Differential Outcome Subgroups in Children with Autism Spectrum Disorder attending Early Intervention

Running Head: ASD OUTCOME SUBGROUPS

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Abstract

Background

The finding of positive outcomes at the group level for children with Autism Spectrum Disorder (ASD) who complete comprehensive early intervention programs often masks considerable individual variability. We therefore aimed to identify subgroups of children based on their response to intervention and to compare outcome variables between groups at two points in time.

Method

We used model-based cluster analysis to explore response to intervention using a longitudinal design for 210 children with ASD who had completed an early intervention program. Children were assessed on entry at Time 1 and again at Time 2 which was after 12 months or when they exited the program (whichever came first) using measures of ASD symptoms (Social Communication Questionnaire), cognition (Mullen Scales of Early Learning), and adaptive behaviour (Vineland Adaptive Behavior Scales-II).

Results

A two cluster solution was identified including a high change group who improved consistently more than the low change group across measures, and showed significantly fewer autism symptoms, higher non-verbal and verbal cognition, and adaptive behaviour composite scores at Time 1.

Conclusions

The findings indicated that children's response to early intervention is not uniform, but instead included subgroups characterised by patterns of high and low change. Further research is needed to identify clinically relevant mediators of differential response group membership.

Keywords: Early Intervention; Autism Spectrum Disorder; Cluster Analysis; Subtyping

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Children with Autism Spectrum Disorder (ASD) show considerable hetereogeneity in terms of their presentation, as well as their developmental trajectory. Positive outcomes at a group level may mask substantial individual differences during pre-school early intervention with some children making considerable progress, yet others making minimal progress or even showing regression (e.g., see Eldevik et al., 2010; Perry et al., 2008). Accordingly, numerous researchers (e.g., Reichow, Barton, Boyd, & Hume, 2014; Schreibman et al., 2015) have called for further research to identify factors associated with differential outcomes with the view to (a) harnessing or mitigating these factors and/or (b) matching individual or subgroups of children with interventions most likely to meet their particular learning needs. To date, most studies have focused on identifying factors prior to intervention in the pre-school years that are associated with levels of, or changes in, children's autism symptoms, cognitive ability, and adaptive behaviour following intervention (see Vivanit et al., 2014 for a summary). This approach to research is essential for identifying factors that help explain differences in gains, but it does not shed light on whether there are patterns in the gains themselves, such as the presence of identifiable subgroups of high, middle, and/or low responders.

An alternative way to identify predictors of outcome, is to categorise children on an identified outcome variable (e.g., cognitive ability), and then examine factors associated with membership to the identified subgroups. Hedvall et al (2015) used this approach to examine factors that predicted membership to 'gained the most' (i.e., children whose composite scores on the Vineland Adaptive Behaviour Scales [VABS] increased by 15% or more) and 'gained the least' (i.e., children whose composite VABS score decreased by 15% of more) subgroups. Participants included 208 children with ASD who were followed up over a two year period a initial assessment (see Fernell et al., 2011). The two groups differed significantly at Time 1 on cognitive level, referral age, milestones passed at 18 months, behaviour problems associated with ASD characteristics, and communication regression (defined as a loss of five or more functional words). Only cognitive development at Time 1, however, made a unique statistically significant contribution as a predictor of outcome group membership using logistic regression (Hedvall et al., 2015). Categorising in this way allows for investigation of factors that may distinguish children by group membership, however the membership criteria may be somewhat arbitrary due to reliance on subjective judgement regarding what constitutes a meaningful difference in outcomes/groups.

An alternative approach to identifying patterns in outcomes is the use of cluster analysis. This approach has been used in ASD research to examine possible subgroups across a range of measures including autism symptomology (e.g., Eaves, Ho, & Eaves, 1994); autism severity, cognitive skills, and adaptive functioning (Kim, Macari, Koller & Chawarksa, 2016; Stevens et al., 2000), and sensory functioning (e.g., Lane, Molloy, & Bishop, 2014). Of particular relevance to the present study, Stevens et al. (2000) identified ‘lower functioning’ and ‘higher functioning’ subgroups during preschool (Time 1) and at school age (Time 2) within a sample of 95 school-aged children with ASD, with the subgroups presenting with significant differences on measures of autism symptoms, cognitive functioning, and language at both time points. Importantly, the study included a longitudinal component, with further analyses revealing cognitive function at preschool (but not social skills or autism symptom severity) strongly predicted group membership at school age. Furthermore, the children in the ‘higher-functioning’ group had improved across all measures over time, whereas children in the ‘lower functioning’ group had made few gains on social and language measures. Likewise, Kim et al., identified clusters cross-sectionally in a community sample of 100 toddlers with ASD, and also identified ‘high-functioning’ and ‘low functioning' clusters that accounted for 53% of their sample (with an additional two intermediate clusters identified). Consistent with Stevens et al., findings, the former group improved across language and social skills between ages 2-3; whereas the latter group showed limited changes over time. These findings suggest that examination of differential outcome subgroups in children with ASD should not be limited to cross-sectional analysis of children's *level of achievement* at a particular time point (e.g., language skills at program exit), but also include analysis of *patterns of change in children's skills* over time (e.g., gains in language skills over the course of intervention).

