Published in final edited form as:

Autism Res. 2019 June ; 12(6): 952–966. doi:10.1002/aur.2097.

Flourishing in Children with Autism Spectrum Disorders

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Abstract

Flourishing is an indicator of positive mental health and is important for Children's development and well-being. We used variables from the National Survey of Children's Health 2016 as indicators of flourishing (difficulty making friends, is bullied, bullies others, shares ideas with family, argues, finishes tasks, does all homework, shows curiosity, stays calm, and cares about doing well in school) to compare differences in parent perceptions of their children with and without autism spectrum disorder (ASD). We anticipate that these findings will help identify intervention targets to support the well-being of individuals with ASD. Children between 6 and 17 years of age, without intellectual disability, brain injury, cerebral palsy, or Down syndrome were included. Total participants were 34,171 controls (male/female = 17,116/17,155) and 812 with ASD (male/female = 668/144). Factor analysis resulted in three-factor structures (social competence, behavioral control, and school motivation) with good model fit (root mean square error of approximation = 0.08, comparative fit index = 0.92, Tucker–Lewis index = 0.89). The multivariate regression model and propensity score with inverse probability of treatment weighting (PS-IPTW) method revealed that children with ASD had lower scores in the social competence and behavioral control factors compared to the control group (all $P < 0.05$). However, no significant differences were found in the school motivation factor between the two groups ($P > 0.05$) in both multivariate regression model and PS-IPTW method. Findings suggest that social competence and behavioral control are indicators of flourishing and are important intervention targets to increase flourishing among children with ASD.

Lay Summary:

Flourishing is an indicator of positive mental health and is important for children's development and well-being. We used variables from The National Survey of Children's Health 2016 to examine differences in parent perceptions of the indicators of flourishing (difficulty making friends, is bullied, bullies others, shares ideas with family, argues, finishes tasks, does all homework, shows curiosity, stays calm, and cares about doing well in school) between children with and without autism spectrum disorders (ASD). We anticipate that this information will help to identify therapeutic targets to support the well-being of individuals with ASD. Children

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

between 6 and 17 years old, without intellectual disability (ID), brain injury (BI), cerebral palsy (CP), or Down syndrome (DS) were included. From the total ($N = 50,212$), we excluded children under age 6 ($n = 14,494$), those who once, but do not currently have ASD ($n = 81$), and those with ID ($n = 432$), BI ($n = 170$), CP ($n = 35$), and DS ($n = 17$), resulting in 34,983 records used. Total participants, age 6–17 years, were 34,171 controls (male/female = 17,116/17,155) and 812 with ASD (male/female = 668/144). Factor analysis resulted in the identification of three flourishing categories among the indicator variables (social competence, behavioral control, and school motivation). Children with ASD had lower scores in the social competence and behavioral control factors compared to the control group. However, there were no significant differences in the school motivation factor between the two groups. Findings suggest that social competence and behavioral control are indicators of flourishing and are important intervention targets to increase flourishing among children with ASD.

Keywords

flourishing; autism; social competence; behavioral control; school motivation; large data

Introduction

Flourishing is an indicator of positive mental health and is important for children's development and well-being [Kandasamy, Hirai, Ghandour, & Kogan, 2018]. Flourishing in childhood is related to longevity [Kern, Della Porta, & Friedman, 2014], specifically health and lower mortality risks [Friedman & Kern, 2014]. Additionally, adolescents with higher flourishing characteristics have fewer school problems, are less likely to try drugs, place themselves in healthier environments, and achieve a better education [Friedman & Kern, 2014]. Conversely, children who do not demonstrate characteristics of flourishing are more likely to be victims of bullying [Kern et al., 2014], participate in aggressive behavior, and demonstrate antisocial behavior [Orkibi, Hamama, Gavriel-Fried, & Ronen, 2018]. Longitudinal research on health and longevity indicate that patterns of behavior in childhood are predictive of adult subjective well-being, particularly sociability and conscientiousness [Kern et al., 2014]. The behavior patterns that children develop in early life become the behavioral tendencies that affect long-term health and well-being.

Defining Flourishing

Flourishing is a construct that is not well-defined in the literature. Park [2015] described a broad definition of flourishing, which included the indicators of positive emotion, engagement, relationships, meaning, and achievement (PERMA), based on Seligman's model [Seligman, 2011]. The constructs of PERMA aligned with well-being in a factor analysis [Kern, Waters, Adler, & White, 2015] and are felt to be necessary to flourish [Seligman, 2011]. Keyes [2007] defined flourishing to include positive emotions, positive psychological functioning, and positive social functioning. The positive emotions that predominate the response tendencies of individuals who flourish are key to understanding the construct of flourishing [Frederickson, 2001]. Emotions influence temperament, personality, memory, and cognition [Ryff & Singer, 2000]. Over time, positive response tendencies become behavioral response patterns, which lead to changes in patterns of

thinking, behaving, and approaching life [Frederickson, 2001]. These tendencies enable an individual to be open to engagement and have the ability to sustain engagement, develop relationships with others, create meaning, and achieve goals.

Positive emotions are correlated with broad pathways of thinking and allow the individual to see a broader range of choices [Franke, Huebner, & Hills, 2017; Gloria & Steinhardt, 2016]. Negative emotions are correlated with narrower thought-action sequences and fewer options to reach individual goals [Franke et al., 2017]. They are physiologically associated with fight-or-flight responses, which narrow and limit one's mindset [Gloria & Steinhardt, 2016]. Positive and negative emotions have long-term outcomes on physical health, mental health, and longevity through autonomic nervous system responses and physiological responses that occur over time [Danner, Snowdon, & Friesen, 2001].

Kern et al. [2015] used factor analysis to identify a four-factor construct as the best fit for flourishing in adults, which included subjective well-being, family relations, subjective achievement, and community relations. Mood stability and sociability predicted subjective well-being, motivation predicted subjective achievement, sociability and energy predicted family relationships, sociability predicted community relationships, and childhood sociability predicted flourishing. Conscientiousness was predictive of low mortality risk, which related to the overall flourishing factor, as well. The results suggested that childhood personality factors are predictive of flourishing in adulthood.

