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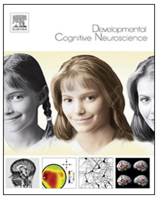

Assessment of culture and environment in the Adolescent Brain and Cognitive Development Study: Rationale, description of measures, and early data

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ABSTRACT

Neurodevelopmental maturation takes place in a social environment in addition to a neurobiological one. Characterization of social environmental factors that influence this process is therefore an essential component in developing an accurate model of adolescent brain and neurocognitive development, as well as susceptibility to change with the use of marijuana and other drugs. The creation of the Culture and Environment (CE) measurement component of the ABCD protocol was guided by this understanding. Three areas were identified by the CE Work Group as central to this process: influences relating to CE Group membership, influences created by the proximal social environment, influences stemming from social interactions. Eleven measures assess these influences, and by time of publication, will have been administered to well over 7,000 9–10 year-old children and one of their parents. Our report presents baseline data on psychometric characteristics (mean, standard deviation, range, skewness, coefficient alpha) of all measures within the battery. Effectiveness of the battery in differentiating 9–10 year olds who were classified as at higher and lower risk for marijuana use in adolescence was also evaluated. Psychometric characteristics on all measures were good to excellent; higher vs. lower risk contrasts were significant in areas where risk differentiation would be anticipated.

1. Introduction and rationale

The Adolescent Brain and Cognitive Development (ABCD) initiative is charged with characterizing the effects of substance use and misuse on the developing brain over the course of adolescence, as well as concurrently measuring a broad range of biological and behavioral antecedents, correlates, and consequences of substance use that are implicated in the development of risk and the moderation of neural processes during late childhood, adolescence, and emerging adulthood (National Institutes of Health, 2015). The study is traversing an interval where major changes are taking place in the brain's structure and functional networks, and where, concomitantly, cognitive, affective, and social developmental changes are taking place. A core task for the study is to developmentally characterize the effects of the different substances of abuse upon these processes. This in turn requires a characterization of the environment and culture, which make these substances available and regulate their use.

The task to evaluate this matrix of questions is a very large one, given the multiple levels of analysis and multiple domains of action needing to be scrutinized. In order to carry this out, the study Council of Investigators for all 19 of the study's sites instituted a process to discuss and map out what the variable network and domain-specific research

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questions needed to be. As described in the opening article of this special issue, nine assessment areas were demarcated, that were grouped in seven assessment workgroups who were charged with the responsibility to make recommendations about what the measurement package needed to be in their assessment area. Workgroup recommendations were ultimately submitted for approval to the ABCD Steering Committee, the governance body of the study. This paper describes the issues considered in selecting the assessment battery for the Culture and Environment component, the content of the measures selected, and the psychometric properties of each instrument.

In addition, since one of the study's goals was to evaluate the prospective effects of substance use on neural development, it was essential that there be a sufficiently large sub-sample of substance abusing youth available so that by late adolescence these effects could begin to be evaluated. For marijuana, the most commonly used of the illicit drugs, by mid-adolescence only 14% of the general population have used in the past 30 days (Johnston et al., 2017). This is an insufficient base-rate to be able to effectively answer the study's questions. To address this issue, the study's sampling design specifies that 50% of participants at enrollment need to be at elevated risk for marijuana use by age 16 (called the "higher risk" group). Using a small number of items already in the ABCD protocol, a screener was devised to select this higher at-risk subgroup. The remainder of the sample is not subject to any selective screening and is called the "lower risk" group. The rationale and details about the screener's development are presented in another paper in this issue (see Loeber et al., 2018). Moreover, if effective precursive models are to be constructed prior to first drug use, at least some of the non-drug variables should be able to differentiate those who will become abusers from those who will not. This paper provides preliminary results on the effectiveness of the Culture and Environment measures to make this differentiation. Results of these analyses are presented along with the psychometric data in Table 3. Sex difference data for the measures is provided in Table 4.

The two content domains of environment and culture play major roles in behavioral development as well as neural development. Although one might regard culture as a component of environment, it is unique in its multi-level, multi-domain effects, and for this reason is discussed as a separate component following a brief review of the role of environmental effects. The environment plays a major role in the initiation of substance use, how much one uses, and how one responds to consequences of that use, both negative and positive. Twin studies have repeatedly demonstrated the magnitude of these effects, showing that somewhere between 40 and 60% of the variance for substance use disorder (SUD) is accounted for by shared and non-shared environment (Kendler et al., 2012). Historically, the heaviest focus in this arena has been on drug-specific behavior, in particular, the environment's role in determining onset of use, the development and maintenance of heavier and/or problematic use, and the creation of rule structures for regulation of access (Clark, 1991; Clayton, 1992). Most fundamentally, onset of use is literally contingent on an adolescent's environment, as it is concretely dependent upon the availability of the substance to the youth. Proximal availability not only determines ease of access, it also provides cueing, which activates neural circuitry relating to expectancies about use. It may also arouse craving (Bachman et al., 1991; Oetting and Donnermeyer, 1998). Regulating structures, both macro-level (e.g. laws regulating availability) and proximal (e.g., the implicit rules about use among those who the child interacts with and/or observes on a daily basis) set brakes on inappropriate use, and provide penalties for violation of those regulations.

Non-drug specific environmental factors also play major roles in shaping onset and course of substance use and transition into SUDs. Some of these influences are protective, such as positivity of the relationship between parent and child (Kerr, Stattin & Burk, 2010), extent of parental awareness of the adolescent's day to day activity, and presence of family rituals—such as sharing dinner together (Fiese, 1993). These behaviors serve to strengthen parent-child affectional ties, and are a buffer against involvement with deviant peers (i.e. reduce the impact of deviant influences, Wills et al., 2018; Karoly et al., 2016). Conversely, adverse family factors, such as family conflict, operate indirectly, but also predict earlier and heavier substance use. The mechanisms of effect operate here by driving the child away from home, disengaging from mainstream goals (e.g., academic achievement), and becoming increasingly involved with deviant peers (Caouette and Feldstein Ewing, 2017). They also shape long term propensities to act in particular ways—i.e., they shape personality—specifically by increasing the likelihood that behavior will be undercontrolled/disinhibited (cf. Zucker et al., 2011) and impulsive (cf. Loukas et al., 2001; Wills et al., 2017). Lastly, in addition to these proximal social interactional influences, the macro-level environment plays a non-drug specific role in shaping substance using behavior. To give but one example, neighborhood residence exerts effects directly—by way of availability of both risk enhancing and protective opportunities, as well as indirectly, by generating a sense of anomie via the presence of high levels of poverty (Schwartz et al., 2018).

