Impact of Personal Control and Access to Supports on Social Determination and Social Participation and Relationships for Adults with Autism Spectrum Disorder

THESIS

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Abstract

The current study explores social outcomes for adults with ASD in comparison to adults with other disabilities by investigating the relationships between social relationships, community inclusion, access to services/supports, and choice to address the following research question: how do individuals with ASD differ from individuals with other disabilities in their reported levels of social relationships and community inclusion? How do reported levels of choice and access to services/supports relate to social relationships and community inclusion for individuals with ASD? Are these relationships different for individuals with disabilities other than ASD? The National Core Indicators Adult Consumer Survey 2009-2010 and 2010-2011 datasets were used as a population from which two samples were drawn, individuals with ASD and individuals with other disabilities. Exploratory and confirmatory factor analyses were used to test the measurement model of the latent constructs of interest, then structured means analysis was used to compare latent variable means, and SEM was used to test a structural model of the relationships of the constructs of interest. Results indicated a measurement model differing from the factor structure consistent with the organization of the NCI survey yielding three novel factors: Social Determination, Social Participation and Relationships, and Personal Control. Individuals with ASD had lower levels of Social Determination and Friendships than individuals with other disabilities. SEM analyses
yielded significant relationships between constructs of interest. Results provide insight with regards to novel statistical, theoretical, and practical approaches to the study of social outcomes for individuals with ASD.
Dedicated to my father, James Mehling, who was always my biggest fan.
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Chapter 1: Introduction

Social Impairment in Autism Spectrum Disorder

Impairment in social interaction is a defining characteristic of Autism Spectrum Disorder (ASD) (Seltzer, Shattuck, Abbeduto, & Greenberg, 2004). Social deficits characteristic of ASD include impairments in the use of non-verbal behavior to regulate social interaction, difficulty establishing and maintaining peer relationships, a lack of shared enjoyment of interests and accomplishments with others, and a general lack of social or emotional reciprocity (American Psychiatric Association, 2013). Social skills are essential for effectively interacting with others and are vital to avoiding interpersonal conflicts and dealing with complex situations. Failure to learn appropriate social skills early in life can result in a “cascade effect” yielding deficits in a multitude of domains resulting in deficient social outcomes characterized by negligible interpersonal relationships and low levels of community inclusion (Weiss & Harris, 2001; Howlin, Goode, Hutton, & Rutter, 2004; Saldana et al., 2009).

Research indicates that social difficulties continue through adolescence and into adulthood for individuals with ASD (Seltzer et al., 2003). Howlin, Mawhood, and Rutter (2000) assessed general social functioning in adult men with ASD and expressive language disorder who were matched for nonverbal IQ and expressive language abilities and found that on a composite measure of social competence, only 10% of individuals
with an expressive language disorder had severe social difficulties versus 74% of individuals with ASD. General social responsiveness as assessed by the ADI and ADOS indicated that the persons with ASD showed significantly fewer greeting behaviors, social responses, and instances of shared enjoyment. Data from the socialization domain of the Vineland Adaptive Behavior Scale also showed similar deficits (Howlin et al., 2000). These findings illustrate the presence of extreme social difficulties in adults with ASD, even when compared with individuals matched for IQ and language abilities, on two known indicators of social functioning.

Whitehouse, Watt, Line, and Bishop (2009) examined social skills and social impairment in 11 high functioning adults with ASD in comparison to adults with specific language impairment, adults with pragmatic language impairment, and typically developing adults. Researchers examined differences in the number of participants per group rated as abnormal on various ADOS-G items related to social skills and found statistically significant group differences indicating that adults with ASD exhibited greater social skills deficits than all other groups (Whitehouse et al., 2009). Thus, significant social impairment remains a concern for adults with ASD even in comparison to adults with similar disabilities.

**Social Outcomes for Adults with ASD**

Existing research indicates that adults with ASD have generally poor social outcomes characterized by fewer friendships and lower levels of community inclusion, in comparison to both typically developing individuals and individuals with disabilities other than ASD (Levy & Perry, 2011). Research also indicates the contribution of IQ,
childhood verbal ability, and overall severity of ASD symptomology as modestly reliable predictors of adult social outcomes (Nordin & Gillberg, 1998; Billstedt, Gillberg, & Gillberg, 2005; 2011). Less is known, however, regarding the impact of environmental characteristics, such as access to appropriate service/supports or the opportunity for choice in the environment, on social outcomes for adults with ASD.

Eaves and Ho (2008) assessed young adult outcomes for individuals with ASD diagnosed between 1978-1984. Of the original 78 participants, 48 individuals participated in the follow-up study. Overall, 46% of individuals were rated as having a poor outcome. In terms of social outcomes, only 33% of individuals reported having at least one friendship involving selectivity, closeness, and enjoyment of each other’s company, 31% of individuals spent time with people involving a hobby or special interest, and 30% attended a social group, church, or club regularly (Eaves & Ho, 2008).

Howlin et al. (2000) examined social outcomes of 19 individuals with high functioning ASD and found that in comparison to adults with language disorders, adults with ASD continued to have significantly greater social and relationship problems in adulthood. Adults with ASD reported having fewer close acquaintances than individuals with language disorders. 53% of adults with ASD had little to no social contact and only 11% were described as making normal social contacts, compared with 30% of adults with language disorders (Howlin et al., 2000). Adults with ASD also showed greater impairment in making and keeping friends with 17% of adults with ASD having friends compared to 45% of adults with language disorders. For adults with ASD, 47% did not share activities with friends versus 31% adults with language disorders. Data on
loneliness for the two groups indicated that few adults with ASD expressed feelings of loneliness whereas for adults with language disorders, “expressed loneliness” corresponded with reported levels of friendships (Howlin et al., 2000). Researchers also explored individuals’ participation in leisure activities and found for adults with ASD, 56% had activities arranged by others however only 5% of adults with language disorders had others arrange their activities. Furthermore, only 11% of adults with ASD versus 40% of adults with language disorders engaged in leisure activities on their own initiative (Howlin et al., 2000).

Whitehouse et al. (2009) conducted a follow-up study of the psychosocial outcomes for 19 adults with specific language impairment (SLI), 7 adults with pragmatic language impairment (PLI), 11 adults with high functioning autism, and 12 typically functioning adults. Results indicated that all groups had some problems with social relationships, but these problems were most pronounced in adults with ASD. At follow-up, information relating to friendships was obtained through relevant questions in the ADI-R. All participants in the typically functioning group had at least one friendship characterized by social/emotional reciprocity compared to 57% of individuals with PLI, 21% of individuals with SLI, and 0% of individuals with ASD. In addition, the ASD group had statistically significantly poorer quality of friendships overall when compared with all three groups (Whitehouse et al., 2009). Thus, not only do individuals with ASD have marked social deficits that persist from childhood into adulthood, social outcomes for adults with ASD including the quantity and quality of friendships, inclusion and integration in the community, and choice making and personal initiative with regards to
socialization, are significantly poorer than both typically developing individuals and individuals with disabilities similar to ASD.

**Relationship between Access to Services/Supports and Social Outcomes**

Ruble and Dalrymple (1996) stressed the importance of investigating the predictive value of environmental variables in outcome research for adults with disabilities. Although factors such as IQ are powerful predictors of social outcomes, factors such as access to services/supports and opportunity for choice are more easily manipulated and responsive to intervention than within-person factors and thus carry significant practical value in predicting social outcomes for adults with ASD. Research has shown the relationship between the availability of a support network, local provision of support, and adult outcomes for individuals with ASD (Lord & Venter, 1992). In addition, Howlin and Yates (1999) found that access to appropriate supports helps individuals with ASD to develop social relationships.

Orsmond, Krauss, and Seltzer (2004) explored the ability of various personal and environmental factors to predict peer relationships and social and recreational activities in adolescents and adults with ASD. Analyses indicated that environmental factors, including a greater number of services received, played a powerful role in predicting the number of social and recreational activities. Furthermore, increased participation in social and recreation activities was positively associated with the number of services received \((B=0.152, p<0.01)\) highlighting the importance of access to appropriate services for adults with ASD (Orsmond et al., 2004).
Eaves and Ho (2008) explored outcomes for young adults with ASD and included in their research open-ended questions for parents regarding unmet support needs. Parents of 80% of adults with ASD reported unmet needs of some kind with 75% indicating an unmet social need. It is likely that this large proportion of unmet social needs was associated with the relatively poor social outcomes found in this study (discussed above) although this relationship was not directly explored.

Additional research has explored the relationships between access to services/supports and Quality of Life (QoL). Social outcomes including interpersonal relationships and community inclusion are two important domains of the QoL construct (Schalock, 2004). Renty and Roeyers (2006) explored the relationship between access to services and supports and QoL for high-functioning adults with ASD using hierarchical multiple regression and found that support characteristics accounted for 51% of the variance in QoL above and beyond demographic variables and disability characteristics (F-change(4,57)=16.59, p<0.001). Their findings indicated that the number of unmet formal support needs was negatively correlated with QoL (R= -0.633, p<0.001). In addition, analyses indicated that for individuals with ASD, QoL is most strongly associated with unmet formal needs regarding accommodation, relationships, and daytime activities (Renty & Royers, 2006). This additional insight emphasizes the important relationship between access to services/supports, interpersonal relationships, and community inclusion for adults with ASD.
**Relationship between Choice and Social Outcomes**

Opportunity for choice is related to social outcomes for adults with disabilities. Research indicates that consumer choice increases interpersonal relationships and community integration for adults with intellectual disability (ID) in that when given the opportunity for choice, many individuals with ID tend to spend more time interacting socially with friends and seeking active involvement in the community (Davis & Faw, 2002). Choice making has also been found to relate directly to community integration in adults with ID. Heller, Miller, and Hsieh (2002) found that in adults with ID, greater opportunity to make choices was associated with higher level of community integration. In addition, research indicates that facilitating choice making in the environment enhances opportunities for community participation (Heller et al., 2002).

Research on the opportunity for choice in adults has primarily focused on adults with ID. Using data from Washington state’s Division of Developmental Disabilities 2002 National Core Indicators, Neely-Barnes, Marcenko, and Weber (2008) examined the relationship between choice and the latent variable QoL as defined by three indicators: Community Inclusion, Rights, and Social Relationships, for 224 adults with mild ID. Using structural equation modeling and multivariate regression, Choice was found to significantly predict Community Inclusion. Significant correlations were also found among Social Relationships, choice of staff, and Community Inclusion (Neely-Barnes et al., 2008). Thus, for adults with mild ID, significant relationships exist between choice, social relationships, and community inclusion.
There is considerably less research on the direct impact of choice on social relationships and community inclusion for adults with ASD. Research has, however, indicated that for adults with ASD, the majority of social outings and other activities are organized by parents or support staff with minimum if any initiative or choice on the part of the adult with ASD (Engstrom, Ekstrom, & Emilsson, 2003; Howlin, 2003; 2005; Howlin et al., 2000; Mawhood, Howlin, & Rutter, 2000; Renty & Roeyers, 2006). Thus, it is possible that lack of choice is at least in part responsible for the poorer social relationships and community inclusion characteristic of adults with ASD.