To our knowledge, cluster analysis has not yet been used to examine *patterns of change in children's skills* over time during early intervention in a community setting. Cluster analysis is an exploratory analysis that is used to identify homogenous groups that can be applied to identify groups of children based on patterns of change in skills over time. The two key advantages of this approach would be (a) the inclusion of a clinically representative sample receiving an ecologically valid intervention, and (b) the use of an empirical method to identify patterns (i.e., clusters), if they exist, in the amount of change children achieve during the intervention rather than assignment to response groups based on a more arbitrary measure (e.g., non-verbal IQ score below/above 70). The use of cluster analysis allows for the analysis of patterns of change over time and empirical identification of response to intervention subgroups. Identification of these subgroups provides an opportunity to identify factors related to differential outcomes which may be used in the future to match individuals or groups of individuals to interventions most likely to meet their needs. Accordingly, our aims in this study were to (a) identify subgroups of pre-school children with ASD based on their response to a comprehensive community based early intervention program across two time points, (b) examine differences in change scores between clusters, and (c) examine differences in chronological age, level of autism symptoms, non-verbal developmental quotient (DQ), verbal DQ, and adaptive behaviour composite scores at Time 1 between clusters.

Method

Ethics

Ethics approval (Griffith University, Protocol Number AHS/47/14/HREC) and gatekeeper approval was granted. Deidentified data pertaining to the variables of interest in this study were extracted from existing data collected by the first author from three sites of the same early intervention agency. Signed informed consent was obtained from all parents of individual participants.

Setting

The early intervention (EI) provider was an accredited provider (Australian Helping Children with Autism package; Australian Government, 2016) and followed the Australian Guidelines for Good Practice (Prior & Roberts, 2012). Three sites were used for data collection across the organisation with each within the same city in Australia. Each of these sites delivered the same early intervention program, providing services for approximately 30-40 children at each, arranged into 3-4 classrooms with approximately 10 children per class grouped by ability level (rather than chronological age). Staff included a multidisciplinary team of teachers, speech pathologists, occupational therapists, and paraprofessionals with childcare training, and each class was led by an early childhood or special education teacher. The staff:child ratio was between 1:2-1:4 varying by learning activity and child need (e.g. level of support required for activities, self-care, and/or behaviour) throughout the program time. Each child attended the program for approximately 20 hours per week.

The EI program has been described previously by Paynter, Riley, Beamish, Davies, and Milford (2013) and Paynter, Riley, Beamish, Scott, and Heussler (2015). It can be described as a “generic” approach in that it does not subscribe to a single approach or philosophy, but instead uses a combined approach drawing from evidence-based practices (see Wong et al., 2015) and best practice guidelines for Australia (Prior & Roberts, 2012); consistent with guidelines for naturalistic developmental behavioural intervention (Schreibman et al., 2015). Intervention strategies used in the program include structured teaching (individual and group-based) based on principles of applied behaviour analysis (e.g., discrete trial teaching, reinforcement, prompting, functional behaviour assessment, and modelling), visual supports (e.g., schedules), along with the use of augmentative and alternative communication strategies (e.g., Picture Exchange Communication System). Specific strategies used with each child are selected based on multidisciplinary evaluation of strengths and needs within a developmental framework and in partnership with families. Individualised goals are selected collaboratively with parents in the form of individual education plans for each child.

The intervention aimed to prepare children for entry to school including development of adaptive behaviour, cognitive skills, and communication skills. Intervention occurs throughout the day in an early learning environment that includes small (2-4 children) and large (10 or more) group activities in natural contexts such as free play, meal times, outside play, self-help activities, as well as more structured teaching times, such as circle and mat times. Speech and occupational therapy is conducted across these activities. Finally, a family education component is included that covers a range of topics (e.g., managing behaviour, supporting communication development, transitions) to support generalisation to the home environment.

