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RESEARCH

Parenting Stress of Parents with Children with Autism Spectrum Disorders with Access to Behavioral Treatment

Linda A LeBlanc[1] · Claire Schutte[1] · Charna Mintz[1] · Brent A Kaplan[2] · Avery Caffee[1] · Alec Sweatman[1]

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Abstract

Parents of children with Autism Spectrum Disorder (ASD) experience higher levels of parenting stress than parents of neurotypical children or children with other conditions, with some evidence of the influence of certain child (e.g., externalizing behavior) and family (e.g., informant relationship to child) variables. Gaps in our understanding still exist in certain areas such as father's parenting stress, stress experienced by parents who have multiple children diagnosed with ASD, and parent stress in diverse samples. This cross-sectional, retrospective study examined family and child variables as they relate to parenting stress in a large, diverse sample of parents at intake to early intensive behavioral intervention services. When examined in isolation, child variables such as challenging behavior, adaptive behavior, and age at diagnosis were differentially associated with parenting stress and one family variable, ethnicity of the family, was also differentially associated with parenting stress. When examined in a multiple regression analysis, the most influential variables were challenging behavior and family ethnicity.

Keywords Autism spectrum disorder · Parenting stress index · Fathers · Behavioral intervention

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Parenting stress (PS) refers to stress experienced when the demands of parenting outweigh the parent's resources to fully promote the development and wellbeing of their children by providing a supportive, nurturing environment (Abidin, 1995; Brooks, 2012; Gianotti et al., 2023). One of the most widely used measures for evaluating stress associated with parenting is the Parenting Stress Index (Baker-Ericzen et al.; 2005; Ingersoll & Hambrick, 2011; Lecavalier et al., 2006), which has both

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a long and short form and is currently in the 4th edition (PSI-4 SF; Abidin, 2012). This measure has been used to study the influence of many different variables on PS including various child and parent characteristics as well as various socio-cultural factors (Bornstein, 2013; Davis & Carter, 2008).

One child characteristic, a diagnosis of an autism spectrum disorder (ASD), has been consistently found to be associated with elevated PS. Parents of children with ASD experience higher levels of PS than parents of typically developing children or children with other developmental disabilities (e.g., Down Syndrome, intellectual developmental disabilities) (Barroso et al., 2018; Hayes & Watson, 2013; Leonardi et al., 2021; Olsen et al., 2022). In many studies, the average PSI Total Stress scores for parents of children with ASD have fallen in the clinically significant range (Patel et al., 2022; Mello et al., 2022); however, there is considerable variability across studies with as many as 70–85% of families' scores falling in the clinically significant range in some studies (Ingersoll & Hambrick, 2011; Kiami & Goodgold, 2017) to less than a quarter of families falling in the clinically significant range (Kayfitz et al., 2010; LeBlanc et al., 2024).

One variable that might influence findings on PS is whether the parent has sought and accessed intervention services for their child (Patel et al., 2022). LeBlanc et al. (2024) examined PS longitudinally at intake and every six months for the first year of treatment in an early intensive behavioral intervention program for a very diverse sample of over 400 children with ASD. Total stress scores, on average, decreased steadily throughout the first year of treatment, and families reporting the most stress at intake experienced the greatest reduction in stress. Challenging behavior was associated with higher levels of PS, consist with a robust literature supporting the influence of challenging behavior on PS (Hayes & Watson, 2013; Mello et al., 2022; Postorino et al., 2019; Stephenson et al., 2023). In addition, initial adaptive behavior scores were not strongly related to PS but increases in adaptive behavior (i.e., change scores across the first year of treatment) were associated with higher levels of PS while were associated with increased stress and increased treatment adherence was associated with less stress. Previous studies have shown that lower levels of child adaptive behavior are associated with higher PS (Baker-Ericzen et al., 2005; Mello et al., 2022; Tomanik et al., 2004) while Rivard et al. (2014) have found that higher adaptive behavior scores on the Vineland were associated with higher levels of stress in both mothers and fathers, perhaps because children with higher adaptive behavior scores may have had a milder presentation of ASD, have been diagnosed later in life, and received fewer services.

Although the average total stress score at intake for LeBlanc et al. (2024) was higher than the normative sample (mean = 56th percentile compared to an expected 50th percentile average), only 10.6% of parents in the sample scored in the elevated or clinically significant range (i.e., 85th percentile or higher), which is lower than in most previously published studies (Kiami & Goodgold, 2017; Mello et al., 2022; Patel et al., 2022). LeBlanc et al. (2024) hypothesized that the relatively small percentage of parents experiencing significant stress may have been due to the fact that all children were enrolled in an early intervention program. A relatively early age of diagnosis, as well as access to treatment services, could serve as protective factors for PS. In addition, the hypothesized that families with higher stress levels may not have

continued to complete the PS measure at subsequent intervals while families with lower stress levels continued to respond leading to lower stress for the longitudinal sample compared to all families that responded at least once. It is also possible that other variables related to PS that were not experimentally examined in that study influenced the relatively low percentage of families with elevated PS. The influential variables examined in other studies on the PS associated with a diagnosis of ASD can generally be conceptualized as child characteristics or parent and family context variables (Bonis, 2016; Rivard et al., 2014; Sim et al., 2017).

Child Characteristics

In addition to challenging behavior and adaptive behavior, the process of receiving a diagnosis of ASD for their child and the timing of that diagnosis have been related to PS (Hickey et al., 2022; Patel et al., 2022). Studies that have focused on the diagnostic experience (e.g., number of providers, number of appointments, wait time from first concerns to a diagnosis) have indicated that longer wait times and seeing more providers prior to diagnosis are associated with heightened stress (Boshoff et al., 2019; Moh & Magiati, 2012; Rivard et al., 2014, 2021). The child's age at diagnosis, independent from wait times or diagnostic experience, and its relation to PS is less understood.

Some studies have suggested that parents of younger children tend to experience more stress (Davis & Carter, 2008; Osborn et al., 2008) while others have found less negative impact with a younger age at diagnosis (Hickey et al., 2022). For example, Osborn et al. (2008) evaluated child age at diagnosis and its relationship to PS and found that the younger the age at diagnosis, the higher the level of PS. Conversely, Meads et al. (2024) found the older the age at diagnosis and longer wait to diagnosis were associated with greater impact on the parent, in the form of more depressive symptoms. Some studies have indicated that children of parents who are together (e.g., married, living together but not married) tend to obtain a diagnosis earlier than children of parents who are not together (Kalb et al., 2021). In addition, single, young mothers have been shown to have an increased risk of PS scores above the clinical cutoff (Enea & Rusu, 2020). These findings suggest that marital status (a family context variable) may interact with age of diagnosis status (a child variable). One factor that is unclear in these previous studies is whether age at diagnosis and PS were moderated by access to treatment services.

Parent Informant and Family Variables

Both mothers and fathers have been studied as parent informants, with mothers being more heavily represented in published studies. Having a child with ASD has been shown to impact both mothers and fathers, however, the literature has been mixed regarding differences in PS levels and influencing variables (Baker-Ericzén et al., 2005; Dijkstra-de Neijs et al., 2024). Some studies have indicated that mothers tend to experience higher levels of PS than fathers (Davis & Carter, 2008; Hastings &

Brown, 2002; Herring et al., 2006). Other studies have shown the opposite, with fathers experiencing higher PS than mothers, including stress scores in the clinically significant range (Rivard et al., 2014). Several studies have shown comparable levels of stress for mothers and fathers of a child with ASD (Davis & Carter, 2008; Giannotti et al., 2023; Hastings et al., 2005) and when measured in dyads, each parent's stress affects the other parent's stress (Patel et al., 2022).

