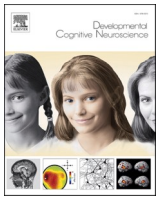
Developmental Cognitive Neuroscience 52 (2021) 101021

Contents lists available at ScienceDirect

Developmental Cognitive Neuroscience

journal homepage: www.elsevier.com/locate/dcn



An update on the assessment of culture and environment in the ABCD Study®: Emerging literature and protocol updates over three measurement waves

Raul Gonzalez [a,*], Erin L. Thompson [a], Mariana Sanchez [b], Amanda Morris [c], Marybel R. Gonzalez [d], Sarah W. Feldstein Ewing [e], Michael J. Mason [f], Judith Arroyo [g], Katia Howlett [h], Susan F. Tapert [d], Robert A. Zucker [i]

[a] Center for Children and Families and Department of Psychology, Florida International University, USA
[b] Department of Health Promotion and Disease Prevention, Robert Stempel College of Public Health & Social Work, Florida International University, USA
[c] Amanda Sheffield Morris, Laureate Institute for Brain Research and Oklahoma State University, USA
[d] Department of Psychiatry, University of California, San Diego, USA
[e] Department of Psychology, University of Rhode Island, USA
[f] Center for Behavioral Health Research, University of Tennessee, USA
[g] National Institute on Alcoholism and Alcohol Abuse, USA
[h] National Institute on Drug Abuse, USA
[i] Department of Psychiatry and Addiction Center, University of Michigan, USA

ARTICLE INFO

Keywords:
substance use
Development
family effects
social interactions
acculturation
cultural identity

ABSTRACT

Advances in our understanding of risk and resilience factors in adolescent brain health and development increasingly demand a broad set of assessment tools that consider a youth's peer, family, school, neighborhood, and cultural contexts in addition to neurobiological, genetic, and biomedical information. The Culture and Environment (CE) Workgroup (WG) of the Adolescent Brain Cognitive Development (ABCD) Study curates these important components of the protocol throughout ten years of planned data collection. In this report, the CE WG presents an update on the evolution of the ABCD Study® CE protocol since study inception (Zucker et al., 2018), as well as emerging findings that include CE measures. Background and measurement characteristics of instruments present in the study since baseline have already been described in our 2018 report, and therefore are only briefly described here. New measures introduced since baseline are described in more detail. Descriptive statistics on all measures are presented based on a total sample of 11,000+ youth and their caregivers assessed at baseline and the following two years. Psychometric properties of the measures, including longitudinal aspects of the data, are reported, along with considerations for future measurement waves. The CE WG ABCD® components are an essential part of the overall protocol that permits characterization of the unique cultural and social environment within which each developing brain is transactionally embedded.

1. Introduction

Leading comprehensive models on risk and resilience factors for development of substance use and mental health problems emphasize the interactions of environmental, genetic, and other biological factors across development (Bronfenbrenner and Ceci, 1994; Steinberg, 2010; Vanyukov et al., 2012). They also highlight the important role of an individual's socio-cultural context, such as family, school, and peer interactions, during adolescence. Despite decades of advances in understanding pathways to substance use, addiction, and mental health problems, progress is often hampered by reliance on geographically confined convenience samples, cross-sectional designs, and sacrificing the breadth of factors examined for a focus on a few select areas of inquiry often examined in isolation.

The Adolescent Brain Cognitive Development (ABCD) Study®, entering its fifth annual measurement wave at the time of this report,

* Correspondence to: Department of Psychology, Psychiatry, and Immunology, Florida International University, 11200 SW 8th Street, AHC4, 461, Miami, FL 33199, USA.
E-mail address: raul.gonzalezjr@fiu.edu (R. Gonzalez).

https://doi.org/10.1016/j.dcn.2021.101021
Received 1 June 2021; Received in revised form 31 August 2021; Accepted 14 October 2021
Available online 16 October 2021

addresses the aforementioned issues and moves the field forward in impactful ways by following a diverse national cohort over a decade of life during the transition from childhood to early adulthood. The ABCD Study® uses a transdisciplinary approach that spans genetic, neuroimaging, neurocognitive, mental health, substance use, family, interpersonal, cultural, and environmental factors, among others. Together with an open-science framework, this allows for an unprecedented opportunity to examine complex models that integrate these various elements to better understand their interactions as potential predictors, moderators, and mediators of adolescent risk and resilience.

The ABCD Study® is organized with multiple working groups that consider and curate measures within members' respective areas of expertise. The Culture and Environment working group (CE WG), described previously (Zucker et al., 2018), is responsible for selecting measures and monitoring data pertaining to cultural factors and the social environment. To our knowledge, there are at least 17 published studies to date using CE measures, covering unique associations between family factors (e.g., conflict, monitoring, acceptance/warmth) and amygdala reactivity (Demidenko et al., 2021); suicidality (Janiri et al., 2020), maladaptive guilt (Donohue et al., 2020), eating disorders (Kerr et al., 2021), and early substance exposure (Wang et al., 2021). In addition, school factors and prosocial behavior appear uniquely associated with general psychopathology, accounting for comorbidities across internalizing and externalizing behaviors (Brislin et al., 2021). Parental warmth and positive school environments may buffer the effects of neighborhood disadvantage on resting-state functional connectivity (Rakesh et al., 2021). CE measures have also been used to create broad constructs of children's biopsychosocial ecologies, clarifying distinctive ways multiple environmental factors covary and are associated with brain organization, cognition, physical activity, behavioral activation and inhibition, and curiosity about alcohol use (M. Gonzalez et al., 2020; Guerrero et al., 2021; Modabbernia et al., 2021; Wade et al., 2021; Zhang et al., 2020).

Specifically, using ABCD baseline data (data release 2.0.1) from 11,875 youth, M. Gonzalez et al. (2020) identified 22 proximal measures posited to be associated with brain structure and cognition across several areas: economic security; psychosocial ecologies; school/-community environment; risk for adverse childhood experiences; psychological health; and perinatal wellbeing (i.e., birth weight, gestational age, prenatal conditions, etc.). These were found to constitute three separate factors: higher access to resources and lower adversity (LF1); social support (LF2); and perinatal wellbeing (LF3). LF1 was found to have a greater impact on measures of brain health among higher-income families compared to lower income families. However, youth from lower-income families that had the highest LF1 scores benefited comparably to their higher-income peers. In contrast, LF2 and LF3 were found to benefit all youth regardless of their family income. Using the same data release, Modabbernia et al. (2021) examined 72 measures, including school engagement and environment, family environment, and neighborhood environment, in relation to various measures of brain structure and function. They identified 14 patterns of covariation among measures that were associated with brain development. Those consisting of income, quality of parent engagement, psychopathology, cognitive ability, and perinatal events were most consistently associated with the neuroimaging data. The authors found that scores on measures often clustered into groups, suggesting that some characteristics and behaviors are rarely isolated. Although both aforementioned studies were cross-sectional (given that longitudinal data from the entire ABCD sample has only recently been released), studies such as these highlight the value of CE measures and provide clues on how resources may be more efficiently targeted and deployed to youth who need them most in ways that maximize their benefit.

Here, we provide an update of the CE WG protocol and new psychometric data since our last report (Zucker et al., 2018), when data were available only on a portion of the sample (N = 4104 youth; N = 4098 caregivers) at baseline. This report contains data on the full sample at baseline, most of the 1-year follow-ups (Y1), and nearly half of the 2-year follow-ups (Y2). Longitudinal data since our last report now makes it possible to examine test-retest reliability and changes in scores over time. Finally, we present information on changes and additions to CE measures already being used in data collection that will be part of upcoming data releases and discuss future directions. Collectively, this information will serve as a resource to investigators using ABCD data and facilitate use of the CE measures.

2. Methods

2.1. Participants

The data used in the current study were from the ABCD Study 3.0 release, which included data collected up to January 15, 2020, and are available upon request from the National Institute of Mental Health data archive (NDA). Across the 21 sites, 11,878 children ages 9–10 enrolled in the study. Within the current report, 11,874 children and/or their caregivers completed at least one CE measure at baseline, with slightly lower frequencies at Y1 (n = 11,208). Given timing differences in recruitment across sites, a little over half of participants' data were available at Y2 (n = 6553). Table 1.

2.2. Data analysis plan

SPSS 26 (IBM Corp. Released, 2019) was used for obtaining means, standard deviations, internal consistencies using Cronbach's alpha (Tables 3 and 4), correlations across measures with both youth and caregiver reports (Table 5), and test-retest reliability across waves using single-rating, absolute-agreement, two-way mixed effects models of intraclass correlation coefficients (ICC) (Table 8), as recommended by Koo and Li (2016). Cronbach's alphas below 0.50 were considered poor, between 0.50 and 0.69 were considered modest, between 0.70 and 0.79 were considered acceptable, and over 0.80 were considered good (Nunnally and Bernstein, 1994). ICC values greater than 0.90 were indicative of excellent reliability, between 0.75 and 0.90 indicative of good reliability, between 0.50 and 0.75 indicative of moderate reliability, and less than 0.50 as poor reliability (Koo and Li, 2016).

Mplus Version 7.4 (Muthen and Muthen, 1998–2012) was used for the remaining analyses, wherein we accounted for nesting of participants among sites and within families. We addressed missing data on the covariates using full information maximum likelihood and Monte Carlo integration. Participants were classified as "higher risk" or "lower risk" at screening based on youth's risk for future cannabis use using the 5-item screener developed by Loeber et al. (2018). Mean differences across risk scores were examined adjusting for sex, age, race, ethnicity, caregiver education, combined household income, and caregiver marital status, excluding analyses for the Native American Acculturation Scale, which did not adjust for race or ethnicity (Tables 6 and 7). This allowed us to parse out variance accounted for by other important sociodemographic factors when examining a specific CE measure. The choice of covariates was informed by theory and prior literature suggesting that the aforementioned may influence factors assessed among CE measures. Furthermore, these correspond with the prespecified covariates provided in the ABCD Data Exploration and Analysis Portal (DEAP; Heeringa and Berglund, 2020; Dick et al., 2021). Effect sizes across risk scores were reported using Cohen's (1992) *d*s.

We also ran unconditional linear growth models to examine change for constructs assessed across all three time points. We assessed model fit using absolute fit indices, including the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). CFI values between 0.90 and 0.94 were used to indicate acceptable fit and values of 0.95 or greater were used to indicate excellent fit; RMSEA values of 0.06 or less were used to indicate excellent fit; and SRMR values of 0.08 or less were used to indicate good fit (Hu and Bentler, 1999). Given the targeted

Table 1
Demographics of ABCD study sample across waves.

Characteristic	Baseline (n = 11,878) N (%)	Y1 (n = 11,235) N (%)	Y2 (n = 6571) N (%)
Age in months, Mean (SD)	9.48 (0.5)	10.48 (0.6)	11.50 (0.7)
Biological Sex at Birth			
Male	6196 (52.2)	5879 (52.3)	3467 (52.8)
Female	5682 (47.8)	5356 (47.7)	3104 (47.2)
Pubertal Stage (Caregiver Report)			
Males			
Pre-pubertal	4161 (67.2)	3201 (54.4)	1185 (34.2)
Early to Post-pubertal	1781 (28.7)	2383 (40.5)	2119 (61.1)
Females			
Pre-pubertal	1677 (29.5)	755 (14.1)	137 (4.4)
Early to Post-pubertal	3788 (66.7)	4334 (80.9)	2793 (90.0)
Pubertal Stage (Youth Report)			
Males			
Pre-pubertal	1640 (26.5)	1573 (26.8)	702 (20.2)
Early to Post-pubertal	3830 (61.8)	3797 (64.6)	2675 (77.2)
Females			
Pre-pubertal	1040 (18.3)	660 (12.3)	145 (4.7)
Early to Post-pubertal	3032 (53.4)	3980 (74.3)	2711 (87.3)
Are you transgender?			
Yes	12 (0.1)	16 (0.1)	19 (0.3)
Maybe	46 (0.4)	83 (0.7)	47 (0.7)
No	7113 (59.9)	9022 (80.3)	6059 (92.2)
Did not understand	4692 (39.5)	2054 (18.3)	388 (5.9)
Race/Ethnicity			
White	6182 (52.0)	5992 (53.3)	3738 (56.9)
Black	1784 (15.0)	1597 (14.2)	768 (11.7)
Hispanic	2411 (20.3)	2226 (19.8)	1271 (19.3)
Asian	252 (2.1)	243 (2.2)	140 (2.1)
Other	1257 (10.5)	1175 (10.5)	654 (10.0)
Sibling Status Within Study			
Single	7900 (66.5)	7395 (65.8)	4224 (64.3)
Sibling	1810 (15.2)	1738 (15.5)	984 (15.0)
Twin	2138 (18.0)	2072 (18.4)	1342 (20.4)
Triplet	30 (0.3)	30 (0.3)	21 (0.3)
Caregiver Completing Survey			
Biological Mother	10,136 (84.3)	9455 (84.2)	5508 (83.8)
Biological Father	1182 (10.0)	1227 (10.9)	756 (11.5)
Adoptive Parent	279 (2.3)	270 (2.4)	158 (2.4)
Custodial Parent	118 (1.0)	102 (0.9)	54 (0.8)
Other	163 (1.4)	144 (1.3)	76 (1.2)
Caregivers Completed in Spanish?			
No	11,226 (94.5)	10,624 (94.6)	6243 (95.0)
Yes	652 (5.5)	611 (5.4)	328 (5.0)
Caregiver Marital Status			
Married	7991 (67.3)	7624 (67.9)	4518 (68.8)
Widowed	97 (0.8)	109 (1.0)	72 (1.1)
Divorced	1082 (9.1)	1064 (9.5)	666 (10.1)
Separated	464 (3.9)	409 (3.6)	245 (3.7)
Never Married	1460 (12.3)	1235 (11.0)	605 (9.2)
Living with Partner	688 (5.8)	682 (6.1)	401 (6.1)
Caregiver Education			
No Degree	604 (5.1)	491 (4.4)	266 (4.0)
High School or Equivalent	1442 (12.1)	1238 (11.0)	677 (10.3)
Some College	1950 (16.4)	1825 (16.3)	1055 (16.1)
College Degree	4871 (41.0)	4688 (41.7)	2843 (43.3)
Graduate Degree	2994 (25.2)	2926 (26.0)	1719 (26.2)
Household Income			
Below $35,000	2290 (19.3)	1974 (17.6)	958 (14.6)
$35,000 - $74,999	2433 (20.4)	2201 (20.0)	1264 (19.2)
$75,000 - $100,000	1572 (13.3)	1460 (13.0)	873 (13.3)
Over $100,000	4565 (38.4)	4729 (42.1)	2976 (45.3)

Note. Caregiver refers to the individual completing the parent portion of the instruments. Percentages do not always add up to 100% due to missingness.

recruitment to increase the proportion of children from lower income families during the later stages of the recruitment process (Heeringa and Berglund, 2020), we do not believe the majority of missing data at Y2 (i.e., the third wave) was missing at random. Therefore, unconditional linear growth models were restricted to youth who had already completed the Y2 assessment as opposed to including the entire ABCD Study® cohort. Analyses used robust maximum likelihood estimates. Detailed results from these models are provided in Table 9 and are graphically depicted in Figs. 1–3. Finally, we provide two Supplementary Tables (S1 and S2) showing pairwise correlations among baseline measures, separately for youth and parents.

3. Measures and results

3.1. Measures of cultural/ethnic group membership, experiences, and values

3.1.1. Vancouver Index of Acculturation

The Vancouver Index of Acculturation (VIA) is a bi-dimensional measure that assesses adherence to American and Heritage cultures on separate subscales and was not developed for a specific racial/ethnic group (Ryder et al., 2000). Substantial evidence links substance use among youth with acculturation (Lui and Zamboanga, 2018; Thai et al., 2010). Previous studies have found that adolescents with stronger ties to "American" culture (compared to their "Heritage" culture) may be at increased risk for substance use (Schwartz et al.,2014; Szapocznik et al., 2007; Unger et al., 2000, 2009). In contrast, a strong commitment to heritage culture can promote social support and encourage values that are protective against risky behaviors like substance use (Lui and Zamboanga, 2018; Martinez et al., 2017; Schwartz et al.,2011, 2012; Unger

Table 2
Culture and environment measure descriptions and characteristics.