Lippman et al. [2014] defined flourishing for adolescents in the categories of relationship skills, flourishing in relationships, flourishing in school and work, helping others to flourish, environmental stewardship, and personal flourishing. Based on these areas, a range of supporting constructs was identified and a scale to measure flourishing was developed. The constructs that emerged as adequately supported and ready for use in the scale ready for use were social competence, parent–adolescent relationship, goal orientation, diligence and reliability, initiative taking, thrift, environmental stewardship, forgiveness, gratitude, and life satisfaction.

Flourishing Indicators

Social competence.—Social competence is defined as the ability to use one's social skills and manage emotional responses within the context of social interactions to meet one's needs [Berkovits & Baker, 2014; Uysal, 2015] and is an indicator of positive development [Blair et al., 2015]. Childhood sociability has been found to predict subjective well-being and positive social relationships in midlife [Kern et al., 2014]. Berkovits and Baker [2014] found that difficulty regulating emotions leads to worse social outcomes for those children. Emotional regulation was found to lay the foundation for social competence, which in turn, results in greater peer acceptance, social skills, and friendship quality [Blair et al., 2015]. Social functioning and the development of social competence require efficient working of the neural system, particularly the frontal areas and emotional appraisal system, including the amygdala and anterior cingulate [Beauchamp & Anderson, 2010].

Parent child–adolescent relationship.—The parent–child relationship is important for child outcomes and lifelong behaviors. A multitude of adverse childhood experiences studies

concur on the negative impact of poor parent–child relationships [Balstreri & Alvira-Hammond, 2016; Felitti et al., 1998; Metzler, Merrick, Klevens, Ports, & Ford, 2017]. Conversely, positive parent–child relationships result in better academic outcomes [Froiland & Davison, 2014; Wilder, 2014], less delinquent behavior [Vanassche, Sodermans, Matthijs, & Swicegood, 2014], decreased substance use [Kuntsche & Kuntsche, 2016], higher social competence [Waller et al., 2015], and well-being later in life [Staffords, Kuh, Gale, Mishra, & Richards, 2016].

Goal orientation/diligence and reliability/finishes tasks/conscientiousness.—

All of these indicators are defined similarly in the literature so we will discuss them together as one construct. One's ability to persevere and persist through a task to its completion is reliant upon one's organization of goal-directed behavior and motivation. Goal setting and goal striving are the foundations of self-regulation [Green, Oades, & Grant, 2006]. Conscientiousness has been found to contribute to better career success [Kern, Friedman, Martin, Reynolds, & Luong, 2009]. Problematic goal-directed behavior has been shown to be a predictor of negative emotions [Swain, Scarpa, White, & Laugeson, 2015]. Goal-directed behavior is thought to be a function of the striatum [Fuccillo, 2016], which integrates cognitive, emotional and motivational information from the pathways of cortical, limbic, and midbrain regions [Macpherson, Morita, & Hikida, 2014]. Maladaptive strategies affect the ability to finish challenging tasks [Clarke, Hill, & Charman, 2017].

Thrift describes the efficient use of money and resources [Lippman et al., 2014]. This behavior is normed in the category of age 16 years and above in the Vineland Adaptive Behavioral Scales, suggesting its development in mid-adolescence [Sparrow, Cicchetti, & Bella, 2005]. The need for planning that will result in the ability to use money and resources efficiently suggest the importance of goal orientation to achieve the skill of thrift.

Environmental Stewardship refers to awareness and assuming responsibility for the environment and taking action based on that knowledge [Lippman et al., 2014]. An assessment has been developed to examine this construct in children from age 12 to 17 years, suggesting that environmental stewardship activities are more evident in children beginning at age 12 [Child Trends, 2012]. The importance of planning for the future in the actions of environmental stewardship suggests a relationship with goal orientation.

Forgiveness is defined as overcoming negative feelings associated with the perception of being hurt by another individual [Lippman et al., 2014]. Forgiveness of transgressors has been shown to develop in 4- and 5-year-old children [Oostenbroek & Vaish, 2018]. Forgiveness is associated with global mental health, life satisfaction, positive affect, and self-esteem [Van Dyke & Elias, 2007]. In children, forgiveness is related to psychological wellbeing [van der Wal, Karremans, & Cillessen, 2016].

Gratitude includes both feeling and expressing thankfulness [Mendonça, Merçon-Vargas, Payir, & Tudge, 2018]. It is associated with overall well-being and prosocial behaviors and traits [McCullough, Emmons, & Tsang, 2002]. In a study of parental and child gratitude and life satisfaction, maternal gratitude was a significant correlate of child life satisfaction and maternal gratitude was correlated with child gratitude [Hoy, Suldo, & Mendez, 2013]. In a

study of elementary school students, gratitude was related to satisfaction in school and positive affect at school [Tian, Du, & Huebner, 2015]. Studies demonstrate, that gratitude is related to positive emotion and influences life satisfaction including the school environment.

Life Satisfaction is defined as personal perception of satisfaction with one's life [Huebner, 2004]. It can be measured across a variety of domains, including school life, friends, and self. Life satisfaction is felt to be a subjective cognitive self-judgment that one's needs are met and that life goals are attainable across work and family and are consistent with personality [Prasoon & Chaturvedi, 2016].

The National Survey of Children's Health 2016 (NSCH) is a nationally representative survey used by the Center for Disease Control to determine prevalence and statistics of diseases and conditions. NSCH identified three behavioral tendencies as indicators of flourishing among children. The behavioral tendencies that were included in the creation of the flourishing construct by NSCH were "child shows interest and curiosity in learning new things," "child works to finish tasks he or she starts," and "child stays calm and in control when faced with a challenge" [CAHMI, 2018, p. 44]. These variables will be labeled *curiosity*, *finishes tasks*, and *emotional regulation* in this article. For *finishes tasks*, see *goal orientation/diligence and reliability/finishes tasks/conscientiousness* previously described.