The variability in findings may be due to several factors related to methodology and the variables measured in prior studies. First, these studies typically have had primarily white samples, relatively small samples, and unequal sample sizes with many more mothers than fathers as participants overall (Davis & Carter, 2008; Rivard et al., 2014). Second, the differences may be due to whether stress is measured in dyads of mothers and fathers (e.g., Davis & Carter, 2008; Giannotti et al., 2023; Rivard et al., 2014) or in mothers and fathers of different children in the same study (e.g., Hastings et al., 2005; Dijkstra-de Neijs et al., 2024) or across studies of only mothers or only fathers. In studies of only fathers, the samples have tended to be particularly small. For example, Davis and Carter (2008) found that among 54 fathers of children with ASD, 28% had stress levels in a clinically significant range. Despite the inclusion of fathers in studies on PS, most published studies to date have examined relatively small samples of fathers, making it challenging to generalize findings to the broader experience of fathers of children with ASD (Rivard et al., 2014).

A small number of studies have evaluated the experience of stress for parents of children with ASD across racial and ethnic groups (Kim et al., 2020; Valicenti-McDermott et al., 2015). Some studies indicate that Asian American and Black/African American parents of children with ASD tend to experience higher levels of PS than other racial or ethnic groups (DeLambo et al., 2010; Kim et al., 2020; Williams et al., 2019). Kim et al. (2020) found that 45% of an ethnically diverse sample of parents from a study on complementary and alternative medicine for ASD scored at the 90th percentile on the PSI-SF with lower stress observed in Latino families. Iadarola et al. (2019) investigated PS via structured interview of underrepresented (e.g., racial or ethnic minority) parents with children with ASD and found common themes of community preference for privacy, community acceptance of the child's diagnosis, and perceived disparities in information and access to treatment. Overall, more research is needed because these studies have had relatively small sample sizes and have been conducted independent of the context of treatment services.

Having one child with ASD can increase the likelihood of having another child with ASD with an estimated re-occurrence of approximately 20% (Ozonoff et al., 2024). Despite the high re-occurrence rates, there is limited literature on the experience of parenting multiple children with ASD. However, there is evidence that parenting multiple children with any neurodevelopmental disability can impact parent well-being. Thompson-Hodgetts et al. (2024) interviewed 10 mothers of multiple children with neurodevelopmental disability via semi-structured interviews and found themes of reported increased knowledge and advocacy skills, negative impact on wellbeing due to increased caregiving demands, and trouble balancing responsibilities with social engagement and support. However, Sim et al. (2017) included families with multiple diagnosed children with ASD and did not find the number of diagnosed children to be significantly related to PS. Additional studies with fami-

lies with multiple diagnosed children are needed to clarify the impact on PS and to determine whether this variable interacts with other variables such as marital status, ethnicity, or challenging behavior.

Rationale for the Current Study

It's been well established that parents of children with ASD experience significantly more stress than parents of other children (Barroso et al., 2018; Leonardi et al., 2021; Olsen et al., 2022) and that child externalizing behavior has been clearly associated with elevated PS (LeBlanc et al., 2024; Postorino et al., 2019; Stephenson et al., 2023). However, findings on the influence of other variables have been inconsistent and less frequently examined. The inconsistencies in findings might be due to relatively small sample sizes, limited diversity of samples, and having a limited number of variables examined within the same multi-variate analysis.

LeBlanc et al. (2024) recently found surprisingly low levels of PS and a low percentage of families with elevated stress in a diverse sample of over 400 parents of children with ASD in behavioral treatment services. The longitudinal nature of that study meant the results represented families who persisted in completing the PS measure throughout at least three time points throughout the first year of treatment rather than all families who may have stopped responding after the beginning of treatment, resulting in a low average of PS. The current study is a cross-sectional follow-up study to LeBlanc et al. (2024) designed to examine PS at intake to treatment services for all families who responded at intake (i.e., the first opportunity) to determine if the level of stress and percentage of stressed families in the prior study could have been due to self-selection (i.e., families experience more PS stopped responding after the first measurement opportunity). A second purpose of the study is to examine PS and the variables influencing PS in the context of behavioral treatment in a very large, diverse sample of families adding additional child and family variables to those previously examined (i.e., challenging behavior, adaptive behavior). We examined differences in PS based on child variables (i.e., age of diagnosis, child behavior, adaptive behavior) and parent and family variables (i.e., parent informant relationship to the child, ethnicity, marital status, number of children diagnosed with ASD).

We hypothesized that significant challenging behavior would be associated with increased PS and that a lower age of diagnosis would be associated with lower PS. We also hypothesized that parents from different ethnic groups would experience different levels of PS without a specific directional expectation (i.e., no specific expectation of which ethnicities would experience more or less stress). In addition, the sample included over 100 families with multiple children in service Simultaneously, which allowed us to examine whether having 2 children in service was associated with higher stress than having only one child in service.

Methods

Participants

Parents

One parent from each household completed the PS and adaptive behavior measures at the onset of their child's treatment. Of the 3,324 parent participants, 2879 (86.7%) were mothers and 445 (13.3%) were fathers (see Table 1 for demographic information). Ethnicity information was available for the vast majority of families with 943 identifying as White/Caucasian (28.1%), 912 as Hispanic or Latin(a)/(o) (27.2%), 585 as Black/African American (17.5%), 488 as Asian (14.6%), 75 as American Indian/Alaska Native (2.2%), 103 as "Other" or "Multiple Ethnicity" (3%), and 218 (6.5%) providing no ethnicity information. The majority of respondents were married ($n=2438$; 73%) while 504 (15%) identified as single, 210 (6%) as divorced, 60 (2%) as separated, 37 (1%) selected other, 10 (below 1%) as widowed, 4 (below 1%) as never married, and no information was provided for 42 (1%). The primary language spoken in the household was English for the vast majority of families ($n=3186$, 95.2%) with Spanish for 58 families (1.7%), and 80 identified as speaking another unspecified language (2.4%).

Children with ASD

All children had entered an early intensive ABA treatment program with a start of services date between October of 2021 and January of 2024. The treatment model generally involves 6–8 h per day of direct treatment for the child and family guid-

Table 1 Demographic information

Demographic Information	
Informant Relationship	Mother (2879, 86.7%)
	Father (445, 13.3%)
Primary Child Gender	Male (2540, 76%)
	Female (784, 24%)
Marital Status	Married (2438; 73%)
	Single (504, 15%)
Race/Ethnicity	Divorced (210, 6%)
	Separated (60, 2%)
	Other (37, 1%)
	Never married (4, below 1%)
	No information (42, 1%)
	White/Caucasian (943, 28/1%)
	Hispanic or Latin(a)/(o) (912, 27.2%)
	Black/African American (585, 17.5%)
	Asian (488, 14.6%),
	American Indian/Alaska Native (75, 2.2%)
	"Other" or "Multiple Ethnicity" (103, 3%)
	No information (218, 6.5%)

ance sessions for the parents/caregivers, consistent with the Council of Autism Service Provider guidelines (CASP, 2024). The number of treatment hours per week may have been lower in the first months of treatment for a very young child or in the later months of treatment for a child of any age as part of a titration in services in preparation for transition to school. Treatment was provided in a one-to-one ratio in both individual and small group instruction using structured and natural environment behavioral teaching procedures designed to be fun, engaging, assent-based, and play-based. Parents typically attended parent guidance sessions twice per month to observe sessions, collaborate on goal and intervention selection, learn teaching strategies, and receive consultation for newly emerging concerns (e.g., sleep issues, new topographies of challenging behavior, safety concerns).