Genetic effects also play a role in determining the potency of these relationships; they contribute both to relative sensitivity of response to specific environments (Trucco et al., 2016) as well as by shaping the propensity to seek out certain environments over others (cf. Hur and Bouchard, 1995; Reiss et al., 2000). A discussion of the ways these effects interact with environmental influences is outside the scope of this paper, but these relationships are discussed in other papers in this issue.

Culture is another major influencing factor that manifests in a variety of behavioral domains, operates at both drug- and non-drug specific levels, and impacts both a child's position and experience within their family as well as their experience of the broader surrounding environment. Developmental trends and age of substance abuse initiation vary in tandem with racial/ethnic background. African Americans have lower rates of illegal drug use as adolescents, but as they age they often show higher rates than the national average (Center for Behavioral Health Statistics and Quality, 2015; Feldstein Ewing et al., 2011). Latino adolescents (age 14–17) have a higher prevalence of several indices of drinking when compared to Black and White youth (Centers for Disease Control and Prevention, 2014). Asian American youth delay onset of substance use (Kosterman et al., 2000; Zapolski et al., 2014, respectively) while American Indian/Alaska Natives begin substance use earlier than national averages (Whitesell et al., 2014).

This variability may reflect racially and ethnically-linked socio-cultural factors or genetic differences that contribute to and/or correlate with race/cultural group differences in risk or protective factors for use (Laland et al., 2010; Shih et al., 2012). In addition, racial/ethnic group membership is not a homogenous variable. There are substantive, often under-discussed within-group differences in substance use patterns that are missed in examinations of race/ethnicity. Unfortunately, such classifications tend to be categorized by census group, and omit examination of the nuanced nature of contributing cultures underneath each of these broader groupings (Iwamoto et al., 2016; Sanchez et al., 2014; Vaeth et al., 2012; Beals et al., 2003). In reality, the influence of cultural factors is highly nuanced, even impacting substance use trajectories by geographic location within a national origin group (Swendsen et al., 2009).

The ABCD study was designed to specifically explore these multiple sources of variance with a protocol that examines the influences of race/ethnicity on substance use from a multidimensional perspective. It thus includes measures of: (a) cultural practices and acculturation (language use, social affiliations, customs and traditions), (b) cultural identification (attachment to cultural groups, associated positive self-esteem); and (c) cultural values (belief systems and behaviors associated with a cultural or ethnic group) (cf. Sam and Berry, 2010; Schwartz et al., 2010, 2018). Given the geographic dispersion of the different cultural groups and the broadly population representative nature of the ABCD sample, sufficient variance exists to carry out this exploration. Solid estimates of these nuances are already possible with the current sample. Its descriptive statistics are as follows: Total Youth sample (as of 7/31/17), N = 4104 (M = 2162; F = 1932; Other sex/gender = 10). Total parent sample N = 4098 (3622 mothers; 468 fathers; 8 other caretaker adults). Current distribution of ethnic identity in the sample is: 60% Whites, 20% Hispanics, 9% African Americans, 2% Asian, 9% other (i.e., Native Americans, Pacific Islanders, multi-ethnic).

2. Description of measures

The influences of culture and environment fall into three general domains of content. Moving from macro-to micro-influence, they are (a) cultural/ethnic group membership and values; (b) proximal social environment, and (c) social interactional influences. We review these content domains below. A variety of general parameters were utilized in instrument selection in order to provide both appropriate and psychometrically sound coverage in the areas of focus. These include age appropriateness for 9–10 year olds, and the known or suspected relevance to substance use trajectories. Being a component within the PhenX toolkit (https://phenx.org) was also a factor in instrument selection, given that comparability with other studies was of high importance. For the cultural measures, showing validity across cultures was vital to measurement selection. Last, given the breadth and time commitment for other measures in the ABCD battery, the entire Culture and Environment (CE) component at baseline had been allotted a time quota of 9 min for the child component and 22 min for the parent component. Therefore, we had to be quite cognizant of time requirements as another parameter in the choice of measures.

In the following text we provide descriptions and brief reviews of the instruments selected and the variables assessed in each of the three domains (see Table 1 for the list of measures) as well as basic measure information and details about validity and psychometric properties (Tables 2 and 3,). Table 2 summarizes the basic data about the measure (number of items, reliability coefficients, administration times for youth and parent forms). Table 3 provides the psychometric data on the measures as well as scores for subgroups that have been selected to be at higher or lower risk for regular marijuana use by mid-adolescence. We also provide statistical contrasts that evaluate the extent to which risk status is being differentiated with each measure. Lastly, Table 4 presents the data on sex differences for each of the measures.

Table 1
Culture and Environment Component: Domains and Measures assessed at Baseline.

	Source
Cutural/Ethnic Group Membership Domain	
Vancouver Index of Acculturation-Short	Ryder et al. (2000)
Multi-Group Ethnic Identity-Revised	Phinney and Ong (2007)
Mexican American Cultural Values Scale	Knight et al. (2010)
Native American Acculturation Scale	Garrett and Pichette (2000)
Acculturation	Alegria et al., 2004/PhenX Toolkit
Proximal Social Environment Domain	
Neighborhood Safety/Crime	PhenX Toolkit (2016a,b)
School Risk & Protective Factors	PhenX Toolkit (2016a,b)
Social Interaction Domain	
Prosocial Tendencies	Goodman et al., 1998/ PhenX Toolkit
Acceptance Subscale from CRPBI-Short	Schaefer (1965)
Parental Monitoring	Chilcoat and Anthony (1996)
Family Environment Scale (Family Conflict subscale)	Moos & Moos (1994)

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

2.1.1. Acculturation

Culture is described as the knowledge, skills, values and behaviors shared among a group of people. Cultural values contribute to adolescent decisions of whether and when to use substances (Shih et al., 2012). Cultural practices change as a result of contact between cultures in a process known as acculturation (Sam and Berry, 2010). Studies have found increased rates of substance use among Latino youth with higher levels of acculturation (De La Rosa, 2002; Vega et al., 2007). Historically, acculturation research has focused on Latinos and employed uni-dimensional, demographic proxies such as language use, foreign versus US birth, or number of years in the US (Lara et al., 2005). To be congruent with prior work in this area, the ABCD study includes this type of measure, utilizing demographic proxy items from the PhenX Toolkit to assess language use and proficiency (See Section 2.1.5: Acculturation via Language Proficiency and Preferences). However, a few studies of acculturation and substance use have begun to examine acculturation as a bi- or multi-dimensional construct (Zemore, 2007). In this conceptualization, acculturation is viewed as a process involving the confluence among heritage-cultural and receiving-cultural practices, values, and identifications (Schwartz et al., 2010). As noted by Berry (1980), receiving-culture acquisition and heritage culture retention need to be regarded as two independent dimensions that intersect to create multiple acculturation outcomes, involving assimilation, separation, integration, and marginalization. The ABCD study allows for an examination of this complex process with its utilization of the Vancouver Index of Acculturation (VIA).