Curiosity.—Curiosity is conceptualized as a broadening of one's frame of mind and thus, results from a positive emotion framework [Gloria & Steinhardt, 2016]. Curiosity is thought to motivate learning and activates reward circuitry in the brain through a mechanism that guides an individual to new information [Kidd & Hayden, 2015]. McReynolds, Acker, and Pietila [1961] found that curiosity in children was related to psychological adjustment. Curiosity is associated with job performance and academic outcomes [Hassinger-Das & Hirsh-Pasek, 2018] thus connecting curiosity to flourishing.

Emotional regulation.—Emotional regulation is defined as one's ability to remain in control and meet one's immediate and long-term goals despite the demands of the environment. To accomplish this, one must be able to use strategies to remain in control and goal focused. Individuals use both adaptive and maladaptive strategies to regulate emotion and generate responses. Positive regulation strategies include flexible problem solving [Mazefsky, Borue, Day, & Minshew, 2014], reappraisal [Samson, Hardan, Podell, Phillips, & Gross, 2015], and the ability to self-soothe when faced with incongruent emotions [Nuske et al., 2017]. In a study examining the relationship between positive emotions, coping, and resilience, positive emotions directly improved the ability to cope with stress using adaptive coping strategies [Gloria & Steinhardt, 2016]. A predominance of positive emotions and positive coping strategies lead to positive well-being [Dunn, 2017] and flourishing [Frederickson, 2001]. Maladaptive strategies, on the other hand, include suppression, rumination, shutting down [Samson, Hardan, Podell, et al., 2015], and behavioral overreactions, such as meltdowns, temper tantrums, aggression, and self-injurious behavior [Berkovits, Eisenhower, & Blacher, 2017; Samson et al., 2014].

Children with Autism Spectrum Disorder

Children with autism spectrum disorder (ASD) demonstrate poorer adult outcomes [Baldwin, Costley, & Warren, 2014; Taylor, Henninger, & Mailick, 2015] and well-being across the lifespan [Barneveld, Swaab, Fagel, van Engeland, & de Sonnevile, 2014; Ikeda, Hinckson, & Krageloh, 2014; Potvin, Snider, Prelock, Wood-Dauphinee, & Kehayia, 2015]. Research findings also indicate that children with ASD encounter difficulty with social relationships [Orsmond, Shattuck, Cooper, Sterzing, & Anderson, 2013; Orsmond, Krauss, & Seltzer, 2004], mental health [Ratcliffe, Wong, Dossetor, & Hayes, 2015; Lieb & Bohnert, 2017; Jackson & Dritschel, 2016], and emotional regulation [Richey et al., 2015; Cai, Richdale, Uljarevic, Dissanayake, & Samson, 2018; Bruggink, Huisman, Vuijk, Kraaij, & Garnefski, 2016]. Impairments in social competence are a core feature of ASD and include deficits in social communication and social interaction [APA, 2013]. These difficulties suggest that children with ASD might flourish less than typically developing peers. Knowing the poor long-term outcomes of individuals with ASD and the importance of flourishing characteristics for life-long health and well-being suggests that examining flourishing in the ASD population is vital. Limited research has quantified the characteristics of flourishing in the ASD population and no studies have examined whether children with ASD are less likely to flourish than typically developing children.

We conducted this study to examine differences between flourishing in typically developing children compared to children with ASD in a large nationally represented data set. The constructs from Lippman et al. [2014] were combined with the constructs identified by the NSCH (2018) to compare flourishing in children with and without ASD in the current study. Refer to Table 1 for details. We hypothesized that children with ASD would demonstrate significantly lower scores in parent perceptions of the indicators of flourishing that were available in this data set: *social competence*, *parent/child relationships*, *goal orientation*, *diligence/reliability/finishes tasks*, *curiosity*, and *self-control*, compared to typically developing peers.

Methods

Participants

The National Survey of Children's Health (NSCH) is a national- and state-level questionnaire composed of responses from US parents and caregivers of children to questions about Children's health and well-being, as well as the Children's level of participation in various types of activities [CAHMI, 2018; Van Dyck, 2004]. Non-institutionalized children from all 50 US states between birth and 17 years of age are represented in the NSCH. The US Census Bureau collected the most recent NSCH from June 2016 to February 2017, which was the survey used for this study. This survey utilized address-based sampling (ABS) frames for households with children to improve sampling coverage with high response rates and to reduce sampling bias [Ghandour et al., 2018; Tourangeau & Plewes, 2013]. The data analyzed for this study are available from the Data Resource Center for Child and Adolescent Health (DRC) website at www.childhealthdata.org.

Participant inclusion criteria were children who: (a) were 6–17 years old, (b) did not have an intellectual disability (ID), defined by Question K2Q60A – “Having a doctor, other health care provider, or educator who told the parent that the child had ID or mental retardation,” (c) did not have a brain injury (BI), defined by Question K2Q46A – “Having a doctor, other health care provider, or educator who told the parent that the child had a BI, concussion or head injury,” (d) did not have cerebral palsy (CP), defined by Question K2Q61A – “Having a doctor, other health care provider, or educator who told the parent that the child had CP,” and (e) did not have Down syndrome (DS), defined by Question DOWNSYN – “Having a doctor, other health care provider, or educator who told the parent that the child had DS.” ID, BI, CP, and DS were excluded to control for the possibility that those conditions might have a confounding effect on the flourishing characteristics. We also excluded those who were ever told, but do not currently have an ASD condition ($n = 81$). Figure 1 presents the study cohort selection procedure. The Institutional Review Board at the University of Texas Medical Branch approved this study as exempt per the use of de-identified public use data. Our study also complied with the NSCH Data Use Agreement.