Measures	Description	Number of Items[a]		Administration Time (Minutes)		Waves Assessed	
		Youth	Caregiver	Youth	Caregiver	Youth	Caregiver
Cultural/Ethnic Group Membership Domain							
Vancouver Index of Acculturation-Short	Acculturation/Bi-culturalism	–	17	–	1.5	–	B, Y2
Acculturation via language proficiency and preference (PhenX)	Language preference & proficiency as acculturation proxy	5	5	0.5	1	B, Y1, Y2	B, Y1, Y2
Native American Acculturation Scale	Tribal affiliation and Native American cultural practices	–	9	–	0.1	–	B
Multi-Group Ethnic Identity-Revised	Racial/Ethnic identity	–	7	–	1	–	B, Y2
Mexican-American Cultural Values Scale[b]	Cultural values of familism, religion, independence, self-reliance	16	28	3	3.5	Y2	B, Y1, Y2
Perceived Discrimination Scale	Perceived discrimination	11	–	1.5	–	Y1, Y2	–
Proximal Social Environment Domain							–
School Risk and Protective Factors	School environment	12	–	1.5	–	B, Y1, Y2	–
School Attendance and Grades	School absences, grades, and individual education programs	2	7	0.5	1.5	Y2	Y2
Neighborhood Safety (PhenX)	Neighborhood safety & crime	1	3	0.5	0.5	B, Y1, Y2	B, Y1, Y2
Community Cohesion (PhenX)	Community cohesion, control, and collective efficacy	–	10	–	2	–	Y2
Social Interaction Domain							
Family Environment Scale (PhenX)[c]	Family relationships, personal growth, maintenance, and change	9	54	1	5	B, Y1, Y2	B, Y1, Y2
Acceptance Subscale from CRPBI-Short[d]	Parental warmth & acceptance of primary caregivers	5	–	1	–	B, Y1,	–
Parental Monitoring	Parental/caregiver monitoring	5	–	1	–	B, Y1, Y2	–
SDQ Prosocial Behavior	Youth's prosocial behavior	3	3	0.5	0.5	B, Y1, Y2	B, Y1, Y2
Peer Behavior Profile: Prosocial & Delinquent Peer Involvement	Peer involvement in prosocial and rule-breaking activities	6	–	0.5	–	Y2	–
Peer Network Health Protective Scale	Close friends' protective behaviors	6	–	1	–	Y2	–
Wills Problem Solving	Approaches to deal with problem situations	6	–	1	–	Y1	–

Note. B = Baseline. Y1 = 1-Year follow-up. Y2 = 2-Year follow-up. CRPBI = Children's Reports of Parental Behavior Inventory. SDQ = Strengths and Difficulties Questionnaire.

[a] Number of items includes all items administered rather than solely those included in subscale analyses.

[b] Youth completed two out of the five subscales.

[c] Six subscales; youth only completed the Conflict subscale, but across all three waves; caregivers completed the Conflict subscale across all three waves and the remaining five subscales at the 2-year follow-up.

[d] Youth reported on both caregivers if they identified a second adult who cares for them a significant amount of the time.

et al., 2009, 2014). Understanding bicultural orientations is also important as it has been linked with lower levels of risk behavior in adolescence and into emerging adulthood (Cano et al., 2020; Schwartz et al., 2015). The VIA captures these constructs in ABCD (Zucker et al., 2018) with two subscales, using a 9-point scale (1=*strongly disagree* to 9=*strongly agree*) with higher scores reflecting greater adherence to "American" or "Heritage" culture.

In an effort to maximize inclusivity, "Heritage" culture was solicited as an open-ended item at baseline data collection. Open-ended responses were subsequently recoded to create a 96-item drop-down menu of racial/ethnic and religious cultural affiliations reported by our participants (e.g., Argentinian, Eastern European, French Canadian, Jewish, Latter-day Saint). If a participant did not endorse a heritage culture outside of "American" culture, the questionnaire was considered complete, and the subsequent items were not administered. At baseline and Y2, only parents were administered the VIA; youth were considered too young to respond meaningfully about their cultural practices. The first administration of the VIA with youth is currently underway during the 3-year follow-up (Y3). Notably, some concerns from families and colleagues emerged over the years regarding the broad application of this measure across cultures where it may not be applicable and even insensitive. As such, modifications are being made to the language of the instrument and to limit administration to only first, second, and third generation immigrant families in future measurement waves.

With regard to psychometrics, the VIA demonstrated good internal consistency for both the "Heritage" and "American" culture subscales in the ABCD sample (Table 4). At baseline, approximately 65% of caregivers identified with a "Heritage" culture and completed the VIA (n = 7,842). The "American" culture subscale was moderately negatively skewed while the "Heritage" culture subscale showed a relatively symmetric distribution. Test-retest reliability between baseline and Y2 was adequate for "Heritage" and "American" culture. Youth classified as "higher risk" at screening had caregivers with lower scores on both "American" and "Heritage" culture subscales across measurement waves (with very small effect sizes), excluding the mean difference in heritage culture at Y2, which was not significant. Growth curves were not estimated for the VIA given that only two time-points were available.

3.1.2. Modified PhenX Acculturation (via language proficiency and preference)

Language proficiency and preference accounts for substantial variance in some measures of acculturation, so it is often used as a proxy. While this unidimensional language-based approach has its limitations in assessing multifaceted aspects of acculturation, the need for a language based, standardized short measure amenable for administration to children beginning at ages 9–10, led to the inclusion of the PhenX items to assess this construct (see Zucker et al., 2018 for further details), among youth and caregivers. The first item requires participants to rate how well they speak English (1 = *poor* to 4 = *excellent*), followed by a question on whether they speak or understand another language or dialect besides English. If no other language is spoken or understood, the questionnaire is considered complete and the subsequent items are not administered. Participants who endorse speaking another language are asked to identify the other language from a drop-down menu (based on open-field responses provided at baseline) and asked three follow up questions: 1) "How well do you speak (the other identified language)?" (1 = *poor* to 4 = *excellent*) 2) "What language do you speak most with your friends?" and 3) "What language do you speak most with your family?" Participants rate these two items on a 5-point scale ranging (1 = *other language all of the time* to 5 = *English all of the time*).

Approximately one quarter of the youth (n = ~4,000) and caregivers (n = ~3,800) reported speaking a language other than English. Spanish was by far the most common language endorsed across

Table 3
Psychometric characteristics of youth measures for each wave.

		Baseline					1-Year follow-up					2-Year follow-up				
Youth measures	Range	N	Skew	M	SD	α[a]	N	Skew	M	SD	α[a]	N	Skew	M	SD	α[a]
Cultural/Ethnic Group Membership Domain																
Language (friends)	1,5	4090	-1.64	4.50	0.77	–	3647	-1.48	4.46	0.76	–	2350	-1.73	4.53	0.73	–
Language (family)	1, 5	4090	-0.85	3.81	1.36	–	3647	-0.86	3.82	1.33	–	2350	-0.98	3.94	1.28	–
MACVS Familism-Obligation (M)	1, 5	–	–	–	–	–	–	–	–	–	–	6525	-0.34	3.88	0.68	0.77
MACVS Familism-Support (M)	1, 5	–	–	–	–	–	–	–	–	–	–	6524	-0.80	4.17	0.63	0.83
MACVS Familism-Referent (M)	1, 5	–	–	–	–	–	–	–	–	–	–	6526	-0.35	3.79	0.76	0.84
Perceived Discrimination Scale (M)	1, 5	–	–	–	–	–	10,866	3.47	1.18	0.39	0.76	6392	3.98	1.15	0.33	0.76
Proximal Social Environment Domain																
SRPF School Environment (T)	6, 24	11,853	-0.88	19.93	2.83	0.61	11,195	-0.95	20.41	2.70	0.65	6531	-0.64	19.60	2.82	0.71
SRPF School Involvement (T)	4, 16	11,853	-0.86	13.06	2.37	0.65	11,195	-0.89	13.28	2.28	0.69	6531	-0.60	12.69	2.34	0.72
SRPF School Disengagement (T)	2, 8	11,853	0.66	3.74	1.46	0.20	11,194	0.60	3.82	1.39	0.19	6531	0.54	3.95	1.35	0.26
School Attendance	0, 6	–	–	–	–	–	–	–	–	–	–	6440	6.51	0.09	0.44	–
School Grades	1, 12	–	–	–	–	–	–	–	–	–	–	6432	1.34	3.17	1.34	–
Neighborhood Safety	1, 5	11,854	-1.02	4.03	1.10	–	11,195	-1.15	4.15	1.00	–	6533	-1.04	4.10	0.99	–
Social Interaction Domain																
FES Conflict Subscale (T)	0, 9	11,854	0.94	2.04	1.95	0.68	11,195	1.04	1.92	1.84	0.67	6531	1.06	1.87	1.84	0.66
CRPBI Acceptance (M, primary caregiver)	1, 3	11,844	-1.83	2.78	0.30	0.71	11,189	-1.89	2.81	0.29	0.72	–	–	–	–	–
Parental Monitoring (M)	1, 5	11,857	-1.14	4.38	0.52	0.46	11,195	-1.31	4.49	0.46	0.47	6533	-1.30	4.50	0.47	0.53
SDQ Prosocial Behavior (M)	0, 2	11,845	-1.08	1.68	0.37	0.58	11,187	-1.23	1.71	0.34	0.53	6533	-1.23	1.72	0.36	0.66
PBP Delinquent Peer Involvement (T)	2, 15	–	–	–	–	–	–	–	–	–	–	6327	2.93	3.61	1.26	0.55
PBP Prosocial Peer Involvement (T)	2, 15	–	–	–	–	–	–	–	–	–	–	6393	-0.10	9.39	2.62	0.45
PNH Protective Scale (T)[b]	0, 27	–	–	–	–	–	–	–	–	–	–	6533	0.04	11.95	8.09	0.49
Wills Problem Solving (T)	6, 30	–	–	–	–	–	11,181	-0.71	23.24	4.97	0.84	–	–	–	–	–

Note. CRPBI = Child's Report of Parental Behavior Inventory. FES = Family Environment Scale. MACVS = Mexican-American Cultural Values Scale. PBP = Peer Behavior Profile. PNH = Peer Network Health. SRPF = School Risk & Protective Factors. SDQ = Strengths & Difficulties Questionnaire. M = Mean score used. T = Total score used.

[a] Internal consistency was based on Cronbach's alpha.

[b] PNH Protect Scale internal consistency based on the three items using a Likert scale.

caregivers (62%) and youth (70%). Frequency of speaking another language with friends was very negatively skewed, whereas a moderate negative skewness was observed for speaking the other language with family members. In each case, this suggested that English was spoken most often among family and friends (Table 3). A similar, yet more modest pattern, of negative skewness was observed for language spoken most with friends and family among caregivers (Table 4). In both cases, the means reflect a tendency for the other language to be spoken more often with family than friends (Tables 3 and 4). There were high correlations between caregiver and youth report on frequency of other language use with family, with more modest correlations for other language use with friends across baseline, Y1, and Y2, respectively (Table 5). At Y2, youth classified as "higher risk" had caregivers who reported more frequently speaking English with family members, after adjusting for covariates. No other mean differences were found across the waves for either youth- or caregiver-reported language preferences (Tables 6 and 7). Among youth, test-retest reliability was poor across waves for language use among friends, but good for language use among family (Table 8). Among caregivers, test-retest reliability for language use among friends and family was good (Table 8). Linear growth curve models showed slight increases in speaking English with friends and family over time among youth with no change for caregivers (Table 9 and Fig. 1). However, there was a significant amount of variability in the slopes of caregivers' language use among friends and family, indicating that while the mean rates of change were nonsignificant, there was a significant amount of variability in rates of change across caregivers. Using language as a proxy of acculturation, these findings suggest different rates of acculturation among caregivers within the ABCD study, with youth showing more acculturation than caregivers across measurement waves.

3.1.3. *Native-American Acculturation Scale*

Cultural engagement, particularly among Native American community members, has been examined as a protective factor against mental health problems (e.g., Baldwin et al., 2011). Nevertheless, the degree to which individuals identify as Native American varies considerably. In response, parents who endorsed "American Indian" or "Alaskan Native" on the demographics survey at baseline were prompted to complete nine questions drawn from the Native American Acculturation Scale (NAAS; Garrett and Pichette, 2000; see also Reynolds et al., 2012). Questions asked about their self-identification (i.e., "Native American and Some non-Native American [White, African American, Latino, and Asian American"]; "Native American and non-Native American, bicultural"; "Non-Native American and some Native American"; "Non-Native American, [e.g., White, African American, Latino, and Asian American"]). These same questions were then asked about their mothers and fathers separately. Next, questions were asked about where they were born and raised (e.g., reservation, rural or urban Native American community), and what contact they have had with Native American communities. The last three questions asked about Native American cultural engagement (i.e., "How much pride do you have in Native American culture and heritage?"; "How would you rate yourself [very Native American, Mostly Native American, Bicultural, Mostly non-Native American, or Very non-Native American]"; and "Do you participate in Native American traditions, ceremonies, occasions, and so on [All of them, Most of them, Some of them, A few of them, None of them]". These last three items were averaged to create an aggregate cultural engagement score.

The ABCD Study® has participants who self-identified as American Indian at sixteen sites, 62 as single race and 348 as multi-racial. Cronbach's alpha for the cultural engagement items was acceptable (Table 4). The cultural engagement score is significantly correlated in

Table 4
Psychometric characteristics of caregiver measures for each wave.