The Vancouver Index of Acculturation (VIA) is a bi-dimensional measure that assesses adherence to the Mainstream and Heritage cultures on separate subscales and was not developed for a specific racial/ethnic group (Ryder et al., 2000). The psychometric properties of the VIA have been reported in a sample of 414 persons (ages 17–37) of Chinese, East Asian and non-mainstream miscellaneous heritage, first and second generation immigrants, adapting to life in Canada (Ryder et al., 2000). The 20-item measure featured 10 pairs of items asking the same question once for the respondent's heritage culture (solicited in an open-ended item at the start of the measure) and once for the mainstream culture. The scale assessed two factors and included items about traditions, social activities, media, cultural values and behavioral preferences. Both heritage culture and mainstream dimensions evidenced high internal consistency ($\alpha = 0.91$–0.92 and 0.85–0.89, respectively). Mean inter-item correlations were high for both heritage (rs = 0.51–0.53) and mainstream culture (rs 0.38–0.44). While scores on the mainstream culture were related to overall indices of mental health, scores on the heritage culture were associated with indices of interdependence and family life satisfaction. For the present study, we conferred with the developers of the scale about deleting two pairs of items thought inappropriate for adolescent respondents (i.e., marriage partner and jokes/humor), changing the label of the mainstream culture to "American" rather than using the original scale label of "North American," and prompting for a wide range of suggested original heritage culture options (e.g., Asian, Black/African American, Hispanic, etc.). The resulting scale consists of 16 items with 9 point Likert responses (1 = strongly disagree to 9 = strongly agree). For the ABCD baseline, the VIA and other cultural measures were administered only to parents because the 9–10 year olds were considered too young to respond meaningfully about their ethnic identity. It is anticipated that these measures will be administered to the youth when they are approaching adolescence at about age 12.

Analyses of current ABCD data involving 4097 adult participants indicated that 2723 identified a heritage culture distinct from mainstream American culture. Participants who did not identify a heritage culture were told not to complete the VIA. Distributions by heritage culture were as follows: 27% European, 17% Hispanic, 7% African American, 4% White American, 13% religious affiliation (i.e. most

Table 2
List of Culture and Environment Measures, Measure Characteristics, Order of Administration, and Administration Time.

Measure (scale alpha)	What it measures	Number of Items in Measure		Administration Time (Min)	
		Youth	Parent	Youth	Parent
Cutural/Ethnic group membership	Membership and values				
Vancouver Index of Acculturation-Short (92/90[a])	Acculturation/Bi-culturalism	–	16	–	5
Multi-Group Ethnic Identity-Revised (0.90)	Cultural affiliation	–	6	–	2
Mexican American Cultural Values Scale (0.92[b])	Cultural values of familism, religion, independence, self-reliance	–	28	–	5
Native American Acculturation Scale (Native American Parents only) (0.67)	Tribal affiliation	–	9	–	5
Acculturation Language pref: youth Language pref: parent (0.35/0.79[c])	Language preference & proficiency	5	5	1	1
PROXIMAL SOCIAL ENVIRONMENT					
Neighborhood Safety & Crime (0.87)	Neighborhood safety & crime	1	3	1	1
School Risk & Protective Factors (0.60/0.64/0.21[d])	School environment	12	–	1	–
SOCIAL INTERACTIONAL INFLUENCES					
Acceptance Subscale from CRPBI-Short[e] (0.71)	Parental warmth & acceptance	5	–	2	–
Family Environment Scale (Family Conflict Subscale) (0.68/ 0.63[c])	Family conflict	9	9	2	2
Parental Monitoring (0.44)	Parental monitoring	5	–	1	–
Prosocial Scale 0.59/0.81[c]	Prosocial behavior	3	3	1	1
Total		31	70	9	22

[a] Heritage culture alpha/American culture alpha.

[b] Overall scale alpha; Subscale alphas: Familism-Support, 0.80; Familism-Obligation, 0.70; Familism-Referent, 0.78; Religion, 0.97; Independence/Self Reliance, 0.61.

[c] Youth scale alpha/Parent scale alpha.

[d] School environment/School involvement/School disengagement.

[e] Also administered to secondary caretaker (father, grandmother, etc.).

commonly defined as Mormon and Jewish), 4% Asian, 3% Native American, and 25% other (i.e., Pacific Islander, Middle Eastern, mixed heritage). The proportion of participants listing a religion as a heritage culture is consistent with research about the important role that religion plays in the lives of racial/ethnic and religious minorities (Cokley et al., 2012).

The VIA exhibited high internal consistency across both the heritage culture ($\alpha = 0.92$) and mainstream culture subscales ($\alpha = 0.90$). Table 3 provides basic psychometric data for the measure for both heritage and mainstream culture subscales. Overall means and standard deviations were as follows: heritage culture subscale ($M = 6.35$, $SD = 1.81$); mainstream culture subscale ($M = 6.81$, $SD = 1.51$). Scores across both subscales were normally distributed. Table 3 also reports basic data and tests for differences between the lower and higher risk-for-adolescent-drug-use subgroups For both subscales, scores of parents from lower risk families were significantly higher than for the higher risk families, indicating higher identification with and connection to both cultures for them. Heritage culture scores for the lower risk families were $M = 6.42$ ($SD = 1.80$), and for the higher risk families were $M = 6.26$ ($SD = 1.83$) ($ES = -0.09$; $p = 0.03$). Mainstream culture scores for lower risk families were, $M = 6.90$ ($SD = 1.48$) and for higher risk families were $M = 6.68$ ($SD = 1.54$) ($ES = -0.15$, $p = 0.0002$).