Participants

Participants were young children aged 30-74 months with ASD attending the early intervention service who completed at least two assessments across two time points by the organisation. The first group included children who entered site 1 between February 2010 and

December 2014. The second group included children who entered sites 2 and 3 between January 2012 and December 2014. Families self-selected sites for their child, usually based on geographic location, and all the sites were located 30-45 minutes apart by car travel time. Eligibility for entry to the program included a Diagnostic and Statistical Manual (DSM)-IV (American Psychiatric Association [APA], 2000) diagnosis of ASD including Autistic Disorder, Asperger Disorder, or Pervasive Developmental Disorder – Not Otherwise Specified, or DSM-5 ASD diagnosis (APA, 2013), by an independent medical practitioner and chronological age at Time 1 between 30 and 74 months. A total of 323 children's data were initially available; participants were excluded if they had only completed one assessment (n = 89), had a Social Communication Questionnaire (SCQ) score of less than 11 (n = 16; as per Eaves, Wingert, Ho, & Mickelson, 2006 suggested cut-off for preschool aged children), or no SCQ (n = 8) resulting in a sample size of 210. The reasons why children had only completed one assessment included: 1) if they were currently enrolled in the program, 2) had exited without sufficient notice to schedule a second assessment, or 3) had been enrolled less than six months prior to exit. There were no differences in child variables (autism symptoms, non-verbal and verbal developmental quotient, or adaptive behaviour skills using the adaptive behaviour composite score, all $p > .05$) at Time 1 between those excluded for completing one assessment and those with two or more assessments.

The final sample comprised of 145 children from site 1 and 65 children from sites 2 and 3, with no significant differences for child variables (autism symptoms, non-verbal and verbal developmental quotient, or adaptive behaviour skills using the adaptive behaviour composite score, all $p > .05$) at Time 1. Of the remaining total of 210 children, 80% were male, with a mean age at first assessment of 44.65 months (SD = 9.20, range 28-68 months). The majority of children's families spoke English as primary language at home (86.5%). Children were not excluded for having co-morbid diagnoses and were retained for ecological validity of the sample. Of the 210 children, 19 children's parents reported co-morbid diagnoses on entry to the program, mainly comprising of attention-deficit hyperactivity disorder, intellectual disability/global developmental delay, and/or chromosomal or syndrome diagnoses (e.g., Kabuki syndrome).

Procedure and Measures

Assessments were completed by the early intervention service staff by a trained assessor (first author or staff under her supervision) not involved in the intervention program at Time 1 and Time 2, which was after 12 months in the program or exit (whichever came first, as long the child had attended a minimum of six months prior to exit). Measures included direct child assessment of cognition and parent-completed questionnaires of autism symptoms and adaptive behaviour.

Cognition**.** Child assessment was conducted using the *Mullen Scales of Early Learning* (MSEL: Mullen, 1995), a standardised assessment of early developmental skills commonly used to assess cognitive functioning in young children with ASD (e.g., Eapen, Črnčec, & Walter, 2013; Vivanti, Dissanayake, Zierhut, & Rogers, 2013). The Visual Reception, Fine Motor, Receptive Language, and Expressive Language subscales were administered. Age equivalent scores were used for the main analysis as many children did not reach the minimum score for calculation of meaningful standard scores. Developmental quotients (DQs) were also calculated (age equivalent divided by chronological age multiplied by 100) for each domain and for non-verbal (fine motor and visual reception) and verbal (receptive and expressive language scales) composites as per previous research (e.g., Yang, Paynter, & Gilmore, 2016).

ASD Symptoms. The *Social Communication Questionnaire*: *Current Form* (SCQ: Berument, Rutter, Lord, Pickles, & Bailey, 1999) is a 40-item questionnaire derived from the *Autism Diagnostic Interview-Revised* (Lord, Rutter, & Le Couteur, 1994). Parents indicate whether a child displayed specific behaviours related to autism; the total score was used as a measure of autism symptoms (e.g., Eapen, Črnčec, & Walter, 2013; Paynter et al., 2013). This measure shows good psychometric properties (Berument et al., 1999).