Summary

Research on adults with ASD has primarily focused on objective measures of outcome including functional independence and employment and has identified ASD severity, verbal abilities, and IQ as reliable predictors for adult outcomes (Billstedt et al., 2005; 2011). Less is known about the predictive value of environmental factors that improve social relationships and community involvement for adults with ASD. Better understanding of the impact of environmental factors such as opportunity for choice and access to services/supports on the social functioning of adults with ASD will provide useful information to guide future policy and practice and will be the focus of this study.

Aims

This study aims to explore whether individuals with ASD differ from individuals with other developmental disabilities (DD) in their reported social relationships and community inclusion and how reported levels of opportunity for choice and access to services/supports may contribute to those differences differentially for individuals with
ASD versus individual with DD other than ASD. The proposed research will address the following research questions: Are there differences in the factor structure of the latent constructs of social relationships, community inclusion, and opportunity for choice between individuals with ASD and individuals with DD other than ASD? How do individuals with ASD differ from individuals with other DD in their levels of social relationships and community inclusion? How do individuals with ASD differ from individuals with DD other than ASD in their opportunities for choice and access to services? What are the relationships between opportunity for choice, access to services/supports, social relationships, and community inclusion for individuals with ASD and do these relationships differ for individuals with DD other than ASD?
Chapter 2: Methods

Data Source

Data were obtained from the National Core Indicator (NCI) Consumer Survey 2009-2010 and 2010-2011 versions (Human Services Research Institute, 2011; 2012). The NCI survey is a component of a national project on the assessment of outcomes for the purpose of quality assurance and enhancement coordinated by the Human Services Research Institute (HSRI) and the National Association of State Directors of Developmental Disabilities Services (NASDDDS). The NCI survey is administered only in states that choose to participate in the NCI program. The purpose of the NCI survey is to identify and measure core indicators of performance of state developmental disabilities services.

Sample

National sample. The 2009-2010 and 2010-2011 NCI Surveys were administered to a random sample of individuals 18 years of age and older who were receiving, at the time of the survey, at least one state service, besides case management. States were asked to complete 400 interviews with members of the random sample thus most states draw an over-sample to account for refusals. Some states did not complete 400 interviews, and others exceeded this goal. A sample size of 400 allows valid comparisons across states.
with a 95% confidence level. Those states with samples below 400 participants are also included in the data.

Seventeen states and one county in California administered the consumer survey in 2009-2010 and together collected background and demographic information and survey data on a total of 11,599 individuals. The participating states represented were: AL, AR, DC, GA, IL, KY, LA, ME, MO, NC, NJ, NY, OH, OK, PA, TX, WY and Orange County, CA. Of the 11,599 individuals, 10.4% or 1,206 individuals have an Autism Spectrum Disorder. Twenty-five states administered the NCI consumer survey in 2010-2011 and together collected background, demographic, and survey data on a total of 8,796 individuals. The participating states represented were AL, AR, AZ, CA, DC, FL, GA, HI, IL, KY, LA, MA, ME, MO, NC, NH, NJ, NM, OH, OK, PA, SD, TX, VT, and WA. Of the 8,796 individuals, 9.3% or 816 individuals have an Autism Spectrum Disorder.

**Study sample.** For this study, data analyzed includes individuals from both the 2009-2010 and 2010-2011 datasets. Thus, the total number of possible participants for this study is N=20,395. From this survey population, there is a total of N=2,022 (9.9%) individuals with ASD. Of the N=2,022 individuals with ASD, 886 individuals have a valid\(^1\) response to both sections 1 and 2 of the NCI Consumer Survey\(^2\). For this study, four groups were drawn from the population of individuals who have valid responses to

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\(^1\) If the interviewer feels that either Section 1 or 2 contains invalid responses they may indicate this on the survey form. All data marked as invalid were excluded from these analyses. Responses to Section 1 may be marked invalid if the individual receiving the services is unable to answer the questions him/herself as this section contains questions that are subjective in nature and must be answered by the individual (e.g. ‘do you ever feel lonely?’, ‘do you have a best friend?’; etc.).

\(^2\) The NCI consists of three sections, Background Information, Section 1, and Section 2. Section 1 contains questions that can only be answered by face-to-face interview with the individual receiving services as they contain subjective questions. Section 2 contains questions that may be answered by an individual who knows the consumer well or the consumer themselves.
both section 1 and 2 of the NCI consumer survey. Two groups consisted of individuals with ASD and two of individuals with DD other than ASD. Individuals with ASD who had valid responses (N=886) were split into two groups, an exploratory group (N=443) and a confirmatory group (N=443) to ensure that exploratory analyses were validated on an independent confirmatory sample. To create the comparison groups, two groups of N=443 individuals with DD other than ASD were drawn from the pooled 2009-2010 and 2010-2011 dataset of individuals with valid responses to section 1 and 2. Individuals for the exploratory non-ASD (N=443) and confirmatory non-ASD (N=443) comparison groups were matched for gender with the ASD groups.

Measure

The NCI adult consumer survey. The NCI Survey is made up of questions intended to collect information regarding various indicators giving a snapshot of system performance and outcomes for individuals with developmental disabilities. Performance indicators explored in this study include survey questions under the categories of: “Friends and Family”, “Community Inclusion”, “Choices”, “Access to Needed Services”, and “Satisfaction with Services/Supports”.

The NCI Adult Consumer Survey is conducted as a face-to-face interview by trained interviewers. To increase standardization and reduce interviewer bias, all interviewers receive consistent training. The NCI Consumer Survey protocol is supported by a national training program for interviewers, including training manuals, presentation slides, training videos, scripts for scheduling interviews, lists of frequently asked questions, picture response formats, and a review of the survey tool.
Threats to the NCI Adult Consumer Survey’s validity include those related to selection bias. States differ in their eligibility requirements for the diagnosis of ASD and qualification requirements for services. In states that have related clauses in their eligibility criteria, a higher percentage of individuals with ASD are served; thus the sample of individuals used in this study may not be equally representative of all participating states. In addition, NCI Consumer Survey data is only collected in states that agree to participate in the program, which may contribute to bias. The NCI Adult Consumer Survey has good reliability as demonstrated by 92-93% inter-rater agreement for past versions of the survey and 80% agreement in test-retest reliability (Smith & Ashbaugh, 2001).

**ASD diagnosis.** The presence of an ASD diagnosis for the purposes of the NCI Adult Consumer survey was determined by a review of the individual’s records on state computer databases during the pre-survey process. Information related to diagnoses is provided by the service coordinator/case manager and is verified by the individual or family member during completion of the survey. Therefore, in the context of this survey, the clinician completing the diagnostic assessment and the instruments used by these clinicians are unknown. However, to be eligible for developmental disability services in all states, a medical diagnosis is required. Despite this common requirement, states vary in their diagnosis of ASD and eligibility requirements to qualify for DD services within that state which may lead to systematic differences in individuals identified as having an ASD across states.
Variables

Previous research using Washington state’s 2002 National Core Indicators Survey examined relationships between Choice and Quality of Life indicators (Community Inclusion, Rights, and Social Relationships) in adults with mild ID by creating manifest variables from sum scores of items from various subsections of the NCI Consumer Survey (Neely-Barnes et al., 2008). The present study aims to expand on this paradigm in that survey items will be treated as indicators of latent constructs as opposed to components of measured variables. The rationale for this approach is that it is likely that different survey items vary in their association with each latent construct as a function of group membership (ASD versus non-ASD). In the present study, survey items initially selected as indicators for each latent construct subjected to exploratory and confirmatory factor analysis are consistent with previous research and with the designated subscales of the NCI survey instrument (Neely-Barnes et al., 2008). Appendix B contains a list of all NCI survey questions initially selected as indicators for each latent construct (Social Relationships, Community Inclusion, and Opportunity for Choice) and for the measured variable, Access to Services/Supports. Appendix C, Figure 1 offers a representation of the hypothesized relationships among the constructs Social Relationships, Community Inclusion, Opportunity for Choice, and Access to Services/Supports.

Social Relationships. Five questions from the “Relationships” section of the NCI Adult Consumer Survey were chosen as initial indicators of overall quality of social relationships for this study. Respondents were asked whether they: 1) have friends, 2) have a best friends, 3) see friends when they want, 4) can go on a date if they want, and
ever feel lonely. Responses were coded as 0 (no), 1 (sometimes), or 2 (yes). Responses to “never feel lonely” were reverse-coded so that for all indicators high scores indicate higher levels of social support. These five variables serve as initial indicators of latent social relationships in exploratory factor analyses.

**Community Inclusion.** Seven questions from the “Community Inclusion” section of the NCI Adult Consumer Survey were chosen as indicators of overall inclusion in the community for this study. Respondents were asked whether in the past month they had gone: 1) shopping, 2) out on errands, 3) out for entertainment, 4) out to eat, 5) out to religious services, 6) out for exercise, and in the past year, 7) if they had gone on vacation. Responses were coded as either 0 (no inclusion in the community) or 2 (access to the community). Each of these seven questions serves as an initial indicator of overall latent community inclusion in exploratory factor analyses.

**Opportunity for Choice.** Eleven questions from the “Choices” section of the NCI Adult Consumer Survey were chosen as indicators of the individual’s overall perception of his/her opportunity for choice (as the individual’s actual opportunity for choice, i.e., number of options presented in each perceived choice, was not taken into account). Respondents were asked whether they chose: 1) where they live, 2) who they live with, 3) who helps them at home, 4) their daily schedule, 5) how to spend their free time, 6) their place of work, 7) their last job, 8) where they go during the day, 9) who helps them during the day, 10) what they buy, and 11) their case manager. Responses were coded as 0 (someone else chose), 1 (person had some role in the choice), or 2
(person made the choice). Each of these 11 questions serves as a variable used as an initial indicator of overall latent perceived choice for exploratory factor analyses.

**Access to Appropriate Services/Supports.** Three questions from the “Access to Services” and “Satisfaction with Services/Supports” sections of the NCI Adult Consumer Survey were chosen to create an index of each individual’s access to the appropriate and necessary services/supports. Respondents were asked: 1) do you get the services you need, 2) does your support staff have adequate training to meet your needs, and 3) do you have a service plan. Responses were coded as 0 (no), 1 (somewhat/maybe), or 2 (yes). Data from these three questions were summed to create an index of each individual’s access to appropriate services and supports with a maximum possible score of 6 and a minimum score of 0 representing high to low access to services/supports respectively.

**Procedure**

The NCI survey data were used as a population from which two samples of interest were drawn for data analyses. One sample included individuals with ASD and the second sample consisted of a comparable group of individuals with DD other than ASD. The two samples were matched on gender and subsequently randomly split into exploratory and confirmatory groups. The de-identified data from the survey materials were analyzed to identify relationships between the variables of interest. Following approval from the Ohio State University IRB, the NCI data was obtained from HSRI/NASDDDS. All NCI data was de-identified. The date of birth had been replaced with chronological age and county of residence was removed for all survey respondents included in the data provided. After completion of the study, the NCI dataset will be
returned to HSRI/NASDDDS in compliance with their policy on the access and use of research data.