We used two survey questions, (a) “*Has a doctor or other health care provider EVER told you that this child has Autism, Asperger’s Disorder, Pervasive Developmental Disorder (PDD), or Autism Spectrum Disorder (ASD)?*– K2Q35A” as well as (b) “*Does this child CURRENTLY have the condition?*– K2Q35B,” to divide our study sample into those children with ASD and those without ASD (controls). If the parents or caregivers of the child answered “yes” to both questions, those participants were placed into the ASD group. If the parent or caregiver indicated “no” to K2Q35A, those participants were placed into the control group. From the total 2016 NSCH sample of $N = 50,212$, we excluded children younger than 6 years old ($n = 14,494$) and those who were ever told, but do not currently have an ASD condition ($n = 81$), and if they reported having ID ($n = 432$), BI ($n = 170$), CP ($n = 35$), and DS ($n = 17$).

Flourishing Categories

Flourishing categories included items representative of indicators previously identified in the literature: *social competence* (making and keeping friends, bullying, and being bullied), *parent/child relationship* (how well can you and this child share ideas or talk about things that really matter), *diligence/reliability/finishes tasks* (child works to finish tasks he or she starts), *curiosity* (interest or curiosity about learning), *emotional regulation* (stays calm when challenged), and *goal orientation* (cares about doing well in school). Refer to Table 2 for specific variables. All categories were coded as 1 – “Definitely true/No difficulty”, 2 – “Somewhat true/A little difficulty”, or 3 – “Not true/A lot of difficulty.” We recorded the response categories into 3 – “Definitely true/No difficulty”, 2 – “Somewhat true/A little difficulty”, or 1 – “Not true/A lot of difficulty” to reflect that a high score indicated a high level of flourishing (refer to Table 2 for details).

Covariates

Demographic covariates used in our study included the following participant variables: age, gender (boy, girl), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), and with/without Attention Deficit Disorder (ADD) or Attention Deficit/

Hyperactivity Disorder (ADHD). Family-based variables included: current health insurance status (yes, no), living in poor socioeconomic status families with incomes less than 100% of the federal poverty level (yes, no), highest level of education of an adult in the household (1 = less than high school to 4 = college degree or higher), mother's overall health status (excellent/very good, not), and father's overall health status (excellent/very good, not). Finally, we used the covariates of whether the family lived in a supportive neighborhood (yes, no) and safe neighborhood (1 = definitely agree to 4 = definitely disagree).

Statistical Analysis

We conducted descriptive statistics, including independent *t*-tests or Wilcoxon rank-sum tests, depending on the normality of distribution of the continuous variables, and chi-square tests for categorical variables to determine demographic differences between children with ASD and those who did not have ASD (control group). We ran a series of factor analyses to determine the factor structure(s) in the 10 flourishing variables. First, we conducted exploratory factor analysis (EFA) with the "weighted least squares with adjustments for the mean and variance" (WLSMV) estimation using half of a random sample to explore potential factor structure(s) among the 10 flourishing related variables. Next, we conducted confirmatory factor analysis (CFA) with the WLSMV estimation using the remaining random sample to confirm the factor structure(s) identified from EFA. Factor structure(s) in the EFA was/were identified based on the eigenvalues on each factor and the distribution of factor loadings on each variable. The final factor structure(s) was/were confirmed by CFA using model fit indices, including comparative fit index (CFI < 0.95 for good fit), Tucker–Lewis Index (TLI < 0.95 for good fit), root mean square error of approximation (RMSEA < 0.08 for adequate fit), and standardized root mean square residual (SRMR < 0.08 for good fit) as well as factor loadings ($\lambda > 0.4$ for acceptable factor loadings) [Brown, 2014; Reeve et al., 2007]. Mplus version 7.11 was used to perform the confirmatory factor analyses [Muthén & Muthén, 2012].

Once factor structure(s) was/were determined, we investigated differences in flourishing between the two comparison groups using two covariate adjustment methods, including a multivariate regression model and inverse probability treatment weighting with propensity scores (PS-IPTW), with a regression model [Rosenbaum & Rubin, 1983]. First, we estimated adjusted mean scores in the factor structure(s) presenting a positive perception in the flourishing variables, utilizing a multivariate regression model by accounting for covariates listed in Table 3. We weighted all regression models using the survey sampling weight to reflect the US population estimations.

Next, we used a regression model with PS-IPTW method to balance generic differences between the two comparison groups in various demographic, clinical, social, and environmental factors and addressed selection bias [Rosenbaum & Rubin, 1983]. The propensity score (PS) for having ASD was generated using a logistic regression model with average treatment (ATE) estimation incorporating all of covariates listed in Table 3 [Rosenbaum & Rubin, 1983]. To assess the balance of covariates, we reported *P*-values from chi-square tests with propensity score (PS) weighting. A normalized weight was used to avoid extreme PS scores by dividing each individual propensity score by the mean of all

propensity scores [Rosenbaum & Rubin, 1983]. In the regression models with PS-IPTW methods, we additionally controlled the balanced covariates when estimating the mean scores in the factor structure(s) presenting a positive perception in the flourishing variables between the two comparison groups (ASD and controls). Statistical significance was determined at an alpha level of 0.05 with two-tailed tests. The study results were expressed with 95% confidence intervals (CIs). All analyses were conducted with the SAS statistical software (Version 9.5; SAS Institute, 2018) for complex study designs.

Results

Figure 1 presents the study flow diagram. After we excluded the children younger than 6 years old ($n = 14,494$), those who were ever told, but do not currently have an ASD condition ($n = 81$), and those reported having ID ($n = 432$), BI ($n = 170$), CP ($n = 35$), and DS ($n = 17$), the remaining 34,983 records were included in our analysis. The children with ASD numbered 812 (2.30%) and the prevalence rate of ASD among US children included in this study aged 6–17 years old was estimated as 2.13% (population estimated $n = 1,038,199$ children). ASD is more prevalent in males, and the boys in our study had a higher ASD prevalence rate compared to girls (population estimated 1.79%, $n = 870,230$; 0.34%, $n = 167,969$, respectively). Table 3 presents demographic characteristics of children in ASD and in the control groups. The children with ASD in our study were also more likely to have a diagnosis of ADHD, live in working poor families, and with poor health statuses of their mothers and fathers. Furthermore, those with ASD were more likely to live in a nonsupportive neighborhood, which was not safe.