2.1.2. *Cultural identification/ethnic identity*

Cultural or ethnic identity refers to the cognitive and affective components of one's sense of belonging to and feelings of connectedness to a group of people, an understanding of the meaning of group membership, positive attitudes toward the group, familiarity with history and culture, and involvement in its practices (Phinney and Ong, 2007). Ethnic/cultural identity is thus conceptualized as a multi-dimensional, dynamic construct that develops over time via exploration and commitment to one's ethnic group (Phinney and Ong, 2007). A *meta*-analysis of 184 studies found positive associations between ethnic identity and well-being, with stronger associations for adolescents and emerging adults (Smith and Silva, 2011). Higher levels of ethnic identity have been associated with positive physical and mental health outcomes including less internalizing and externalizing risk behaviors across youth of various ethnic and racial backgrounds (Rivas-Drake et al., 2014; Smith and Silva, 2011; Umaña-Taylor et al., 2015). On the basis of these findings we would anticipate that a stronger ethnic identity should also be related to a lower level of substance abuse, and possibly also lower use. Ethnic identity has been posited to develop between adolescence and emerging adulthood (Phinney, 1993). However, there has not been sufficient research exploring how ethnic identity emerges during this critical developmental period and the mechanisms linking it to health and well-being (Smith and Silva, 2011). The short interval between assessments, and the deep measurement structure of the ABCD protocol will allow this to happen.

Ethnic identity is assessed in the ABCD study with the **Multigroup Ethnic Identity Measure-Revised** (MEIM-R, Phinney and Ong, 2007). The original 12-item version of the MEIM scale is part of the PhenX Toolkit. We use a 6-item version validated with college students (Phinney and Ong, 2007; Yoon, 2011) and adult women (Brown et al., 2014). The MEIM-R has a correlated two-factor structure with measurement invariance across Whites, African Americans, Hispanics, Asians, and multi-ethnic respondents (Brown et al., 2014). Respondents self-categorize their ethnic group identity via an open-ended item on the MEIM-R.

Six close-ended items then assess exploration of and commitment to one's ethnic identity on a 5-point scale from (1) strongly disagree to (5) strongly agree. Research has indicated good reliability, with internal consistency (Cronbach's α) ranging from 0.76 to 0.91 for the two subscales and 0.81–0.89 for the overall scale (Phinney and Ong, 2007; Yoon, 2011; Brown et al., 2014). At baseline the MEIM-R was administered only to parents.

Data analyses was conducted on MEIM-R responses from the first 3848 adult (parent) participants. Distributions of ethnic identity in the sample were 62% Whites, 15% Hispanics, 9% African Americans, 7% other (i.e., Asians, Native Americans, Pacific Islanders, multi-ethnic),

Table 3
Psychometric Characteristics of ABCD Measures; Discriminability of Higher and Lower Risk subsamples.

Measures	N	Range (min, max)	Skewness	Total Sample	Lower Risk	Higher Risk	t-statistic	LR vs HR	ES [95% CI]
				M (SD)	M (SD)	M (SD)		(p-value)	
Youth									
Cultural/Ethnic Group Membership Domain									
[†]Acculturation (friends)	1598	1, 5	−1.74	4.52 (0.76)	4.54 (0.70)	4.49 (0.82)	−1.52	0.13	−0.07 [−0.17, 0.03]
[†]Acculturation (family)	1598	1, 5	−0.92	3.86 (1.34)	3.87 (1.31)	3.84 (1.39)	−0.55	0.58	−0.02 [−0.12, 0.08]
Proximal Social Environment Domain									
[†]Neighborhood Safety	4090	1, 5	−1.12	4.11 (1.04)	4.17 (0.97)	4.03 (1.12)	−4.18	< 0.0001	−0.14 [−0.20, −0.07]
[†]SRPF School Environment (Total)	4089	6, 24	−0.78	19.93 (2.76)	20.17 (2.57)	19.62 (2.98)	−6.31	< 0.0001	−0.20 [−0.26, −0.14]
[†]SRPF School Involvement (Total)	4089	4, 16	−0.84	13.12 (2.31)	13.28 (2.20)	12.89 (2.45)	−5.39	< 0.0001	−0.17 [−0.23, −0.11]
[†]SRPF School Disengagement (Total)	4089	2, 8	0.69	3.69 (1.42)	3.60 (1.36)	3.80 (1.49)	4.30	< 0.0001	0.14 [0.08, 0.20]
Social Interaction Domain									
CRPBI Acceptance (Mean, primary caregiver)	4090	1, 3	−1.88	2.79 (0.30)	2.80 (0.28)	2.77 (0.32)	−4.18	< 0.0001	−0.10 [−0.16, −0.04]
FES Conflict Subscale (Mean)	4091	0, 9	0.99	1.97 (1.92)	1.81 (1.84)	2.18 (2.02)	5.93	< 0.0001	0.19 [0.13, 0.26]
Parental Monitoring (Mean)	4092	1.8, 5	−1.11	4.41 (0.49)	4.46 (0.47)	4.36 (0.52)	−6.47	< 0.0001	−0.20 [−0.27, −0.14]
SDQ Prosocial Behavior (Mean)	4088	0, 2	−0.108	1.69 (0.36)	1.70 (0.35)	1.67 (0.38)	−3.06	0.002	−0.08 [−0.14, −0.02]
Parent									
Cultural/Ethnic Group Membership Domain									
VIA Heritage Culture (Mean)	2723	1, 9	−0.45	6.35 (1.81)	6.42 (1.80)	6.26 (1.83)	−2.24	0.03	−0.09 [−0.16, −0.01]
VIA Mainstream Culture (Mean)	2723	1, 9	−0.82	6.81 (1.51)	6.90 (1.48)	6.68 (1.54)	−3.77	0.0002	−0.15 [−0.22, −0.07]
MEIM-R Exploration (Mean)[††]	3848	1, 5	0.17	2.80 (1.02)	2.80 (1.01)	2.80 (1.02)	0.043	0.97	0 [−0.06, 0.06]
MEIM-R Commitment (Mean)[††]	3848	1, 5	0.20	2.47 (0.90)	2.45 (0.90)	2.50 (0.89)	1.59	0.11	0.06 [−0.01, 0.12]
MACVS Familism-Support (Mean)	4096	1, 5	−0.59	4.14 (0.60)	4.17 (0.60)	4.10 (0.60)	−3.89	0.0001	−0.12 [−0.18, −0.05]
MACVS Familism-Obligations (Mean)	4096	1, 5	−0.02	3.61 (0.66)	3.61 (0.67)	3.62 (0.65)	0.39	0.70	0.02 [−0.05, 0.08]
MACVS Familism-Referent (Mean)	4096	1, 5	−0.18	3.35 (0.78)	3.38 (0.77)	3.32 (0.79)	−2.35	0.019	−0.08 [−0.14, −0.02]
MACVS Independence/Self-reliance (Mean)	4096	1, 5	0.02	3.56 (0.60)	3.55 (0.61)	3.59 (0.60)	2.06	0.039	0.07 [0.004, 0.13]
MACVS Religion (Mean)	4096	1, 5	−0.17	3.35 (0.78)	3.25 (1.45)	3.25 (1.40)	0.071	0.94	0 [−0.06, 0.06]
Native American Acculturation Scale (Mean)	118	1, 5	−0.63	3.39 (0.75)	3.35 (0.61)	3.43 (0.87)	0.65	0.52	0.11 [−0.25, 0.47]
[†]Acculturation (friends)	1324	1, 5	−1.13	4.04 (1.18)	4.06 (1.16)	4.02 (1.19)	−0.66	0.51	−0.03 [−0.14, 0.08]
[†]Acculturation (family); $r_{YP} = 0.65$	1325	1, 5	−0.79	3.76 (1.36)	3.78 (1.35)	3.72 (1.38)	−0.82	0.41	−0.04 [−0.15, 0.07]
Proximal Social Environment Domain									
†Neighborhood Safety (Mean); $r_{YP} = 0.24$	4092	1, 5	−1.01	4.00 (0.92)	4.06 (0.90)	3.92 (0.95)	−4.53	< 0.0001	−0.15 [−0.21, −0.09]
Social Interaction Domain									
FES Conflict Subscale (Mean); $r_{YP} = 0.18$	4097	0, 9	0.65	2.47 (1.88)	2.24 (1.77)	2.78 (1.97)	9.27	< 0.0001	0.29 [0.23, 0.35]
SDQ Prosocial Behavior (Mean); $r_{YP} = 0.19$	4075	0, 2	−1.83	1.75 (0.41)	1.81 (0.37)	1.67 (0.44)	−10.74	< 0.0001	−0.35 [−0.41, −0.29]

