapy	-	.22*	-	-
Psychological or psychiatric services	-	-	-	-.34**
Recreational services	-	.24*	-	-
Transportation services	-	.22*	-	-
R^2	.41	.52	.21	.30

Note. $N_s = 59$ for both models and both groups.

* $p < .05$. ** $p < .01$.

Table 6. Percentage of Adults by Group Receiving or in Need of Each Service

Service	Received service			Unmet service need		
	Down syndrome	Autism spectrum disorders	$\chi^2(1, N=136)$	Down syndrome	Autism spectrum disorders	$\chi^2(1, N=136)$
Physical therapy	7.5	5.9	0.14	7.5	14.7	1.79
Occupational therapy	7.5	14.9	1.88	3.0	29.9	17.62***
Speech and language therapy	9.0	8.8	0.00	17.9	36.8	6.03*
Psychological or psychiatric services	19.4	63.2	26.71***	3.0	10.3	2.90
Personal care assistance	14.9	33.3	6.27*	4.5	4.3	0.00
Recreational services	71.6	46.4	8.96**	13.4	29.0	4.90*
Transportation services	65.7	59.4	0.57	10.4	8.7	0.12
Income support	97.0	82.6	7.64**	0.0	4.3	2.98
Vocational services	77.6	44.8	15.21***	9.0	16.4	1.68

Note. *N*s = 67 adults with Down syndrome and 69 adults with autism spectrum disorders.

* $p < .05$. ** $p < .01$. *** $p < .001$.

each of the nine types of services that were assessed. We also present the percentage of adults who did not receive but needed each service. Adults with autism spectrum disorders received significantly more psychological or psychiatric services and more personal care assistance than did adults with Down syndrome, whereas adults with Down syndrome received significantly more recreational services, vocational services, and income support than did adults with autism spectrum disorders. Adults with autism spectrum disorders had a significantly greater unmet need for occupational therapy, speech and language therapy, and recreational services than did adults with Down syndrome.

Discussion

Our study extends comparisons of individuals with autism spectrum disorders and Down syndrome into adulthood and shows that relative to adults with Down syndrome, adults with autism spectrum disorders who also had intellectual disability continue to show the pattern of poorer outcomes that past researchers have documented as evident during childhood. Although the two groups were comparable with respect to achieving vocational independence, adults with autism spectrum disorders and comorbid intellectual disability were living in less independent residential settings and had less

contact with friends and neighbors than did adults with Down syndrome, two core components of independence in adult life (Howlin et al., 2004). Adults with autism spectrum disorders were also found to have lower ratings of overall independence in adult life than did adults with Down syndrome. Only 37.4% of adults in the former group were rated as having a moderate or high level of independence in adult life compared with 62.3% of adults with Down syndrome. Impairments in social skills and communication in adults with autism spectrum disorders may be contributing to their poorer outcomes in contact with friends and neighbors. However, we note that adults in both groups were comparable in having infrequent contact with friends and neighbors. Thus, the poorer outcome on this component of independence in adult life cannot fully be accounted for by impairments associated with the core features of autism spectrum disorders.

In addition to having poorer overall adult outcomes as compared to adults with Down syndrome, adults with autism spectrum disorders were also more impaired in other variables associated with adult functioning. They were less able to carry out typical tasks of daily living, had poorer literacy skills, exhibited more behavior problems, received fewer services, and had more unmet service needs than did adults with Down syndrome, even when level of intellectual disabili-

ity was controlled. Our results suggest that the gap between individuals with autism spectrum disorders and Down syndrome observed in childhood does not narrow with age but, instead, persists into adulthood and that the pattern of behavior problem and symptom abatement observed in adults with autism spectrum disorders (Shattuck et al., 2007) is not so prominent as to overcome existing group differences with adults who have Down syndrome.

There were clear differences between the average adult with autism spectrum disorders and the average adult with Down syndrome in our sample. The former lived in a community residence, visited with friends less frequently than once a month (i.e., about 1 to 10 times per year), and participated in a sheltered workshop or a day habilitation program. He or she was in good health, needed assistance to do most activities of daily living, was able to read and write only a few words, and exhibited at least three different types of problem behaviors (most commonly an unusual habit, withdrawn behaviors, and self-injurious behaviors). This average individual with autism spectrum disorders received more than three services (most frequently income support, psychological or psychiatric services, and transportation services) and had one unmet service need.

In comparison, the average adult with Down syndrome lived at home with his or her parents, visited with friends about once a month, and worked in a sheltered workshop, a profile consistent with the findings of other investigators (Carr, 2008). He or she was in good to excellent health, was independent or needed only partial assistance on most daily living tasks, was able to read and write a few words or sentences, and exhibited only one type of problem behavior (most commonly an unusual habit). This average adult received more than three services (most frequently income support, vocational services, and agency sponsored recreational or social activities) and had less than one unmet service need.