The EFA revealed three dominant factor structures in the 10 flourishing variables (eigenvalues: factor 1 = 3.76, factor 2 = 1.27, factor 3 = 0.90; Supporting Information Figure S1). Based on the EFA 3-factor structure, the CFA confirmed that each variable had high factor loadings ($\lambda = 0.412$ – 0.817) on each factor structure with marginal model fit values (RMSEA = 0.080, CFI = 0.921, TLI = 0.889, SRMR = 0.045). Table 4 presents the CFA 3-factor structure with factor loadings on each factor. Factor 1 was composed of social competence items consisting of *being bullied*, *bullying others*, *arguing too much*, and *having difficulty making friends*. Factor 2 was composed of behavioral control items consisting of *curiosity*, *finishing tasks*, *staying calm and in control when faced with a challenge*, and *sharing ideas and talking with parents about things that really matter*. Factor 3 was composed of school motivation items, consisting of *care about doing well in school* and *does all required homework*.

Propensity Matching

After applying the PS-IPTW method, all demographic variables and covariates were balanced between the two comparison groups (all $P > 0.05$ in Table 3) which resulted in separate parsimonious regression models for the three flourishing factors. Figure 2 and Table 5 present the mean differences of a positive perception in the three flourishing factor structures between children with ASD and those without ASD from multivariate regression models (upper panel) and regression models with the PS-IPTW method (lower panel). The children with ASD had lower scores in the social competence and behavioral control factors

compared to the control group in the regression models with the PS-IPTW method and multivariate regression model (all $P < 0.05$). However, no significant differences were found in the school motivation factor between the comparison groups in both covariate adjustment models (all $P > 0.05$).

Discussion

To the best of our knowledge, this is the first study examining the concept of parental perception of flourishing in children with ASD. The use of this large data set and the weighting of all analyses using the study sampling weight to reflect the US population estimations gave it a high level of generalizability. Using propensity score matching made the results more robust than traditional regression modeling because we were able to control for selection bias and for the various personal and environmental covariates related to flourishing.

The EFA and CFA revealed that the flourishing indicators present a 3-factor construct. This suggests that the characteristics of social competence, behavioral regulation, and school motivation are vital for one's ability to flourish and identifies potential intervention targets to address problems related to flourishing in children with ASD.

Factor 1 was composed of social competence items consisting of *being bullied*, *bullying others*, *arguing too much*, and *having difficulty making friends*. These items all seem to be related to social awareness and social skills. Results indicated that the children with ASD had lower scores than their typically developing peers. Social impairment is a core diagnostic feature of ASD [APA, 2013] and is consistently reported in the literature [Church, Alisanski, & Amanullah, 1999; Volkmar, Lord, Bailey, Schultz, & Klin, 2004]. In addition, children with ASD demonstrate more negative emotions than positive emotions compared to typically developing peers [Hirschler-Guttenberg, Golan, Ostfeld-Etzion, & Feldman, 2015; Samson, Wells, Phillips, Hardan, & Gross, 2015]. Richey et al. [2015] found that individuals with ASD had decreased the ability to regulate brain areas critical for increasing positive affect, resulting in problems interpreting the positive affective impact of social stimuli.

Factor 2 was composed of behavioral control items, specifically *curiosity*, *finishing tasks*, *staying calm and in control when faced with a challenge*, and *sharing ideas and talking with parents about things that really matter*. These items all seem to be related to having emotional control and executive function that allows them to be able to successfully participate in activities. Children with ASD demonstrated lower abilities in these areas compared to their typically developing peers. These findings are consistent with previous literature.

Curiosity

A paucity of studies addresses curiosity in the ASD literature, although a core characteristic of people with ASD is displaying restricted, repetitive, or stereotypical patterns of behavior [APA, 2013], which suggests decreased curiosity. To support early development, infants usually have an inner drive to be curious and explore their environments. Research findings

suggest that infants at high risk for ASD demonstrate very different behavior than typically developing infants, specifically delays in object exploration [Koterba, Leezenbaum, & Iverson, 2014; Kaur, Srinivasan, & Bhat, 2015; Libertus, Sheperd, Ross, & Landa, 2014]. Yet, Yechiam, Arshavsky, Shamay-Tsoory, Yaniv, and Aharon [2010] found that individuals with ASD, unlike controls, demonstrate a decision-making pattern of repeated shifting between choice alternatives during complex problem solving that does not diminish with task experience. This pattern of intense exploratory search of options with decreased sensitivity to the reward structure indicates a cognitive problem-solving process that could be construed as curiosity to explore all options when making decisions. One aspect of the construct of curiosity is having a broad framework from which decisions are made. This drive to explore all options could be beneficial for difficult problems with multiple possible solutions. Further refinement of the construct of curiosity seems to be needed to be able to clarify if individuals with ASD demonstrate less curiosity, or if curiosity just manifests differently than it does in neurotypical individuals.