Notes: Sample sizes of Higher Risk and Lower Risk participants differed across measures; however, the overall proportion of “Higher Risk” participants was 42% in the overall ABCD sample at the time these data were analyzed; LR = Lower Risk; HR = Higher Risk; Statistic for all Lower vs. Higher Risk Group ES = Effect Size (expressed as Cohen’s d); CI = Confidence Interval.

SRPF = School Risk & Protective Factors; SDQ = Strengths & Difficulties Questionnaire; CRPBI = Child’s Report of Parental Behavior Inventory; FES = Family Environment Scale; VIA = Vancouver Index of Acculturation; MEIM-R = Multigroup Ethnic Identity Measure – Revised; MACVS = Mexican-American Cultural Values Scales.

r_{YP} = Pearson correlation between Youth and Parent measure; p-values for all correlations < 0.0001.

[†] PhenX items or measure.

[††] Exploration/commitment r = 0.64, $p < 0.0001$.

and 7% reporting no ethnic identity. Tables 2 and 3 provide the basic psychometric data for the measure. The MEIM-R Total Score did not differentiate between higher and lower risk families [Higher risk score, M = 2.65 (SD = 0.87); Lower risk score, M = 2.63 (SD = 0.87), p = 0.39]. And also as shown in Table 3, neither of the subscales differentiated either.

2.1.3. Cultural values

As already noted, values are a primary mechanism by which culture is transmitted. The internalization of these values is among the most essential developmental milestones of adolescence (Knight et al., 2010). Given that cultural values can guide decision making in health and risk contexts for youth, they may also aid in understanding distinct substance use trajectory differences across racial/ethnic groups, as youth develop over the course of childhood and adolescence (Nasim et al., 2011; Schwartz et al., 2012). The ABCD study is assessing the values of religiosity, familism, and independence/self-reliance, and their interaction over time, and as they may relate to the development of substance use.

A recent literature review indicates there is an inverse relationship between religiosity/spirituality and substance use among adolescents (Kub and Solari-Twadell, 2013). In addition, although religion was found to protect 10th grade youth against substance use, the effect was stronger for White than for Black or Hispanic youth (Wallace et al.,

Table 4
Sex Differences in Response to the ABCD Measures.