		Baseline					1-Year follow-up					2-Year Follow-up				
Caregiver measures	Range	N	Skew	M	SD	α[a]	N	Skew	M	SD	α[a]	N	Skew	M	SD	α[a]
Cultural/Ethnic Group Membership Domain																
VIA Heritage Culture (M)	1, 9	7842	-0.50	6.33	1.87	0.92	–	–	–	–	–	4332	-0.37	6.16	1.93	0.92
VIA American Culture (M)	1, 9	7842	-0.89	6.81	1.57	0.90	–	–	–	–	–	4332	-0.79	6.71	1.64	0.91
Language (friends)	1, 5	3817	-1.12	4.03	1.19	–	3568	-1.15	4.05	1.17	–	2150	-1.22	4.13	1.10	–
Language (family)	1, 5	3823	-0.76	3.75	1.36	–	3530	-0.80	3.77	1.37	–	2131	-0.90	3.85	1.32	–
Native American Acculturation Scale (M)	1, 5	391	0.41	2.61	0.81	0.69	–	–	–	–	–	–	–	–	–	–
MEIM-R Exploration (M)	1, 5	11,187	-0.16	3.17	1.03	0.89	–	–	–	–	–	6484	-0.09	3.08	1.02	0.88
MEIM-R Commitment (M)	1, 5	11,187	-0.25	3.50	0.91	0.87	–	–	–	–	–	6484	-0.17	3.42	0.91	0.87
MEIM-R Overall Score (M)	1, 5	11,187	-0.15	3.33	0.89	0.90	–	–	–	–	–	6484	-0.07	3.25	0.88	0.90
MACVS Familism-Support (M)	1, 5	11,872	-0.66	4.16	0.61	0.80	11,208	-1.00	4.05	0.67	0.83	6551	-0.82	4.06	0.65	0.83
MACVS Familism-Obligations (M)	1, 5	11,872	-0.08	3.63	0.66	0.70	11,208	-0.26	3.50	0.70	0.73	6551	-0.21	3.57	0.68	0.73
MACVS Familism-Referent (M)	1, 5	11,872	-0.18	3.38	0.78	0.78	11,208	-0.22	3.27	0.80	0.80	6551	-0.22	3.31	0.78	0.80
MACVS Independence/Self-Reliance (M)	1, 5	11,872	0.01	3.56	0.62	0.61	11,208	-0.25	3.48	0.65	0.66	6551	-0.15	3.52	0.63	0.66
MACVS Religion (M)	1, 5	11,872	-0.41	3.35	1.41	0.97	11,208	-0.31	3.24	1.44	0.98	6551	-0.27	3.21	1.42	0.98
Proximal Social Environment Domain																
School: Unexcused Absences	1, 6	–	–	–	–	–	–	–	–	–	–	6081	6.45	0.11	0.53	–
School: Grades	1, 12	–	–	–	–	–	–	–	–	–	–	6441	1.08	3.64	2.24	–
School: Current IEP	0, 1	–	–	–	–	–	–	–	–	–	–	6171	1.70	0.18	0.38	–
Neighborhood Safety (M)	1, 5	11,870	-0.89	3.89	0.98	0.88	11,208	-0.87	3.89	0.95	0.88	6552	-0.82	3.89	0.91	0.87
Community Cohesion (M)	1, 5	–	–	–	–	–	–	–	–	–	–	6549	-0.21	3.72	0.69	0.80
Community Control (M)	1, 5	–	–	–	–	–	–	–	–	–	–	6549	-0.85	3.97	0.78	0.83
Community Collective Efficacy (M)	1, 5	–	–	–	–	–	–	–	–	–	–	6549	-0.59	3.84	0.66	0.87
Social Interaction Domain																
FES Conflict (T)	0, 9	11,874	0.67	2.54	1.96	0.66	11,193	0.65	2.43	1.89	0.66	6549	0.69	2.44	1.98	0.69
FES Activity-Recreation (T)	0, 9	–	–	–	–	–	–	–	–	–	–	6545	-0.49	5.56	1.99	0.62
FES Cohesion (T)	0, 9	–	–	–	–	–	–	–	–	–	–	6545	-1.41	7.33	1.62	0.58
FES Expressiveness (T)	0, 9	–	–	–	–	–	–	–	–	–	–	6545	-0.62	6.03	1.44	0.25
FES Intellectual-Cultural (T)	0, 9	–	–	–	–	–	–	–	–	–	–	6545	-0.57	6.16	1.97	0.61
FES Organization (T)	0, 9	–	–	–	–	–	–	–	–	–	–	6544	-0.61	6.14	2.08	0.65
SDQ Prosocial Behavior (T)	0, 2	11,854	-1.77	1.75	0.40	0.80	11,206	-1.59	1.72	0.42	0.80	6553	-1.56	1.73	0.41	0.80

Note. FES = Family Environment Scale. MACVS = Mexican-American Cultural Values Scale. MEIM-R = Multigroup Ethnic Identity Measure – Revised. SDQ = Strengths & Difficulties Questionnaire. VIA = Vancouver Index of Acculturation. M = Mean score used. T = Total score used.
[a] Internal consistency was based on Cronbach's alpha.

Table 5
Correlations between youth and caregiver measures across waves.

	Baseline	1-year follow-up	2-year follow-up
Cultural/Ethnic Group Membership Domain			
Language (friends)	.25	.24	.30
Language (family)	.64	.68	.69
MACVS Familism-Obligation (M)	–	–	.14
MACVS Familism-Support (M)	–	–	.14
MACVS Familism-Referent (M)	–	–	.20
Proximal Social Environment Domain			
School: Unexcused Absences	–	–	.12
School Grades	–	–	.56
Neighborhood Safety	.30	.32	.31
Social Interaction Domain			
FES Conflict Subscale (T)	.20	.21	.27
SDQ Prosocial Behavior (M)	.18	.20	.20

Note. FES=Family Environment Scale. MACVS = Mexican-American Cultural Values Scale.
SDQ = Strengths & Difficulties Questionnaire. M = Mean score used. T = Total score used.
All p values were <0.001.

expected directions with parent reported familism scales from the MACVS (r's range from.14 to.21), as well as the ethnic identity exploration ($r = 0.37$), ethnic identity commitment ($r = 0.39$), and the overall ethnic identity score from the Multi-Group Ethnic Identity Measure - Revised (MEIM-R) ($r = .42$), which we describe below. Cultural engagement from the NAAS was also correlated with parent reported involvement in activities related to their family culture on the VIA ($r = .23$). The nine questions from the Native American Acculturation Scale will be asked of youth in subsequent years.

3.1.4. *Multi-Group Ethnic Identity Measure – Revised*

Ethnic identity refers to the quality of a person's affiliation with their own ethnic group (Phinney and Ong, 2007) and is posited to develop between adolescence and emerging adulthood (Phinney, 1993). It is conceptualized as a multi-dimensional construct that involves exploring the meaning of one's identity and sense of commitment or belonging to that identity (Ong et al., 2010). Higher levels of ethnic identity, specifically in ethnic minority youth, have been linked with positive physical and mental health outcomes and less externalizing risk behaviors such as substance use across youth of varying ethnic and racial backgrounds (Smith and Silva, 2011; Unger et al., 2020; Zapolski et al., 2017).

Ethnic identity is assessed in the ABCD Study® with the Multi-Group Ethnic Identity Measure - Revised (MEIM-R: Phinney and Ong, 2007; Brown et al., 2014): a 6-item scale with two subscales. Respondents are asked to identify their ethnic group from a 14-item drop-down menu, followed by rating six Likert-style items related to one's ethnic identity (1 = *strongly disagree* to 5 = *strongly agree*) with higher scores reflecting higher levels of ethnic identity. In earlier data releases, items were scored so that lower values reflected higher ethnic identity. As of the 3.0 data release, this issue has been corrected across all waves to correspond to the scoring of the original scale, whereby higher values reflect greater ethnic identity. Overall, the MEIM-R yields mean value summary scores for the Commitment subscale, Exploration subscale, and a total scale score. At baseline and Y2, only caregivers were administered the measure, as initial informal pilot testing across sites suggested youth had some difficulties understanding the instrument. Notably, previous

Table 6
Discriminability of higher and lower risk subsamples: youth measures.

	Baseline					1-year follow-up					2-year follow-up				
	Lower Risk		Higher Risk			Lower Risk		Higher Risk			Lower Risk		Higher Risk		
Youth measures	M	SD	M	SD	ES	M	SD	M	SD	ES	M	SD	M	SD	ES
Cultural/Ethnic Group Membership Domain															
Language (friends)	4.51	0.77	4.49	0.76	0.03	4.47	0.76	4.44	0.76	0.05	4.55	0.73	4.52	0.74	0.05
Language (family)	3.78	1.34	3.83	1.38	-0.04	3.82	1.32	3.83	1.34	-0.01	3.95	1.25	3.94	1.30	0.01
MACVS Familism-Obligation (M)	–	–	–	–	–	–	–	–	–	–	3.89	0.68	3.85	0.69	0.05
MACVS Familism-Support (M)	–	–	–	–	–	–	–	–	–	–	4.19	0.63	4.14	0.63	0.08**
MACVS Familism-Referent (M)	–	–	–	–	–	–	–	–	–	–	3.81	0.76	3.76	0.77	0.08**
Perceived Discrimination Scale (M)	–	–	–	–	–	1.16	0.39	1.22	0.39	-0.15***	1.12	0.33	1.16	0.33	-0.11***
Proximal Social Environment Domain															
SRPF School Environment (T)	20.14	2.82	19.65	2.82	0.17***	20.61	2.68	20.13	2.67	0.18***	19.78	2.81	19.33	2.81	0.17***
SRPF School Involvement (T)	13.22	2.36	12.84	2.36	0.16***	13.45	2.27	13.02	2.26	0.20***	12.85	2.33	12.46	2.33	0.17***
SRPF School Disengagement (T)	3.66	1.45	3.85	1.46	-0.13***	3.74	1.38	3.95	1.38	-0.16***	3.86	1.34	4.08	1.34	-0.17***
School Attendance	–	–	–	–	–	–	–	–	–	–	0.08	0.44	0.09	0.44	-0.03
School Grades	–	–	–	–	–	–	–	–	–	–	3.05	2.00	3.36	2.00	-0.16***
Neighborhood Safety	4.07	1.08	3.97	1.10	0.10***	4.20	0.99	4.08	1.00	0.12***	4.13	0.99	4.05	0.99	0.08**
Social Interaction Domain											–	–	–	–	–
FES Conflict Subscale (T)	1.89	1.94	2.26	1.94	-0.19***	1.80	1.87	2.08	1.87	-0.15***	1.75	1.82	2.04	1.83	-0.16***
CRPBI Acceptance (M)	2.79	0.30	2.76	0.30	0.11***	2.82	0.29	2.78	0.29	0.16***	–	–	–	–	–
Parental Monitoring (Mean)	4.41	0.51	4.35	0.52	0.13***	4.51	0.45	4.45	0.45	0.14***	4.53	0.46	4.46	0.46	0.16***
SDQ Prosocial Behavior (M)	1.69	0.37	1.66	0.37	0.10***	1.74	0.34	1.68	0.34	0.16***	1.73	0.36	1.70	0.36	0.09***
PBP Delinquent Peer Involvement (T)	–	–	–	–	–	–	–	–	–	–	3.55	1.24	3.69	1.28	-0.12***
PBP Prosocial Peer Involvement (T)	–	–	–	–	–	–	–	–	–	–	9.51	2.63	9.18	2.59	0.13***
PNH Protective Scale (T)	–	–	–	–	–	–	–	–	–	–	12.21	8.07	11.57	8.11	0.08**
Wills Problem Solving (T)	–	–	–	–	–	3.95	0.82	3.78	0.82	0.22***	–	–	–	–	–

Note. CRPBI = Child's Report of Parental Behavior Inventory. FES = Family Environment Scale. MACVS = Mexican-American Cultural Values Scale. PBP = Peer Behavior Profile. PNH = Peer Network Health. SRPF=School Risk & Protective Factors. SDQ = Strengths & Difficulties Questionnaire. M = Mean score used. T = Total score used. ES = Cohen's *d* effect size based on adjusted mean differences. Covariates included sex, age, race/ethnicity, caregiver education, combined household income, and caregiver marital status.

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

studies examining the psychometric properties of the original MEIM in younger children have found the reliability estimates to be less stable in this age group (Reese et al., 1998). The bulk of studies in the current literature base that examine ethnic identity among youth have also been conducted with middle and late adolescent samples (Wantchekon and Umaña-Taylor, 2021; Whitehead et al., 2009). As such, the MEIM-R is currently being administered to youth for the first time during Y3, with plans for assessment at future measurement waves.

With regards to psychometrics, the MEIM-R has demonstrated good internal consistency among caregivers for subscales and total scale summary scores across timepoints (Table 4). Overall, no differences in caregiver ethnic identity were observed between youth classified as "higher risk" versus "lower risk", with the exception of a very small effect size for the Commitment subscale at baseline, where mean scores of caregiver ethnic identity were slightly higher for "lower" risk youth (Table 7). Additionally, scores maintained a relatively symmetrical distribution. Growth curves were not estimated for the MEIM-R given that only two time-points were examined.

3.1.5. *Mexican-American Cultural Values Scale*

The Mexican-American Cultural Values Scale (MACVS) is an assessment tool originally developed to assess cultural values often associated with Mexican-American families, but is useful for measuring family values across many cultural traditions (Knight et al., 2010). Five subscales are used in the ABCD Study®. The administration of MACVS has previously been described in Zucker et al., 2018. Briefly, the ABCD Study® uses three MACV familism subscales: Family Support, Family Obligation, and Family Referent, as well as two additional subscales: Independence/Self-Reliance and Religion (Table 2). Caregivers were administered all five subscales across all three annual measurements. Youth were first administered three of the five subscales of the MACVS (Family Obligation, Support, and Referent) at Y2.

For caregivers, the Family Support subscale scores across all measurement waves were moderately negatively skewed, with responses on average indicating endorsement of higher family support (Table 4). Scores on all other subscales for the rest of the measurement waves appeared fairly symmetrical. The internal consistencies for all MACVS subscales were acceptable across each annual assessment. The Religion subscale showed excellent retest-reliability between measurement waves. In contrast, the three Familism subscales and the Independence/Self-Reliance subscale showed moderate retest reliability scores between measurement waves, suggesting variability between waves in caregiver reports in these subscales (Table 8). The linear growth models for MACVS subscales indicated inconsistent model fits, with poorer RMSEA compared to the CFI and SRMR fit statistics (Table 9). The average growth rate over individual scores for each subscale across measurement waves declined slightly; however, there was also significant variability in the initial scores at baseline as well as in the growth rate of individuals across measurement waves. On average, youth in the "higher risk" group had slightly lower scores for the three Familism subscales and the Religion subscale, after adjusting for all covariates.

For youth, the Family Support subscale was moderately negatively skewed, with responses on average indicating endorsement of higher family support among youth. Scores on the Obligation and Referent subscales were fairly symmetrical and the internal consistencies on all three subscales were acceptable (Table 3). The correlations between youth and caregiver reported scores on the three Familism subscales were small, suggesting a low correspondence between youth and caregiver endorsement of family values on these subscales (Table 5).

To assess the correspondence between parent and youth report of family values, the MACV subscales for Religion and Independence/Self-Reliance will be administered to both the parent and youth at Y3, while the subscales for Familism (Family Obligation, Support, and Referent) will be administered to both the parent and youth at the 4-year follow-

Table 7
Discriminability of higher and lower risk subsamples: caregiver measures.

	Baseline					1-year follow-up					2-year follow-up				
	Lower Risk		Higher Risk			Lower Risk		Higher Risk			Lower Risk		Higher Risk		
Caregiver measures	M	SD	M	SD	ES	M	SD	M	SD	ES	M	SD	M	SD	ES
Cultural/Ethnic Group Membership Domain															
VIA Heritage Culture (M)	6.41	1.86	6.24	1.87	0.09***	–	–	–	–	–	6.24	1.92	6.06	1.92	0.10**
VIA American Culture (M)	6.88	1.56	6.72	1.58	0.10***	–	–	–	–	–	6.76	1.64	6.66	1.65	0.06
Language (friends)	4.00	1.20	4.06	1.19	-0.05	4.03	1.17	4.08	1.18	-0.05	4.11	1.10	4.15	1.11	-0.04
Language (family)	3.73	1.36	3.77	1.36	-0.03	3.74	1.84	3.82	1.39	-0.06	3.77	1.32	3.96	1.32	-0.18***
Native American Acculturation Scale (M)	2.65	0.80	2.57	0.83	0.12	–	–	–	–	–	–	–	–	–	–
MEIM-R Exploration (M)	3.17	1.04	3.17	1.03	0.00	–	–	–	–	–	3.08	1.02	3.09	1.01	-0.01
MEIM-R Commitment (Mean)	3.52	0.92	3.48	0.91	0.05*	–	–	–	–	–	3.44	0.91	3.41	0.91	0.03
MEIM-R Overall Score (M)	3.34	0.89	3.32	0.88	0.02	–	–	–	–	–	3.26	0.88	3.25	0.88	0.01
MACVS Familism-Support (M)	4.19	0.61	4.12	0.60	0.12***	4.08	0.67	4.01	0.67	0.11***	4.10	0.65	3.99	0.65	0.17***
MACVS Familism-Obligations (M)	3.65	0.67	3.61	0.66	0.06**	3.52	0.70	3.49	0.70	0.05*	3.60	0.74	3.52	0.67	0.11***
MACVS Familism-Referent (M)	3.42	0.78	3.34	0.77	0.10***	3.30	0.80	3.23	0.79	0.08***	3.35	0.78	3.27	0.78	0.12***
MACVS Independence/Self-reliance (M)	3.56	0.62	3.56	0.61	-0.02	3.48	0.65	3.48	0.64	-0.01	3.53	0.63	3.53	0.62	0.00
MACVS Religion (M)	3.38	1.43	3.32	1.40	0.04*	3.28	1.45	3.21	1.43	0.05*	3.24	1.43	3.17	1.42	0.06*
Proximal Social Environment Domain															
School: Unexcused Absences	–	–	–	–	–	–	–	–	–	–	0.09	0.53	0.14	0.54	-0.10***
School: Grades	–	–	–	–	–	–	–	–	–	–	3.37	2.18	4.02	2.21	-0.31***
School: Current IEP	–	–	–	–	–	–	–	–	–	–	.14	0.37	0.23	0.38	-0.26***
Neighborhood Safety (M)	3.93	0.96	3.84	0.98	0.10***	3.93	0.94	3.84	0.96	0.10***	3.92	0.89	3.88	0.92	0.04
Community Cohesion (M)	–	–	–	–	–	–	–	–	–	–	3.76	0.69	3.67	0.69	0.15***
Community Control (M)	–	–	–	–	–	–	–	–	–	–	4.00	0.78	3.93	0.78	0.09**
Community Collective Efficacy (M)	–	–	–	–	–	–	–	–	–	–	3.88	0.43	3.80	0.66	0.13***
Social Interaction Domain															
FES Conflict (T)	2.28	1.92	2.88	1.94	-0.31***	2.20	1.86	2.74	1.87	-0.29***	2.21	1.96	2.73	1.96	-0.26***
FES Activity-Recreation (T)	–	–	–	–	–	–	–	–	–	–	5.72	1.98	5.31	1.96	0.22***
FES Cohesion (T)	–	–	–	–	–	–	–	–	–	–	7.50	1.61	7.07	1.60	0.27***
FES Expressiveness (T)	–	–	–	–	–	–	–	–	–	–	6.06	1.44	5.98	1.44	0.06*
FES Intellectual-Cultural (T)	–	–	–	–	–	–	–	–	–	–	6.24	1.96	6.06	1.96	0.10***
FES Organization (T)	–	–	–	–	–	–	–	–	–	–	6.38	2.05	5.81	2.06	0.27***
SDQ Prosocial Behavior (M)	1.81	0.40	1.67	0.40	0.35***	1.78	0.41	1.64	0.41	0.35***	1.79	0.40	1.64	0.40	0.37***