The child participants included 2540 (76%) male and 784 (24%) female individuals with ASD. Of these children (referred to as primary children), 111 were the second child of their family in services (i.e., a sibling diagnosed with ASD was already in services). Child age at the start of services ranged from 16.8 to 154.8 months with a mean age of 48 months (sd = 17.7) and a median age of 44 months. Child age at diagnosis was calculated as the difference between the date of birth and date of diagnosis and ranged from 11 to 153 months with a mean of 40.2 months and a standard deviation of 15.7 months. The child sample had a Vineland-3 Adaptive Behavior Composite mean score of 67.3 (sd = 10.7, range 28–112) at intake with the highest subscale scores on motor skills (mean = 80.5, sd = 12.1) and daily living skills (mean = 71.1, sd = 13.2) and the lowest scores on socialization (mean = 67.8, sd = 13.3) and communication (mean = 60.5, sd = 18.1).

Diagnostic Confirmation and Description All children and siblings had an independently conferred diagnosis of ASD from a qualified provider with appropriate diagnostic documentation according to the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (American Psychiatric Association, 2022) or the International Classification of Diseases-Tenth Edition (World Health Organization, 2016). When it was available from the medical record, the results of the diagnostic tool used by the evaluating clinician were included for purposes of describing the sample. Those results are presented as severity or likelihood descriptors so that similar information could be presented across tools.

A diagnostic severity or probability measure was available for 2525 (80.1%) of the child participants. A Childhood Autism Rating Scale-Second Edition (CARS-2; Schloper et al., 2010) was available in the medical record for 1585 children with 52 scored in the minimal to no symptoms of ASD range, 851 scored in the mild to moderate symptoms range, and 682 scored in the severe symptoms range. The Autism Diagnostic Observation Scale-Second Edition (ADOS-2; Lord et al., 2012) was available with either standard administration ($n = 511$) or modified administration ($n = 310$) during the pandemic caused by Covid-19. Of the 302 children who had an ADOS-2 Module 1–3 comparison score with standard administration, 27 scores were in the low range, 152 were in the moderate range, and 123 were in the high range. Of the 209 children who had an ADOS-2 Toddler Module with standard administration, 18 scores were in the mild to moderate range of concern and 191 were in the

moderate to severe range of concern. Of the 310 children who had an ADOS-2 with modified administration using masks, all were scored as definite differences. The Autism Spectrum Rating Scales (ASRS; Goldstein & Naglieri, 2009) was available for 119 children with 18 described with the average descriptor, 15 described with the slightly elevated symptoms descriptor, 81 described as elevated, and 5 described with very elevated.

Measures

Parenting Stress Index – Fourth Edition Short Form (PSI-4 SF)

The PSI-4 SF (Abidin, 2012) is an updated and shortened form of the original PSI (Abidin, 1983). Both the short and long form of this parent self-report questionnaire have recently been recommended for use with families of children with ASD as a research tool, and as a socially important patient-reported outcome measure (International Consortium of Health Outcomes Measurement, 2023). Parents read statements (e.g., "My child makes more demands on me than most children.") and select a score on a 5-point Likert-scale to indicate the extent to which they agree or disagree with the statement (1 = ''strongly disagree'', 5 = ''strongly agree''). Scores in the 85th percentile and above are considered elevated; specifically with percentiles ranging from 85th-89th considered "high" and scores in the 90th percentile and above considered "clinically significant" (Abidin, 2012). The PSI-4 SF provides a total stress score and three component subscale scores (Abidin, 2012): (a) Parental Distress, (b) Parent-Child Dysfunctional Interaction (PCDI), and (c) Difficult Child. For the PSI-SF 3, Zaidman-Zait et al. (2011) found a 6-factor structure for parents of children with autism rather than 3-factor structure used in standard scoring of the PSI-SF. However, we used the electronic, automatically-scored version of the PSI-SF 4, which does not provide alternative scoring, so the original factors are reported here.

Challenging Behaviors

For each client, the presence of significant challenging behavior that was actively targeted in treatment was noted for 4 categories of behavior: (a) self-injurious behavior, (b) aggression, (c) property destruction, and (d) elopement. This information was coded based on the medical record and behavior intervention plan. Clients may have exhibited other topographies of behavior (e.g., tantrums, stereotypy); however, only these four categories of behavior were coded as these represented the greatest social, health, and safety risks for the child or others. In addition, challenging behaviors such as these can often lead families to restrict outings in public, impacting quality of life (Lutz et al., 2012; Olsen et al., 2022).

Aggression was defined as any topography of behavior involving forceful, physical contact using any body part or item with another person (peers and adults), including hitting, kicking, biting, scratching, and hair pulling. Elopement was defined as any topography of behavior as an attempt to physically leave (e.g., walk, run, crawl) an adult's presence, safe area, or physical instructional setting (e.g., table and chairs,

desk, group of peers), without permission outside of an average of a 2-foot radius. Property destruction was defined as throwing or breaking objects or visibly damaging any property. Self-Injurious behavior was defined as any topography of behavior that caused or could cause physical tissue damage to one's body either with or without the use of an item including banging the head or other body part against objects, self-biting, self-scratching, self-pinching, pulling one's own hair, and striking or slapping oneself.

Children may have exhibited multiple topographies of the same category, and the specific topographies in a category may have changed over time, but the category was still counted only once. This procedure resulted in a score of 0 (i.e., no topographies of challenging behavior from any of these four categories at any point during the first year of treatment) to 4 (i.e., at least one topography of challenging behavior from each of the categories).

Vineland Adaptive Behavior Scales-Third Edition, (Vineland-3) Caregiver Rating Form, Comprehensive The Vineland-3 (Sparrow et al., 2016), Caregiver Rating form is a norm-referenced parent questionnaire used to evaluate adaptive skills in individuals of all ages. The comprehensive form includes 381 items that are rated by the caregiver according to how often their child performs certain skills (0 = never, 1 = sometimes, 2 = usually or often). In addition to a summary measure referred to as the Adaptive Behavior Composite, four primary domains are evaluated including communication, socialization, daily living skills and motor skills. These domain areas are broken down into subdomains, helping further evaluate specific skill areas within the broader domains. The Vineland-3 is commonly used to assess adaptive skills in children and adults with ASD and other developmental diagnoses. Information from the caregiver rating form is useful in identifying strengths and weaknesses across adaptive skill domains, as well as help diagnose intellectual impairment.

Analyses

Our primary statistical analysis consisted of examining levels of PS associated with each of the child and family constellation variables of interest in isolation. Parent informant and family variables included: (a) number of children diagnosed with ASD in treatment services, (b) marital status (recoded as either married or not married), (c) ethnicity (recoded as Asian, Black or African American, Hispanic or Latino, White and Other, which combined the three smallest percentages categories of other, multiple ethnicity, and American Indian/Native Alaskan), and (d) parent relationship to child (i.e., mother, father). Child variables included: (a) age at diagnosis, (b) VABS-3 scores at intake, and (c) challenging behavior. Throughout our analyses, we used Bayesian methods because, unlike frequentist methods, they yield a full posterior distribution for each parameter estimate. This allows us to directly quantify uncertainty in probabilistic terms—for example, by summarizing the range within which the parameter lies with a given probability (e.g., a 95% credible interval). When we report a 95% credible interval, it can be interpreted as indicating a 95% probability that the *true value of the parameter lies within that interval*, given the data and prior information (Morey et al., 2016).