**Data analyses.** Analysis of the descriptive statistics and exploratory factor analyses were completed using SPSS Version 20.0 (IBM, 2011) and confirmatory factor analyses, latent mean comparisons, and structural equation modeling was completed using SPSS Amos 20 (IBM, 2012).

**Missing data.** The SPSS Missing Values Analysis (MVA) module was used to examine missing data patterns. Items with high levels of “missingness” (>40%) in either group were dropped from further analyses in both groups. These items included: “did you choose where you work” and “did you choose your job staff”. For analysis of descriptive statistics, exploratory factor analyses, and t-tests carried out in SPSS, pairwise deletion of missing data was used. In confirmatory factor analyses, latent mean comparisons, and structural equation modeling carried out in Amos, full information maximum likelihood (FIML) procedures were used to estimate missing data. Simulation studies have shown that imputing missing data using FIML estimation procedures more accurately represents associations among variables than does listwise or pairwise deletion of missing data, even when data are not missing entirely at random (Little & Rubin, 1989; Muthén, Kaplan, & Hollis, 1987). It is likely that consumers with missing data from this survey failed to respond for nonrandom reasons related to their ability to communicate or comprehend the content of the questions. Therefore, FIML was used in the Amos software for estimating relationships among latent variables and indicators in the present analyses.
**Exploratory and confirmatory factor analyses.** Exploratory factor analyses (EFA) were conducted using the exploratory ASD (N=443) and exploratory non-ASD (N=443) groups. Initially, EFA was conducted separately in each group using pairwise deletion of missing values, maximum likelihood extraction, and oblimin factor rotation. All initial indicators of the three hypothesized latent constructs (Social Relationships, Community Inclusion, and Opportunity for Choice) were entered into one analysis in each group respectively to allow indicators to freely load on any number of possible factors. Following this initial EFA, items loading most strongly on each derived factor were then tested in individual EFAs for that given factor separately in each sample (ASD and non-ASD). These analyses serve the purpose of exploring the factor structure of each of the latent variables, Social Relationships, Community Inclusion, and Opportunity for Choice, and informing the selection of indicators with high factor loadings (>.20) in both groups to be used as indices of each latent construct in further analyses. Due to the initial exploratory nature of these analyses, some indicators may be excluded from further analyses if they are found to be minimally related (factor loadings <.20) to the latent variables of interest in one or both samples (Mulaik, 2010).

After EFA procedures were completed, the confirmatory ASD and confirmatory non-ASD groups were used in separate confirmatory factor analyses (CFA) to validate the structure of the factors derived during the EFA procedures and to test the adequacy of the hypothesized measurement model. CFA was carried out in Amos and used FIML estimation of missing values. First, all factors and their measured indicators were entered together in one analysis, restricting indicators to only load on the factor found to be most
associated with that indicator during EFA procedures. Following this initial CFA, each factor and its indicators were tested in separate CFAs to further verify the adequacy of the measurement model for each latent construct.

**Structured means analysis.** After the factor structure of each latent variable was confirmed using CFA in both groups of individuals with and without ASD, structural equation modeling (SEM) was used as a framework to test differences of group means on each of the derived latent variables using structured means analysis (Millsap, 2011). These analyses were carried out using the entire study sample (N=1,772) simultaneously across both groups using a multi-group model. In this model, to estimate the difference between the two groups’ means on a latent variable, the non-ASD group serves as a reference group and is held constant with its mean on the given construct fixed to zero (Byrne, 2010; Dimitrov, 2006). This allows the mean of each latent variable in the ASD group to represent the difference between the construct means of the two groups. Structured means analysis functions under the assumptions of configural invariance, the extent to which the same number of factors best represents the data for both groups, and measurement invariance, the extent to which factor loadings are operating similarly across groups (Byrne, 2010; Dimitrov, 2006). In testing of assumptions for structured means analysis, all assumptions were met. Structured means analysis serves the purpose of providing information with regards to whether or not differences exist between groups on levels of derived latent variables. Group mean difference for the Access to Services/Supports manifest variable was also tested using an independent samples t-test.
**Structural equation modeling.** The Amos software package (IBM, 2012) was used to fit several structural equation models with FIML estimation of missing values and maximum likelihood (ML) estimation procedures to evaluate the relationships between the derived latent variables and the manifest variable, Access to Services/Supports. Appendix C, Figure 1 depicts the hypothesized relationships between constructs.

ML estimation procedures for structural equation modeling (SEM) make several assumptions with regards to a dataset including independent distribution of sample observations, multivariate normal distribution of measured variables, that the hypothesized model is approximately correct, that a sample covariance matrix is being analyzed, and that the sample is sufficiently large in size to measure the asymptotic properties of parameter, standard error, and model fit estimates (Tabachnick & Fidell, 2012). In testing assumptions of the ML procedure, all assumptions were met with the exception that measured variables were found to demonstrate moderate levels of non-normality indicated by moderate levels of skew and kurtosis. The multivariate normality required for the application of hypothesis testing in SEM with ML estimation is almost never fully achieved with raw empirical data (Gao, Mokhtarian, & Johnston, 2008). Simulation studies indicate that when estimates of skew and kurtosis are within the threshold of moderate non-normality (skew=2, kurtosis=8) for most variables, biases of resulting ML estimates are minimal, especially in the context of large sample sizes and moderate correlation among variables (Harlow, 1985; Muthén & Kaplan, 1985; Curran, West, & Finch, 1996; Gao et al., 2008). In this study the skew and kurtosis of most measured indicators used in SEM fell within the threshold of moderate non-normality.
thus ML estimation is appropriate in the context of these analyses. The model development approach of SEM was used in which a theoretically driven model was tested and then subsequently modified to improve fit (Sass, 2011). Due to the exploratory nature of the initial model development as well as the moderate non-normality of the data, the model was developed using the exploratory group (N=443) of individuals and then confirmed using the confirmatory group (N=443) from each sample (ASD and non-ASD respectively) which offers independent validation of the parameter estimates and fit indices of the SEM model.

Criteria used to test the measurement and structural model are squared multiple correlations ($R^2$) to explain the relative contributions of each latent variable to the other latent variables and regression estimates ($\beta$) to measure the contribution of each measured variable to its respective latent variable. Multiple fit indices will be used to assess the overall goodness of fit for the structural models. The chi-square statistic ($\chi^2$), its relative degree of freedom, and its p-value are reported, as is traditional in the SEM literature; however, it is important to note that the $\chi^2$ test statistic is impacted by sample size thus is of limited utility in determining goodness of fit as large sample size increases the likelihood of Type-1 error for this statistic (Jöreskog & Sörbom, 1993). Model fit will therefore be determined based on three additional fit indices including the relative/normed chi-square test statistic, the comparative fit index (CFI), and the root mean square of approximation (RMSEA) (Browne and Cudeck, 1989). Wheaton, Muthen, Alwin, and Summers (1977) developed the relative/normed chi-square test statistic ($\chi^2/df$) to minimize the impact of sample size on the $\chi^2$ test statistic. There is a
lack of general consensus with regards to the acceptable ratio for this statistic with recommendations ranging from 5.0 (Wheaton et al., 1977) to a more conservative estimate of 2.0 (Tabachnick & Fidell, 2012) indicting a good fit. The CFI has values ranging from 0 to 1 with values over 0.9 indicating a good fit (Hu & Bentler, 1999). Simulation studies have shown that changes in both sample size and multivariate normality did not have an effect on the CFI across multiple models (Gao et al., 2008). The RMSEA can be interpreted as follows: values less than or equal to .05 indicate a close fit, values between .05 and .08 indicate an acceptable fit, and values above .08 indicate a poor fit (Kline, 1998).
Chapter 3: Results

Descriptive Statistics and Correlations

ASD and Non-ASD samples were matched for gender as the significant majority (N=656, 74%) of individuals with ASD in this sample are male reflecting the gender distribution of the population (Center for Disease Control and Prevention, 2012). ASD and Non-ASD samples were found to be comparable on other key demographic variables including age, gender, race, ID diagnosis, level of ID, psychiatric diagnosis, seizure disorder diagnosis, and residential placement (Table 1 presents descriptive statistics by group for gender, age, diagnosis of ID, psychiatric diagnosis and seizure disorder; Table 2 presents statistics for test of mean difference and effect size for demographic variables). Individuals with ASD were younger on average (average age=33.2 years; SD=12.0) than individuals with DD other than ASD (average age=43.8 years; SD=14.6), t(1767)=16.754, p=0.00; Glass’s Δ=0.73. Of individuals diagnosed with ASD, 86% were found to also have a diagnosed intellectual disability compared with 94% of individuals with DD other than ASD although this difference was non-significant, t(1756)=0.93, Glass’s Δ=0.04. This increased percentage of ID diagnosis in individuals with DD other

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1 Glass’s Δ is a measure of effect size calculated by taking the difference in means between groups and dividing by the standard deviation of the control group rather than the pooled standard deviation as in Cohen’s d. The rationale for dividing by the control group’s standard deviation is that in many cases this estimate is closer to the population standard deviation, especially in large sample sizes and is more likely to be untainted by factors associated with membership in the treatment group (Glass, McGaw, & Smith, 1981). When the scale of a dependent variable is not inherently meaningful (as in the case with all demographic variables excluding age), it is useful to consider the difference between means in standardized units, in effect size. Thus, effect size will be reported for all mean differences. Conventionally, effect size below 0.2 is considered small, above .8 is considered large, and values near 0.5 are considered to be moderate.
than ASD was primarily accounted for by an increased prevalence of mild ID in the non-ASD sample, as a result, mean differences were found in level of ID across groups although the effect size of this difference is small, \( t(1742) = -2.620, p=0.009 \), Glass’s \( \Delta = 0.15 \). Despite this difference, the distribution of level of ID across groups is similar (see Table 3 for frequency and percentage for levels of ID by group). There were no significant group differences in race, \( t(1742) = -0.740, p=0.46 \); Glass’s \( \Delta = 0.03 \) (see Table 4 for statistics on race by group). Individuals with DD other than ASD were more likely to be diagnosed with a seizure disorder, \( t(1770) = 3.671, p=0.00 \); Glass’s \( \Delta = 0.17 \), and with a psychiatric diagnosis, \( t(1770) = 4.113, p=0.00 \); Glass’s \( \Delta = 0.19 \), than individuals with ASD, although the effect sizes for these differences were small. Individuals with ASD and with DD other than ASD were similar in their residential placement, \( t(1763) = -0.537, p=0.519 \), Glass’s \( \Delta = 0.02 \) with most individuals in both samples living either with a parent or relative or in a group home (see Table 5 for descriptive statistics on residential placement). Correlations between measured variables included in the CFA and SEM models are moderate in both individuals with ASD (see Table 6) and individuals with DD other than ASD (see Table 7). Covariances for measured variables are also presented in Appendix A Table 8 for individuals with ASD and Table 9 for individuals with DD other than ASD.
Table 1