Note. FES=Family Environment Scale. MACVS = Mexican-American Cultural Values Scale. MEIM-R = Multigroup Ethnic Identity Measure – Revised. SDQ = Strengths & Difficulties Questionnaire. VIA=Vancouver Index of Acculturation. M = Mean score used. T = Total score used. ES = Cohen's *d* effect size based on adjusted mean differences. Covariates included sex, age, race/ethnicity, caregiver education, combined household income, and caregiver marital status. The model including the Native American Acculturation Scale did not control for race/ethnicity.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

up (Y4). The MACV subscales will not be administered in the 5-year follow-up (Y5).

3.1.6. Perceived Discrimination Scale

Racial and ethnic discrimination is often viewed as a chronic stressor and is linked to numerous adverse outcomes including increased risk for mental health problems and health disparities (Williams and Mohammed, 2009), including among youth (Sanders-Phillips et al., 2009). The Perceived Discrimination Measure was included in the ABCD protocol to obtain information from youth about experiences of discrimination. The measure was introduced during the one-year follow-up when youth were about 10–11 years of age, thus presenting an opportunity to assess this construct at a time when youth's racial/ethnic identity is developing. The instrument consists of 11 items, which were obtained from two separate instruments: The 2006 Boston Youth Survey (e.g., Garnett et al., 2014) and the "Measure of Perceived Discrimination" (MPD; Phinney et al., 1998). Both instruments have been used successfully with school-aged children, had wording deemed sufficiently concrete, clear, and simple to be understood by 10- to 11-year-olds, and covered aspects of discrimination in addition to racial/ethnic discrimination. A single item from the 2006 Boston Youth Survey, which asks if a youth has experienced discrimination in the last 12 months across 4 different areas, was adapted to ask separately about each of the 4 areas with a yes/no response: racial/ethnic discrimination; discrimination due to country of origin; discrimination due to gender identity; discrimination due to body type/weight. The remaining 7 items are from the MPD and focus specifically on discrimination perceived to occur due to ethnic/racial background. The instrument uses a 5-point Likert scale and asks about frequency of discrimination experienced from teachers, adults outside of school, and other students. Three additional items ask about frequency of feeling unwanted or unaccepted by "American Society." The 7-items from the MPD yield an overall summary score reflecting the mean responses across all items, with higher scores reflecting a greater degree of perceived discrimination. Participants are allowed to choose "refuse to answer" or "don't know" for each of the items assessed.

With regards to psychometrics, the responses on the MPD were highly positively skewed at both the 1-year and 2-year follow-ups (Table 2). Overall, the measure demonstrated acceptable internal consistency across measurement waves. However, reliability was poor from the 1-year to 2-year follow-up (Table 7). Because the questionnaire queries about perceived discrimination in the last 12 months, it is possible that isolated incidents of perceived discrimination may have occurred at one measurement wave, but not another, contributing to poorer reliability.

At both the 1-year and 2-year follow-up, approximately 12% of participants endorsed having experienced any type of discrimination, with most reporting discrimination due to weight (1 yr: 5.8%; 2 yr: 4.8%), followed by race, ethnicity, or skin color (1 yr: 4.2%; 2 yr: 4.7%). However, when broken down by participants' race/ethnicity, the results markedly differed. Discrimination of any type was experienced most among Non-Hispanic Black youth (1 yr: 21.4% 2 yr: 20.2%), followed by Hispanic youth (1 yr: 14.6%; 2 yr: 14.7%). Of note, only 7.5% of Asian youth reported experiences of discrimination at the 1-year follow-up,

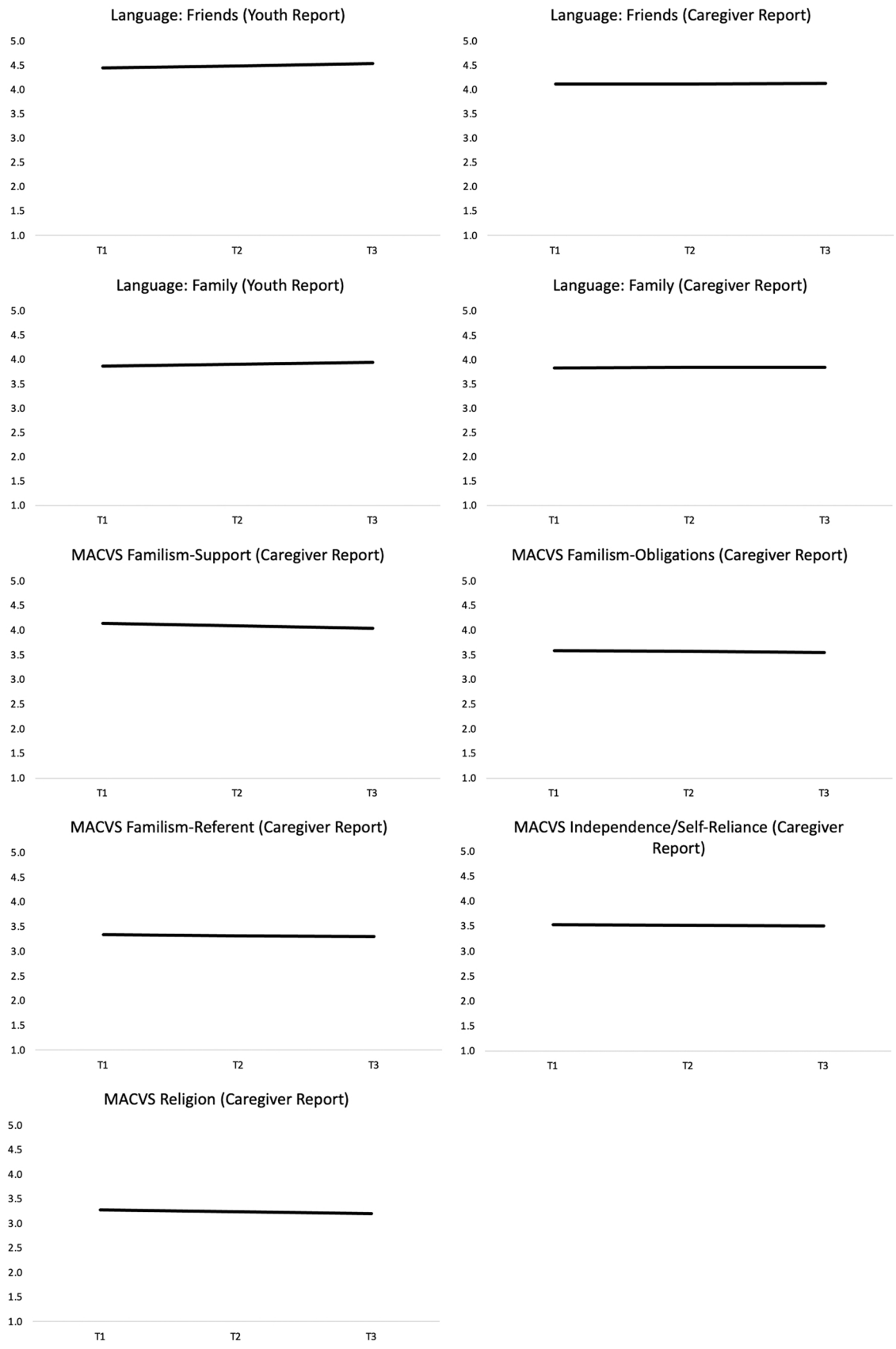


Fig. 1. Growth model trajectories for measures within the cultural/ethnic group membership domain.

Fig. 2. Growth model trajectories for measures within the proximal social environment domain.

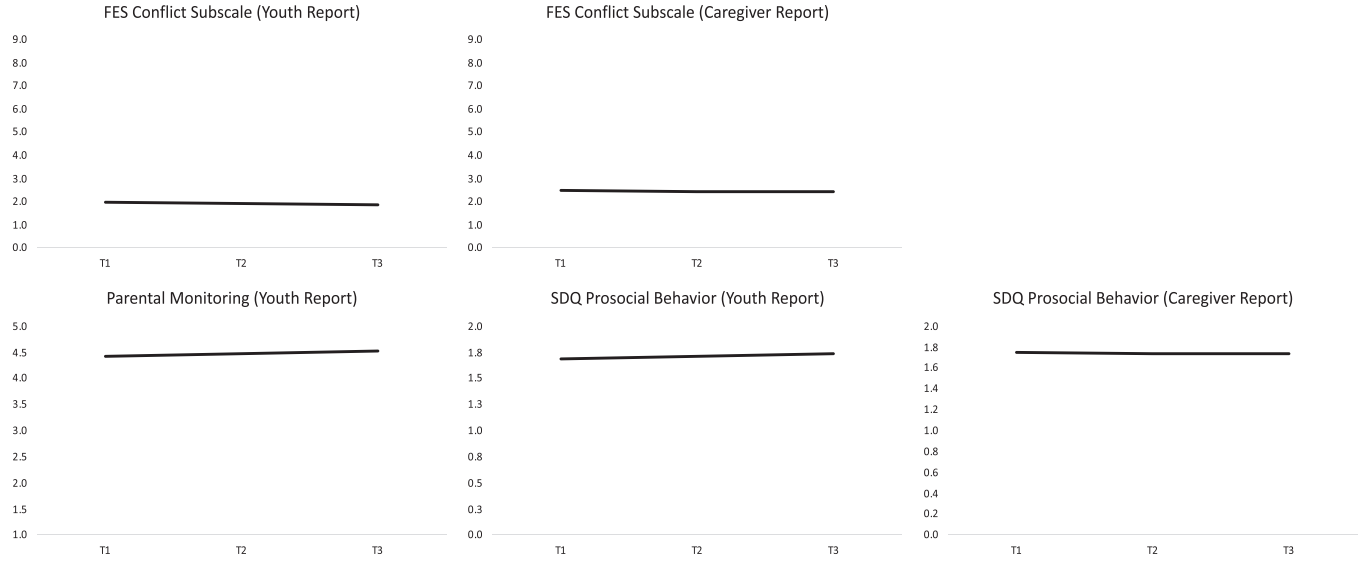


Fig. 3. Growth model trajectories for measures within the social interaction domain.

but this increased to 11% at the 2-year follow-up, unlike Hispanic, and non-Hispanic Black youth who showed comparable rates across measurement waves. Youth classified as "higher risk" at screening reported slightly higher scores on the MPD at both measurement waves, suggesting more perceived discrimination, compared to those identified as "lower risk." However, these effect sizes were very small at the one-year and two-year follow-ups, respectively (Table 5). Because data on this measure was collected at only two time-points, growth curves could not be estimated.

3.2. Measures of the proximal social environment

3.2.1. School Risk and Protective Factors

The School Risk and Protective Factors questionnaire (SRPF) examines youth's perceptions of the school's general environment, amount of school involvement, and the degree to which the youth is disengaged from school. This measure has been administered to youth at every annual visit since the inception of the study and has been previously described in detail (Zucker et al., 2018). Briefly, items for this measure were a subset from the PhenX School Risk and Protective Factors (Hamilton et al., 2011), which is based on items from the Communities That Care (CTC) Youth Survey (Arthur et al., 2007). Details on modifications and items retained from the original PhenX instrument have been described previously (Zucker et al., 2018). Responses on the 12 items yield scores for three summary variables: School Environment (6 items), School Involvement (4 items), and School Disengagement (2 items).

The SRPF subscales were moderately skewed, with School Environment and Involvement negatively skewed and School Disengagement positively skewed, with higher scores reflecting more school disengagement (Table 3). Internal consistency for the subscales ranged from modest (School Environment and School Involvement) to poor (School Disengagement). Across measurement waves, this improved slightly to the acceptable range for School Environment and School Involvement, but remained poor for School Disengagement. The poor internal consistency for these measures may stem from the small number of items in each subscale. Intercorrelations among the summary scores were significant and similar across measurement waves, with the highest observed between School Environment and School Involvement ($rs = 0.63$ to 0.58) and the lowest between School Disengagement and

Table 8
Test-retest reliability across waves.

	Baseline to Year 1		Year 1 to Year 2		Baseline to Year 2	
Youth measures	n	ICC	n	ICC	n	ICC
Cultural/Ethnic Group Membership Domain						
Language (friends)	2699	0.37	1570	0.43	1605	0.32
Language (family)	2699	0.79	1570	0.82	1605	0.79
Perceived Discrimination Scale (M)	–	–	6122	0.36	–	–
Proximal Social Environment Domain						
SRPF School Environment (T)	11,178	0.39	6402	0.41	6519	0.31
SRPF School Involvement (T)	11,178	0.48	6402	0.48	6519	0.37
SRPF School Disengagement (T)	11,177	0.38	6401	0.42	6519	0.32
Neighborhood Safety	11,179	0.37	6403	0.42	6522	0.30
Social Interaction Domain						
CRPBI Acceptance (M, primary caregiver)	11,165	0.47	–	–	–	–
FES Conflict Subscale (T)	11,179	0.46	6402	0.49	6521	0.40
Parental Monitoring (M)	11,182	0.42	6403	0.48	6524	0.36
SDQ Prosocial Behavior (M)	11,163	0.39	6402	0.45	6518	0.35
Caregiver Measures						
Cultural/Ethnic Group Membership Domain						
VIA Heritage Culture (M)	–	–	–	–	3304	0.57
VIA American Culture (M)	–	–	–	–	3304	0.56
Language (friends)	2992	0.81	1695	0.81	1723	0.78
Language (family)	2961	0.82	1665	0.84	1709	0.80
MEIM-R Exploration (M)	–	–	–	–	6095	0.56
MEIM-R Commitment (M)	–	–	–	–	6095	0.55
MEIM-R Overall Score (M)	–	–	–	–	6095	0.59
MACVS Familism-Support (M)	11,204	0.61	6414	0.62	6551	0.62
MACVS Familism-Obligations (M)	11,204	0.63	6414	0.62	6551	0.62
MACVS Familism-Referent (M)	11,204	0.68	6414	0.68	6551	0.66
MACVS Independence/Self-reliance (M)	11,204	0.52	6414	0.51	6551	0.51
MACVS Religion (M)	11,204	0.92	6414	0.92	6551	0.91
Proximal Social Environment Domain						
Neighborhood Safety (M)	11,203	0.63	6415	0.63	6549	0.58
Social Interaction Domain						
FES Conflict Subscale (T)	11,191	0.58	6411	0.61	6549	0.57
SDQ Prosocial Behavior (M)	11,187	0.55	6416	0.55	6539	0.53

Note. CRPBI = Child's Report of Parental Behavior Inventory. FES = Family Environment Scale. MACVS=Mexican-American Cultural Values Scale. MEIM-R = Multigroup Ethnic Identity Measure – Revised. SRPF=School Risk & Protective Factors. SDQ = Strengths & Difficulties Questionnaire. VIA = Vancouver Index of Acculturation. M = Mean score used. T = Total score used. ICC = Intraclass Correlation Coefficient. All ICC p values were <0.001.