Adaptive Behaviour. The *Vineland Adaptive Behavior Scales- 2nd Edition* (VABS: Sparrow, Dominic, Cicchetti, & Balla, 2005) parent-caregiver version was used to measure adaptive behaviour in four domains: Communication, Daily Living skills, Socialisation, and Motor Skills. Each domain is comprised of scores of two-three subdomains (e.g., Communication includes receptive, expressive, and written communication). Domain age equivalent scores were calculated by averaging subdomain age equivalent scores as recommended in previous research with this population (Carter et al., 1998; Yang et al., 2016) as being more sensitive to change over time in intervention. As some participants were under three years of age, the written language subdomain was excluded from calculation of average age equivalent scores on the communication domain and only the receptive and expressive scales were used. This measure shows good psychometric properties (Sparrow et al., 2005) and has been widely used to assess changes in adaptive behaviour in other ASD early intervention studies (e.g., Paynter et al., 2015; Vivanti, Paynter, et al., 2014)

Analysis

Statistical analyses were conducted using SPSS (IBM Corp., Released 2010) and *R* (v 2.15, Vienna, Austria). Calculations of new variables (e.g., DQs), descriptive data, data screening, and imputation of missing values was completed in SPSS. These values were used for the R model-based cluster analysis (mclust: Fraley & Rafferty, 2002; Fraley, Rafterty, Murphy, & Scrucca, 2012) to identify subgroups of the sample. In R, variables were standardised and model-based cluster analysis using the Bayesian Information Criteria (BIC) completed to determine the fit of the data to a range of potential Gaussian models as outlined by Lane, Molloy, and Bishop (2014). Higher BIC scores indicate better balance between data fit and model complexity. The advantage of this approach over traditional hierarchical clustering methods (e.g., K-means) is that the complexity of the model is considered alongside data fit (Lane et al., 2014) and avoids fitting the data to a pre-defined set of clusters (Chen & Gopalakrishnan, 1998). To examine differences in change scores between clusters and differences in demographic variables and assessments, t-tests were calculated in SPSS. This approach to analysis was modelled on previous research into ASD (sensory) subtypes in ASD by Lane et al (2014).

Results

Data Screening

Table 1 shows Time 1 participant characteristics. Change in developmental quotients were calculated for each of the four subscales of the Mullen by subtracting the Time 1 score from the Time 2 score for each child, and change in age equivalent scores were calculated for each of the four Vineland scales likewise. Screening of these variables revealed individual outliers ($z > \pm 3.29$) on individual change scores on the Mullen DQ change score: Fine Motor scale ($n = 1$) and Expressive Language scale ($n = 2$); Vineland age equivalent change score: Communication ($n = 1$), Daily living ($n = 1$), Socialisation ($n = 1$), and Motor ($n = 2$). These eight individual scores were excluded from analyses. Screening for missing data revealed fewer than 5% of values were missing (4.82%) on change scores and those that were missing were completely at random, as indicated by Little's MCAR test, χ^2 (62) = 61.507, $p = .494$. However, deletion would lead to exclusion of 15% of cases for cluster analysis thus, expectation maximisation (EM) substitution in SPSS was used to impute missing values for cluster analysis only. Follow-up analyses were conducted without EM substitution and data was deleted listwise by analysis.

Cluster Analysis

Figure 1 shows the BIC values for each cluster solution considered including nine different clusters (x-axis) and 10 Gaussian models (each represented by a different icon). The figure legend identifies characteristics of each Gaussian model including specific variance and geometric features (for a detailed description see Fraley & Raftery, 2002). The two cluster solution showed the highest BIC score, suggesting a balance between model fit and complexity, and was consequently selected for further examination.

Characteristics of Subgroups

Cluster 1 included 115 participants (24 females, 91 males), and cluster 2 included 95 participants (18 females, 77 males); with a similar proportion of males: females in each, χ^2 (1, N = 210) = .12, *p* = .72, Cramer's *V* = .024. The two clusters were compared using t-tests to further explore differences in change scores between groups, see Table 2. On average participants in Cluster 2 (herein referred to as *high change group*) scored significantly higher than participants in Cluster 1 (herein referred to as *low change group*) on all change measures. There were no significant differences between clusters on the time between assessments (i.e. intervention time between).

Comparison of Time 1 Variables between Subgroups

To examine differences in chronological age, level of autism symptoms, non-verbal developmental quotient (DQ), verbal DQ, and adaptive behaviour composite scores at Time 1 between clusters, t-tests of Time 1 scores were compared across the two clusters. As seen in Table 3 participants in the *high change group* (Cluster 2) showed significantly fewer autism symptoms, and higher non-verbal and verbal DQ, and adaptive behaviour composite scores at intake compared to the *low change group*. Age did not differ significantly between groups, nor did number with a reported comorbidity.