We used Bayesian versions of correlations and general linear models (e.g., multiple linear regression). For correlations, we report the median posterior of the correlation coefficient, 95% credible interval, and Bayes Factor (BF; a ratio indicating degree of evidence for one hypothesis over another; in our case the degree of evidence associated with the hypothesis that the *real* correlation coefficient is *not equal to 0*). All linear models were estimated using MCMC with 4 chains and 4000 (2000 warmup) iterations per chain. All R-hat values were below 1.01 (Vehtari et al., 2017) and all Effective Sample Sizes exceeded 1000 (Bürkner, 2017), suggesting good model convergence and reliable posterior estimates.

The Bayesian GLM was estimated using the R Statistical language (version 4.4.1; R Core Team, 2024) on macOS 15.3.1 with the brms package (version 2.21.0; Bürkner, 2017). Other primary packages used included BayesFactor (version 0.9.12; Morey & Rouder, 2024), easystats (version 0.7.3; Lüdecke et al., 2022), modelsummary (version 2.1.1; Arel-Bundock, 2022), bayestestR (version 0.14.0; Makowski et al., 2019), marginaleffects (version 0.21.0; Arel-Bundock et al., 2024), and ggplot2 (version 3.5.1; Wickham, 2016).

Results

For the entire sample, the mean total stress raw score was 84.6 with a standard deviation of 23.2. The mean total stress t-score was 52.4 with a standard deviation of 9.0. The mean percentile score was 59.3 with a standard deviation of 25.0. Together, these values indicate that the sample, on average, experienced elevated PS compared to the normative sample for the PSI-4 (i.e., normative mean t-score of 50 and percentile of 50). However, only 12.5% ($n = 415$) of the sample had a percentile score at 85 or higher, which is the range for elevated stress or clinically significant stress on the PSI-4 (Abidin, 2012). On subscales, scores were consistent with the normative sample scores on the parental distress subscale (mean t-score = 49.5, standard deviation = 9.5; mean percentile = 50.9, standard deviation = 27.7) while scores, on average, were slightly elevated on the PCDI subscale (mean t-score = 53.1, standard deviation = 8.5, mean percentile 62.7, standard deviation = 22.5) and the difficult child subscale (mean t-score = 54.3, standard deviation = 10.0; mean percentile = 64.1, standard deviation 26.3).

Parent and Family Variables

Table 2 provides the PSI-4 Total Stress levels associated with three dichotomous parent informant and family variables: (a) parental relationship to the child (i.e., mother, father), (b) marital status with all non-married subcategories grouped together, and (c) number of children in the household in service (i.e., one, two). Of these variables, the number of children in the household in service was associated with observed differences in PS with families with two children in service experiencing higher stress than those with one child in service. However, the group means differed by only 0.73 units and zero fell within the 95% CI [−2.37, 0.95] suggesting uncertainty in the true difference. With regard to the Probability of Direction (PD; the proportion of the

Table 2 Levels of total stress associated with dichotomous family variables

Variable	Score		T-Score		Percentile	
	Mean (Sd)		Mean (Sd)		Mean (Sd)	
Parent Relationship	Mother	Father	Mother	Father	Mother	Father
	84.8 (23.4	83.6 (22.2	52.5 (8.9	52.0 (9.2)	59.5 (24.9)	57.9 (26.2)
Marital Status	Married	Not Married	Married	Not Married	Married	Not Married
	84.75 (23.9)	84.3 (21.3)	52.5 (9.0)	52.3 (8.8)	59.3 (25.1)	59.1 (24.9)
Children in Service	1	2	1	2	1	2
	84.6 (23.3)	86.7 (22.4)	52.4 (9.0)	53.2 (9.3)	59.2 (24.9)	61.2 (26.4)

Note: Sd = Standard deviation

posterior distribution that is above or below zero reflecting the certainty of *direction*), the value was 80.25% providing moderate confidence the effect is negative (i.e., 1 child is associated with lower stress than 2 children). However, with a Region of Practical Equivalence (ROPE; defined as the range of values around zero that are considered *practically equivalent* to a no effect) score of 57.97%, a majority of the effect fell within the region of practical equivalence [−0.90, 0.90]. With a Bayes Factor (BF; quantification of the strength of evidence) of 0.168, the evidence favors the null hypothesis (H_0) over the alternative hypothesis (H_1). Thus, there are likely no meaningful differences in Total Stress t-scores between households with one and two children in services. The other variables (i.e., marital status, relationship to the child) were not associated with differences in scores.

We determined the association between ethnicity and Total Stress t-scores using a Bayesian linear regression with categorical ethnicity predictors, which is the Bayesian equivalent to an analysis of variance. Figure 1, panel A illustrates the differences associated with ethnicity on parent total stress scores when considered as a variable in isolation. The highest levels of stress, graphed as t-scores, were observed for families identifying as White followed by Asian, the combined other group, Hispanic/Latino, and Black/African American. Pairwise comparisons (Fig. 1, panel B) indicate no overlap in the ranges (i.e., differences in t-scores) for several subgroupings.

Child Variables

The first child variable examined was age at diagnosis. The mean age of diagnosis was 40.2 months with a standard deviation of 15.7 months and a range of 11–153 months. While the majority of children were diagnosed at a young age, a full range of childhood ages were represented in the sample. The relationship between age at diagnosis and parent Total Stress was evaluated with a Bayesian correlation coefficient (ρ). The estimated correlation was $\rho = 0.08$ with a 95% CI of [0.047, 0.115], suggesting that the true association is likely small and positive (i.e., higher age at diagnosis is associated with slightly higher stress). The relatively narrow credible interval indicates low uncertainty around the estimate.

Table 3 depicts the Bayesian correlations between PSI-4 scores and Vineland-3 scores, including the subscales/subdomains of each. Several significant relations were noted. While Total Stress t-scores and Vineland-3 Total (i.e., adaptive behavior composite) were not meaningfully correlated, the motor skills subdomain of the Vine-