School Environment ($r = -0.33$ to -0.30). School Disengagement was moderately correlated with School Involvement across measurement waves ($rs = -0.53$ to -0.48). Similarly, one-year and two-year test-retest reliability was poor.

Comparisons of youth identified as "higher" or "lower risk" at screening differed significantly on each of the subscales at each annual visit, albeit with small effect sizes (Table 6). "Higher risk" youth endorsed a poorer school environment, less school involvement, and more disengagement. Linear growth curves of the subscales showed poor fit for School Environment and School Involvement, which appear to not follow a linear trend (Table 9 and Fig. 2). School Disengagement, on the other hand, showed good fit and a trend for scores to increase over time. Further analyses will need to explore if school transitions (e.g., elementary to middle school) among the youth may have contributed to these findings.

3.2.2. School Attendance and Grades

School participation and performance remain an important aspect of adolescents' lives and serve as a predictor and outcome measure linked to substance use and mental health (Bryant et al., 2003; Verboom et al., 2014). Questions on School Attendance and Grades (SAG) were introduced in Y2 to obtain information from youth and their caregiver about the youths' grades, the known number of excused and unexcused school absences, and participation in an Individualized Education Program (IEP). Actual school records across the many school districts and sites involved in the ABCD Study® were not available at the outset of the study, thus we relied on youth and caregiver self-report. Although not without criticism, self-report of school grades is reported to be a viable alternative among adolescent samples (Wood et al., 2012). Querying both youth and caregivers about grades and absences may also reveal discrepancies that may be further explored. Items querying about school attendance were modeled off similar questions asked in other large scale studies of youth (e.g., Bugbee et al., 2019), as were those asking about grades and IEPs (e.g., Tourangeau et al., 2005; Miech et al., 2008). Responses were adapted to allow reporting of grades across various systems used in the United States. This measure is planned to be administered during future measurement waves, and the caregiver report has been modified to also capture reasons a youth may have an IEP. It is important to note that the responses for academic performance are currently assigned a value of "1" to the highest possible performance (i.e., A+) and the value assigned increases with poorer grades (i.e., 2; A- = 3; B+ = 4, and so forth, with F = 12). This results in larger values assigned to poorer grades, which is counter-intuitive for many. Based on feedback from researchers, future ABCD data releases will reverse scoring on this item such that higher values are associated with better performance.

Because the items on this measure are not designed to assess a unified construct, psychometric data on internal consistency was not calculated. Rather, we presented data individually for two items that are administered to both youth and caregivers: youth grades and number of unexcused absences in the last four weeks (Tables 3 and 4). Across youths and caregivers, data were very positively skewed, with most respondents reporting, on average, very few unexcused absences and grades that would be within the A- to B+ range. Self-reported grades showed moderate correlations between youth and caregiver report. Perhaps not surprisingly, correlations between unexcused absences reported by youth and those reported by caregivers were weak (Table 5). Comparisons of "higher" and "lower risk" youth showed significantly better grades among "lower risk" youth based on both caregiver and youth report (Tables 6 and 7). Caregivers of "higher risk" youth reported significantly more unexcused absences; however, this was not the case for youth self-report, which showed no significant differences between risk classification. Caregiver report indicated that approximately 9.1% of youth enrolled at Y2 were currently in an IEP, with an additional 3.7% endorsing the youth having previously been enrolled. Enrollment in an IEP was more likely for "higher risk" youth. However, across all analyses, effect sizes were relatively small.

3.2.3. Neighborhood Safety

Items from the PhenX Neighborhood Safety protocol have been administered to youth and caregivers across all annual measurement waves. Details on this measure and the importance of this construct within the ABCD Study® has been described previously (Zucker et al., 2018). Briefly, the items for the full PhenX Neighborhood protocol were derived from the "Safety from Crime'' items from scales assessing neighborhood characteristics in prior studies (Echeverria et al., 2004; Mujahid et al., 2007). The original PhenX measure consists of three items assessing subjective feelings about safety and the presence of crime in the respondent's neighborhood. We retained the item thought to be most appropriate for our participants' age range for administration to youth. All three items are administered to caregivers, whereas only one item is administered to youth. This measure is expected to be continued in future measurement waves; however, in the future, the ABCD Study® may collect and include actual neighborhood crime

Table 9
Fit indices and estimates for unconditional linear growth models.

Youth measures	χ^2	*df*	CFI	RMSEA	SRMR	Intercept $\underline{x}$	Slope $\underline{x}$	Intercept $\int^2$	Slope $\int^2$	Cov (I/S)
Cultural/Ethnic Group Membership Domain										
Language (friends)	12.90***	1	0.96	0.07	0.01	4.45***	0.04**	0.23***	0.04*	-0.03
Language (family)[a]	34.34***	3	0.98	0.07	0.02	3.87***	0.04***	1.43***	0.02	-0.05**
Proximal Social Environment Domain										
SRPF School Environment (T)	341.67***	1	0.81	0.23	0.09	20.20***	-0.20***	3.06***	0.46***	-0.27*
SRPF School Involvement (T)	291.10***	1	0.89	0.21	0.07	13.26***	-0.22***	2.79***	0.41***	-0.35***
SRPF School Disengagement (T)	13.25***	1	0.99	0.04	0.01	3.68***	0.13***	0.94***	0.15***	-0.16***
Neighborhood Safety	69.56***	1	0.95	0.10	0.03	4.12***	0.00	0.43***	0.07***	-0.05**
Social Interaction Domain										
FES Conflict Subscale (T)	19.20***	1	0.99	0.05	0.01	1.95***	-0.05***	1.77***	0.21***	-0.19***
Parental Monitoring (Mean)	110.20***	1	0.94	0.13	0.04	4.42***	0.05***	0.10***	0.01**	-0.01*
SDQ Prosocial Behavior (Mean)	16.89***	1	0.99	0.05	0.01	1.69***	0.02***	0.05***	0.01**	0.00
Caregiver Measures										
Cultural/Ethnic Group Membership Domain										
Language (friends)	12.66***	1	0.99	0.07	0.01	4.11***	0.01	1.15***	0.08**	-0.09**
Language (family)	0.90	1	1.00	0.00	0.00	3.83***	0.01	1.55***	0.08**	-0.06*
MACVS Familism-Support (M)	51.86***	1	0.96	0.09	0.02	4.14***	-0.05***	0.26***	0.01**	-0.01
MACVS Familism-Obligations (M)	153.29***	1	0.93	0.15	0.03	3.59***	-0.02***	0.32***	0.02**	-0.02**
MACVS Familism-Referent (M)	106.53***	1	0.96	0.13	0.02	3.34***	-0.02***	0.44***	0.002**	-0.02*
MACVS Independence/Self-Reliance (M)	74.02***	1	0.96	0.11	0.02	3.53***	-0.01**	0.21***	0.01	-0.01
MACVS Religion (M)	30.84***	1	0.99	0.07	0.01	3.28***	-0.04***	1.94***	0.04***	-0.05***
Proximal Social Environment Domain										
Neighborhood Safety (M)	1.33	1	1.00	0.01	0.00	3.94***	-0.03***	0.59***	0.04***	-0.05***
Social Interaction Domain										
FES Conflict Subscale (T)	8.06**	1	1.00	0.03	0.01	2.47***	-0.02	2.06***	0.04	0.06
SDQ Prosocial Behavior (M)	6.01*	1	1.00	0.03	0.01	1.75***	-0.01***	0.10***	0.00	0.00

Note: Analyses were restricted to participants with Year 2 data.

[a] Residual variance was constrained to be equal across waves to account for negative residual variance on the slope factor within the original model. FES = Family Environment Scale. MACVS=Mexican-American Cultural Values Scale. PBP = Peer Behavior Profile. PNH = Peer Network Health. MEIM-R = Multigroup Ethnic Identity Measure – Revised. SRPF = School Risk & Protective Factors. SDQ = Strengths & Difficulties Questionnaire. df = degrees of freedom; CFI = Comparative Fit Index. RMSEA = Root Mean Square Error of Approximation. SRMR = Standardized Root Mean Square Residual. Cov (I/S) = Covariance between intercept and slope.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

information based on geo-coded data.

For youth, data were severely negatively skewed with responses generally indicating agreement with the statement "My neighborhood is safe from crime" (Table 3). "Higher" and "lower risk" youth differed significantly on this item, with higher risk youth reporting less safe neighborhoods (Table 6). However, the difference was very small and mean responses for both groups were within the same qualitative range. Across the three items completed by caregivers, mean responses were also severely negatively skewed and similar to youth, and internal consistency among the items was good (Table 4). Caregivers' responses differed significantly between "higher" and "lower risk" youth, albeit with small effect sizes, at baseline and Y1, but not at Y2 (Table 7). Correlations between the single item completed by youth and the summary score generated from caregivers' responses were significant, but modest (Table 5). Across waves, Y1 and Y2 ICCs were poor for youth report, but moderate for caregiver report (Table 8).

3.2.4. PhenX Neighborhood Collective Efficacy – Community Cohesion and Informal Social Control

The PhenX Neighborhood Collective Efficacy - Community Cohesion and Informal Social Control measure (referred to herein as the "Collective Efficacy" scale) is a 10-item self-report measure first administered to caregivers during Y2 (and is administered again at Y4). Collective efficacy refers to the level of social cohesion in a neighborhood and willingness of neighbors to work together toward common goals and social good (Sampson et al., 1997). Lower collective efficacy is linked to numerous adverse outcomes, including community violence, crime, victimization, child maltreatment, and psychological distress (Sampson et al., 2002), childhood and adolescent obesity (Cohen et al., 2006), and risky sexual behaviors (Browning et al., 2008). Items on this measure provide a 5-point Likert scale for responses (*strongly agree* to *strongly disagree*; *very likely* to *very unlikely*), some of which are reverse scored, to generate two subscales (Social Cohesion and Social Control) and an overall summary score (Collective Efficacy). Questions on social cohesion focus on trust and unity in a community (e.g., "this is a close-knit neighborhood;" "people in this neighborhood can be trusted"). Items that contribute to the Social Control subscale reflect neighbors' willingness to intervene in the face of socially undesirable behaviors (e.g., "If there was a fight in front of your house and someone was being beaten or threatened, how likely is it that your neighbors would break it up?"). The validity of this scale has been supported by its use in several large-scale and longitudinal studies, including the Project on Human Development in Chicago Neighborhoods (Earls and Buka, 1997) and the Fragile Families and Child Wellbeing Study (Reichman et al., 2001). Others have shown support for the measure's validity and reliability (Sampson et al., 1997; Schmidt et al., 2014).

Caregivers' reports on the Community Efficacy scale suggested adequate psychometric properties (Table 4). Participant responses were only slightly negatively skewed, with responses across the two subscales and overall summary score tending to reflect more cohesion, control, and collective efficacy. Internal consistency was high for all scores. Small but significant effect sizes were observed comparing "higher" and "lower risk" youth, with cohesion, control, and collective efficacy being slightly lower for those youth's identified as "higher risk" at screening (Table 7). The Community Efficacy summary score showed low, but significant correlations with the Neighborhood Safety summary score, based on caregiver report at Y2 ($r = 0.22$).

3.3. Measures of social interaction

3.3.1 Family Environment Scale (Subscales of Family Conflict, Activity-Recreational Orientation, Cohesion, Expressiveness, Intellectual-Cultural Orientation, and Organization).

3.3.1. Family Environment Scale (FES) subscales

3.3.1a The Conflict subscale of the FES (Moos and Moos, 1976) was selected to assess one of the core aspects of social interaction and family climate (Zucker et al., 2018). An extensive literature has indicated that these characteristics are directly relevant to the development of substance abuse and of externalizing behaviors more generally, leading to interpersonal difficulties, trouble with the law, and ultimately to the impairment of a successful adaptation to adult life (Glatz et al., 2020; Loukas et al., 2001). Moreover, given these multiple effects on behavior, a reasonable hypothesis is that a relationship also exists between level of experienced conflict and brain maturation in areas relating to emotional expression and impulse control.

The central nature of this social interactional domain led to the decision to administer the measure at all waves. Given the likelihood of differences in experience of this intimate social environment for children and caregivers, it was administered to both youth and caregiver. Analyses indicate differences in level of ratings were systematically present, with youth reporting lower conflict than their caregiver. Youth data also indicated some decrease in perceived conflict with increasing age, while parent/caregiver responses show more stability (Tables 3, 4, and 9). The effectiveness of this measure as an indicator of familial relationship quality is brought home by the fact that for both generations, Conflict effect sizes for differentiation of "higher" from "lower risk" families were among the highest in the entire CE battery (Tables 6 and 7). Differentiation across all three waves was stronger among caregiver reports.

3.3.1b FES subscales of Cohesion, Activity-Recreational Orientation, Intellectual-Cultural Orientation, Expressiveness, and Organization joined the Caregiver protocol at Y2 and have been administered yearly since then. Subsets of these measures focus on different domains of family behavior. The Cohesion and Conflict subscales focus on social connectedness and the degree to which family behavior reflects more the positive or negative pole of this dimension. These two subscales are among the most highly correlated in the FES battery ($Y2_{Caregiver/Youth}$ $r = -0.38$. Although coded separately, there is substantial bidirectionality to the content. Cohesion subscale items reflect positivity and bondedness in the family's relationships (some with reversed content and coding); Conflict subscale items reflect discord. A number of factor analyses involving the two measures have shown that they load on the same factor, and because of complementarity of item content have also been used to create a bidirectional Conflict-Cohesion scale that more effectively covers both positive and negative poles of the construct (Jester et al., 2005; Ketelaar et al., 2017; Sanford et al., 1999).

The Activity-Recreational and Intellectual-Cultural Orientation subscales assess the family's interest in, value of, and participation in activities in the broader community. The Organization and Expressiveness subscales assess structural characteristics of the family's relationships, how well organized and prepared family behavior is, and how strongly family members are encouraged to express feelings. Content homogeneity is acceptable for most of the subscales (Table 4). With the exception of the Expressiveness subscale, internal consistency reflected a modest degree of within-scale content homogeneity. The Expressiveness subscale however, displayed very poor scale homogeneity. This problem has also shown up in earlier studies where factor analysis at the item level indicated low homogeneity of item content (Sanford et al., 1999). Although this subscale did differentiate between "higher" and "lower risk" families (Table 7), given its significant psychometric and content heterogeneity problems, continued utilization of this measure in later data waves needs to be re-evaluated.

3.3.2. CRPBI Acceptance Scale

Parental acceptance and warmth are predictors of children's mental health, well-being, and lower substance use (Steinberg, 2001; Morris et al., in press). Moreover, the parent-child relationship continues to be an important predictor of adjustment during adolescence (Day and Padilla-Walker, 2009). Starting at baseline, a subset of acceptance items from the Child Report of Behavior Inventory (CRPBI, Schaefer, 1965; see also Barber, 1997) was used to assess youth's perceptions of caregiver acceptance. These items were also asked at Y1 and will continue to be administered at various waves throughout the study. Items are asked via youth report for the caregiver participating in the study, typically biological mothers, and a secondary caregiver chosen by the youth (e.g., father, grandparent). Youth respond on a three-point scale to items reflecting caregiver warmth and acceptance (e.g., "makes me feel better after talking over my worries"; "smiles at me very often").