Measures	N	Male M (SD)	Female M (SD)	t-statistic	p-value	ES [95% CI]
Youth						
Cultural/Ethnic Group Membership Domain						
Acculturation (friends)	1594	4.57 (0.74)	4.48 (0.77)	2.41	0.016	0.12 [0.02, 0.22]
Acculturation (family)	1594	3.87 (1.36)	3.85 (1.33)	0.22	0.83	0.015 [−0.08, 0.11]
Proximal Social Environment Domain						
Neighborhood Safety	4079	4.11 (1.05)	4.12 (1.03)	−0.36	0.72	−0.01 [−0.07, 0.05]
SRPF School Environment (Total)	4078	19.70 (2.85)	20.21 (2.65)	5.88	< 0.0001	−0.19 [−0.25, −0.12]
SRPF School Involvement (Total)	4078	12.76 (2.39)	13.52 (2.16)	0.60	< 0.0001	−0.35 [−0.39, −0.27]
SRPF School Disengagement (Total)	4078	3.87 (1.44)	3.47 (1.37)	8.97	< 0.0001	0.28 [0.22, 0.35]
Social Interaction Domain						
CRPBI Acceptance (Mean, mother)	4079	2.77 (0.31)	2.81 (0.29)	3.67	< 0.0002	−0.13 [−0.19, −0.07]
FES Conflict Subscale (Mean)	4080	2.07 (1.93)	1.85 (1.92)	3.64	0.0003	0.11 [0.05, 0.18]
Parental Monitoring (Mean)	4081	4.22 (0.51)	4.50 (0.46)	−10.44	< 0.0001	−0.58 [−0.64, −0.51]
SDQ Prosocial Behavior (Mean)	4077	1.61 (0.39)	1.77 (0.32)	−13.73	< 0.0001	−0.45 [−0.51 −0.38,]
Parent						
Cultural/Ethnic Group Membership Domain						
VIA Heritage Culture (Mean)	2719	6.39 (1.80)	6.32 (1.82)	1.03	0.301	0.04 [−0.04, 0.11]
VIA Mainstream Culture (Mean)	2719	6.83 (1.49)	6.78 (1.53)	0.80	0.42	0.03 [−0.04, 0.11]
MEIM-R Exploration (Mean)	3840	2.80 (1.03)	2.80 (1.01)	0.18	0.86	0 [−0.06, 0.06]
MEIM-R Commitment (Mean)	3840	2.48 (.92)	2.46 (.88)	0.40	0.69	0.02 [−0.04, 0.09]
MACVS Familism-Support (Mean)	4086	4.16 (0.60)	4.12 (0.61)	1.83	0.067	0.07 [0, 0.13]
MACVS Familism-Obligations (Mean)	4086	3.62 (0.65)	3.60 (0.67)	1.15	0.25	0.03 [−0.03, 0.09]
MACVS Familism-Referent (Mean)	4086	3.37 (0.77)	3.33 (0.79)	1.42	0.16	0.05 [−0.01, 0.11]
MACVS Independence/Self-reliance (Mean)	4086	3.56 (0.61)	3.56 (0.60)	−0.077	0.94	0 [−0.06 0.06,]
MACVS Religion (Mean)	4086	3.24 (1.42)	3.26 (1.44)	−0.55	0.58	−0.01 [−0.08, 0.05]
Native American Acculturation Scale (Mean)	118	3.43 (0.72)	3.36 (0.77)	0.51	0.61	0.08 [−0.27, 0.45]
Acculturation (friends)	1322	4.05 (1.16)	4.03 (1.19)	0.28	0.78	0.02 [−0.09, 0.13]
Acculturation (family)	1323	3.74 (1.37)	3.77 (1.35)	−0.50	0.62	−0.02 [−0.13, 0.02]
Proximal Social Environment Domain						
Neighborhood Safety (Mean)	4082	4.04 (0.90)	3.95 (0.95)	3.08	0.0021	0.10 [0.04, 0.16]
Social Interaction Domain						
FES Conflict Subscale (Mean)	4087	2.53 (1.90)	2.39 (1.84)	2.43	0.015	0.07 [0.01, 0.14]
SDQ Prosocial Behavior (Mean)	4065	1.70 (0.44)	1.81 (0.36)	−9.06	< 0.0001	−0.27 [−0.33, −0.21]

Notes: Analyses done only with male vs female youth sex. Ns vary for individual analyses because some measures had unique “qualifier” questions required before proceeding to the main measure (see text) and not all Ss endorsed the qualifier. Overall, Male N = 2162; female N = 1932 (52.8% and 47.2% respectively). N = 10 endorsed “other”. This subset not included in analyses because N too small to utilize as a separate category.
Reports on the measures answered by parents are categorized based on sex of their child.

2007). A longitudinal study from middle school students also indicates that family effects—in this case family connectedness and parent respect–were protective against substance use initiation for Whites and Asians but not for Blacks or Hispanics (Shih et al., 2012). Longitudinal examination of different aspects of familism will allow us to probe about the role of family in protecting against substance use, as these influences play out developmentally in different racial/ethnic backgrounds. The ABCD study has the potential to do that.

Familism, religion, and independence/self-reliance are being measured with subscales from the **Mexican American Cultural Values Scale (MACVS)** (Knight et al., 2010). The instrument is a 50-item measure that is identical for adults and adolescents. The full scale contains a total of 9 subscales, of which we employed five along with one composite measure in this study. Responses are on a five point scales ranging from (1 = not at all to 5 = completely). Three MACVS familism subscales were used: a) family support subscale, emphasizing the maintenance of close family relationships; b) family obligation subscale, the valuing of tangible support and caregiving of family members; and c) family referent subscale, reliance on communal/familial relations. As suggested by the developers, a composite familism score was calculated in addition to separate subscale scores. In addition, the MACVS independence/self-reliance subscale was included to tap independence/individualism versus interdependence/collectivism. This domain, associated with prioritization of family relations and interdependence on kin, is anticipated to vary among US racial/ethnic groups (Greenfield, 1994, Greenfield, 2009). In this regard, it is important to note that despite its designation as a scale to assess Mexican-American cultural values, the measure is also useful to assess family values in non-Mexican families. Analyses on the ABCD sample to date show that the familism subscales have favorable psychometric properties (see Tables 2 and 3 for detailed values). Alphas range between 0.61 and 0.97, and even for the subscale with the lowest reliability (the Independence/Self-Reliance subscale), reliability was slightly higher than seen in prior validation studies and data were normally distributed.

As predicted, significant associations were found among the three cultural components assessed (identification, practices, and values). Moreover, cultural values were associated with heritage and American practices as measured by the VIA. Among the 2723 participants that identified a culture of heritage outside of mainstream American culture, increased heritage and mainstream cultural practices were both significantly associated with higher levels of familism (heritage: $r = 0.31$, $p < 0.001$; mainstream: $r = 0.24$, $p < 0.001$), religiosity (heritage: $r = 0.25$, $p < 0.001$; mainstream: $r = 0.13$, $p < 0.001$), and greater independence/self-reliance (heritage: $r = 0.16$, $p < 0.001$; mainstream: $r = 0.14$, $p < 0.001$). Level of family support and reliance on familial relationships were both significantly higher in the lower risk families ($p = 0.0001$ and $p = 0.019$) respectively, while prioritizing of independence and self-reliance over interdependence on kin was significantly higher in the higher risk families ($p = 0.039$). None of the other value scales showed differences. These analyses demonstrate good psychometric properties for the measures, and characterize plausible differences between the lower and higher risk families. At the same time, the associations between constructs may vary once stratified by racial/ethnic group.

2.1.4. Native American culture and substance use

Substance use begins earlier among American Indians/Alaska Natives compared to other cultural groups within the United States, which puts Native youth at risk for escalating use over a longer period of time (Whitesell et al., 2014). Earlier onset is simultaneously a risk factor for achievement of a higher level of substance use problems and abuse than in the rest of the population (Gruber et al., 1996; Hingson et al., 2008). The epidemiologic data bear this out in a comprehensive sample of almost 1400 Native American youth, selected by region and living in or near reservations, prevalence of substance use (48%) and disorder (15%), marijuana use rates (56% in 8th grade, 61% in 10th grade, and 68% in 12th grade), binge drinking, and OxyContin® use were substantially higher than those reported in the comparable year national Monitoring the Future data (Stanley et al., 2014). Moreover, the development of these problems appears to be an ongoing and dynamic process, with monthly marijuana use increasing steadily across the adolescent years (Walls et al., 2013).