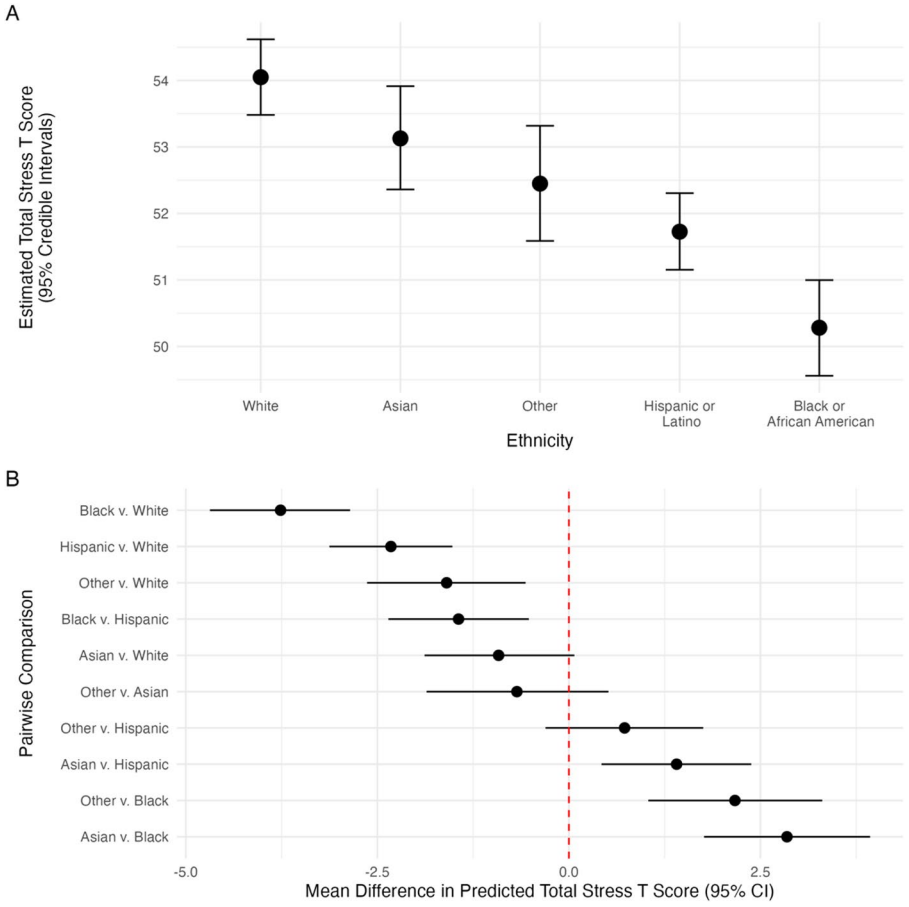

Fig. 1 Parenting total stress T-Scores by ethnicity group. Note: "Other" represents the combined categories of other or multiple ethnicity, and American Indian/Alaska native which together represented 5.2% of the sample

land-3 was negatively correlated with Total Stress on the PSI-4 (extreme evidence). The PCDI subscale was also negatively correlated with the Vineland −3 Adaptive Behavior Composite (extreme evidence). Several other subscales-subdomain pairs also showed meaningful correlations. Although the Parental Distress subscale was not meaningfully correlated with any subdomains of the Vineland – 3, the PCDI subscale was negatively correlated with the Daily Living, Socialization, and Motor Skills subdomains of the Vineland–3 (all with extreme evidence). In addition, the Difficult Child subscale of the PSI-4 was negatively correlated with the Socialization (extreme evidence) and the Motor Skills (very strong evidence) subdomains and was positively correlated with the Communication subdomain (extreme evidence). Interested readers can consult the supplemental materials for a parallel table of frequentist Pearson correlations. These show similar patterns, with some additional significant correlations—such as between the two Total scores and the Parental Distress subscale—as well as a few additional subdomain associations.

Table 3 Bayesian correlations between parenting stress and child adaptive behavior

	Total	Communication	Daily Living	Socialization	Motor Skills
Total Stress	ρ = −0.03 [−0.07, −0.00] BF_{10} = 0.19, *n* = 3122	ρ = 0.04 [0.01, 0.08] BF_{10} = 0.489, *n* = 3122	ρ = −0.04 [−0.07, −0.00] BF_{10} = 0.236, *n* = 3121	ρ = −0.11 [−0.15, −0.08] BF_{10} = >100, *n* = 3121***	ρ = −0.10 [−0.13, −0.06] BF_{10} = >100, *n* = 3072***
Parental Distress	ρ = 0.00 [−0.03, 0.04] BF_{10} = 0.028, *n* = 3122	ρ = 0.06 [0.02, 0.09] BF_{10} = 4.473, *n* = 3122	ρ = −0.01 [−0.05, 0.02] BF_{10} = 0.038, *n* = 3121	ρ = −0.05 [−0.08, −0.01] BF_{10} = 1.011, *n* = 3121	ρ = −0.06 [−0.09, −0.02] BF_{10} = 5.963, *n* = 3072
Parent-Child Dysfunctional Interaction	ρ = −0.13 [−0.16, −0.09] BF_{10} = >100, *n* = 3122***	ρ = −0.06 [−0.10, −0.03] BF_{10} = 9.317, *n* = 3122	ρ = −0.10 [−0.14, −0.07] BF_{10} = >100, *n* = 3121***	ρ = −0.18 [−0.22, −0.15] BF_{10} = >100, *n* = 3121***	ρ = −0.14 [−0.17, −0.10] BF_{10} = >100, *n* = 3072***
Difficult Child	ρ = 0.02 [−0.02, 0.05] BF_{10} = 0.04, *n* = 3122	ρ = 0.10 [0.06, 0.13] BF_{10} = >100, *n* = 3122***	ρ = 0.01 [−0.03, 0.04] BF_{10} = 0.03, *n* = 3121	ρ = −0.08 [−0.12, −0.05] BF_{10} = >100, *n* = 3121***	ρ = −0.07 [−0.10, −0.03] BF_{10} = 33.047, *n* = 3072**

Median posterior ρ with 95% credible intervals and Bayes Factors[11] * BF_{10} >10 (strong evidence), ** BF_{10} >30 (very strong evidence), *** BF_{10} >100 (extreme evidence) Prior scale used is Cauchy(0, 0.7071), meaning centered at zero and allowing moderate-sized correlations in either direction

Differences were associated with the number of categories of challenging behavior with a higher number of categories (*n* = 3, 4) resulting in higher total stress t-scores (see Fig. 2, panel A). We fitted a Bayesian linear model to predict the PSI-4 Total Stress t-score with total categories of challenging behavior modeled as a monotonic ordinal predictor variable (Bürkner & Charpentier, 2020). The estimate of the intercept (estimated Total Stress t score with no categories of challenging behavior) was 50.86 (95% CI [49.80, 51.72]) and the overall monotonic effect of more categories of challenging behavior was 0.66 (95% CI [0.38, 0.98]), which is the expected difference between zero categories of challenging behavior and four categories of challenging behavior. Modeling the predictor as a monotonic ordinal allows for estimating how much each transition between adjacent category levels contributes to the overall effect. These proportions reflect the expected increase in Total Stress associated with moving from one level of challenging behavior to the next (Bürkner & Charpentier, 2020). Simply, these parameters help understand which increase in the number of categories is associated with the largest increase in Total Stress levels. Estimates for the difference in transitioning to higher categories were 0.25 (95% CI [0.01, 0.54]; zero to one), 0.14 (95% CI [0.01, 0.39]; one to two), 0.37 (95% CI [0.09, 0.69]; two to three), and 0.24 (95% CI [0.02, 0.52]; three to four). These results suggest that stress increases most notably when transitioning between two and three categories of challenging behavior.

We also examined the effects of categories of the number of challenging behaviors on subscale scores (see Fig. 2, panels B, C, and D). In addition to the clear effects on Total Stress, the subscales most impacted by more categories of challenging behavior were Difficult Child and PCDI with little effect observed on the Parental Distress subscale. Specific categories of challenging behavior were differentially associated with increased scores on Total Stress and subscale scores. Elopement was not strongly associated with increased Total Stress scores or any subscale scores while the other