Sample Demographic Information

<table>
<thead>
<tr>
<th></th>
<th>Gender (male)</th>
<th>Age</th>
<th>Diagnosed with ID (yes)</th>
<th>Psychiatric Diagnosis (yes)</th>
<th>Seizure Disorder (yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autism</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exploratory (N=443)</td>
<td>334(75.4%)</td>
<td>33.58(0.59)</td>
<td>379(85.6%)</td>
<td>126(28.4%)</td>
<td>74(16.7%)</td>
</tr>
<tr>
<td>Confirmatory (N=443)</td>
<td>321(72.5%)</td>
<td>32.76(0.56)</td>
<td>382(86.2%)</td>
<td>125(28.2%)</td>
<td>68(15.3%)</td>
</tr>
<tr>
<td><strong>Non-Autism</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exploratory (N=443)</td>
<td>333(75.2%)</td>
<td>43.35(0.70)</td>
<td>418(94.4%)</td>
<td>171(38.6%)</td>
<td>87(19.6%)</td>
</tr>
<tr>
<td>Confirmatory (N=443)</td>
<td>323(72.9%)</td>
<td>44.30(0.69)</td>
<td>413(93.2%)</td>
<td>161(36.3%)</td>
<td>116(26.2%)</td>
</tr>
</tbody>
</table>

*Note: Gender, Diagnosis of ID, Psychiatric Diagnosis, and Seizure Disorder statistics are presented as frequency(percentage). Statistics for Age are presented mean(standard deviation).*
Table 2

Demographic Variable Mean Difference and Effect Size between ASD (N=886) and Non-ASD (N=886) Samples

<table>
<thead>
<tr>
<th>Variable</th>
<th>T-Test for Equality of Means</th>
<th>Effect Size (Glass's Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>df</td>
</tr>
<tr>
<td>Gender</td>
<td>0.07</td>
<td>1767</td>
</tr>
<tr>
<td>Race</td>
<td>-0.74</td>
<td>1742</td>
</tr>
<tr>
<td>Age</td>
<td>16.75</td>
<td>1767</td>
</tr>
<tr>
<td>Diagnosis of ID?</td>
<td>0.94</td>
<td>1756</td>
</tr>
<tr>
<td>Level of ID</td>
<td>-2.63</td>
<td>1713</td>
</tr>
<tr>
<td>Psychiatric Diagnosis</td>
<td>4.11</td>
<td>1770</td>
</tr>
<tr>
<td>Seizure Disorder</td>
<td>3.67</td>
<td>1770</td>
</tr>
<tr>
<td>Residential Placement</td>
<td>-0.54</td>
<td>1763</td>
</tr>
</tbody>
</table>

Note: Cases with missing data were excluded on an analysis by analysis case.

Table 3

Descriptive Statistics on Level of Intellectual Disability by Group

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>No ID</td>
<td>58(13.1%)</td>
<td>55(12.4%)</td>
<td>20(4.5%)</td>
<td>30(6.8%)</td>
</tr>
<tr>
<td>Mild</td>
<td>130(29.3%)</td>
<td>155(35.0%)</td>
<td>214(48.3%)</td>
<td>191(43.1%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>124(28.0%)</td>
<td>121(27.3%)</td>
<td>138(31.2%)</td>
<td>128(28.9%)</td>
</tr>
<tr>
<td>Severe</td>
<td>45(10.2%)</td>
<td>44(9.9%)</td>
<td>33(7.4%)</td>
<td>44(9.9%)</td>
</tr>
<tr>
<td>Profound</td>
<td>31(7.0%)</td>
<td>20(4.5%)</td>
<td>15(3.4%)</td>
<td>20(4.5%)</td>
</tr>
<tr>
<td>Unspecified</td>
<td>22(5.0%)</td>
<td>12(2.7%)</td>
<td>8(1.8%)</td>
<td>11(2.5%)</td>
</tr>
<tr>
<td>Level Unknown</td>
<td>13(2.9%)</td>
<td>18(4.1%)</td>
<td>4(0.9%)</td>
<td>11(2.5%)</td>
</tr>
<tr>
<td>Missing</td>
<td>20(4.5%)</td>
<td>18(4.1%)</td>
<td>11(2.5%)</td>
<td>8(1.8%)</td>
</tr>
</tbody>
</table>

Note: Statistics presented as frequency(percentage).
### Table 4

*Descriptive Statistics for Race by Group*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian or Alaska native</td>
<td>0 (0.0%)</td>
<td>2 (0.5%)</td>
<td>5 (1.1%)</td>
<td>3 (0.7%)</td>
</tr>
<tr>
<td>Asian</td>
<td>7 (1.6%)</td>
<td>2 (0.5%)</td>
<td>3 (0.7%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>81 (18.3%)</td>
<td>81 (18.3%)</td>
<td>79 (17.8%)</td>
<td>89 (20.1%)</td>
</tr>
<tr>
<td>Pacific islander</td>
<td>0 (0.0%)</td>
<td>2 (0.5%)</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>White</td>
<td>337 (76.1%)</td>
<td>329 (74.3%)</td>
<td>334 (75.4%)</td>
<td>323 (72.9%)</td>
</tr>
<tr>
<td>Other race not listed</td>
<td>11 (2.5%)</td>
<td>12 (2.7%)</td>
<td>11 (2.5%)</td>
<td>9 (2.0%)</td>
</tr>
<tr>
<td>Two or more races</td>
<td>1 (0.2%)</td>
<td>5 (1.1%)</td>
<td>2 (0.5%)</td>
<td>7 (1.6%)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>3 (0.7%)</td>
<td>3 (0.7%)</td>
<td>2 (0.5%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Missing</td>
<td>3 (0.7%)</td>
<td>7 (1.6%)</td>
<td>6 (1.4%)</td>
<td>12 (2.7%)</td>
</tr>
</tbody>
</table>

*Note:* Statistics presented as frequency(percentage).

### Table 5

*Descriptive Statistics on Residential Placement*

<table>
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<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized institutional facility</td>
<td>46 (10.4%)</td>
<td>36 (8.1%)</td>
<td>43 (9.7%)</td>
<td>42 (9.5%)</td>
</tr>
<tr>
<td>Group home</td>
<td>103 (23.3%)</td>
<td>104 (23.5%)</td>
<td>125 (28.2%)</td>
<td>115 (26.0%)</td>
</tr>
<tr>
<td>Agency-operated apartment</td>
<td>22 (5.0%)</td>
<td>17 (3.8%)</td>
<td>24 (5.4%)</td>
<td>25 (5.6%)</td>
</tr>
<tr>
<td>Independent home or apartment</td>
<td>35 (7.9%)</td>
<td>47 (10.6%)</td>
<td>74 (16.7%)</td>
<td>55 (12.4%)</td>
</tr>
<tr>
<td>Parent/relative’s home</td>
<td>194 (43.8%)</td>
<td>201 (45.4%)</td>
<td>116 (26.2%)</td>
<td>145 (32.7%)</td>
</tr>
<tr>
<td>Foster care or host home (home of unrelated paid caregiver)</td>
<td>24 (5.4%)</td>
<td>17 (3.8%)</td>
<td>27 (6.1%)</td>
<td>22 (5.0%)</td>
</tr>
<tr>
<td>Nursing facility</td>
<td>0 (0.0%)</td>
<td>2 (0.5%)</td>
<td>5 (1.1%)</td>
<td>8 (1.8%)</td>
</tr>
<tr>
<td>Other</td>
<td>16 (3.6%)</td>
<td>14 (3.2%)</td>
<td>23 (5.2%)</td>
<td>20 (4.5%)</td>
</tr>
<tr>
<td>Don’t know</td>
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<td>2 (0.5%)</td>
<td>5 (1.1%)</td>
<td>9 (2.0%)</td>
</tr>
<tr>
<td>Missing</td>
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<td>1 (0.2%)</td>
<td>1 (0.2%)</td>
<td>2 (0.5%)</td>
</tr>
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*Note:* Statistics are presented as frequency(percentage).
Table 6  
Correlation Among Variables Used in SEM for the Autism Sample

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<td>.133**</td>
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<td>.089*</td>
<td>.149**</td>
<td>.068</td>
<td>.119**</td>
<td>.497**</td>
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</tr>
</tbody>
</table>

Note: Pearson Correlations; *p<0.05; **p<0.01.

1 'person chose home staff'
2 'person chose day activity staff'
3 'person chose case manager/service coordinator'
4 'person chooses how to spend free time?'
5 'person chooses daily schedule'
6 'person chooses what you buy with his/her money'
7 'can you go on a date if you want to'
8 'in the past month, do you (does this person) go shopping?'
9 'in past month, do you (does this person) go to restaurant or coffee shop?'
10 'in past month, do you (does this person) go out for entertainment?'
11 'in past month, do you (does this person) go out on errands or appointments?'
12 'in past year, did you (did this person) go on vacation?'
Table 7
Correlations Among Variables used in SEM for the Non-Autism Sample

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<td>.086*</td>
<td>.407**</td>
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<tr>
<td>8</td>
<td>.091*</td>
<td>.089*</td>
<td>.044</td>
<td>.067*</td>
<td>.093**</td>
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<td>.074*</td>
<td>.080*</td>
<td>.049</td>
<td>.010</td>
<td>.289**</td>
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<tr>
<td>10</td>
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<td>.069</td>
<td>.051</td>
<td>.031</td>
<td>.053</td>
<td>.035</td>
<td>.050</td>
<td>.316**</td>
<td>.322**</td>
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<td>11</td>
<td>.159**</td>
<td>.089*</td>
<td>.065</td>
<td>.066</td>
<td>.060</td>
<td>.087*</td>
<td>.058</td>
<td>.300**</td>
<td>.194**</td>
<td>.131**</td>
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<td>12</td>
<td>.118**</td>
<td>.037</td>
<td>.087*</td>
<td>.013</td>
<td>.042</td>
<td>.034</td>
<td>.096*</td>
<td>.066</td>
<td>.168**</td>
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<td>.138</td>
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<td>.099**</td>
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<tr>
<td>14</td>
<td>.115**</td>
<td>.025</td>
<td>.073*</td>
<td>.056</td>
<td>.067</td>
<td>.026</td>
<td>.124**</td>
<td>.093**</td>
<td>.108**</td>
<td>.118**</td>
<td>.064</td>
<td>.116**</td>
<td>.403**</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Pearson Correlations; *p<0.05; **p<0.01.