Emotional Regulation

Children with ASD are more likely to experience stress and anxiety than their typically developing peers [Clarke et al., 2017; Chin, Chao, Chang, Li, & Chen, 2017]. Regulation and effective coping strategies help individuals manage anxiety and stress [Samson, Huber, & Gross, 2012]. Coping strategies to manage stress require perspective-taking abilities, executive functioning, and cognitive-linguistic abilities [Jahromi, Meek, & Ober-Reynolds, 2012; Losh & Capps, 2006; Samson et al., 2012]. Children with ASD demonstrate difficulties with *emotional regulation*, including less use of adaptive *emotional regulation* strategies [Samson, Hardan, Lee, Phillips, & Gross, 2015], negative mood and irritability [Nuske et al., 2017], poor emotional awareness [Mazefsky et al., 2014] and atypical sensory modulation [Baranek, Boyd, Poe, David, & Watson, 2007]. Studies of functional connectivity and neural imaging indicate differences in functional connectivity between frontal lobe and parietal, limbic, and temporal lobes in individuals with ASD [Catani et al., 2016], which are important for *emotional regulation* [Etkin, Büchel, & Gross, 2015]. Wessing, Rehbein, Postert, Färniss, and Junghöfer [2013] found that the dorsolateral prefrontal cortex and parietal lobe were activated in cognitive reappraisal, while amygdala activity was decreased [Burklund, Creswell, Irwin, & Lieberman, 2014], which is important for the downregulation of negative emotions [Hermann, Bieber, Keck, & Stark, 2014]. The process of cognitive reappraisal requires a cognitive shift as demonstrated by the dorsolateral prefrontal cortex and parietal lobe and a focus away from the negative emotions, which is seen with decreasing amygdala activation. Connectivity in the systems supporting *emotional regulation* strategies and positive emotions are aberrant in individuals with ASD [Richey et al., 2015], resulting in decreased use of *emotional regulation* strategies and subsequent emotional and behavioral problems among individuals with ASD [Samson, Hardan, Podell, et al., 2015].

Factor 3 consisted of school motivation items, specifically *cares about doing well in school* and *does all required homework*. These item scores were not significantly different between children with and without ASD, which indicates that children with ASD are as interested in doing well in school as their peers and are as responsible in completing their homework.

This is not clearly supported by previous studies, which have found that children with ASD have difficulties with school success. Ashburner, Ziviani, and Rodger [2010] found that 54% of students with ASD in mainstream classrooms were rated as academically underachieving by their teachers. The teachers identified attention difficulties, anxiety, depression, and oppositional and aggressive behaviors as problems that limited performance of students with ASD, despite these students receiving a range of specialist support services in the classroom. Sparapani, Morgan, Reinhardt, Schatschneider, and Wetherby [2016] found that for children with ASD, the time spent in a well-regulated state was related to time spent in productive classroom activity and that children with ASD spent less than half of their classroom time in a well-regulated state. Additionally, the researchers found that children with ASD responded to less than half of the attempts for social interaction with them. These findings suggest that poor classroom performance may be related to poor behavioral regulation (factor 2) and poor social competence (factor 1), rather than to school motivation (factor 3). In conclusion, social competence and behavioral control issues appear to be barriers to optimal school performance and are important targets for intervention.

Children with ASD have difficulty participating in their life roles as children, as well as transitioning into adult roles. Flourishing contributes to the development of independence that is critical for all youth to successfully transition into adulthood [Hume, Boyd, Hamm, & Kucharczyk, 2014]. Few published studies have explored flourishing among school-aged children by examining its indicators. No published studies have examined them among children with ASD. As previously stated, connectivity in the brain systems supporting emotional regulation strategies and positive emotions are aberrant in individuals with ASD [Richey et al., 2015], resulting in decreased use of emotional regulation strategies and subsequent emotional and behavioral problems among individuals with ASD [Samson, Wells, Phillips, et al., 2015]. Neuroimaging studies suggest widespread aberrations in functional connectivity in individuals with ASD [Rashid et al., 2018] and disrupted neural adaptation when learning new tasks, which is related to ASD symptom severity [Schipul & Just, 2016]. Abnormal cortical connectivity in dorsal and ventral attention networks may affect the brain areas involved in goal-driven, endogenous attention control [Fitzgerald et al., 2014]. Abnormal cerebro-cerebellar circuits in individuals with ASD resulting in increased repetitive behavior, dysregulation, decreased reward learning behavior and decreased imitation and praxis [D'Mello & Stoodley, 2015] could contribute to difficulties with the behavioral tendencies that are indicators of flourishing: *social competence* and *behavioral control*. A better understanding of the functional connectivity differences and their contribution to flourishing is important to understand the biological basis for difficulties seen among individuals with ASD and long-term outcomes.

We examined the construct of flourishing to understand differences in the underlying indicators to be able to better identify interventions that support the well-being of individuals with ASD. Early intervention studies that may alter the course of brain development in children with ASD have shown promising results [Dawson et al., 2012]. *Social competence* and *behavior control*, being significant predictors of flourishing, have been identified as important targets for affecting the ability to flourish among this population. Interventions directed at these factors, including social skills interventions, the use of emotional regulation strategies via positive emotions, cognitive processes, and

calming sensory strategies may improve coping skills, increase curiosity, increase flourishing, and ultimately, enhance psychological well-being.

Limitations of this study include the inability to confirm ASD diagnosis among the participants, inclusion of primarily non-Hispanic white samples in the analysis, and no examination of the impact of ADD/ADHD attentional difficulties on diligence and reliability/conscientiousness/finishing tasks. In addition, indicators external to the child were not included in this analysis because the intent was to examine factors that might be targeted for therapeutic interventions for the children. These include exclusion of the impact of poor maternal and paternal health on ratings provided (i.e. poor maternal/paternal health may be associated with more negative ratings of children regardless of child functioning) and the impact of less supportive neighborhoods as a distal factor impacting parent ratings of children in the ASD sample. Each of the variables included a very limited number of caregiver questions, so had potential for subjectivity and did not include detailed information about each of them. Yet, at the most basic level, these characteristics impact emotional constructs and behavior patterns that have profound functional effects for individuals with ASD.