Discussion

Our first two aims in this study were to identify, and then examine, differences between subgroups of pre-school children with ASD based on adaptive behaviour and developmental outcomes. Using model-based cluster analysis, we identified a two-cluster solution based on changes in age-equivalent scores on the VABS-II and DQs on the MSEL for children attending a community based EI program. Further analyses revealed significant between group differences in change scores on all assessed domains on the MSEL and VABS-II, reflecting *high change* and *low change* groups across both direct and parent-reported measures of autism symptoms, cognition, and adaptive behaviour. The disparity in change between groups is most apparent for expressive and receptive communication, indicating this may be a particularly salient area of individual differences in preschool outcomes where a subgroup shows a subdued response.

Our findings are consistent with those of Stevens et al. (2000) and Kim et al (2016) who identified ‘lower functioning’ and ‘higher functioning’ subgroups based on cluster analysis cross-sectionally. Stevens et al. identified clusters at school follow-up; and Kim et al (2016) identified clusters at intake, and found these clusters were related to significant differences in outcomes between clusters. A significant contribution of the current study is our demonstration of convergent validity of these findings through replicating these subgroups from the opposite direction – by first identifying a two-cluster (low versus high change group) solution – and doing so via a method of model-based cluster analysis that avoided fitting the data to a pre-defined set of clusters (Chen & Gopalakrishnan, 1998). Accordingly, the findings of the three studies with each identifying clusters differently, converge on the notion that there are indeed, at least in these three samples, groups of children with distinguishable differences in response to intervention. Whether additional intermediate subgroups may exist as identified in Kim et al (2016), with differing patterns of strengths/weaknesses across areas, is an important question for future research.

A clear clinical and research priority is to identify factors that are associated with *low* and *high change* in response to intervention, with the view to (a) altering the formulation of the chosen intervention provided in order to improve outcomes for those at risk of not responding and/or (b) to identify moderating factors that may predispose a child to benefit more from one intervention than another. Accordingly, in addressing our third aim, we examined between cluster differences in child characteristics at Time 1. Consistent with Hedvall et al. (2015), we found significant differences for cognition (non-verbal DQ), but also additional differences in language (verbal DQ) and a composite measure of adaptive behaviour. However, in contrast to Hedvall et al, clusters did not differ based on chronological age at intake, suggesting that the age appropriateness of a child's skills (in this study measured by developmental quotients) rather than age itself, may best distinguish which children are likely to make high and low intervention gains. Nevertheless, this finding must be interpreted with caution, given the relatively narrow age range of participants in the study.

Despite the ecological validity of conducting research with community-based samples, doing so has inherent challenges that must be considered when interpreting the findings. Primarily, in common with previous studies in this area (e.g., Perry et al., 2008; Kim et al., 2016; Stevens et al., 2000), there is no comparison group; thus, maturation effects cannot be conclusively ruled out as an explanation for changes over time. To some extent our focus on developmental trajectory subgroups compensates for this; however, this weakness is acknowledged and future research with a comparison group (waitlist and/or different treatment of similar intensity) is recommended which would also permit exploration of relative effects of different interventions for individual children and/or subgroups.

Nevertheless, we feel the present data provides an important and novel contribution through identification of subgroups based on differential outcomes and provides convergent validity to previous findings (Kim et al., 2016; Stevens et al., 2000) to the discrimination of at least two subgroups of children who may be differentiated at intake by the cognitive and adaptive skills, and ASD symptomatology. Whether they may be further discriminated based on age of diagnosis, age at commencement of intervention (e.g., intervention prior to the program evaluated), or other child/family characteristics beyond intake scores is an important question for future research.

The two-cluster solution capturing high and low intervention gains has three key implications. First, there is a need for greater detail and transparency in reporting of intervention outcomes for children with ASD in research, in order to capture the differing individual outcomes. Current approaches to evaluating interventions (e.g., National Autism Center, 2015) focus on the quality, quantity, and consistency of research findings across studies, taking into consideration overall group effects. Yet, within each intervention, it is possible that there are clusters of children making high versus low gains, and without transparent reporting the opportunity to compare the effectiveness of interventions for these subgroups, is missed. Second, examination of outcomes should include analysis to elucidate different patterns of outcomes (e.g., subgroups of high and low achievers) and factors that predict these. In this respect, we concur with Vivanti et al., (2014) regarding the need for future research that uses theory-driven selection of putative predictors, the use of measures directly relevant to the hypothesised mechanisms of learning in each program (e.g., social learning, imitation), and the examination of factors beyond the child to include family and environmental factors. Finally, the fact that significant differences in non-verbal cognition in our study, along with that by Hedvall et al. (2015), points to the importance of assessing cognitive functioning as part of diagnosis and intake to early intervention programs, consistent with guidelines for best practice (e.g., National Institute for Health and Clinical Excellence, 2013; Prior & Roberts, 2012).