1. ‘person chose home staff’
2. ‘person chose day activity staff’
3. ‘person chose case manager/service coordinator’
4. ‘person chooses how to spend free time?’
5. ‘person chooses daily schedule’
6. ‘person chooses what you buy with his/her money’
7. ‘can you go on a date if you want to’
8. ‘in the past month, do you (does this person) go shopping?’
9. ‘in past month, do you (does this person) go out to restaurant or coffee shop?’
10. ‘in past month, do you (does this person) go out for entertainment?’
11. ‘in past month, do you (does this person) go out on errands or appointments?’
12. ‘in past year, did you (did this person) go on vacation?’
13. ‘has friends’
14. ‘has best friend’
Measurement Model of Latent Constructs for Individuals with and without ASD

Initial exploratory factor analysis (EFA) using pairwise exclusion of missing values, maximum likelihood factor extraction, and oblimin rotation was conducted separately in the ASD and non-ASD exploratory groups. In both exploratory samples, a three-factor structure emerged. In both groups, items that did not load adequately on any of the three factors were dropped. Items dropped in the ASD exploratory group included: 1) did you go out for religious services, 2) are you ever lonely, 3) can you see your friends, and 4) did you help make your service plan. Items dropped in the non-ASD exploratory group included: 1) are you ever lonely, 2) can you see your friends, 3) did you help make your service plan. Following this initial EFA, items loading on each specific factor were entered in separate EFAs in each group to confirm adequate fit. EFA results indicated a factor structure differing from that of the hypothesized structure based on the organization of the NCI Survey. Whereas survey items were hypothesized to load on three factors, “Social Relationships”, “Community Inclusion”, and “Opportunity for Choice” consistent with the structure of the NCI survey, items from survey subsections cross-loaded across factors yielding three factors more appropriately named “Social Determination”, “Social Participation and Relationships”, and “Personal Control”. This new emerging measurement model was largely consistent across individuals with and without ASD. Table 10 lists each factor and its measured indicators and factor loadings for the ASD group, the Non-ASD group, and indicators that loaded on each derived factor consistently across both groups.
Table 10
*Exploratory Factor Analysis Factor Loadings by Group*

<table>
<thead>
<tr>
<th></th>
<th>Social Determination</th>
<th>Social Participation and Relationships</th>
<th>Personal Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASD</td>
<td>Non-ASD</td>
<td>Shared Items</td>
</tr>
<tr>
<td>Person chose home staff</td>
<td>-.741</td>
<td>.849</td>
<td>X</td>
</tr>
<tr>
<td>Person chose day activity staff</td>
<td>- .697</td>
<td>.665</td>
<td>X</td>
</tr>
<tr>
<td>Person chose roommates</td>
<td>.514</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person chose day activity</td>
<td>.573</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person chose case manager</td>
<td>- .697</td>
<td>.537</td>
<td>X</td>
</tr>
<tr>
<td>Person chose home</td>
<td>.579</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person chose how to spend free time</td>
<td>.619</td>
<td>.690</td>
<td>X</td>
</tr>
<tr>
<td>Person chose daily schedule</td>
<td>.687</td>
<td>.626</td>
<td>X</td>
</tr>
<tr>
<td>Person chooses what to buy</td>
<td>.591</td>
<td>.571</td>
<td>X</td>
</tr>
<tr>
<td>Person can date if they want to</td>
<td>.290</td>
<td>.351</td>
<td>X</td>
</tr>
<tr>
<td>Do you go shopping?</td>
<td>.628</td>
<td>.587</td>
<td>X</td>
</tr>
<tr>
<td>Do you go out to restaurants/coffee?</td>
<td>.510</td>
<td>.517</td>
<td>X</td>
</tr>
<tr>
<td>Do you go out for entertainment?</td>
<td>.533</td>
<td>.515</td>
<td>X</td>
</tr>
<tr>
<td>Do you go out for errands/appts?</td>
<td>.376</td>
<td>.419</td>
<td>X</td>
</tr>
<tr>
<td>Do you go on vacation?</td>
<td>.377</td>
<td>.358</td>
<td>X</td>
</tr>
<tr>
<td>Do you go out for exercise?</td>
<td>.345</td>
<td></td>
<td>-.328</td>
</tr>
<tr>
<td>Do you go out for religious services?</td>
<td>.344</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a best friend?</td>
<td>.300</td>
<td>.300</td>
<td>X</td>
</tr>
<tr>
<td>Do you have friends?</td>
<td>.310</td>
<td>.257</td>
<td>X</td>
</tr>
</tbody>
</table>

*Notes:* Factor analyses conducted individually in each exploratory group (exploratory ASD, N=443; exploratory, non-ASD N=443). Exploratory factor analyses were completed using pairwise deletion of missing values, maximum likelihood factor extraction, and Oblimin rotation method with Kaiser Normalization. “Shared Items” represents the items that were related to the latent construct in both exploratory groups that were subsequently used in confirmatory factor analyses.
Following EFA, confirmatory factor analysis (CFA) was conducted using only the indicators that loaded on each derived factor across both groups (see Appendix A for a list of all NCI questions selected as final indicators for each of the latent variables) to verify that the measurement model derived in EFA fit the data in an independent validation samples. CFA was conducted separately in each group using the independent validation samples (confirmatory ASD, N=443; confirmatory non-ASD, N=443). Several CFAs were conducted including a CFA of the measurement model derived using EFA, a CFA testing the hypothesized factor structure based on the structure of the NCI Survey, and a CFA testing the hypothesized structure of the NCI Survey only including indicators that EFA analyses indicated as having adequate factor loadings (> .20 on any factor). Fit indices for the three CFAs in both the ASD and Non-ASD group are presented in Table 11. Results confirmed the factor structure derived in the EFA as the best fitting measurement model in both the ASD and non-ASD groups (RMSEA = .060, CFI=0.835; RMSEA=.051, CFI=0.873, respectively) when compared with the NCI Survey measurement model, which had mediocre fit in both the ASD and Non-ASD group (RMSEA=.083, CFI=0.588; RMSEA=.088, CFI=0.561, respectively). Factor loadings for the CFA of the derived measurement model are presented in Table 12. After evaluating the fit of the full CFA model, model specification and fit was calculated for each latent variable sub-cluster of the hypothesized model in each group to confirm the measurement model for all three latent variables individually (see Table 13 for goodness of fit statistics for the factor structure of each latent variable by group). Overall, CFA results confirms the measurement model derived using EFA procedures of the three latent variables,
Social Participation and Relationships, Social Determination, and Personal Control and confirms the superior fit of the derived measurement model over the NCI survey measurement model in both the ASD and Non-ASD confirmatory groups.

Table 11

*Fit Indices for Confirmatory Factor Analytic Models by Group*

<table>
<thead>
<tr>
<th></th>
<th>RMSEA</th>
<th>CFI</th>
<th>$X^2$</th>
<th>Relative/normed $X^2$ (X²/df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derived Factor Structure</td>
<td>ASD Confirmatory (N=443)</td>
<td>.060</td>
<td>0.835</td>
<td>193.400(74), p=.00</td>
</tr>
<tr>
<td></td>
<td>Non ASD Confirmatory (N=443)</td>
<td>.051</td>
<td>0.873</td>
<td>159.875(74), p=.00</td>
</tr>
<tr>
<td>NCI Survey Structure</td>
<td>ASD Confirmatory (N=443)</td>
<td>.083</td>
<td>0.588</td>
<td>749.507(186), p=.00</td>
</tr>
<tr>
<td></td>
<td>Non ASD Confirmatory (N=443)</td>
<td>.088</td>
<td>0.561</td>
<td>821.493(186), p=.00</td>
</tr>
<tr>
<td>Modified NCI Survey Structure</td>
<td>ASD Confirmatory (N=443)</td>
<td>.096</td>
<td>0.584</td>
<td>666.707(132), p=.00</td>
</tr>
<tr>
<td></td>
<td>Non ASD Confirmatory (N=443)</td>
<td>.103</td>
<td>0.555</td>
<td>752(132), p=.00</td>
</tr>
</tbody>
</table>

*Notes:* The “derived Factor Structure” model represents the CFA model based on factors derived in this study using EFA procedures. The “NCI Survey Structure” model is based on the subsections of the NCI survey and uses all questions from each subsection. The “Modified NCI Survey Structure” model is based on the structure of the NCI survey factor structure however indicators with poor factor loading in EFA procedures were dropped.
Table 12

**Standardized Regression Weights for Derived CFA Model**

<table>
<thead>
<tr>
<th></th>
<th>ASD Confirmatory</th>
<th>Non-ASD Confirmatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>p&lt;.01</td>
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<tr>
<td><strong>Social Determination</strong></td>
<td></td>
<td></td>
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<tr>
<td>Chose free time</td>
<td>.755</td>
<td>**</td>
</tr>
<tr>
<td>Chose daily schedule</td>
<td>.775</td>
<td>**</td>
</tr>
<tr>
<td>Chose what to buy</td>
<td>.566</td>
<td>**</td>
</tr>
<tr>
<td>Can date if wants to</td>
<td>.200</td>
<td>**</td>
</tr>
<tr>
<td><strong>Personal Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chose home staff</td>
<td>.698</td>
<td>**</td>
</tr>
<tr>
<td>Chose day activity staff</td>
<td>.741</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>.550</td>
<td>**</td>
</tr>
<tr>
<td><strong>Social Participation and Relationships</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Went shopping</td>
<td>.444</td>
<td>**</td>
</tr>
<tr>
<td>Went to restaurant</td>
<td>.460</td>
<td>**</td>
</tr>
<tr>
<td>Went out for entertainment</td>
<td>.549</td>
<td>**</td>
</tr>
<tr>
<td>Went for errands/apps</td>
<td>.432</td>
<td>**</td>
</tr>
<tr>
<td>Went on vacation</td>
<td>.369</td>
<td>**</td>
</tr>
<tr>
<td>Has friend</td>
<td>.365</td>
<td>**</td>
</tr>
<tr>
<td>Has best friend</td>
<td>.391</td>
<td>**</td>
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</tbody>
</table>

**Note:** CFA was based on the factor structure derived using EFA using only indicators found to load on a given factor in both the exploratory ASD and exploratory Non-ASD groups. The regression weights for “Do you go shopping?” “Person chooses how to spend free time” and “Person chose home staff” were fixed to 1.0. **significant at p<0.01.**
Table 13:

<table>
<thead>
<tr>
<th>Goodness-of-Fit Statistics for CFA Latent Variable Measurement Model</th>
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<tbody>
<tr>
<td>Goodness-of-Fit Indices</td>
</tr>
<tr>
<td>--------------------------</td>
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<tr>
<td>Personal Control ASD</td>
</tr>
<tr>
<td>non-ASD</td>
</tr>
<tr>
<td>Social Determination ASD</td>
</tr>
<tr>
<td>non-ASD</td>
</tr>
<tr>
<td>Social Participation and Relationships ASD</td>
</tr>
<tr>
<td>non-ASD</td>
</tr>
</tbody>
</table>

Note: Fit statistics presented for CFA of the derived factor structure based on EFA procedures.