The more distal reasons for Native American youths' higher use rates are complex; family, peer influences and emotional distress are known risk factors. Trauma and exposure to stress are also highly prevalent in the American Indian community and are highly comorbid with substance use (Ehlers et al., 2013; Whitesell et al., 2009). The lack of treatment resources across communities further compounds the problem (Radin et al., 2015). Moreover, the earlier age of onset for drug use has been associated with increased rates of victimization, cognitive challenges, and suicidal behavior (Kropp et al., 2013). Finally, early puberty, problematic substance use by parents (O'Connell et al., 2007) and relationships with deviant peers have all been related to the more problematic patterns (Whitesell et al., 2014). Conversely, strong relationships with parents and prosocial peers, school bonding (Dickens et al., 2012) and a strong cultural identity (Baldwin et al., 2011) are all protective factors for Native youth.

Given these relationships, it is essential to be able to assess the degree of identification with Native American cultural values within the ABCD Native American subsample. The **Native American Cultural Acculturation Scale** (Garrett and Pichette, 2000) was selected to fill this need, and caregivers who identify their children as American Indian report on their Native American identity using this measure. Currently, approximately 3% of the ABCD sample designate their children this way. For the ABCD protocol, 9 items from the original 20-item scale were selected to assess the degree of identification with one's American Indian ancestry: contact with the American Indian community, pride in native history, and children's involvement in Native American traditions. Item responses involve making a choice among a graded set of five statements that vary in their level of intensity of endorsement of the item. At approximately the 40% waypoint for ABCD data collection, data were available from 122 families. For the 9 item scale, no differences were present for contrasts between boys and girls or between higher and lower risk families.

2.1.5. Acculturation (via language proficiency and preferences)

Language use accounts for much of the variance in some measures of acculturation, so it is used as a proxy indicator for a participant's level of acculturation—that is, the extent to which an individual from one cultural group adapts and borrows traits and values from another culture. (At the same time, this language based approach is not without its limitations, and for that reason, as previously noted, the more comprehensive measure of acculturation, the Vancouver Index of Acculturation, was also included in the protocol.) However, the need also for a language based, short measure amenable for administration to 9–10 year olds and the more general project preference for the use of standardized measures led us to utilization of the PhexX items which would assess this content. **The Acculturation Questionnaire** is a subset of questions from the PhenX Acculturation protocol. The PhenX items come from questions used by the National Latino and Asian American Study (NLAAS) (Alegria et al., 2004), which were originally derived from the "Short Acculturation Scale for Hispanics" (Marin et al., 1987). These items ask about proficiency and preference for speaking a given language in different settings. The questionnaire consists of five items administered independently to both parent and child. The first item requires participants to rate how well they speak English (i.e., poor, fair, good, excellent). This is followed by a question asking how well they speak or understand another language or dialect besides English. If no other language is spoken or understood, the questionnaire is considered complete. Otherwise, participants who endorse speaking another language are asked to identify the other language and then asked two additional questions. The first asks which language is spoken most with friends and the second asks which language is spoken most with family. Participants rate each of these items on a 5-point scale ranging from "other language all of the time" to "English all of the time." Participants are provided with an option to answer "don't know" or "refused." These items will allow us to track changes in the parent and child over the course of the ABCD study.

Data are currently available on 4096 parents and 4092 youth. Of those, about 95% of parents and 98% of youth endorsed "good" or "excellent" for their proficiency in speaking English. Youth (39%) were more likely than parents (32%) to endorse speaking or understanding another language. We speculate that the higher percentage of youth speaking languages other than English may reflect the popularity of dual-language programs in many school districts. This has prompted us to include an additional item on the measure that inquires about participation in such programs. Spanish was by far the most common other language endorsed by parents (50%) and youth (53%) Among parents endorsing knowledge of another language, average scores for the items querying language spoken to friends suggested that English was spoken most of the time ($M = 4.04$, $SD = 1.18$, $n = 1324$), as was the case when speaking with family members ($M = 3.76$, $SD = 1.36$, $n = 1325$). A similar pattern was observed for youth (friends: $M = 4.52$, $SD = 0.76$; family $M = 3.86$, $SD = 1.34$). In both cases, the means reflect a tendency for the "other" language to be spoken more often with family than friends. None of these differentiations in language preference choice when speaking with friends or with family, for both youth and parents, significantly differentiated high risk from low risk families.

Finally, it is important to keep in mind that the ABCD protocol is only available in English for youth and English or Spanish for parents. Data are currently only available on 220 parents that have completed the protocol in Spanish. This number will undoubtedly continue to grow as the sample accumulates and in the final sample a different pattern of responses on this instrument may be present.

2.2. Measures of the proximal social environment

2.2.1. Neighborhood Safety/Crime

An increasing literature has documented the macro-level, long term effects of neighborhood characteristics upon the development of psychopathology and substance abuse among children and youth (e.g., Lambert et al., 2004; Luthar and Cushing, 1999). These influences are not simply about the presence of alcohol outlets, or the visibility of drug-dealing in a particular neighborhood. Studies have shown that neighborhood social disorganizational characteristics, including crime, violence, and social instability—seemingly distal level characteristics—have problematic impact upon the children growing up in these contexts (Buu et al., 2009). In short, they have significant proximal level effects. For this reason, it was considered essential to index those characteristics in ABCD. The measure we used was taken from the PhenX Toolkit, and was derived from the "Safety from Crime" items of scales assessing neighborhood characteristics (Echeverria et al., 2004; Mujahid et al., 2007). The PhenX measure consists of three statements assessing feelings about safety and presence of crime in the respondent's neighborhood, including feeling safe walking in one's neighborhood, violence in the neighborhood, and crime in the neighborhood. Each item is rated on a 5-point Likert scale ranging from "strongly agree (5)" to "strongly disagree (1)." Parents rate all three items. The "neighborhood" is defined as "an area within about a 20-min walk (or about a mile) from your home." Although all three items will be utilized in later data waves, for youth at the baseline visit we retained only one item thought to be most appropriate for our participants' age range, (i.e., "My neighborhood is safe from crime").