Knowing that individuals with ASD demonstrate decreased quality of life [Ikeda et al., 2014] and decreased activity participation [Ratcliff, Hong, & Hilton, 2018], future research needs to examine how these behavioral tendencies that contribute to flourishing impact activity participation in individuals with ASD. More research is needed to investigate differences in other flourishing indicators that have been identified in the literature: *thrift, environment stewardship, forgiveness, gratitude, and life satisfaction*, between children with and without ASD and their strength as indicators of flourishing through large data analysis and through smaller studies that can use assessments that more deeply quantify the indicators and can confirm the ASD diagnoses. Differences between children with ASD who have comorbid ADD/ADHD should be examined for diligence and reliability/conscientiousness/finishes tasks. In addition, the impact of external factors, such as poor maternal and paternal health and neighborhood supportiveness are important to examine in future studies of children with ASD. In addition, while the current study utilized a propensity score matching method to control for selection bias, there could be unmeasured confounding variables due to the nature of the cross-sectional design and limited sets of variables in this survey. Therefore, future studies that utilize robust statistical methods (e.g. instrumental variable analysis) to control for unmeasured confounding variables and mimic the random assignment of comparison groups are needed [Rassen, Schneeweiss, Glynn, Mittleman, & Brookhart, 2009].

Conclusion

Based on the indicators of flourishing examined in this study (*social competence, behavioral control, and school motivation*), children with ASD had significant differences and lower scores in social competence and behavioral control compared to controls. As a result, children with ASD are at greater risk for decreased psychological, social, and physical well-being, which ultimately reduces adult independence. These findings confirm the need to identify and address social skills, positive emotions and positive affect, and emotional

regulation for individuals who have ASD as early as possible. By addressing these targets, professionals have the potential impact on psychological well-being and eventual adult success.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was supported in part by grant# K12 HD055929 from the National Institutes of Health (NIH). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH. The authors report no conflicts of interest.

Grant sponsor: National Institutes of Health; Grant number: K12 HD055929

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Figure 1.
Study flow diagram.

Figure 2.
Comparison of means for flourishing factors.

Table 1.

Flourishing Indicators from Literature

Construct	Definition	Similar constructs from other models
Social competence	As demonstrating the skills necessary to get along and function well with others [Lippman et al., 2014] Regulation of effect, cognition, and behavior to attain social goals and good social relationships [Uysal, 2015]	Relationships [Seligman, 2011] Positive social functioning [Keyes, 2007] Sociability [Kern et al., 2014]
Parent-child/adolescent relationship	Quality of interaction and attitudes about the relationship Parenting involvement which can include monitoring, communication, rule-setting, and rule-adherence by the parent [Kuntsche & Kuntsche, 2016]	Family relations [Kern et al., 2014] Positive social functioning [Keyes, 2007]
Goal orientation	A mindset that allows an individual to act upon personal and interpersonal aims	Subjective achievement [Kern et al., 2014] Positive emotion [Seligman, 2011]
Diligence and reliability, Finishes tasks, Conscientiousness	“The performance of task with thoroughness and effort from start to finish where one can be counted on to follow through on commitments and responsibilities.” [Lippman et al., 2014, p.13]	Engagement [Seligman, 2011] Subjective achievement [Kern et al., 2014] Meaning and achievement [Seligman, 2011] “Child works to finish tasks he or she starts” [Child and Adolescent Health Measurement Initiative (CAHMI), Data Resource Center for Child and Adolescent Health, 2018]
Thrift	Time management, money management, inhibition [Lippman et al., 2014]	Adolescent age range skill [Sparrow et al., 2005] Subjective achievement [Kern et al., 2014]
Environmental stewardship	Awareness and assuming responsibility for the environment and taking action based on that knowledge [Lippman et al., 2014]	Begins at age 12 [Child Trends, 2012].
Forgiveness	Overcoming negative feelings associated with the perception of being hurt by another individual [Lippman et al., 2014] Reestablishment of positive feelings towards one that has done wrong to reconcile and reestablish cooperation [Oostenbroek & Vaish, 2018]	Positive emotion [Seligman, 2011]
Gratitude	Appreciation of the positive things in one's life [Lippman et al., 2014] Associated with overall well-being and prosocial behaviors and traits [McCullough et al., 2002]	Positive emotion [Seligman, 2011]
Life satisfaction	Being happy with one's life Includes personal perception of satisfaction with one's life [Huebner, 2004]	Meaning and achievement [Seligman, 2011] Subjective well-being [Kern et al., 2014]
Curiosity	Internally motivated information seeking [Kidd & Hayden, 2015]	“Child shows interest and curiosity in learning new things” [CAHMI, 2018]
Emotional regulation	The ability to monitor and modulate emotions and arousal [Berkovits & Baker, 2014] to meet situational demands [De Groot & Van Strien, 2017] Ability to regulate emotions appropriately and effectively [Samson et al., 2014]	“Child stays calm and in control when faced with a challenge” [CAHMI, 2018]

Table 2.

Flourishing Indicator Variables Included in Analysis

Construct	NSCH survey item	Study variable
Social competence	Child has difficulty making and keeping friends	MAKEFRIEND
	Child is bullied, picked on, or excluded by other children. Age 6–17	Bullied
Parent-child relationship	Child bullies others, picks on them or excludes them. Age 12–17	K7Q71_R
	How well can you and this child share ideas or talk about things that really matter	ShareIdeas_16
	Child argues too much	K7Q70_R
Diligence and reliability	Child works to finish tasks he or she starts	K7Q84_R
	Child does all required homework	K7Q83_R
Curiosity	Child shows interest and curiosity in learning new things	K6Q71_R
Emotional regulation	Child stays calm and in control when faced with a challenge	K7Q85_R
Goal orientation	Cares about doing well in school	K7Q82_R

Table 3.