Patterns of responses and associations for study caregiver and second caregiver were very similar. For study caregiver, the internal consistency of the scale was acceptable (Table 3), and test-retest was poor from baseline to Y1 (Table 8). Scale scores were generally high and negatively skewed (Table 3). Acceptance scores varied significantly when comparing "higher" and "lower risk" youth, with "lower risk" youth reporting more acceptance, albeit with small effects sizes (Table 6).

3.3.3. Parental Monitoring

The Parental Monitoring scale (Karoly et al., 2015) evaluates the protective nature of caregiver knowledge of their child's whereabouts, and the degree to which that intersects with shielding their youth from health-risk related behaviors. Details on the nature and socio-developmental theory behind this measure are described in Zucker et al. (2018). Briefly, the Parental Monitoring measure has five questions that assess parents' active efforts to keep track of their child's whereabouts, at home and when they are not at home (e.g., who they are with; what they are doing). All items use a Likert scale ranging from *never* (1) to *almost always* (5). This measure has thus far been administered to youth across all waves; however, it is planned to query caregivers at future measurement waves.

Internal consistency for these items was poor to modest across waves (Table 3). Scores were uniformly high, indicating a high degree of parent knowledge and supervision, with a low degree of variance across waves. Because of this, in the first three waves, the measure showed some negative skew. In terms of associations with "higher" and "lower risk" subsamples, the Parental Monitoring scale reliably differentiated the two youth risk groups, with robust but relatively small effect sizes across waves (Table 6). Specifically, "lower risk" youth showed significantly greater parental supervision across waves. In terms of test-retest reliability, ICCs for this measure were poor at the varying intervals assessed (Table 8). For the Parental Monitoring measure, the linear growth model showed a somewhat inconsistent fit (i.e., acceptable to good CFI and SRMR fits but poor RMSEA fit). However, it followed a significant linear trend for scores to increase slightly over time (Table 9 and Fig. 3).

3.3.4. SDQ Prosocial Behavior Scale

Numerous studies have demonstrated the importance of youth prosocial behavior in child and adolescent adjustment (Eisenberg et al., 2009). Yearly and at baseline, youth's prosocial behavior was assessed using the prosocial scale of the Strengths and Difficulties Questionnaire (SDQ, Goodman et al., 1998) and was reported on by caregivers and youth. Items are rated on a 0–2 scale and include questions such as, "My child is considerate of other people's feelings;" and "I am helpful if someone is hurt, upset, or feeling sick." Cronbach alphas were acceptable or better (Tables 3 and 4). Intraclass correlations indicated moderate test-retest reliability among caregivers but poor test-retest reliability among youth (Table 8). Caregiver and youth reports were significantly associated with caregiver acceptance, family conflict, monitoring, school disengagement, school involvement, school environment, problem solving, prosocial peer behavior, and peer rule breaking, in expected directions with strong associations among youth reports of variables. Moreover, prosocial behavior was higher among "lower" versus "higher risk" participants for caregiver and youth reports (Tables 6 and 7), and scale scores tended to be negatively skewed with most participants reporting high levels of prosocial behavior (Tables 3 and 4). Correlations between caregiver and youth report were modest and significant (Table 5), and prosocial behavior levels were slightly

more positive over the three years for youth report, but flat for parent report (Table 9 and Fig. 3).

3.3.5. Peer Behavior Profile subscales

The influence of peers is one of the strongest contextual factors shaping the development of rule breaking behavior, substance use, and engagement in the broader community and its culture (Criss et al., 2002; Dishion et al., 2008). Thus, it has great relevance to other factors assessed by the CE WG. Developmentally, these influences come strongly into their own as adolescence starts to emerge. With that in mind, the Peer Behavior Profile (PBP; Bingham et al., 1995), a measure of peer involvement assessing the differentiated quality of peer contacts, was added to the Youth protocol at Y2, with the plan to continue use yearly thereafter. Items were derived from earlier measures assessing these social influence networks (Hirschi, 1969; Jessor et al., 1983; Trucco et al., 2017). Because of time constraints, truncated versions (3 items per scale) of the two subscales deemed most relevant: Peer Involvement (PPI) and Delinquent Peer Involvement (DPI), were chosen. The PPI measure assesses the extent to which the youth's friendship network consists of prosocial peers (friends who get good grades, are athletes, attend religious services). The DPI measure assesses the extent to which the friendship network involves rule breaking/delinquent peers (e.g., friends who skip school, shoplift, are suspended). Specific items all were predictors in the NIAAA Screening Initiative (National Institute on Alcohol Abuse and Alcoholism NIAAA, 2011), that had, from ages 8–11, predicted problem alcohol use into mid to late adolescence (Brown et al., 2010). Participants report on the proportion of their peers are involved in these activities on a 5-point scale ranging from *none or almost none* to *all or nearly all*.

Descriptive and analytic statistics indicated that the two measures are operating in differentiated ways that would be anticipated based on item content and the differences in prevalence of these behaviors in the social environment (Table 3). The DPI measure is significantly positively skewed, and involvement with delinquent peers was uncommon for most youth. In contrast, the PPI measure was normally distributed, with more dispersion of responses across items. At the same time, both measures differentiated between "lower" from "higher risk" subsamples, although the mean difference between groups was substantially higher with the PPI than with the DPI (Table 6). Given the substantially lower frequency of delinquent activity, this statistical difference would be expected. However, despite the distinct social differences and potential consequences relating to these two kinds of activity, the very small correlation between the subscales ($r = -0.04$ $p = .002$) indicates social involvement with one set of peers does not preclude involvement with the other, at least at this developmental waypoint.

3.3.6. Peer Network Health

Protective Peer behaviors against substance use were captured with the Peer Network Health measure, an adapted five-item self-report scale derived from the Adolescent Social Network Assessment (ASNA, Mason et al., 2004). The ASNA collects substance use risk and protection information on each participant's close peer group. The ASNA has favorable internal reliability (Cronbach's alpha $= 0.84$ and correlates significantly in the expected direction with self-reported measures of substance use (any alcohol, marijuana or other substance; $r = -0.64$ (Mason et al., 2011). For the ABCD Study®, we used five items whereby youth report on their three closest friends' protective behaviors against substance use. The items are, 1) "During the last 6 months, have any of your close friends ever suggested that you *not* use drugs or alcohol?", 2) "During the last 6 months, have any of your close friends given you help with school, with money, with transportation, or help by talking through problems?", 2.a.) (If *yes* to item 2): "How much help did your close friends give you?", 3) "During the last 6 months, have any of your close friends encouraged you to get or stay involved with sports or exercise, school teams or clubs, volunteering, or religious activities?", and 3.a.) (If *yes* to item 3): "How much did your close friends encourage you?" Responses are encoded as: Item 1, *No* = 0, *Yes* = 3; Items 2 and 3, *No* = 0, *Yes* = 2; Items 2a and 3a responses range from 1 to 10, with 1 indicating little help or encouragement and 10 indicating lots of help or encouragement. Items are summed to produce a summary score with higher scores interpreted as greater protection against substance use; that is, greater peer network health. Internal consistency for this measure among ABCD youth was lower than in prior published studies. We speculate this is likely due to the smaller item subset used in ABCD compared to the original instrument. Nonetheless, youth identified as "higher risk" at screening showed lower scores on this measure compared to "lower risk" youth (Table 6). Moving forward, we anticipate continuing to administer this measure in future visits every other year.

3.3.7. Wills Problem Solving Scale (WPSS)

Problem-solving is a major component of resilience for children living in environments with high risk load. It provides the tools to not succumb to risk factors often encountered in difficult environments. The WPPS (Wills et al., 1998; Wills and Dishion, 2004), provides a measure of this via a 6-item scale answered on a 5-point response scale (*Never* = 1 to *Usually* = 5). The scale was added to the Y1 protocol, with plans to re-administer it on alternate years. Average item endorsement level indicated fairly high endorsement of these behaviors, and internal consistency of responses across items was good (Table 3). Moreover, the WPPS effectively differentiates "higher" from "lower risk" youth (Table 6) and had the largest observed effect across youth measures in the CE battery.

4. Discussion

In Zucker et al. (2018), we provided rationale and descriptions of measures introduced by the CE WG of the ABCD Study®, along with preliminary psychometric data on a portion of the ABCD baseline sample. In this report, we provide an update to CE WG measures and data. Importantly, we also provided updated psychometric information based on the ABCD NDA 3.0 data release, which includes the full baseline sample, most of the Y1 data, and a portion of the Y2 data. In addition, we presented emerging data on test-retest reliability of measures administered at multiple time points, as well as linear growth curves showing data trajectories across measurement waves for those measures administered at three timepoints. Collectively, this information is intended to assist those working with CE WG measures.

Distributions of data with the full baseline sample and across available data at subsequent measurement waves were consistent with those reported in Zucker et al. (2018). Most measures showed adequate internal consistency, with several exceptions. Specifically, among youth, poor internal consistency was observed for subscales from PhenX School Risk and Protective Factors, FES Family Conflict, Parental Monitoring, Peer Behavior Profile, and Peer Network Health. Internal consistency of measures was better for those completed by caregivers, with the exception of some subscales from the FES, the MACVS Independence/Self-Reliance subscale, and the NAAS. Correlations between youths and caregivers when completing the same measure were generally modest, with the exception of PhenX Acculturation language spoken with family and School Grades showing much higher correlations. Very low correlations were observed for School Unexcused Absences and MACVS Familism-Obligation and Familism-Support subscales. Low correlations among multiple informants on youth behavior is commonly reported in the literature (Achenbach et al., 1987; Duhig et al., 2000). Despite this, almost all measures administered to youth and caregivers demonstrated statistically significant differences between those youth identified as "lower" or "higher risk" at study enrollment based on screening questions designed to predict mid-adolescent cannabis involvement (Loeber et al., 2018), even when controlling for numerous sociodemographic confounds. All differences were in the expected direction, substantiating the validity of the

constructs as risk or resilience factors. However, effect sizes were generally small, which is consistent with other findings emerging from the ABCD data (Dick et al., 2021; Owens et al., 2020). Moreover, we note that unadjusted models without covariates or those including different covariates would likely yield different results. Importantly, with few exceptions (e.g., Clark et al., 2021; Karcher et al., 2020; Hawes et al., 2020; Watts et al., 2020) there is insufficient published literature on measurement invariance across the many measures within ABCD across numerous relevant sociodemographic characteristics, but such studies are emerging. This is an important undertaking for future investigation.

Test-retest reliability of measures was modest to good for all measures completed by caregivers, but all youth measures showed poor test-retest reliability, despite many of the same measures showing adequate internal consistency. The notable exception was PhenX Acculturation languages spoken with family. It is possible that these findings may be influenced by less reliable reporting among youth, by more variability in developmental changes of youth, and/or by the youth experiencing more changes in their family or school environment (e.g., transition from elementary to middle school). Investigators using ABCD CE data that includes youth report should consider the low reliability observed in the youth sample for CE measures and the impact it may have on their results. Test-retest reliability generally increased slightly for youth on most measures when comparing ICCs from baseline to Y1 with those from Y1 to Y2. It may be of interest to investigators to examine if reliability improves at subsequent measurement waves as youth develop into young adulthood. Linear growth models showed adequate fit and statistically significant slopes for most measures across youths and parents, with the exception of the School Environment and School Involvement subscales of PhenX School Risk and Protective factors, on which youth showed fluctuating scores across measurement waves, perhaps also reflecting school or grade transitions. There were also a few instances in which the RMSEA value was poor but other fit statistics indicated adequate or good fit. Notably, there was a significant amount of variability in the intercepts and slopes across the measures, indicating that initial frequencies and rates of change varied across individuals. This provides an opportunity for future research on moderators that result in different trajectories among youth, thus providing a more nuanced understanding on what may cause divergences in individual trajectories.

Several limitations are important to consider as they pertain to the results of the current report, as well as when working with ABCD Study® data in general. First, our analyses relying on classifications of "higher" or "lower" risk were based on caregiver reports of externalizing behavior in youth and self-reported caregiver smoking captured at screening, prior to baseline (Loeber et al., 2018). Although these items were found to be highly predictive of early-onset cannabis use across several adolescent longitudinal cohorts, this variable is not intended as an outcome measure in the ABCD Study®. Nonetheless, for the purposes of this report, we found it a valuable construct to employ, given that the data were captured prior to study entry and substance use is still not common in the ABCD sample given youths' age. Many of our statistical analyses were significant, but effect sizes were often modest in magnitude. This is not an unexpected finding given results emerging from the ABCD Study® and the common occurrence and importance of such small effects have been previously discussed in this context (Dick et al., 2021; Owens et al., 2020). Finally, although the ABCD cohort is a large, national, and diverse sample, it also differs from the general U.S. population in several ways (Garavan et al., 2018). It is also important to note that the central aim of this report was to provide descriptive and psychometric data on measures curated by the CE workgroup rather than to engage in specific hypothesis testing. Subset analyses based on specific participant characteristics (e.g., sex, pubertal status, family income, parental education level, language administered) may yield different descriptive and psychometric data across subgroups. Similarly, youth and caregiver data are likely influenced by numerous potential moderators that can be explored by the broader scientific community given the "open science" model. The ABCD data is rich and offers information on numerous participant and family characteristics, biological factors, neuroimaging data, mental health, and various contextual factors, thus providing opportunities for further investigation.

Investigators planning on using CE WG measures in their analyses of CE data may benefit from considering existing and upcoming changes to our protocol during future data releases. All constructs described in this report will continue to be assessed for the near future. Forthcoming data releases will also include information on youth ethnic identity and cultural family values, which have only been administered to caregivers at the time of the 3.0 data release. This will allow investigators to also assess gaps between youth and caregivers. Some measures of acculturation, namely, the Vancouver Index of Acculturation, will eventually be phased out in order to make room for other measures. Nevertheless, other brief scales such as the Phenx Acculturation Scale will continue being administered throughout the course of the study. Future measurement waves also will assess resistance to peer influence, where youth spend their time, and an attempt to capture information on the early childhood environment via caregiver self-report. The CE WG is continually reassessing the constructs and frequency of measurement to balance the limited time allowed for assessments with the rapid and dynamic changes that youth are undergoing during adolescence. When taken together with CE measures, ABCD data on genetics, neuroimaging, cognition, physical health, and the numerous other domains assessed within the ABCD Study® will invariably lead to new insights into the identification and prevention of many adverse life-long conditions that manifest in adolescence.

Funding sources

This work was supported by the National Institutes of Health [U01DA041156: Raul Gonzalez; T32DA043449: Erin Thompson; 5S21MD010683: Mariana Sanchez; U01AA021692-09S1 Marybel Gonzalez; U01DA041148 Sarah W. Feldstein Ewing; U01DA051037: Michael J. Mason; U01 DA041089, U24 DA041147: Susan F. Tapert; U01DA041106: Robert A. Zucker].

Data statement

Data used in the preparation of this article were obtained from the Adolescent Brain Cognitive Development SM (ABCD) Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA). This is a multisite, longitudinal study designed to recruit more than 10,000 children age 9–10 and follow them over 10 years into early adulthood. The ABCD Study® is supported by the National Institutes of Health and additional federal partners under award numbers U01DA041048, U01DA050989, U01DA051016, U01DA041022, U01DA051018, U01DA051037, U01DA050987, U01DA041174, U01DA041106, U01DA041117, U01DA041028, U01DA041134, U01DA050988, U01DA051039, U01DA041156, U01DA041025, U01DA041120, U01DA051038, U01DA041148, U01DA041093, U01DA041089, U24DA041123, U24DA041147. A full list of supporters is available at https://abcdstudy.org/federal-partners.html. A listing of participating sites and a complete listing of the study investigators can be found at https://abcdstudy.org/consortium_members/. ABCD consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in the analysis or writing of this report. This manuscript reflects the views of the authors and may not reflect the opinions or views of the NIH or ABCD consortium investigators. The ABCD data repository grows and changes over time. The ABCD data used in this report came from the ABCD 3.0 data release DOI 10.15154/1519007. DOIs can be found at https://nda.nih.gov/abcd/query/abcd-curated-annual-release-3.0.html.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The work presented herein is only possible due to the time, commitment, and contributions of the many families that have chosen to participate in this historic study and the staff, research assistants, and team members that carry out the critical work. We are incredibly grateful. We are also thankful for the work of all Culture and Environment Workgroup members for their valuable contributions to this protocol and the Cherokee Nation Institutional Review Board for feedback on the manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.dcn.2021.101021.