Mean Group Differences in Variables of Interest

Because CFA indicated a comparable factor structure for both the ASD and Non-ASD groups on the latent constructs of Social Participation and Relationships, Social Determination, and Personal Control, it was appropriate to test for mean group differences on the each of these latent constructs. Preliminary analyses were conducted using nested SEM models to test for configural invariance, the extent to which the number of factors and the factor patterns are similar across group (tested using an unconstrained SEM model) and invariance of factor loadings, the extent to which parameters and measurement structure are equivalent across group (tested by assigning equality constraints on certain parameters across groups), in both the ASD and non-ASD groups simultaneously (Byrne, 2010). Both the assumptions of configural invariance and invariance of factor loadings were met (\( \Delta \text{CFA}=0.004 \) which meets the recommended
cutoff criteria of 0.01; Byrne, 2010). Thus, using the CFI difference test as a criterion upon which to determine evidence of invariance, it can be concluded that the factor levels are operating similarly across the ASD and non-ASD groups.

Following assumption testing, latent mean differences were tested between individuals with and without ASD on the derived latent variables of Social Participation and Relationships, Social Determination, and Personal Control using the full study sample (N=1,772). The resulting mean SEM model had adequate fit ($\chi^2=669.55$, df=170, $p=0.00$; adjusted $\chi^2=3.94$; RMSEA=.041; CFI=0.831). Results indicated that individuals with ASD had significantly lower levels of Social Determination than individuals with DD other than ASD (Mean difference estimate = -0.13, $p<0.001$). However, no significant group differences were found in levels of Social Participation and Relationships (Mean difference estimate =-0.011, $p=0.58$) or Personal Control (Mean difference estimate=0.002, $p=0.95$).

Structured means analysis was also used to test the difference in level of friendships$^4$ between groups through creation of a latent “Friendship” variable with the measured indicators: 1) do you have friends and 2) do you have a best friend. Results indicated that individuals with ASD had significantly lower levels of friendship than individuals with DD other than ASD (Mean difference estimate= -0.114, $p<0.001$).

Finally, group differences in level of Access to Services/Supports were tested using an independent sample t-test in the full study sample (n=1,772). Results indicated

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$^4$ This was a post hoc analysis conducted to address the research question with regards to group differences in social relationships between individuals with ASD and individuals with DD other than ASD. Due to the nature of the derived measurement model, this research question could not be adequately addressed without some temporary adjustment to the model to create a latent variable more directly related to social relationships than “Social Participation and Relationships”.
that no significant differences existed between groups on reported levels of Access to Services/Supports, \( t(1227) = -1.309, p=0.191 \).

**Structural Model of Latent Variable Relationships**

The hypothesized structural model contains the following variables: (1) observed endogenous variables (all measured indicators of Personal Control, Social Determination, and Social Participation and Relationships), (2) the observed exogenous variable Access to Services/Supports, (3) the latent exogenous variable Personal Control, (4) the latent endogenous variables Social Determination and Social Participation and Relationships, and (5) the unobserved exogenous variables including error terms and latent factor residual terms. Latent variables are represented by ellipses in the model whereas observed variables are represented by rectangles and serve as indicators of their respective underlying latent variable construct. Endogenous variables represent dependent variables that are predicted by other variables in the model, whereas exogenous variables are equivalent to independent variables (Byrne, 2010). Figure 2 presents the theoretically driven structural model and its parameter estimates in individuals with and without ASD. Standardized regression coefficients were used to represent the independent contributions of each observed variable to the prediction of its respective latent variable and were significant in both the ASD and non-ASD groups at \( p<0.01 \).
Figure 2. Hypothesized model fitted in exploratory ASD and exploratory non-ASD samples. Standardized regression weights presented Non-ASD; ASD. Model Fit: Non-ASD $\chi^2=115.83$ (n=443, df=85), RMSEA=0.029; CFI=0.958; ASD $\chi^2=123.91$ (n=443, df=85), RMSEA=0.032; CFI=0.952. **p<0.01; *p<0.05; a indicates a regression weight that was fixed to 1.
The structural model had a good fit in both groups (see Table 14 for model fit statistics) although not all paths between latent variables were significant across both groups.

Table 14

<table>
<thead>
<tr>
<th>Fit Indices for Structural Equation Models by Group</th>
<th>RMSEA</th>
<th>CFI</th>
<th>$\chi^2$ (df)</th>
<th>Relative/normed $\chi^2$ (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesized SEM Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASD Exploratory (N=443)</td>
<td>.032</td>
<td>0.952</td>
<td>123.905(85), p=0.00</td>
<td>1.46</td>
</tr>
<tr>
<td>Non-ASD Exploratory (N=443)</td>
<td>.029</td>
<td>0.958</td>
<td>115.828(85), p=0.02</td>
<td>1.36</td>
</tr>
<tr>
<td>Final ASD Model</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ASD Exploratory (N=443)</td>
<td>.034</td>
<td>0.952</td>
<td>112.219(74), p=0.00</td>
<td>1.52</td>
</tr>
<tr>
<td>ASD Confirmatory (N=443)</td>
<td>.041</td>
<td>0.923</td>
<td>129.634(74), p=0.00</td>
<td>1.75</td>
</tr>
<tr>
<td>Final Non-ASD Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-ASD Exploratory (N=443)</td>
<td>.029</td>
<td>0.957</td>
<td>117.778(86), p=0.01</td>
<td>1.37</td>
</tr>
<tr>
<td>Non-ASD Confirmatory (N=443)</td>
<td>.036</td>
<td>0.928</td>
<td>135.691(86), p=0.00</td>
<td>1.58</td>
</tr>
</tbody>
</table>

*Note: The hypothesized model represents the first theoretical model tested in the exploratory groups. The Final ASD Model and Final Non-ASD Model represent final models for each group created by modifying the hypothesized model to retain only significant paths in each group respectively.*

For this model, in the ASD group, Personal Control had a significant relationship to Social Determination. Personal Control also had a significant relationship to Social Participation and Relationships. These relationships were in the expected direction in that individuals with greater levels of Personal Control experienced greater levels of Social Determination and greater levels of Social Participation and Relationships. The
correlation between Access to Services/Supports and Personal Control was not significant. The relationships between Access to Services/Supports and Social Determination and Social Participation and Relationships were both non-significant. The hypothesized model explains 7% of the variance in Social Participation and Relationships ($R^2 = .065$) and 17% of the variance in Social Determination ($R^2 = .167$) for individuals with ASD, in other words, Access to Services/Supports and Personal Control contributed a great deal to the explanation of variation in Social Determination and contributed somewhat to the explanation of the variance in Social Participation and Relationships.

In the non-ASD group, Personal Control also had a significant relationship to Social Determination and to Social Participation and Relationships, although these associations were slightly weaker than for individuals with ASD. Thus, individuals with DD other than ASD who experienced greater levels of Personal Control also experienced greater levels of Social Determination and greater levels of Social Participation and Relationships. In individuals with DD other than ASD, the correlation between Personal Control and Access to Services/Supports was significant. Thus, increased Access to Services/Supports was associated with higher levels of Personal Control in this sample. Furthermore, Access to Services/Supports also had a significant relationship to Social Participation and Relationships in individuals with DD other than ASD indicating that those individuals with increased Access to Services/Supports also experienced higher levels of Social Participation and Relationships. However, the relationship between Access to Services/Supports and Social Determination was not significant. The hypothesized model explains 9% of the variance in Social Participation and Relationships.
(R²=.089) and 6% of the variance in Social Determination (R²=.059) for individuals with ASD, in other words, Access to Services/Supports and Personal Control contributed somewhat to the explanation of variation in Social Determination and the variance in Social Participation and Relationships.

Although this theoretically driven model demonstrates good fit in both individuals with and without ASD, it is not the most parsimonious model for either group as it retains insignificant paths in both groups that do not notably improve the fit of the model. As a result, alternative models were developed separately in both the ASD and non-ASD exploratory groups by dropping insignificant paths for each group respectively and then confirming adequate fit of the modified model in the confirmatory group of individuals with and without ASD respectively. Final models for each group retain only significant paths and demonstrate good fit (see Table 14 for model fit statistics). Several mathematically equivalent alternative models were developed; however, these models were inferior with regards to parsimony in that some non-significant paths were retained that did not improve model fit. All mathematically equivalent alternative models were also theoretically less parsimonious than the final models for each group. The resulting final models for the ASD group (see Figure 3) and the non-ASD group (see Figure 4) both demonstrated good fit and represent the most parsimonious and well-fitting structural models for both groups.
Figure 3. Modified ASD Model; Standardized regression weights presented Exploratory Group; Confirmatory Group. Model Fit: Exploratory $\chi^2=112.22$ (n=443; df=74), RMSEA=0.034; CFI=0.952; Confirmatory $\chi^2=129.63$ (n=443, df=74), RMSEA=0.041; CFI=0.923. **p<0.01; *p<0.05; a indicates a regression weight that was fixed to 1.
Figure 4: Final SEM Model for Individuals with Disabilities other than ASD

**Figure 4. Modified Non-ASD Model; Standardized regression weights presented Exploratory Group; Confirmatory Group. Model Fit: Exploratory $\chi^2=117.78$ (n=443; df=86), RMSEA=0.029; CFI=0.957; Confirmatory $\chi^2=135.69$ (n=443, df=86), RMSEA=0.036; CFI=0.928. **p<0.01; *p<0.05; $^a$ indicates a regression weight that was fixed to 1.**
In the ASD group, the final model contains significant paths from Personal Control to Social Determination and from Personal Control to Social Participation and Relationships. In this model, the Access to Services/Supports manifest variable and all paths from this variable were dropped as they were non-significant and did not substantially improve the fit of the model. The final model for individuals with ASD explains 6% of the variance in Social Participation and Relationships ($R^2=.064$) in the exploratory group and 8% of the variance in Social Participation and Relationships ($R^2=.083$) in the confirmatory group. The model explains 16% of the variance in Social Determination ($R^2=.159$) in the exploratory group and 7% of the variance in Social Determination ($R^2=.073$) in the confirmatory group. In other words, Personal Control contributes somewhat to the explanation of variation in Social Determination and the variance in Social Participation and Relationships for individuals with ASD.

In the non-ASD group, the final model is identical to the theoretical model except that the path from Access to Services/Supports to Social Determination was dropped as it was non-significant and did not substantially improve the fit of the model. The final model for individuals with DD other than ASD explains 9% of the variance in Social Participation and Relationships ($R^2=.087$) in the exploratory group and 10% of the variance in Social Participation and Relationships ($R^2=.100$) in the confirmatory group. The model explains 5% of the variance in Social Determination ($R^2=.052$) in the exploratory group and 5% of the variance in Social Determination ($R^2=.049$) in the confirmatory group. Thus, Personal Control and Social Access/Support contributes
somewhat to the explanation of variation in Social Determination and the variance in Social Participation and Relationships for individuals with DD other than ASD.
Chapter 4: Discussion

The findings of this study have important implications at the statistical, theoretical and practical level regarding the nature and quality of social outcomes for individuals with ASD as well as the relationships among these social outcomes and associated environmental factors. In addition, this study offers important insight regarding how the very nature of social outcomes as well as the relationship between these outcomes and environmental factors differs between individuals with ASD and individuals with DD other than ASD.