Conclusion

Our examination of children's gains in cognition and adaptive behaviour following a comprehensive community-based early intervention program revealed a two cluster solution comprising *high change* and *low change* groups. The finding highlights the need for more detailed and transparent examination and reporting in ASD intervention research, to allow for sophisticated comparison of the relative effects of different interventions for individual children, particularly those with the most substantial learning needs. To this end, the fact that children in the low-change group had presented with significantly lower cognitive skills at intake to intervention, points to both the research and clinical need to identify children at risk for *low change*, to understand what other factors confer risk, and to intervene with additional and/or different interventions in an attempt to maximise their learning outcomes.

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Table 1

Participant Characteristics at Time 1: Age, Adaptive Behaviour Composite Score, Non-verbal and Verbal Developmental Quotient (DQ)*

	Mean (SD)	*Range*
Age at Intake Mullen (months) (*n* = 209)	44.65 (9.20)	28-68
Age at Time 2 Mullen (months) (*n* = 206)	55.09 (8.02)	37-75
Adaptive Behaviour Composite Score (*n* = 203)	68.91 (10.44)	44-98
Non-verbal DQ (*n* = 209)	59.17 (19.79)	14.91-134.44
Verbal DQ (*n* = 209)	41.03 (22.57)	6.94-115.96

***** Note totals are < 210 due to missing data

Table 2

t-tests of Clusters on Change in Mullen Scales of Early Learning Developmental Quotient (DQ) and Vineland Scales Domain Age Equivalent (AE) Scores

Change Score	*Cluster 1* (*n* = 111) *Mean (SD)*	*Cluster 2* (*n* = 93) *Mean (SD)*	*t (df)*	*P*	*Cohen's d*
Mullen Scales of Early Learning DQ					
Visual Reception	.09 (12.44)	12.33 (20.59)	5.23 (202)	< .001	.72
Fine Motor	-3.25 (10.88)	5.83 (17.19)	4.58 (202)	< .001	.63
Receptive Language	1.04 (9.45)	18.69 (16.21)	9.68 (202)	< .001	1.33
Expressive Language	-.77 (10.73)	12.61 (19.85)	6.12 (202)	< .001	.84
Time between assessments (months)	10.59 (3.27)	10.68 (3.59)	.18 (203)	.85	.03
Vineland AE					
Communication (106, 92)	5.02 (11.55)	17.22 (11.49)	7.43 (196)	< .001	1.06
Socialisation (104, 92)	.14 (7.36)	11.34 (14.98)	5.54 (194)	< .001	.95
Daily Living (102, 92)	6.44 (6.94)	18.74 (21.43)	6.71 (192)	< .001	.77
Motor Skills (103, 92)	5.35 (12.24)	12.44 (16.14)	3.48 (193)	< .001	.49
Time between assessments (months)	10.86 (3.01)	10.96 (2.65)	.27 (197)	.79	.04

Table 3

Comparison of Clusters on Intake Variables: Chronological Age, Autism Symptoms, Non-verbal and Verbal Developmental Quotient (DQ), Adaptive Behaviour Composite, and Co-morbid Diagnosis

Variable	*Cluster 1* (*n* = 115) *Mean (SD)*	*Cluster 2* (*n* = 94) *Mean (SD)*	*t (df)*	*P*	*Cohen's d*
*Chronological Age**	45.66 (9.17)	43.40 (9.13)	1.77 (207)	.08	.25
Autism Symptoms (SCQ)	20.52 (5.17)	17.34 (4.42)	4.74 (208)	< .001	.66
Non-verbal DQ	52.80 (19.88)	66.96 (16.74)	5.50 (207)	< .001	.77
Verbal DQ	35.53 (22.18)	47.75 (21.28)	4.03 (207)	< .001	.56
Adaptive Behaviour Composite Score	64.56 (9.38)	73.95 (9.32)	7.13 (201)	< .001	1.00
	Cluster 1 (*n* = 105)	Cluster 2 (*n* = 92)	χ^2	*p*	*Cramer's V*
Co-morbid diagnosis presence (n)	9	10	.004 (1, *N* = 178)	.951	.075

* At time 1 Mullen assessment; cluster numbers smaller for co-morbidity due to missing data.