References

Achenbach, T.M., McConaughy, S.H., Howell, C.T., 1987. Child/adolescent behavioral and emotional problems: implications of cross-informant correlations for situational specificity. Psychol. Bull. 101 (2), 213–232. https://doi.org/10.1037/0033-2909.101.2.213.

Arthur, M.W., Briney, J.S., Hawkins, J.D., Abbott, R.D., Brooke-Weiss, B.L., Catalano, R. F., 2007. Measuring risk and protection in communities using the Communities That Care Youth Survey. Eval. Progr. Plan. 30 (2), 197–211. https://doi.org/10.1016/j.evalprogplan.2007.01.009.

Baldwin, J.A., Brown, B.G., Wayment, H.A., Nez, R.A., Brelsford, K.M., 2011. Culture and context: buffering the relationship between stressful life events and risky behaviors in American Indian youth. Subst. Use Misuse 46 (11), 1380–1394. https://doi.org/10.3109/10826084.2011.592432.

Barber, B.K., 1997. Introduction: adolescent socialization in context—the role of connection, regulation, and autonomy in the family. J. Adolesc. Res. 12 (1), 5–11. https://doi.org/10.1177/0743554897121002.

Bingham, C.R., Fitzgerald, H.E., Zucker, R.A., 1995. Peer Behavior Profile/Peer Activities Questionnaire. Unpublished questionnaire. East Lansing: Department of Psychology. Michigan State University.

Brislin, S.J., Martz, M.E., Joshi, S., Duval, E.R., Gard, A., Clark, D.A., Hyde, L.W., Hicks, B.M., Taxali, A., Angstadt, M., Rutherford, S., Heitzeg, M.M., Sripada, C., 2021. Differentiated nomological networks of internalizing, externalizing, and the general factor of psychopathology ('*p* factor') in emerging adolescence in the ABCD study. Psychol. Med. 1–11. https://doi.org/10.1017/S0033291720005103.

Bronfenbrenner, U., Ceci, S.J., 1994. Nature-nurture reconceptualized in developmental perspective: a bioecological model. Psychol. Rev. 101 (4), 568–586. https://doi.org/10.1037/0033-295x.101.4.568.

Browning, C.R., Burrington, L.A., Leventhal, T., Brooks-Gunn, J., 2008. Neighborhood structural inequality, collective efficacy, and sexual risk behavior among urban youth. J. Health Soc. Behav. 49 (3), 269–285. https://doi.org/10.1177/002214650804900303.

Brown, S.A., Donovan, J.E., McGue, M.K., Schulenberg, J.E., Zucker, R.A., Goldman, M. S., 2010. Youth alcohol screening workshop II: determining optimal secondary screening questions. Alcohol. Clin. Exp. Res. 34 (6), 267A.

Brown, S.D., Unger Hu, K.A., Mevi, A.A., Hedderson, M.M., Shan, J., Quesenberry, C.P., Ferrara, A., 2014. The Multigroup Ethnic Identity Measure-Revised: measurement invariance across racial and ethnic groups. J. Couns. Psychol. 61 (1), 154–161. https://doi.org/10.1037/a0034749.

Bryant, A.L., Schulenberg, J.E., O'Malley, P.M., Bachman, J.G., Johnston, L.D., 2003. How academic achievement, attitudes, and behaviors relate to the course of substance use during adolescence: a 6–year, multiwave national longitudinal study. J. Res. Adolesc. 13 (3), 361–397. https://doi.org/10.1111/1532-7795.1303005.

Bugbee, B.A., Beck, K.H., Fryer, C.S., Arria, A.M., 2019. Substance use, academic performance, and academic engagement among high school seniors. J. Sch. Health 89 (2), 145–156. https://doi.org/10.1111/josh.12723.

Cano, M.Á., Sánchez, M., De La Rosa, M., Rojas, P., Ramírez-Ortiz, D., Bursac, Z., Meca, A., Schwartz, S.J., Lorenzo-Blanco, E.I., Zamboanga, B.L., Garcini, L.M., Roncancio, A.M., Arbona, C., Sheehan, D.M., de Dios, M.A., 2020. Alcohol use severity among Hispanic emerging adults: examining the roles of bicultural self-efficacy and acculturation. Addict. Behav. 108, 106442 https://doi.org/10.1016/j.addbeh.2020.106442.

Clark, D.A., Brislin, S., Clark, D.B., Durbin, C.E., Parr, A.C., Ahonen, L., Hicks, B.M., 2021. Differential item functioning in reports of delinquent behavior between Black and White youth: evidence of measurement bias in self-reports of arrest in the Adolescent Brain Cognitive Development (ABCD) study. PsyArXiv. https://doi.org/10.31234/osf.io/mfq38.

Cohen, J., 1992. A power primer. Psychol. Bull. 112 (1), 155–159. https://doi.org/10.1037//0033-2909.112.1.155.

Cohen, D.A., Finch, B.K., Bower, A., Sastry, N., 2006. Collective efficacy and obesity: the potential influence of social factors on health. Soc. Sci. Med. 62 (3), 769–778. https://doi.org/10.1016/j.socscimed.2005.06.033.

Criss, M.M., Pettit, G.S., Bates, J.E., Dodge, K.A., Lapp, A.L., 2002. Family adversity, positive peer relationships, and children's externalizing behavior: a longitudinal perspective on risk and resilience. Child Dev. 73 (4), 1220–1237. https://doi.org/10.1111/1467-8624.00468.

Day, R.D., Padilla-Walker, L.M., 2009. Mother and father connectedness and involvement during early adolescence. J. Family 23 (6), 900–904. https://doi.org/10.1037/a0016438.

Demidenko, M.I., Ip, K.I., Kelly, D.P., Constante, K., Goetschius, L.G., Keating, D.P., 2021. Ecological stress, amygdala reactivity, and internalizing symptoms in preadolescence: Is parenting a buffer? Cortex 140, 128–144. https://doi.org/10.1016/j.cortex.2021.02.032.

Dick, A.S., Lopez, D.A., Watts, A.L., Heeringa, S.G., Reuter, C., Bartsch, H., Fan, C.C., Kennedy, D.N., Palmer, C., Marshall, A., Haist, F., Hawes, S., Nichols, T.E., Barch, D. M., Jernigan, T.L., Garavan, H., Grant, S., Pariyadath, V., Hoffman, E., Thompson, W., 2021. Meaningful effects in the adolescent brain cognitive development study. BioRxiv. https://doi.org/10.1101/2020.09.01.276451.

Dishion, T.J., Piehler, T.F., Myers, M.W., 2008. Dynamics and ecology of adolescent peer influence. In: Prinstein, M.J., Dodge, K.A. (Eds.), Duke Series in Child Development and Public Policy. Understanding Peer Influence in Children and Adolescents. The Guilford Press, pp. 72–93.

Donohue, M.R., Tillman, R., Perino, M.T., Whalen, D.J., Luby, J., Barch, D.M., 2020. Prevalence and correlates of maladaptive guilt in middle childhood. J. Affect. Disord. 263, 64–71. https://doi.org/10.1016/j.jad.2019.11.075.

Duhig, A.M., Renk, K., Epstein, M.K., Phares, V., 2000. Interparental agreement on internalizing, externalizing, and total behavior problems: a meta-analysis. Clin. Psychol. Sci. Pract. 7 (4), 435–453. https://doi.org/10.1093/clipsy.7.4.435.

Earls, F., Buka, S.L., 1997. Project on Human Development in Chicago Neighborhoods. National Institute of Justice, Washington, DC.

Echeverria, S.E., Diez-Roux, A.V., Link, B.G., 2004. Reliability of self-reported neighborhood characteristics. J. Urban Health. Bull. N. Y. Acad. Med. 81 (4), 682–701. https://doi.org/10.1093/jurban/jth151.

Eisenberg, N., Morris, A.S., McDaniel, B., Spinrad, T.L., 2009. Moral cognitions and prosocial responding in adolescence. In: Lerner, R.M., Steinberg, L. (Eds.), Handbook of Adolescent Psychology: Individual Bases of Adolescent Development. John Wiley & Sons Inc, pp. 229–265. https://doi.org/10.1002/9780470479193.adlpsy001009.

Garavan, H., Bartsch, H., Conway, K., Decastro, A., Goldstein, R.Z., Heeringa, S., Jernigan, T., Potter, A., Thompson, W., Zahs, D., 2018. Recruiting the ABCD sample: design considerations and procedures. Dev. Cogn. Neurosci. 32, 16–22. https://doi.org/10.1016/j.dcn.2018.04.004.

Garnett, B.R., Masyn, K.E., Austin, S.B., Miller, M., Williams, D.R., Viswanath, K., 2014. The intersectionality of discrimination attributes and bullying among youth: An applied latent class analysis. Journal of Youth and Adolescence 43 (8), 1225–1239. https://doi.org/10.1007/s10964-013-0073-8.

Garrett, M.T., Pichette, E.F., 2000. Red as an apple: Native American acculturation and counseling with or without reservation. J. Couns. Dev. 78 (1), 3–13. https://doi.org/10.1002/j.1556-6676.2000.tb02554.x.

Glatz, T., Lippold, M., Jensen, T.M., Fosco, G.M., Feinberg, M.E., 2020. Hostile interactions in the family: patterns and links to youth externalizing problems. J. Early Adolesc. 40 (1), 56–82. https://doi.org/10.1177/0272431618824718.

Gonzalez, M.R., Palmer, C.E., Uban, K.A., Jernigan, T.L., Thompson, W.K., Sowell, E.R., 2020. Positive economic, psychosocial, and physiological ecologies predict brain structure and cognitive performance in 9-10-year-old children. Front. Hum. Neurosci. 14, 578–822. https://doi.org/10.3389/fnhum.2020.578822.

Goodman, R., Meltzer, H., Bailey, V., 1998. The Strengths and Difficulties Questionnaire: a pilot study on the validity of the self-report version. Eur. Child Adolesc. Psychiatr. 7 (3), 125–130. https://doi.org/10.1007/s007870050057.

Guerrero, M.D., Barnes, J.D., Tremblay, M.S., Pulkki-Råback, L., 2021. Typologies of family functioning and 24-h movement behaviors. Int. J. Environ. Res. Public Health 18 (2), 699. https://doi.org/10.3390/ijerph18020699.

Hamilton, C.M., Strader, L.C., Pratt, J.G., Maiese, D., Hendershot, T., Kwok, R.K., Hammond, J.A., Huggins, W., Jackman, D., Pan, H., Nettles, D.S., Beaty, T.H., Farrer, L.A., Kraft, P., Marazita, M.L., Ordovas, J.M., Pato, C.N., Spitz, M.R., Wagener, D., Haines, J., 2011. The PhenX Toolkit: get the most from your measures. Am. J. Epidemiol. 174 (3), 253–260. https://doi.org/10.1093/aje/kwr193.

Hawes, S.W., Waller, R., Thompson, W.K., Hyde, L.W., Byrd, A.L., Burt, S.A., Gonzalez, R., 2020. Assessing callous-unemotional traits: development of a brief, reliable measure in a large and diverse sample of preadolescent youth. Psychol. Med. 50 (3), 456–464.

Heeringa, S.G., Berglund, P.A., 2020. A guide for population-based analysis of the Adolescent Brain Cognitive Development (ABCD) Study baseline data. BioRxiv. https://doi.org/10.1101/2020.02.10.942011.

Hirschi, T., 1969. Causes of Delinquency. University of California Press, Berkeley, CA.

Hu, L.-T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equat. Model. 6 (1), 1–55. https://doi.org/10.1080/10705519909540118.

IBM Corp. Released, 2019. IBM SPSS Statistics for Macintosh, Version 26.0. IBM Corp, Armonk, NY.

Janiri, D., Doucet, G.E., Pompili, M., Sani, G., Luna, B., Brent, D.A., Frangou, S., 2020. Risk and protective factors for childhood suicidality: a US population-based study. Lancet Psychiatry 7 (4), 317–326. https://doi.org/10.1016/S2215-0366(20)30049-3.

Jessor, R., Costa, F., Jessor, L., Donovan, J.E., 1983. Time of first intercourse: a prospective study. J. Personal. Soc. Psychol. 44 (3), 608–626. https://doi.org/10.1037/0022-3514.44.3.608.

Jester, J.M., Nigg, J.T., Adams, K., Fitzgerald, H.E., Puttler, L.I., Wong, M.M., Zucker, R. A., 2005. Inattention/hyperactivity and aggression from early childhood to adolescence: heterogeneity of trajectories and differential influence of family environment characteristics. Dev. Psychopathol. 17 (1), 99–125. https://doi.org/10.1017/50954579405050066.

Karcher, N.R., Loewy, R.L., Savill, M., Avenevoli, S., Huber, R.S., Simon, T.J., Leckliter, I. N., Sher, K.J., Barch, D.M., 2020. Replication of associations with psychotic-like experiences in middle childhood from the Adolescent Brain Cognitive Development (ABCD) study. Schizophr. Bull. Open 1 (1), sgaa009. https://doi.org/10.1093/schizbullopen/sgaa009.

Karoly, H.C., Callahan, T., Schmiege, S.J., Feldstein Ewing, S.W., 2015. Evaluating the Hispanic Paradox in the context of adolescent risky sexual behavior: the role of parent monitoring. J. Pediatr. Psychol. 41 (4), 429–440. https://doi.org/10.1093/jpepsy/jsv039.

Kerr, K.L., Ralph-Nearman, C., Colaizzi, J.M., DeVille, D.C., Breslin, F.J., Aupperle, R.L., Paulus, M.P., Morris, A.S., 2021. Gastric symptoms and low perceived maternal warmth are associated with eating disorder symptoms in young adolescent girls. Int. J. Eating Disord. Adv. Online Publ. 54, 1009–1018. https://doi.org/10.1002/eat.23516.

Ketelaar, M., Bogossian, A., Saini, M., Visser-Meily, A., Lach, L., 2017. Assessment of the family environment in pediatric neurodisability: a state-of-the-art review. Dev. Med. Child Neurol. 59 (3), 259–269. https://doi.org/10.1111/dmcn.13287.

Knight, G.P., Gonzales, N.A., Saenz, D.S., Bonds, D.D., German, M., Deardorff, J., Roosav, M.W., Updegraff, K.A., 2010. The Mexican American cultural values scale for adolescents and adults. J. Early Adolesc. 30 (3), 444–481. https://doi.org/10.1177/0272431609338178.

Koo, T.K., Li, M.Y., 2016. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J. Chiropr. Med. 15 (2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012.

Loeber, R., Clark, D.B., Ahonen, L., FitzGerald, D., Trucco, E.M., Zucker, R.A., 2018. A brief validated screen to identify boys and girls at risk for early marijuana use. Developmental Cognitive Neuroscience 32, 23–29. https://doi.org/10.1016/j.dcn.2018.03.011.

Loukas, A., Fitzgerald, H.E., Zucker, R.A., von Eye, A., 2001. Parental alcoholism and co-occurring antisocial behavior: prospective relationships to externalizing behavior problems in their young sons. J. Abnorm. Child Psychol. 29 (2), 91–106. https://doi.org/10.1023/a:1005281011838.

Lui, P.P., Zamboanga, B.L., 2018. A critical review and meta-analysis of the associations between acculturation and alcohol use outcomes among Hispanic Americans. Alcohol. Clin. Exp. Res. 42 (10), 1841–1862. https://doi.org/10.1111/acer.13845.

Martinez, M.J., Huang, S., Estrada, Y., Sutton, M.Y., Prado, G., 2017. The relationship between acculturation, ecodevelopment, and substance use among hispanic adolescents. J. Early Adolesc. 37 (7), 948–974. https://doi.org/10.1177/0272431616636228.