Demographics Between Children with ASD and Those Who Without ASD Before and After Applying the Inverse Probability Treatment Weighting with Propensity Scores

Characteristics	Demographic Distributions before PS-IP/TW				Demographic Distributions after PS-IP/TW			
	Total (N = 34,983)	ASD (N = 812)	Control (N = 34,171)	P	Total (Weighted N = 24,933)	ASD (Weighted N = 12,027)	Control (Weighted N = 12,906)	P
Age, Mean (SD)	12.1 (3.4)	12.0 (3.3)	12.1 (3.4)	0.1860	12.1 (3.6)	12.1 (15.1)	12.0 (2.5)	0.6919
Gender				<0.0001 ^a				0.1371
Boy	17784 (50.8%)	668 (82.3%)	17116 (50.1%)		13658 (54.8%)	6916 (57.5%)	6741 (52.2%)	
Girl	17199 (49.2%)	144 (17.3%)	17055 (49.9%)		11275 (45.2%)	5110 (42.5%)	6164 (47.8%)	
Race				0.7437				0.5751
Non-Hispanic white	24643 (70.4%)	586 (71.2%)	24275 (70.4%)		18274 (73.3%)	8690 (72.3%)	9583 (74.3%)	
Non-Hispanic black	2087 (6.0%)	54 (6.5%)	2047 (6.0%)		823 (3.4%)	361 (3.0%)	461 (3.5%)	
Hispanic	3855 (11.0%)	82 (10%)	3809 (11.0%)		2695 (10.8%)	1448 (12.0)	1247 (9.7%)	
Other	4398 (12.6%)	101 (12.3%)	4326 (15.6%)		3140 (12.6%)	1525 (12.7%)	1614 (12.5%)	
ADHD (Yes)	4312 (12.4%)	430 (53.0%)	3882 (11.2%)	<0.0001 ^a	3003 (12.1%)	1572 (13.1%)	1431 (11.1%)	0.0821
Current insurance (Yes)	33533 (96.2%)	794 (97.9%)	32739 (96.2%)	0.0111 ^a	24137 (96.8%)	11574 (96.2%)	12596 (97.3%)	0.3803
Living in working poor families (Yes)	2120 (6.2%)	52 (6.5%)	2068 (6.2%)	0.7190	1038 (4.2%)	511 (4.2%)	527 (4.1%)	0.8971
Parents' education attainment				0.1545				0.5541
Less than high school	816 (2.4%)	20 (2.5%)	796 (2.4%)		291 (1.2%)	111 (1.0%)	179 (1.4%)	
High school degree	4520 (13.2%)	110 (13.8%)	4410 (13.2%)		2814 (11.3%)	1537 (12.8%)	1277 (9.9%)	
Some college	7916 (23.2%)	208 (26.2%)	7708 (23.1%)		5060 (20.3%)	2382 (19.8%)	2677 (20.7%)	
College degree or higher	20859 (61.1%)	456 (57.4%)	20403 (61.2%)		16767 (67.3%)	7995 (66.4%)	8771 (68.0%)	
Overall health status of mother (Very good)	20676 (65.9%)	356 (48.7%)	20320 (66.4%)	<0.0001 ^a	16363 (65.6%)	7607 (63.3%)	8756 (67.9%)	0.1133
Overall health status of father (Very good)	18818 (67.8%)	342 (55.6%)	18476 (68.1%)	<0.0001 ^a	16589 (66.5%)	7818 (65.0%)	8770 (68.0%)	0.3165
Supportive neighborhood (Yes)	21080 (62.2%)	373 (47.4%)	20707 (62.6%)	<0.0001 ^a	15699 (63.0%)	7402 (61.6%)	8296 (64.3%)	0.3598
Safe neighborhood, Mean (SD) ^b	1.32 (0.55)	1.44 (0.65)	1.31 (0.55)	<0.0001 ^a	1.29 (0.5)	1.29 (2.4)	1.29 (0.4)	0.8829

Note. PS-IP/TW = inverse probability treatment weighting with propensity scores. ASD = autism spectrum disorder. ADHD = attention deficit disorder or attention deficit.

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^aStatistical significance at an alpha level of 0.05.

^b1 = definitely agree, 2 = somewhat agree, 3 = somewhat disagree, 4 = definitely disagree.

Table 4.

Three Factor Structures in the 10 Flourishing Variables with Factor Loadings

Factor	Variable	Factor loadings	Standard error	<i>P</i>
Social competence	Bullied	0.586	0.007	0.000
	Bullies others	0.412	0.008	0.000
	Argue too much	0.566	0.007	0.000
	Make friends	0.660	0.007	0.000
Behavioral control	Curiosity	0.558	0.006	0.000
	Finishes tasks	0.751	0.005	0.000
	Stay calm	0.635	0.006	0.000
	Share ideas	0.477	0.007	0.000
School motivation	Homework	0.777	0.005	0.000
	Do well school	0.817	0.005	0.000

Note. Confirmatory factor analysis (CFA) with weighted least squares with adjustments for the mean and variance (WLSMV) estimation.

Table 5.

Performance of Presenting a Positive Perception in Social Competence, Behavioral Control and School Motivation Factor Between Children with ASD and Those Who Without ASD from Multivariate Regression Model and Propensity Score Inverse Probability of Treatment Weighting (PS-IPTW) Method

Estimation method	Flourishing factor	ASD			Control		
		Adj. Mean	SE		Adj. Mean	SE	P
Multivariate regression model ^b	Social competence	8.76	0.15		9.88	0.11	<0.0001 ^c
	Behavioral control	8.14	0.17		9.14	0.08	<0.0001 ^c
	School motivation	4.56	0.11		4.65	0.07	0.3531
PS-IPTW model ^a	Social competence	8.61	0.23		9.79	0.20	<0.0001 ^c
	Behavioral control	8.67	0.25		9.38	0.22	0.0004 ^c
	School motivation	4.56	0.09		4.62	0.09	0.4582

^aAll covariates were balanced between children with ASD and those who without ASD by the PS-IPTW method (all $P > 0.05$).

^bCovariates were adjusted, including age, ADHD, race, parents' educational attainment, living in working poor families, current insurance, gender, over-all health status of mother or father, and supportive neighborhood.

^cStatistical significance at an alpha level of 0.05.