Most relevant published research to date has involved creating sum scores of survey subdomains of the NCI Adult Consumer Survey and then comparing various groups based on sum scores of various constructs. This study offers a novel data-driven approach to the analysis of the NCI Adult Consumer Survey data. The NCI Survey was designed to be administered to all persons who receive state DD services rather than specific subpopulations, thus it is important to consider how survey items function in a given population of interest before drawing conclusions regarding any given construct in a specific sub-population. The approach taken in this study first explored the contribution of each survey item to the latent construct it is intended to measure in each sample (adults with ASD and adults with DD other than ASD) before testing the relationships between
these latent constructs. Results of exploratory factor analyses yielded an alternative empirically-derived factor structure comparable in both groups of individuals (with and without ASD) that differs from a factor structure consistent with the theoretical organization of the NCI survey items. This emerging factor captures an alternative and theoretically compelling conceptualization of social outcomes and associated environmental factors for adults with and without ASD.

Three novel factors emerged as a result of these analyses: Personal Control, Social Determination, and Social Participation and Relationships. The Personal Control factor is a latent variable capturing the extent to which an individual has control of basic choices that dictate important aspects of that individual’s daily life, primarily, the extent to which individuals choose their provider staff (see Appendix D for indicators of Personal Control for each group). The Social Determination factor is a latent variable capturing the extent to which a given individual is making socially relevant choices in their life with regards to how they spend their time, what they buy, and whether or not they date (see Appendix E for indicators of Social Determination for each group). Items making up the Personal Control and Social Determination factors primarily came from the “Choice” section of the NCI Survey. Dividing choice items in this way makes theoretical sense in that there is an important distinction between making long term-oriented choices regarding one’s staff and making day-to-day social choices regarding how one spends one’s time.

The Social Participation and Relationships factor is a latent variable capturing the extent to which individuals are participating in their community and forming friendships
(See Appendix F for indicators of Social Participation and Relationships for each group). Indicators of the Social Participation and Relationships factor came from both the “Friends and Family” and “Community Inclusion” sections of the NCI Survey. These items logically fit together to the extent that they capture the essence of the level of meaningful social involvement an individual has both in their community and in the lives of others. Taken as a whole these latent constructs offer a novel conceptualization of social outcomes for individuals with and without ASD grounded in empirical validation and may be useful in future research on social outcomes for individuals with and without ASD.

Although the latent variables Social Determination, Social Participation and Access, and Personal Control emerging in both populations shared several indicators across groups, it is important to note that the factor structure of each latent construct was not entirely equivalent across groups. This finding has both practical and theoretic implications. From a practical standpoint, it is critical to note that analyses in this study were conducted using exclusively shared indicators of each latent construct to facilitate comparison across groups and thus do not capture the slightly unique flavors of each latent construct in the ASD versus non-ASD groups. Further research is warranted both on the shared and unique factor structure of each latent variable in both populations to shed light on the nature of these constructs between and within given populations of interest.

Results indicate that individuals with ASD had significantly lower levels of Social Determination than individuals without ASD despite non-significant differences between
groups on Access to Services/Supports and Personal Control. This may indicate that individuals with ASD are exercising less Self-Determination and choice-making in their daily lives with regards to how they spend their time, money, and whether or not they date despite having similar access to services and personal control compared to individuals with DD other than ASD. Further research is warranted on the construct of Social Determination and its distinction from more fundamental choice-making as this construct represents an important social outcome that may be a target of future interventions with individuals with ASD.

Individuals with ASD also had lower levels of friendships than individuals without ASD despite non-significant group mean differences for the latent construct Social Participation and Relationships. This implies that although individuals in both groups are participating in the community at similar rates, that participation may be translating to increased friendships for individuals without ASD but is not translating into increased friendships for individuals with ASD. This finding has practical implications for individuals with ASD in that research and policy may want to focus not only on increasing community inclusion for adults with ASD but also finding ways to make that inclusion more meaningful, that is, not just increasing their access to the community but also their actual level of personal engagement in the community thus increasing the likelihood that this community participation translates to increased friendships for individuals with ASD. This finding may also be an objective indicator of the semantic differences between social "integration" versus social "inclusion". Although these analyses do not support the presence of quantitative differences between group levels of
community participation, qualitative differences clearly exist that warrant further research.

Results also indicate that for individuals with and without ASD, a significant relationship exists between Personal Control and Social Determination as well as between Personal Control and Social Participation and Relationships, thus increasing basic and fundamental choice-making in areas that exert control over the individual’s life in major domains may improve social outcomes including the individual’s amount of social choice-making. This is an important finding consistent with much of the current literature on individuals with ID that has found a relationship between choice and social outcomes. However, this relationship is a relatively novel finding for individuals with ASD as there exists significantly less research to date explicitly modeling the relationship between choice and social outcomes for individual in this population.

Finally, findings from this study indicated a striking difference in the relationship between Access to Services/Supports and social outcomes for individuals with and without ASD. Contrary to the hypothesized relationships, results indicate that in these groups, Access to Service/Supports is related to improved social outcomes in individuals with DD other than ASD in a way that it is different from individuals with ASD. This finding also warrants further research and consideration. It is important to bear in mind that the NCI survey is only administered to individuals already receiving services, so it is possible that this finding would not replicate if a more representative sample of all individuals with DD were used rather than a sample comprised of individuals with DD who meet eligibility for state services. Results also indicate that for individuals with ASD
it is possible that the level of perceived control over the services he/she does receive is more important than the training of their staff and the actual presence of adequate services. Thus, although a service may be deemed necessary/appropriate, if it is not a service that the individual wants or the individual does not have some basic level of control over the personnel delivering that service, access to that service will not likely significantly contribute to improved social outcomes for individuals with ASD. These findings warrant further research but suggest potential important policy implications in that it would be more cost effective to increase an individual’s control over their services than to increase the amount of actual services an individual receives.

**Strengths and Limitations**

This study has several important strengths. First, this study utilized a large nationally representative sample of adults receiving state disability services. The use of a large sample allows for greater reliability in more sophisticated statistical analyses. Secondly, the large sample size made it possible to create exploratory and confirmatory sub-groups of sufficient size for both the ASD and non-ASD samples. This allows model validation to be conducted in a novel group of individuals independent from the group used for model development. This independent validation approach adds assurance that findings are not a statistical artifact as the replication of findings in an independent sample provides evidence for the validity of the results.

A further strength of the study relates to the use of EFA and CFA to derive an empirically driven and theoretically valid measurement model creating novel latent constructs representing social outcomes and related environmental factors. The primary
strength of this approach lies in the assessment of each indicator’s contribution to its respective latent construct and the selection of only indicators significantly related to a given latent constructs in both groups to be used in further analyses. The use of SEM is an additional strength of this study as SEM allows for the measurement and testing of complex relationships between observed latent variables and enables the estimation of relationships between factors free of measurement error. Furthermore, SEM offers a novel paradigm for the testing of group mean differences that is appropriate for evaluating group differences on latent constructs. This generated novel well-fitting SEM models of the relationships between access to services, choice, and social outcomes for individuals with and without ASD that can be used in future research to model these relationships within novel samples (Tabachnick & Fidell, 2012).

There are several limitations to this study that should be considered when interpreting findings. First, the use of a pre-existing dataset meant that researchers had no control over survey structure, question selection, or wording. Questions for the NCI survey were developed to assess outcomes across a broad range of disabilities and consequently may be less sensitive to the measurement of outcomes in specific populations. Furthermore, the standardized approach to surveying used in the NCI Consumer Survey does not allow for more in-depth exploration of issues addressed in the survey or the decision-making processes used by individuals in the responses they provide. It is known that individuals with DD may have difficulty answering certain types of questions and may, at times, struggle to provide accurate information, which may have an impact on the results of this study. Also, the processes used to determine an ASD
diagnoses is not recorded in the NCI survey, which may result in inconsistency in diagnostic criteria across participants. In addition, it is also possible that some individuals in the survey, particularly older individuals, may have significant characteristics of ASD yet may have never been given an ASD diagnosis due to lesser awareness of co-occurring disabilities in the past. Furthermore, cross-sectional sampling limits the interpretation of study results; without a repeated-measures design, causal inferences cannot be made. Future research exploring the relationships between access to services/supports, choice, and social outcomes would benefit from the use of longitudinal data to advance the understanding of how access to services and personal control impact social outcomes across time.

**Conclusions**

This study has contributed to the literature through the development and validation of novel measurement and structural models of social outcomes including Social Determination and Social Participation and Relationships and the relationship of these outcomes to environmental factors responsive to intervention including Personal Control and Access to Services/Supports for individuals with and without ASD. Although these factors contribute only modestly to the variance in social outcomes, such contributions are consistent with the literature (Neely-Barnes et al., 2008) and bear notable practically significance.

Overall, results of this study provide insight with regards to novel statistical, theoretical, and practical approaches to the study of social outcomes for individuals with
ASD in hopes to inform future policy and practice and ultimately have a positive impact on the quality of life of individual with and without ASD.
References


Appendix A: Covariance Matrices for ASD and Non-ASD Group
Table 8:
Covariance Among Variables used in SEM for the Autism Sample

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5  ‘person chooses daily schedule’
6  ‘person chooses what you buy with his/her money’
7  ‘can you go on a date if you want to’
8  ‘in the past month, do you (does this person) go shopping?’
9  ‘in past month, do you (does this person) go out to restaurant or coffee shop?’
10 ‘in past month, do you (does this person) go out for entertainment?’
11 ‘in past month, do you (does this person) go out on errands or appointments?’
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13 ‘has friends’
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Table 9
Covariance Among Variables used in SEM for the Non-Autism Sample

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6  ‘person chooses what you buy with his/her money’
7  ‘can you go on a date if you want to’
8  ‘in the past month, do you (does this person) go shopping?’
9  ‘in past month, do you (does this person) go out to restaurant or coffee shop?’
10 ‘in past month, do you (does this person) go out for entertainment?’
11 ‘in past month, do you (does this person) go out on errands or appointments?’
12 ‘in past year, did you (did this person) go on vacation?’
13 ‘has friends’
14 ‘has best friend’
Appendix B: NCI Survey Questions Selected as Initial Indicators for Exploratory Factor Analyses
FRIENDS AND FAMILY

Key: (SX_QX)=(Section 1 or 2_ Question #)

1. (S1_Q27) Do you have friends you like to talk to or do things with?
   (2) Yes, has friends who are not staff or family
   (1) Yes, all friends are staff or family, or cannot determine
   (0) No, does not have friends
   (9) Don’t know, no response, unclear response

2. (S1_Q28) Do you have a best friend, or someone you are really close to?
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

3. (S1_Q29) Can you see your friends when you want to see them?
   (8) NOT APPLICABLE - does not have any friends
   (2) Yes, can see friends when s/he wants to
   (1) Sometimes can’t see friends
   (0) No, often unable to see friends
   (9) Don’t know, no response, unclear response