Although adults with Down syndrome have fewer impairments than do those with autism spectrum disorders, we note that they still have some limitations. No individual with Down syndrome met the criteria for a very high level of independence in adult life, namely, living independently, seeing their friends several times a week, and working in competitive employment.

Furthermore, about a third of the adults with Down syndrome never visited with friends or did so only once in the past year, and 15% had no vocational activity.

Our findings also indicate that the factors associated with independence in adult life in individuals with Down syndrome differ from those associated with independence among individuals with autism spectrum disorders. Functional abilities were related to better outcomes for both groups, whereas receiving more services (speech and language, recreational, transportation) were related to better outcomes only for adults with Down syndrome. This difference is noteworthy, as adults with autism spectrum disorders were less likely to receive recreational services and more likely to be in need of recreational services and speech and language therapy compared to adults with Down syndrome.

Another predictor of overall independence among adults with autism spectrum disorders was *not* receiving psychological or psychiatric services. Our findings suggest that adults with autism spectrum disorders not receiving psychological or psychiatric services are more likely to have better adult outcomes. Comorbidity of psychological disorders among individuals with autism spectrum disorders has been a relatively understudied area until recently (Tsakanikos et al., 2006). Early indications suggest that the prevalence of psychopathology among these adults is no different from their peers with intellectual disability (Melville et al., 2008; Tsakanikos et al., 2006), yet over 60% of adults with autism spectrum disorders in our sample were receiving psychological or psychiatric services (versus 19% of adults with Down syndrome). It will be important for future researchers to examine the best ways to assess psychological and psychiatric needs among adults with autism spectrum disorders so that appropriate interventions can be put in place. Identifying the presence of comorbid behavior problems or psychological disorders in adolescents and young adults with autism spectrum disorders prior to exiting the school system and leaving the family home may be the best way to target services to this population and to minimize the long-term impact of these disorders on overall independence in adult life.

It was surprising that behavior problems did not emerge as a significant predictor of independence in adult life in our model. In examining this

finding in more detail, we found that behavior problems were inversely correlated with residential independence, vocational independence, and overall independence in adult life on a bivariate level, $r_s = -.18, -.23,$ and $-.28,$ respectively, all $p_s < .05.$ However, in the regression model, behavior problems did not predict independence in adult life beyond functional abilities and service use. This suggests that for adults in both groups, adaptive behaviors may be more strongly related to independence in adult life than are maladaptive behaviors. However, this finding warrants replication in future research and, thus, should be interpreted cautiously.

A major strength of this study is that we were able to assess the lives of adults with autism spectrum disorders in comparison to a group of individuals with another type of developmental disability. In addition to the difference in diagnostic status, however, there were also other differences between our samples that resulted from the fact that they were initially recruited to participate in different studies. All of the individuals with Down syndrome were required to be coresiding with their families at the time that the study began, which could have contributed to some of the differences seen between the groups. Indeed, adults who lived with their families were more likely to be in need of services and receive fewer services than adults living in community residences. Although we controlled for residential status whenever possible, we were not able to do so in the independence in adult life analyses because one of the components of independence in adult life was residential status. Similarly, due to nonindependence, we were unable to account for the complex relationship between services received and unmet need for services in predicting adult outcomes because questions about unmet needs were asked only when the particular service was not received.

Other sample limitations included the fact that most of the families were Caucasian and all volunteered to participate. Thus, these families may not be entirely representative of other families with adult children who have autism spectrum disorders or Down syndrome. Furthermore, because all of the adults with autism spectrum disorders also had intellectual disability, these findings may not be fully applicable to adults with autism spectrum disorders with average intelligence. Finally, although we controlled for level of intellectual disability, the fact

that adults with autism spectrum disorders had lower levels of intellectual disability may have contributed to their poorer outcomes in unknown ways.

Even in comparison to adults with significant disabilities, the life skills of adults with autism spectrum disorders are severely lacking. A primary goal of service provision efforts should be to elevate the skills and activities of adults with autism spectrum disorders to be more commensurate with those of adults with other types of developmental disabilities. Although a person's level of cognitive ability may be less malleable, especially in adulthood, it is certainly within our grasp as service providers to try to improve a person's level of functional abilities. Greater deficits in functional abilities, which are first apparent in comparative studies of children with autism spectrum disorders, may have cumulative effects over the life course that ultimately limit the independence of these adults. In addition, autism spectrum disorders-related social and communication impairments may impact relative rates of functional skill acquisition and negatively influence the trajectory of skill development in these individuals. Investigations are needed to determine why children and adults with autism spectrum disorders do not appear to benefit from the same services as do individuals with other kinds of intellectual and developmental disabilities so that new, more effective methods of service delivery can be developed.

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