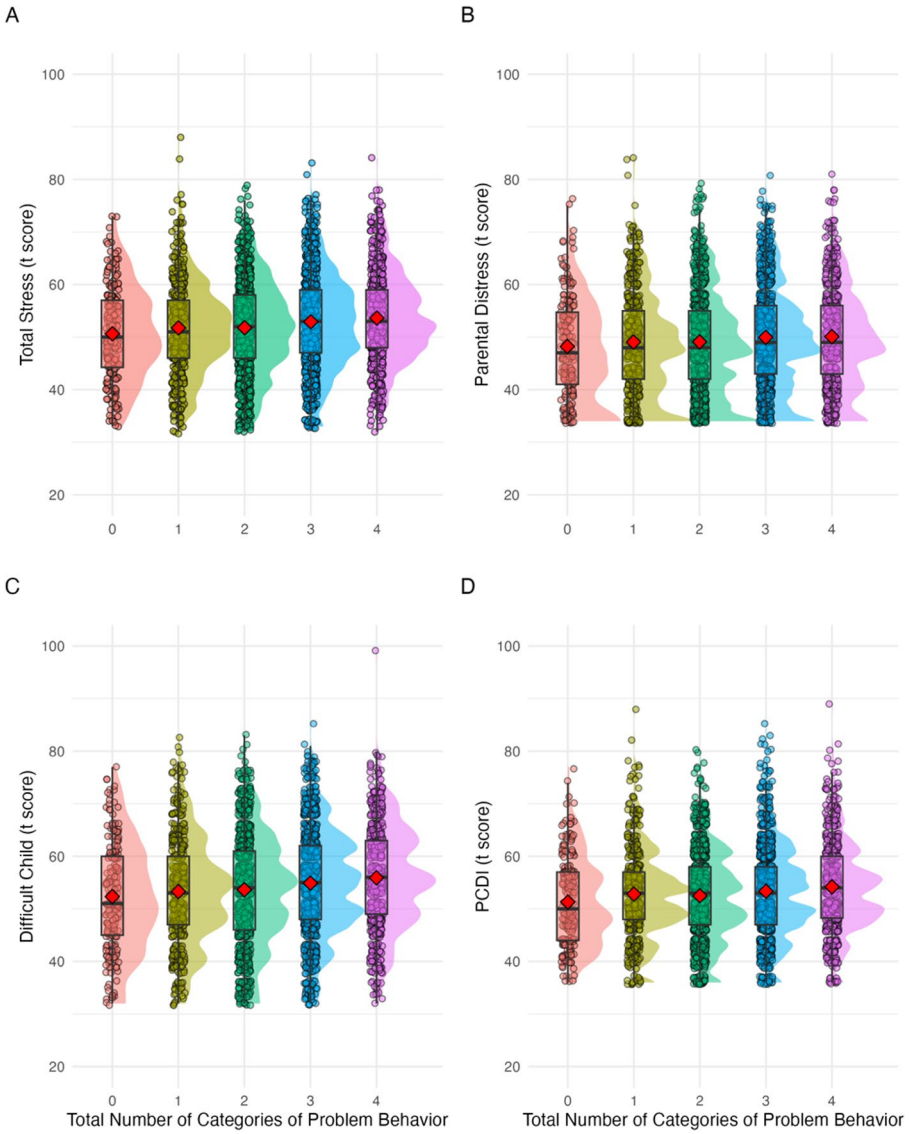

Fig. 2 Parenting stress T-Scores by number of categories of challenging behavior. Note: This figure displays a half violin plot combined with a box plot. The half violin plot represents the density of the data. The box represents the interquartile range (i.e., encompassing 50% of the data), the whiskers extend to 1.5 times the interquartile range, and the bold horizontal line represents the median value. The red diamond represents the mean

three topographies were each associated with moderate to overwhelming evidence of increased t-scores on Total Stress or at least one subscale: (a) aggression (Total, Difficult Child, PCDI), (b) property destruction (Difficult Child), and (c) self-injurious behavior (Total, Difficult Child, PCDI) (see the supplemental materials for additional details on the Bayesian analyses for each category).

Regression Analysis

After examining the aforementioned variables in isolation, we constructed a larger multivariate regression model to determine the extent to which the variables were jointly associated with Total Stress levels. To do this, and in most regression models, the model is constructed such that the *effect of a variable* is in comparison to some reference value, and this reference value is contained in the intercept. To achieve an interpretable intercept (e.g., a realistic age versus an age of zero), we chose to center our numeric predictors at the sample means and specifying nominal categorical variables with the most prevalent value as the reference group. Predictor variables included: (a) Vineland-3 Total (i.e., Adaptive Behavior Composite) score (centered at the sample mean of 67.3), (b) age at diagnosis in months (centered at the sample mean of 40.2), (c) total categories of challenging behavior (as a monotonic ordinal predictor), (d) number of children in service (1 [reference], 2), (e) ethnicity (white [reference], (f) marital status (married [reference], not married), and (g) parental relationship (mother [reference], father). Therefore, our intercept represented a white, married mother with one child in service and a child 40.2 months old with a Vineland-3 Total score of 67.3 and no challenging behaviors. We compared three models: one with main effects only, one with a single interaction between Vineland and age at diagnosis, and one with an interaction between Vineland-3 and age at diagnosis and an interaction between Vineland-3 and total categories of challenging behavior. Leave-one-out cross validation (LOO; Vehtari et al., 2017) suggested the second model with only one interaction term provided the highest predictive performance.

The estimated Total Stress t-scores for the reference group (child with Vineland = 67.3, diagnosed at 40.2 months, with no challenging behaviors and family attributes of one child in service, married, and a mother) was 52.32 (95% CI [51.04, 53.42]). Each one-point increase in Vineland-3 score was associated with a small decrease in stress (0.04, 95% CI [−0.07, −0.01]) while each additional month of age of diagnosis was associated with a slight increase in stress (0.05, 95% CI [0.01, 0.03]). Having two children in service (vs. one) was associated with a modest increase in stress (0.84, 95% CI [−0.85, 2.49]), but the wide credible intervals indicate considerable uncertainty. Likewise, being not married (vs. married) was associated with higher stress (0.18, 95% CI [−0.53, 0.89]) and being a father (vs. mother) was associated with lower stress (−0.85, 95% CI [−1.79, 0.11]), but both estimates were accompanied by higher uncertainty. The effects of ethnicity were largely consistent with the univariate analysis: compared to white, those identifying as Black/African American displayed the lowest amount of stress (−3.91, 95% CI [−4.86, −2.96]), followed by Hispanic/Latino (−2.37, 95% CI [−3.20, −1.54]), Other (−1.60, 95% CI [−2.66, −0.53]), and Asian (−0.53, 95% CI [−1.56, 0.48]). The effect of the total number of categories of challenging behaviors was also consistent with the Simple regression model. In this model, the overall monotonic effect of increasing from zero to four categories was 0.71 (95% CI [0.42, 1.06]). Estimates for the difference in transitioning to higher categories were 0.27 (95% CI [0.02, 0.57]; zero to one), 0.16 (95% CI [0.01, 0.43]; one to two), 0.38 (95% CI [0.12, 0.69]; two to three), and 0.19 (95% CI [0.01, 0.45]; three to four). These results suggest stress increases most notably

when transitioning from two to three categories of challenging behavior, followed by the transition from zero to one.

Discussion

Parents of children with ASD experience significantly more PS than parents of other children (Barroso et al., 2018; Hayes & Watson, 2013; Leonardi et al., 2021; Olsen et al., 2022), with prior studies identifying child variables (e.g., challenging behavior, adaptive behavior, age of the child) and parent and family variables (e.g., parent informant, socio-cultural variables) as influencing levels of PS (LeBlanc et al., 2024; Postorino et al., 2019; Stephenson et al., 2023; Williams et al., 2019). However, most studies of PS have had relatively small sample sizes (e.g., 20–200 parents), somewhat limited diversity, and limited information about family access to treatment resulting in a need for additional studies of the influence of these variables.