4. (S1_Q30) Can you go on a date if you want to?
   (8) NOT APPLICABLE - does not want to date
   (2) Yes, can date, or is married or living with partner
   (1) Yes, but there are some restrictions or rules about dating
   (0) No
   (9) Don’t know, no response, unclear response

5. (S1_Q31) Do you ever feel lonely?
   (2) Yes, often feels lonely (more than half the time)
   (1) Sometimes (about half the time)
   (0) No, not often (less than half the time)
   (9) Don’t know, no response, response unclear

COMMUNITY INCLUSION

6. (S2_Q54) In the past month, did you (did this person) go shopping?
   (2) Yes
   (0) No
   (9) Don’t know
7. (S2_Q55) In the past month, did you (did this person) go out on errands or appointments?
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

8. (S2_Q56) In the past month, did you (did this person) go out for entertainment?
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

9. (S2_Q57) In the past month, did you (did this person) go out to a restaurant or coffee shop?
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

10. (S2_Q58) In the past month, did you (did this person) go out to a religious service or spiritual practice?
    (2) Yes
    (0) No
    (9) Don’t know, no response, response unclear

11. (S2_Q59) In the past month, did you (did this person) go out for exercise?
    (2) Yes
    (0) No
    (9) Don’t know, no response, unclear response

12. (S2_Q60) In the past year, did you (did this person) go away on a vacation?
    (2) Yes
    (0) No
    (9) Don’t know, no response, response unclear

CHOICES

13. (S2_Q61) Who chose (or picked) the place where you live?
    (2) Person made the choice
    (1) Person had some input
    (0) Someone else chose
    (9) Don’t know, no response, unclear response
14. (S2_Q63) Did you choose (or pick) the people you live with (or did you choose to live by yourself)?
   (2) Yes, chose people s/he lives with, or chose to live alone
   (1) Chose some people or had some input
   (0) No, someone else chose
   (9) Don’t know, no response, unclear response

15. (S2_Q64) Did you choose (or pick) who helps you at home?
   (8) NOT APPLICABLE- no staff in the home
   (2) Yes, person chose staff
   (1) Staff are assigned but can be changed if requested by the person
   (0) No, someone else chose
   (9) Don’t know, no response, unclear response

16. (S2_Q65) Who decides your daily schedule (like when to get up, when to eat, when to go to sleep)?
   (2) Person decided
   (1) Person has help deciding
   (0) Someone else decides
   (9) Don’t know, no response, unclear response

17. (S2_Q66) Who decides how you spend your free time (when you are not working, in school, or at the day program)?
   (2) Person decides
   (1) Person has help deciding
   (0) Someone else decides
   (9) Don’t know, no response, unclear response

18. (S2_Q67) Who chose (or picked) the place where you work?\(^5\)
   (8) NOT APPLICABLE- no job in the community
   (2) Person made the choice
   (1) Person had some input
   (0) Someone else chose
   (9) Don’t know, no response, unclear response

19. (S2_Q69) Do you choose (or pick) who helps you at your job?\(^6\)
   (8) NOT APPLICABLE- no community job or job staff
   (2) Yes, person chose staff

\(^5\) Dropped following preliminary analyses due to high percentage of missingness
\(^6\) Dropped following preliminary analyses due to high percentage of missingness
20. (S2_Q70) Who chose (or picked) where you go during the day?
   (8) NOT APPLICABLE - no day program or other activity
   (2) Person made the choice
   (1) Person had some input
   (0) Someone else chose
   (9) Don’t know, no response, unclear response

21. (S2_Q72) Do you choose (or pick) who helps you during the day?
   (8) NOT APPLICABLE - no day program/other activity or day staff
   (2) Yes, person chose staff
   (1) Some staff, or staff are assigned but can be changed if requested by person
   (0) No, someone else chose staff
   (9) Don’t know, no response, unclear response

22. (S2_Q73) Do you choose what you buy with your spending money?
   (2) Person chooses
   (1) Person has help choosing what to buy or has set limits (such as small items but not big items)
   (0) Someone else chooses
   (9) Don’t know, no response, unclear response

23. (S2_Q74) Did you choose or pick your case manager/service coordinator?
   (8) NOT APPLICABLE - no case manager/service coordinator
   (2) Yes, chose case manager/service coordinator
   (1) Case manager/service coordinator was assigned but can be changed if requested by the person
   (0) No, someone else chose case manager/service coordinator
   (9) Don’t know, no response, unclear response

ACCESS TO NEEDED SERVICES

24. (S2_Q79) Do you get the services you need?
   (2) Yes
   (1) Sometimes, or doesn’t get enough of the services needed
   (0) No
   (9) Don’t know, no response, unclear response

25. (S2_Q80) Do you feel your support staff have the right training to meet your needs?
   (8) NOT APPLICABLE - person does not have support staff
   (2) Yes
(1) Maybe, not sure
(0) No
(9) Don’t know, no response, unclear response, or respondent is support staff

SATISFACTION WITH SERVICES/SUPPORTS

26. (S1_Q36) Do you have a service plan?
   (2) Yes
   (1) Maybe, not sure
   (0) No
   (9) Don’t know, no response, unclear response
Appendix C: Hypothesized Relationship Among Theoretical Constructs Based on NCI Survey Structure
Figure 1. This figure represents the hypothesized relationships between the constructs “Access to Services”, “Opportunity for Choice”, “Social Relationships”, and “Community Inclusion” to be tested using structural equation modeling.
Appendix D: Indicators of Personal Control
PERSONAL CONTROL

Key: (SX_QX)= (Section 1 or 2_ Question #)
* = Indicator of Personal Control in ASD group only
** = Indicator of Personal Control and Relationships in Non-ASD group only
*** = Indicator of Personal Control shared across ASD and Non-ASD groups

1. (S2_Q64) Did you choose (or pick) who helps you at home? ***
   (8) NOT APPLICABLE- no staff in the home
   (2) Yes, person chose staff
   (1) Staff are assigned but can be changed if requested by the person
   (0) No, someone else chose
   (9) Don’t know, no response, unclear response

2. (S2_Q72) Do you choose (or pick) who helps you during the day? ***
   (8) NOT APPLICABLE- no day program/other activity or day staff
   (2) Yes, person chose staff
   (1) Some staff, or staff are assigned but can be changed if requested by person
   (0) No, someone else chose staff
   (9) Don’t know, no response, unclear response

3. (S2_Q74) Did you choose or pick your case manager/service coordinator? ***
   (8) NOT APPLICABLE/ BLE- no case manager/service coordinator
   (2) Yes, chose case manager/service coordinator
   (1) Case manager/service coordinator was assigned but can be changed if requested by the person
   (0) No, someone else chose case manager/service coordinator
   (9) Don’t know, no response, unclear response

4. (S2_Q63) Did you choose (or pick) the people you live with (or did you choose to live by yourself)? **
   (2) Yes, chose people s/he lives with, or chose to live alone
   (1) Chose some people or had some input
   (0) No, someone else chose
   (9) Don’t know, no response, unclear response

5. (S2_Q70) Who chose (or picked) where you go during the day? **
   (8) NOT APPLICABLE- no day program or other activity
   (2) Person made the choice
   (1) Person had some input
   (0) Someone else chose
   (9) Don’t know, no response, unclear response
6. (S2_Q61) Who chose (or picked) the place where you live? **
   (2) Person made the choice
   (1) Person had some input
   (0) Someone else chose
   (9) Don’t know, no response, unclear response

7. (S2_Q59) In the past month, did you (did this person) go out for exercise? *
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response
Appendix E: Indicators of Social Determination
SOCIAL DETERMINATION

Key: (SX_QX)= (Section 1 or 2_ Question #)
* = Indicator of Social Determination in ASD group only
** = Indicator of Social Determination in Non-ASD group only
*** = Indicator of Social Determination shared across ASD and Non-ASD groups

1. (S2_Q65) Who decides your daily schedule (like when to get up, when to eat, when to go to sleep)? ***
   (2) Person decided
   (1) Person has help deciding
   (0) Someone else decides
   (9) Don’t know, no response, unclear response

2. (S2_Q66) Who decides how you spend your free time (when you are not working, in school, or at the day program)? ***
   (2) Person decides
   (1) Person has help deciding
   (0) Someone else decides
   (9) Don’t know, no response, unclear response

3. (S2_73) Do you choose what you buy with your spending money? ***
   (2) Person chooses
   (1) Person has help choosing what to buy or has set limits (such as small items but not big items)
   (0) Someone else chooses
   (9) Don’t know, no response, unclear response

4. (S1_Q30) Can you go on a date if you want to? ***
   (8) NOT APPLICABLE- does not want to date
   (2) Yes, can date, or is married or living with partner
   (1) Yes, but there are some restrictions or rules about dating
   (0) No
   (9) Don’t know, no response, unclear response

5. (S2_Q63) Did you choose (or pick) the people you live with (or did you choose to live by yourself)? *
   (2) Yes, chose people s/he lives with, or chose to live alone
   (1) Chose some people or had some input
   (0) No, someone else chose
   (9) Don’t know, no response, unclear response

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6. (S2_Q70) Who chose (or picked) where you go during the day? *
   (8) NOT APPLICABLE- no day program or other activity
   (2) Person made the choice
   (1) Person had some input
   (0) Someone else chose
   (9) Don’t know, no response, unclear response
Appendix F: Indicators of Social Participation and Relationships
SOCIAL PARTICIPATION AND RELATIONSHIPS

Key: (SX_QX)= (Section 1 or 2_ Question #)
*     = Indicator of Social Participation and Relationships in ASD group only
**   = Indicator of Social Participation and Relationships in Non-ASD group only
***  = Indicator of Social Participation and Relationships shared across ASD and Non-ASD groups

1. (S2_Q54) In the past month, did you (did this person) go shopping? ***
   (2) Yes
   (0) No
   (9) Don’t know

2. (S2_Q55) In the past month, did you (did this person) go out on errands or appointments? ***
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

3. (S2_Q56) In the past month, did you (did this person) go out for entertainment? ***
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

4. (S2_Q57) In the past month, did you (did this person) go out to a restaurant or coffee shop? ***
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response

5. (S2_Q60) In the past year, did you (did this person) go away on a vacation? ***
   (2) Yes
   (0) No
   (9) Don’t know, no response, response unclear

6. (S1_Q27) Do you have friends you like to talk to or do things with? ***
   (2) Yes, has friends who are not staff or family
   (1) Yes, all friends are staff or family, or cannot determine
   (0) No, does not have friends
   (9) Don’t know, no response, unclear response

7. (S1_Q28) Do you have a best friend, or someone you are really close to? ***
   (2) Yes
   (0) No
(9) Don’t know, no response, unclear response

8. (S2_Q58) In the past month, did you (did this person) go out to a religious service or spiritual practice? **
   (2) Yes
   (0) No
   (9) Don’t know, no response, response unclear

9. (S2_Q59) In the past month, did you (did this person) go out for exercise? **
   (2) Yes
   (0) No
   (9) Don’t know, no response, unclear response