Mason, M., Cheung, I., Walker, L., 2004. Substance use, social networks, and the geography of urban adolescents. Subst. Use Misuse 39 (10–12), 1751–1777. https://doi.org/10.1081/JA-200033222.

Mason, M.J., Mennis, J., Schmidt, C.D., 2011. A social operational model of urban adolescents' tobacco and substance use: a mediational analysis. J. Adolesc. 34 (5), 1055–1063. https://doi.org/10.1016/j.adolescence.2010.11.002.

Miech, R., Azur, M., Dusablon, T., Jowers, K., Goldstein, A.B., Stuart, E.A., Walrath, C., Leaf, P.J., 2008. The potential to reduce mental health disparities through the comprehensive community mental health services for children and their families program. J. Behav. Health Serv. Res. 35 (3), 253–264. https://doi.org/10.1007/s11414-008-9123-5.

Modabbernia, A., Janiri, D., Doucet, G.E., Reichenberg, A., Frangou, S., 2021. Multivariate patterns of brain-behavior-environment associations in the adolescent brain and cognitive development study. Biol. Psychiatry 89 (5), 510–520. https://doi.org/10.1016/j.biopsych.2020.08.014.

Moos, R.H., Moos, B.S., 1976. A typology of family social environments. Family Process 15 (4), 357–371. https://doi.org/10.1111/j.1545-5300.1976.00357.x.

Morris, A.S., Ratliff, E., Cosgrove, K.T., & Steinberg, L. (in press). Parenting, we know even more things: a decade in review. J. Res. Adolesc.

Mujahid, M.S., Diez Roux, A.V., Morenoff, J.D., Raghunathan, T., 2007. Assessing the measurement properties of neighborhood scales: from psychometrics to ecometrics. Am. J. Epidemiol. 165 (8), 858–867. https://doi.org/10.1093/aje/kwm040.

Muthen, L.K., Muthen, B.O., 1998-2012. Mplus User's Guide, seventh ed. Muthen & Muthen, Los Angeles, CA.

National Institute on Alcohol Abuse and Alcoholism [NIAAA]. (2011). Unpublished analysis of 2000–2009 data from the National Survey on Drug Use and Health (NSDUH), an annual nationwide survey sponsored by the Substance Abuse and Mental Health Services Administration.

Nunnally, J.C., Bernstein, I.H., 1994. Psychometric Theory, third ed. McGraw Hill, New York, NY.

Ong, A.D., Fuller-Rowell, T.E., Phinney, J.S., 2010. Measurement of ethnic identity: recurrent and emergent issues. Identity Int. J. Theory Res. 10 (1), 39–49. https://doi.org/10.1080/15283481003676226.

Owens, M.M., Potter, A., Hyatt, C.S., Albaugh, M., Thompson, W.K., Jernigan, T., Yuan, D., Hahn, S., Allgaier, N., Garavan, H., 2020. Recalibrating expectations about effect size: a multi-method survey of effect sizes in the ABCD study. PsyArXiv 16, 0257535. https://doi.org/10.31234/osf.io/tn9u4.

Phinney, J.S., 1993. A three-stage model of ethnic identity development in adolescence. In: Bernal, M., Knight, G. (Eds.), Ethnic Identity: Formation and Transmission Among Hispanics and Other Minorities. State University of New York Press, Albany, NY, pp. 61–79.

Phinney, J.S., Madden, T., Santos, L.J., 1998. Psychological variables as predictors of perceived ethnic discrimination among minority and immigrant adolescents. Journal of Applied Social Psychology 28 (11), 937–953. https://doi.org/10.1111/j.1559-1816.1998.tb01661.x.

Phinney, J.S., Ong, A.D., 2007. Conceptualization and measurement of ethnic identity: current status and future directions. J. Couns. Psychol. 54 (3), 271–281. https://doi.org/10.1037/0022-0167.54.3.271.

Rakesh, D., Seguin, C., Zalesky, A., Cropley, V., Whittle, S., 2021. Associations between neighborhood disadvantage, resting-state functional connectivity, and behavior in the Adolescent Brain Cognitive Development (ABCD) Study®: moderating role of positive family and school environments. Biol. Psychiatry Cogn. Neurosci. Neuroimaging Adv. Online Publ. 6, 877–886. https://doi.org/10.1016/j.bpsc.2021.03.008.

Reese, L.R.E., Vera, E.M., Paikoff, R.L., 1998. Ethnic identity assessment among inner-city African American children: evaluating the applicability of the Multigroup Ethnic Identity Measure. J. Black Psychol. 24 (3), 289–304. https://doi.org/10.1177/0013164403063003010.

Reichman, N.E., Teitler, J.O., Garfinkel, I., McLanahan, S.S., 2001. Fragile families: sample and design. Children Youth Serv. Rev. 23 (4–5), 303–326. https://doi.org/10.1016/S0190-7409(01)00141-4.

Reynolds, A.L., Sodano, S.M., Ecklund, T.R., Guyker, W., 2012. Dimensions of acculturation in Native American college students. Meas. Eval. Couns. Dev. 45 (2), 101–112. https://doi.org/10.1177/0748175611428330.

Ryder, A.G., Alden, L.E., Paulhus, D.L., 2000. Is acculturation unidimensional or bidimensional? A head-to-head comparison in the prediction of personality, self-identity, and adjustment. J. Personal. Soc. Psychol. 79 (1), 49–65. https://doi.org/10.1037//0022-3514.79.1.49.

Sampson, R.J., Morenoff, J.D., Gannon-Rowley, T., 2002. Assessing "neighborhood effects": social processes and new directions in research. Ann. Rev. Sociol. 28 (1), 443–478. https://doi.org/10.1146/annurev.soc.28.110601.141114.

Sampson, R.J., Raudenbush, S.W., Earls, F., 1997. Neighborhoods and violent crime: a multilevel study of collective efficacy. Science 277 (5328), 918–924. https://doi.org/10.1126/science.277.5328.918.

Sanders-Phillips, K., Settles-Reaves, B., Walker, D., Brownlow, J., 2009. Social inequality and racial discrimination: risk factors for health disparities in children of color. Pediatrics 125 (Suppl 3), S176–S186.

Sanford, K., Bingham, C.R., Zucker, R.A., 1999. Validity issues with the Family Environment Scale: psychometric resolution and research application with alcoholic families. Psychol. Assess. 11 (3), 315–325. https://doi.org/10.1037/1040-3590.11.3.315.

Schaefer, E.S., 1965. A configurational analysis of children's reports of parent behavior. J. Consult. Psychol. 29 (6), 552–557. https://doi.org/10.1037/h0022702.

Schmidt, N.M., Tchetgen Tchetgen, E.J., Ehntholt, A., Almeida, J., Nguyen, Q.C., Molnar, B.E., Azrael, D., Osypuk, T.L., 2014. Does neighborhood collective efficacy for families change over time? The Boston Neighborhood Survey. J. Community Psychol. 42 (1), 61–79. https://doi.org/10.1002/jcop.21594.

Schwartz, S.J., Unger, J.B., Baezconde-Garbanati, L., Benet-Martínez, V., Meca, A., Zamboanga, B.L., Szapocznik, J., 2015. Longitudinal trajectories of bicultural identity integration in recently immigrated Hispanic adolescents: links with mental health and family functioning. Int. J. Psychol. 50 (6), 440–450. https://doi.org/10.1002/ijop.12196.

Schwartz, S.J., Unger, J.B., Des Rosiers, S.E., Huang, S., Baezconde-Garbanati, L., Lorenzo-Blanco, E.I., Villamar, J.A., Soto, D.W., Pattarroyo, M., Szapocznik, J., 2012. Substance use and sexual behavior among recent Hispanic immigrant adolescents: effects of parent-adolescent differential acculturation and communication. Drug Alcohol Depend. 125 (Suppl 1), S26–S34. https://doi.org/10.1016/j.drugalcdep.2012.05.020.

Schwartz, S.J., Unger, J.B., Des Rosiers, S.E., Lorenzo-Blanco, E.I., Zamboanga, B.L., Huang, S., Baezconde-Garbanati, L., Villamar, J.A., Soto, D.W., Pattarroyo, M., Szapocznik, J., 2014. Domains of acculturation and their effects on substance use and sexual behavior in recent Hispanic immigrant adolescents. Prev. Sci. Off. J. Soc. Prev. Res. 15 (3), 385–396. https://doi.org/10.1007/s11121-013-0419-1.

Schwartz, S.J., Weisskirch, R.S., Zamboanga, B.L., Castillo, L.G., Ham, L.S., Huynh, Q.L., Park, I.J., Donovan, R., Kim, S.Y., Vernon, M., Davis, M.J., Cano, M.A., 2011. Dimensions of acculturation: associations with health risk behaviors among college students from immigrant families. J. Couns. Psychol. 58 (1), 27–41. https://doi.org/10.1037/a0021356.

Smith, T.B., Silva, L., 2011. Ethnic identity and personal well-being of people of color: a meta-analysis. J. Couns. Psychol. 58 (1), 42–60. https://doi.org/10.1037/a0021528.

Steinberg, L., 2001. We know some things: parent–adolescent relationships in retrospect and prospect. J. Res. Adolesc. 11 (1), 1–19. https://doi.org/10.1111/1532-7795.00001.

Steinberg, L., 2010. A dual systems model of adolescent risk-taking. Dev. Psychobiol. 52 (3), 216–224. https://doi.org/10.1002/dev.20445.

Szapocznik, J., Prado, G., Burlew, A.K., Williams, R.A., Santisteban, D.A., 2007. Drug abuse in African American and Hispanic adolescents: culture, development, and behavior. Ann. Rev. Clin. Psychol. 3, 77–105. https://doi.org/10.1146/annurev.clinpsy.3.022806.091408.

Thai, N.D., Connell, C.M., Tebes, J.K., 2010. Substance use among Asian American adolescents: influence of race, ethnicity, and acculturation in the context of key risk and protective factors. Asian Am. J. Psychol. 1 (4), 261–274. https://doi.org/10.1037/a0021703.

Tourangeau, K., Brick, M., Byrne, L., Le, T., Nord, C., West, J., & Hausken, E.G. (2005). Early Childhood Longitudinal Study, kindergarten class of 1998–99 (ECLS-K): Third grade methodology report. NCES 2005–018. National Center for Education Statistics.

Trucco, E.M., Villafuerte, S., Burmeister, M., Zucker, R.A., 2017. Beyond risk: prospective effects of GABA Receptor Subunit Alpha-2 (GABRA2) × Positive Peer Involvement on adolescent behavior. Dev. Psychopathol. 29 (3), 711–724. https://doi.org/10.1017/S0954579416000419.

Unger, J.B., Cruz, T.B., Rohrbach, L.A., Ribisl, K.M., Baezconde-Garbanati, L., Chen, X., Trinidad, D.R., Johnson, C.A., 2000. English language use as a risk factor for smoking initiation among Hispanic and Asian American adolescents: Evidence for mediation by tobacco-related beliefs and social norms. Health Psychol. 19 (5), 403–410. https://doi.org/10.1037/0278-6133.19.5.403.

Unger, J.B., Ritt-Olson, A., Wagner, K.D., Soto, D.W., Baezconde-Garbanati, L., 2009. Parent-child acculturation patterns and substance use among Hispanic adolescents: a longitudinal analysis. J. Prim. Prev. 30 (3–4), 293–313. https://doi.org/10.1007/s10935-009-0178-8.

Unger, J.B., Schwartz, S.J., Huh, J., Soto, D.W., Baezconde-Garbanati, L., 2014. Acculturation and perceived discrimination: predictors of substance use trajectories from adolescence to emerging adulthood among Hispanics. Addict. Behav. 39 (9), 1293–1296. https://doi.org/10.1016/j.addbeh.2014.04.014.

Unger, J.B., Sussman, S., Begay, C., Moerner, L., Soto, C., 2020. Spirituality, ethnic identity, and substance use among American Indian/Alaska Native adolescents in California. Subst. Use Misuse 55 (7), 1194–1198. https://doi.org/10.1080/10826084.2020.1720248.

Vanyukov, M.M., Tarter, R.E., Kirillova, G.P., Kirisci, L., Reynolds, M.D., Kreek, M.J., Conway, K.P., Maher, B.S., Iacono, W.G., Bierut, L., Neale, M.C., Clark, D.B., Ridenour, T.A., 2012. Common liability to addiction and "gateway hypothesis": theoretical, empirical and evolutionary perspective. Drug Alcohol Depend. 123 (Suppl 1), S3–S17. https://doi.org/10.1016/j.drugalcdep.2011.12.018.

Verboom, C.E., Sijtsema, J.J., Verhulst, F.C., Penninx, B.W., Ormel, J., 2014. Longitudinal associations between depressive problems, academic performance, and social functioning in adolescent boys and girls. Dev. Psychol. 50 (1), 247–257. https://doi.org/10.1037/a0032547.

Wade, N.E., Palmer, C.E., Gonzalez, M.R., Wallace, A.L., Infante, M.A., Tapert, S.F., Jacobus, J., Bagot, K.S., 2021. Risk factors associated with curiosity about alcohol use in the ABCD cohort. Alcohol 92, 11–19. https://doi.org/10.1016/j.alcohol.2021.01.002.

Wang, Z., Buu, A., Lohrmann, D.K., Shih, P.C., Lin, H.C., 2021. The role of family conflict in mediating impulsivity to early substance exposure among preteens. Addict. Behav. 115, 106779 https://doi.org/10.1016/j.addbeh.2020.106779.

Wantchekon, K.A., Umaña-Taylor, A.J., 2021. Relating profiles of ethnic–racial identity process and content to the academic and psychological adjustment of black and latinx adolescents. J. Youth Adolesc. 1–20.

Watts, A.L., Smith, G.T., Barch, D.M., Sher, K.J., 2020. Factor structure, measurement and structural invariance, and external validity of an abbreviated youth version of the UPPS-P Impulsive Behavior Scale. Psychol. Assess. 32 (4), 336–347. https://doi.org/10.1037/pas0000791.

Whitehead, K.A., Ainsworth, A.T., Wittig, M.A., Gadino, B., 2009. Implications of ethnic identity exploration and ethnic identity affirmation and belonging for intergroup attitudes among adolescents. J. Res. Adolesc. 19 (1), 123–135. https://doi.org/10.1111/j.1532-7795.2009.00585.x.

Wills, T.A., Dishion, T.J., 2004. Temperament and adolescent substance use: a transactional analysis of emerging self-control. J. Clin. Child Adolesc. Psychol. 33 (1), 69–81. https://doi.org/10.1207/S15374424JCCP3301_7.

Wills, T.A., Windle, M., Cleary, S.D., 1998. Temperament and novelty seeking in adolescent substance use: convergence of dimensions of temperament with constructs from Cloninger's theory. J. Personal. Soc. Psychol. 74 (2), 387–406. https://doi.org/10.1037//0022-3514.74.2.387.

Wood, J.J., Lynne-Landsman, S.D., Langer, D.A., Wood, P.A., Clark, S.L., Eddy, J.M., Ialongo, N., 2012. School attendance problems and youth psychopathology: structural cross-lagged regression models in three longitudinal data sets. Child Dev. 83 (1), 351–366. https://doi.org/10.1111/j.1467-8624.2011.01677.x.

Zapolski, T., Fisher, S., Banks, D.E., Hensel, D.J., Barnes-Najor, J., 2017. Examining the protective effect of ethnic identity on drug attitudes and use among a diverse youth population. J. Youth Adolesc. 46 (8), 1702–1715. https://doi.org/10.1007/s10964-016-0605-0.

Zucker, R.A., Gonzalez, R., Feldstein Ewing, S.W., Paulus, M.P., Arroyo, J., Fuligni, A., Morris, A.S., Sanchez, M., Wills, T., 2018. Assessment of culture and environment in the Adolescent Brain and Cognitive Development Study: rationale, description of measures, and early data. Dev. Cogn. Neurosci. 32, 107–120. https://doi.org/10.1016/j.dcn.2018.03.004.