LeBlanc et al. (2024) provided an examination of PS in the context of behavioral treatment with a large, diverse sample of over 400 parents of young children with ASD. Though total stress scores at intake were slightly elevated on average (mean = 56th percentile; 10.6% of families in the elevated or clinically significant range), families in their sample were not experiencing as much stress as in many in previously published studies of PS (Kiami & Goodgold, 2017; Mello et al., 2022; Patel et al., 2022). LeBlanc et al. hypothesized that the fact that all children had access to behavioral treatment may have contributed to the observed low levels of PS compared to other studies conducted outside of the treatment context, perhaps due to an early age of diagnosis and access to treatment services. While challenging behavior and adaptive behavior were related to PS levels, LeBlanc et al. did not examine many of the other family and child variables that might influence PS (e.g., race/ethnicity, number of children, parental relationship).

This cross-sectional follow-up study to LeBlanc et al. (2024) examined PS at intake to behavioral treatment in a diverse sample of over 3000 families, including over 400 fathers and over 100 families with multiple children with ASD in treatment services. This sample is significantly larger than any previously published study on PS and included multiple child and family variables in a multi-variate analysis. Overall, PS Total Scores for the entire sample were similar to LeBlanc et al. (2024) in that the average score was slightly higher than the normative sample, but only about 12% of the sample scored in the elevated or clinically significant range. These findings are similar to the findings of LeBlanc et al. (2024) indicating that families that continued responding and were included in the longitudinal analysis had similar levels of stress to those who respond only the first time. These levels of PS are similar to Olsen et al. (2022), who reported similar PSI t-scores (i.e., above the normative mean, but not in the clinically significant range) for parents of children with ASD under age 3. However, these results are lower than those reported in other studies of families of young children, including those who had access to early intervention (unspecified model) services (Mello et al., 2022; Patel et al., 2022).

Parent Informant and Family Context Variables

A few studies have evaluated PS for parents of children with ASD across racial and ethnic groups and have indicated that Asian American and Black/African American parents of children with ASD tend to experience higher levels of PS than other racial or ethnic groups (DeLambo et al., 2010; Kim et al., 2020; Williams et al., 2019). The current study represents one of the largest and most diverse sets of families with similar sized samples identifying as White/Caucasian (943; 28.1%) and Hispanic or Latin(a)/(o) (912, 27.2%) and as Back/African American (585, 17.5%) and Asian (488, 14.6%) and a smaller combined group of Other or Multiple Ethnicity and American Indian/Alaska Native (5.2%). The equal distribution across race/ethnicity is important as other large samples studies such as Kim et al. (2020) examined a predominantly while sample (70%) and significantly smaller samples of other groups (i.e., 4–11% depending on the group).

White/Caucasian families reported the highest levels of PS (significantly different than Black/African American, Hispanic/Latino, and a combined other group) followed by Asian families (significantly different than Hispanic/Latino and a combined other group). In contrast, Black/African American families reported the lowest levels of PS, which is in contrast to the findings of Williams et al. (2019) and Kim et al. (2020) who found higher PS in these groups. Kim et al. (2020) found higher PS in this group using a 3-item combined score from a national children's health survey and it is possible that the use of a different measure of PS contributed to the difference in findings. In addition, one notable difference between the current study and many other studies on PS is early access to diagnostic and behavioral treatment services. That is, families of every ethnicity in this sample had obtained a diagnosis and behavioral treatment at a relatively young age whereas many other studies of PS have examined across a larger age range and have not focused on families in intensive behavioral treatment (e.g., Giannotti et al., 2023; Hayes & Watson, 2013). Kim et al. (2020) found that race/ethnicity moderated the effects of resilience (i.e., higher resilience, less PS), particularly for Black/African American parents and parents who reported no emotional support had higher stress regardless of race/ethnicity. It may be that access to services serves as a protective factor for PS either directly via child improvements or provision of emotional support or indirectly through a third variable such as resilience, which might influence navigating access to services as well as PS. Finally, it is worth noting that in spite of the differences observed between groups, total stress t-scores were, on average, below 55 with similarly shaped distributions of scores and small tails in the range of elevated or clinically significant stress (see supplemental materials) for every race/ethnic group.

The prior literature on the number of children with ASD and PS is limited, in spite of the increased likelihood of recurrence within siblings. Thompson-Hodgetts et al. (2024) interviewed a small number of mothers of multiple children with neurodevelopmental disability and found negative impact on wellbeing due to increased caregiving demands. However, Sim et al. (2017) included families with multiple diagnosed children with ASD and did not find the number of diagnosed children to be significantly related to PS. Our findings suggest there is a small increase in PS with a second child with ASD in services, though the wide credible interval limits

the confidence in this difference and that other variables are more strongly associated with differences in PS. While this may seem counterintuitive, it may be that families stress does not double but increases a small amount with a second child with ASD because of their previous experiences with the first child. For example, since they have already successfully navigated systems related to accessing diagnostic and treatment services once, they may feel better prepared to do so again (i.e., higher self-efficacy; Hastings & Brown, 2002) mitigating some of the stress associated with navigating these systems (Boshoff et al., 2019; Moh & Magiati, 2012).

The literature has been mixed regarding differences in PS levels between mothers and fathers and the variables that might be influencing stress (Baker-Ericzén et al., 2005; Dijkstra-de Neijs et al., 2024). Our findings are consistent with studies that have shown comparable levels of stress for mothers and fathers (Davis & Carter, 2008; Hastings et al., 2005), although it is important to note that the mothers and fathers in this study were not dyads parenting the same child. That is, only a single parent completed the PSI-4 for each child with ASD. Our data suggest that on average, in a large diverse sample of parents, mothers and fathers experienced similar levels of stress and that other variables (e.g., ethnicity, challenging behavior, adaptive behavior) were more influential. Like many studies on PS, many more mothers are represented than fathers (Flippin & Crais, 2011); however, this is one of the largest published samples of fathers with over 400. In addition, these mothers and fathers were actively enrolled in behavioral treatment for their child(ren), which may positively influence them compared to families that do not have access to treatment. That is, these mothers and fathers showed comparable levels of PS and those levels were lower for each group than in previous studies examining stress outside of the context of treatment (e.g., Dijkstra-de Neijs et al., 2024) or while on a waiting list for services (Patel et al., 2022).

Child Variables

Perhaps the most consistent finding on PS and ASD is that the presence of child challenging behavior increases PS (Hayes & Watson, 2013; Mello et al., 2022; Postorino et al., 2019; Stephenson et al., 2023). The influence of these behaviors on PS has been shown to be more significant than other variables such as severity of ASD symptoms, timing of diagnosis, and family socioeconomic status (Bonis, 2016; Hickey et al., 2022; Olsen et al., 2022). LeBlanc et al. (2024) found that the presence of multiple categories of challenging behaviors was associated with higher levels of PSI-4 Total Stress scores.

Our current findings replicate the effects of the strong influence of challenging behavior on PSI-4 Total Stress scores (Mello et al., 2022; Postorino et al., 2019; Stephenson et al., 2023) and extend the literature by examining these effects with respect to specific topographies of challenging behavior and the influence of various subscale scores. The Difficult Child and PCDI subscale scores were most influenced by more categories of challenging behavior with no clear effect on the Parental Distress subscale. In addition, elopement was not associated with increased scores while each of the other three categories were associated with moderate to overwhelming evidence of increased Total Stress and subscale scores. These findings contribute to the over-

whelming evidence supporting the relationship between challenging behavior and PS and suggest that future studies should perhaps include an analysis of subscale scores. However, the finding of differential effects for the specific topography categories (i.e., no effect of elopement, strong effects for the other three categories) suggests that challenging behavior should not be examined as a monolith as some behaviors may have less effect on PS while others have a strong effect.

Our findings are preliminary and should be further examined in additional studies investigating whether specific topographies of behavior are associated with differential effects on parental stress and well-being. For example, it is unclear why elopement was not associated with increased stress given the safety risks for this behavior, but several possible factors might contribute to this finding. First, it is possible that elopement is too broad of a category that could encompass bolting across the room in a large but safe area such as a treatment center, bolting out the front door of a building into a parking lot or street, and wandering away in public. The first situation might not impact parent stress while the other two might produce significant stress and worry. Second, there may be differences in family perspectives and level of concern about elopement versus other externalizing behavior such as aggression particularly for younger children such as those included in this sample. Third, parents may be more comfortable using strategies to prevent or manage elopement in public (e.g., holding hands with their young child to prevent elopement) than they are managing another behavior, such as property destruction, which could influence the amount of stress experienced during public outings. In summary, this interesting finding about the effects of different topographies should be taken as an initial finding worthy of additional research rather than as evidence that elopement does not influence parent stress.

At the level of total scores, no strong association was noted between the PSI-4 Total Stress t-scores and the Vineland-3 Total (i.e., adaptive behavior composite) scores. This finding is similar to LeBlanc et al. (2024) where overall Vineland scores were not strongly related to PS, but change scores on the Vineland across one year were related to PS. However, several subdomains on the Vineland-3 were negatively correlated with PSI-4 Total scores and two (PCDI, Difficult Child) of the three PSI-4 subscales. Similar to the findings with challenging behavior, the Parental Distress subscale was not correlated with any aspect of adaptive behavior, suggesting that the uniquely stressful aspects of parenting a child with ASD are not sampled in the items of this subscale of the PSI-4. These findings are consistent with other studies that have found that lower levels of child adaptive behavior are associated with higher PS (Baker-Ericzen et al., 2005; Mello et al., 2022; Tomanik et al., 2004) and specifically with Mello et al. (2022) who found higher scores on the PCDI subscale when child adaptive behavior scores were lower.

The final child variable examined in our analysis was the child's age at diagnosis, which ranged from 11 to 153 months (i.e., 12.75 years) with a mean age of 40.2 months (i.e., 3.33 years). While the majority of children were diagnosed at a young age, a full range of childhood ages were represented in the sample. Our findings indicate that there is a small, positive correlation between age at diagnosis and PS (i.e., older age of diagnosis, higher stress), and the regression analysis indicated that each additional month older that the mean age at diagnosis was associated with a 0.05 unit

increase in stress scores. These findings are consistent with other studies that have indicated that the diagnostic process, especially when it is lengthy or delayed, can be stressful for parents or have a negative impact on wellbeing (Boshoff et al., 2019; Hickey et al., 2022; Meads et al., 2024). These findings also support the results of Hickey et al. (2022) who found less of negative impact on parent wellbeing with a younger age at diagnosis and stand in contrast to those of Osborn et al. (2008) who found higher stress with a younger age at diagnosis. Unlike some other studies on PS, all families in this analysis had access to behavioral treatment services at the time of completion of the PSI-4 (i.e., within a month of the start of treatment) which may account for, or partially account for, the lower levels of stress observed in this sample compared to other published studies on PS (Kiami & Goodgold, 2017; Mello et al., 2022; Patel et al., 2022). That is, is it possible that access to evidence-based treatment may mitigate some of the stressful effects of parenting a child with ASD even at the beginning of services, particularly when access occurs before school age. However, it is not possible to draw strong conclusions about the effects of access to treatment due to the lack of a no-treatment control group and the retrospective nature of the study.

Limitations and Conclusions

Several limitations are worthy of note, at least some of which are related to the retrospective nature of this study. Unfortunately, diagnostic information was not available for all participants in the sample and the information that was available was from a variety of tools (e.g., ADOS-2, CARS-2, ASRS). Thus, we were not able to use diagnostic symptom severity in the statistical model, though some prior studies have found differential effects of symptom severity on PS. Thus, these findings should not be interpreted as indicating that any of the variables that we examined have stronger impacts on PS than those that we were unable to examine. In addition, our measure of challenging behavior was based on only four categories of behavior with significant implications for health and safety (e.g., self-injurious behavior, elopement), whereas other studies have used a broader range of behavior including stereotypic, disruptive, and repetitive behavior (Postorino et al., 2019; Stephenson et al., 2023) and used rating scales as the measure of challenging behavior (Postorino et al., 2019; Rodriguez et al., 2019; Stephenson et al., 2023). With respect to findings related to multiple children in services, there certainly may have been families in our sample who had multiple children with ASD, but only one was receiving treatment services. Thus, we are not able to draw conclusions about the effects of multiple children with ASD and must limit conclusions to families with multiple children in treatment.

In summary, this retrospective cross-sectional study on PS included one of the largest, most diverse samples of families of children with ASD at the beginning of behavioral intervention services. Overall levels of PS were relatively low compared to other studies examining PS in families of children with ASD, which may be in part due to access to diagnostic and treatment services when the child is young. Given the increased access to services for young children throughout the U.S., this may suggest that it is important to examine variables that influence PS for families with access to treatment as the patterns of PS may look different in that context. Although overall

levels of PS were relatively low compared to other published studies of PS, evidence was found for the influence of various parent and family context variables (e.g., race/ethnicity) and child variables (e.g., challenging behavior, adaptive behavior, age at diagnosis). Other variables (e.g., one versus two children in service, marital status) had negligible effects or highly uncertain small effects on PS for these families.

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Author Contributions The first four authors (LL, CS, CM, BK) contributed to the study conceptualization and design. The first draft of the manuscript was written by the first(LL), second(CS), and fourth (BK)authors. The fourth author(BK) provided all statistical analyses and created all figures, tables, and supplemental materials. The first four authors edited, commented on, and approved the final manuscript. The fifth (AC) and sixth (AS) authors retrieved data, checked the accuracy of the data, and assisted with the literature review.

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Data Availability De-identified data can be made available upon request to the first author. All data are provided in the figures in boxplots and violin plots.

Declarations

Competing interests The first three authors are employed by and have equity in Action Behavior Centers. The fourth author served as an unpaid statistical research consultant. The fifth and sixth authors are employed by Action Behavior Centers.

Ethics Approval This archival study was reviewed and approved by the WCG Institutional Review Board and has been conducted in compliance with the guidelines of this board as well as ethical guidelines of the Behavior Analyst Certification Board and in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Human Ethics and Consent To Participate This archival study did not require additional consent beyond the initial informed consent for services, which included acknowledgement of inclusion of data in aggregate outcomes analyses to be presented only in deidentified form.

Data Inclusion Data from 422 of these participants were included as the Time 1 PSI-4 measurement in a longitudinal analysis of parenting stress published in LeBlanc et al. (2024).

Potential COIs The first three authors have equity in, and are employed by the company (name redacted for blind review). The fifth and sixth authors are employed by the company (name redacted for blind review). No other potential conflicts are noted.

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Authors and Affiliations

Linda A LeBlanc[1] · Claire Schutte[1] · Charna Mintz[1] · Brent A Kaplan[2] · Avery Caffee[1] · Alec Sweatman[1]

✉ Linda A LeBlanc
linda.leblanc@actionbehavior.com

Claire Schutte
claire.schutte@actionbehavior.com

Charna Mintz
charna.mintz@actionbehavior.com

Brent A Kaplan
brentakaplan@gmail.com

Avery Caffee
avery.cafee@actionbehavior.com

Alec Sweatman
alec.sweatman@actionbehavior.com

[1] Action Behavior Centers, Austin Texas, United States

[2] codedbx, Lexington, Kentucky, United States