On average, parents report relative safety in their neighborhoods (M = 4.00, SD = 0.92), which corresponds to "agree" across the three items, which are all phrased in a manner where more agreement corresponds to more safety. This is consistent with their children's response on the single item about safety in their neighborhood (M = 4.11, SD = 1.04). Correlations between parent and youth report were modest but significant ($r = 0.24$, $p < 0.0001$). It is also worth noting that, on average, 9.3% of youth and 18% of parents in our current sample reported disagreeing or strongly disagreeing with positive statements about their neighborhood's safety. Importantly, ratings of neighborhood safety differed significantly between Higher and Lower Risk participants, for both youth and parent reports ($p < 0.0001$ for both). This is also consistent with the findings that less deviant activity (including drug use) takes place in the neighborhoods of lower risk youth (Buu et al., 2009).

2.2.2. School risk and protective factors

The concept of a child's connectedness to his/her school has a long history in substance use research as well as in developmental research more broadly. Several theoretical models have viewed academic pursuits as a major component of mainstream (versus deviant) values, hence a positive connection with this domain is an important protective factor against becoming involved in substance use. For example, value on achievement is a central concept in problem behavior theory (Jessor and Jessor, 1977), connection with school is a similarly important part of the Hawkins group's social development model (Hawkins et al., 1985; Hawkins et al., 1992), and academic competence is posited in developmental models as a central contributor to self-esteem and resilience in childhood and adolescence (Harter, 2012; Wills et al., 2018). Empirically, measures of academic involvement have been shown to be protective against substance use (e.g., Bryant et al., 2003) and also have been an important mediator of the effects of more distal factors on substance use (Wills et al., 2011, 2016). School connectedness is posited to be protective against substance use through relations to component processes such as greater identification with mainstream achievement values, higher self-esteem, and reduced affiliation with deviant peers. There have been few tests of this hypothesis, as well as the one testing the direct effects from academic involvement to (less) substance use and (higher) well-being. However, the few studies that have examined these relationships have confirmed them (Wills et al., 2006; Wills et al., 2016).

In the ABCD protocol, the 12-item Inventory for School Risk and Protective Factors (SRPF) was selected to assesses three dimensions of this general concept of a child's connectedness to his/her school: school teacher and classroom environment, personal involvement in school, and alienation from academic goals. The items in the SRPF inventory were derived from the content domains for the School Social Environment section in the PhenX Toolkit. Because the 39-item PhenX measure was deemed too long for the ABCD study, analogous items were included from similar measures that the investigators had used with young children, including the Academic Competence Scale (Harter, 2006) and the Communities That Care Youth Survey (Arthur et al., 2007). Six items were selected to tap school climate/environment (e.g., "In my school, students have lots of chances to help decide things like class activities and rules," "My teacher notices when I am doing a good job and lets me know about it"); they tap into the child's experience of the school as an environment providing opportunities and support. Four items were selected as the best indicators for positive involvement in school (e.g., "I like school because I do well in class," "In general, I like school a lot"). An initial multi-item inventory to tap alienation from school was constructed but a number of items were dropped for length reasons, and the final scale for the Wave 1 interview had two items ("Usually, school bores me," "Getting good grades is not so important to me") assessing the experience of lack of involvement and alienation. These items are reverse scored.

The SRPF inventory is scored for these three scales. Psychometric data on the measures is provided in Table 3; at time of analysis, the N was 4089. Alphas for the School Environment Scale ($\alpha = 0.60$) and the School Involvement Scale ($\alpha = 0.64$) were moderately high. For the Alienation from School Scale, there were only two items and alpha was 0.21. Although none of these scales had an exactly normal distribution, all were useable for analysis without transformation. Each of the SRPF scales significantly discriminated between lower- and higher-risk youth and scores were all as would be anticipated based on prior work, with more school engagement (achievement, involvement) and less school alienation in the lower risk group (all p values < 0.0001).

2.3. Measures of social interaction

2.3.1. Youth's perception of parents' acceptance and responsiveness (Acceptance Scale)

Research indicates that parents' acceptance and responsiveness are associated with child and adolescent adjustment across a variety of domains including school achievement, antisocial behavior, and substance use (see Baumrind, 1991; Steinberg, 2001). In the ABCD study, the **Acceptance Scale,** a subscale of the Child Report of Behavior Inventory (CRPBI; Schaefer, 1965; see also Barber et al., 1994; Barber, 1997), is used to assess youth's perceptions of caregiver warmth, acceptance, and responsiveness. The scale was shortened from 10 to five items and youth respond to items describing caregivers' behaviors on a three-point scale indicating the extent to which their caregiver's behavior fits the descriptor on a particular item indicating warmth or acceptance (e.g., "Makes me feel better after talking over my worries with him/her"; "Smiles at me very often"). Children first report on their primary caregiver, who is also part of the study and is usually the mother. They report next on a secondary caregiver, but one that the child spends a significant amount of time with (e.g., other parent, stepparent, grandparent, aunt, uncle).

Mean reported level of acceptance/warmth from primary caregiver = 2.79 (SD = 0.30); Range = 1–3; coefficient $\alpha = 0.71$. For the other caregiver (71% father), mean = 2.69 (SD = 0.38); Range = 1–3; $\alpha = 0.76$. There also was moderate agreement in the child's perception of experienced level of acceptance/warmth for the two caregivers ($\text{rho} = 0.44$, $p < 0.0001$). Findings indicate that low risk participants are reporting higher acceptance by the primary caregiver (M = 2.80, SD = 0.28) compared to high risk youth (M = 2.77, SD = 0.32, $p < 0.0001$). A similar pattern of experienced acceptance/warmth was reported for the secondary caregiver. Other indicators of the scale's construct validity were its correlations in the ABCD sample with responses on the Prosocial Behavior ($r = 0.33$); Parent monitoring ($r = 0.35$); and Family conflict ($r = -0.30$), scales.

2.3.2. Family conflict scale (a subscale of the family environment scale)

The family is the most proximal social environment in which the child is embedded, and it influences the course of risk for substance abuse from the earliest years of life (Zucker, 2006). Within that social matrix, conflict is one of the strongest predictors of risk for substance abuse, both as a mediator and moderator (Espelage et al., 2014). Homes where there is parental substance abuse are more likely to be high in conflict (Loukas et al., 2003). They also are more likely to expose children to spousal violence and parental divorce (Leonard 2002; Roberts and Linney, 2000), risk factors in their own right for the development of substance abuse in the children. Furthermore, family conflict mediates the relationship between parent substance use and child externalizing behavior, the most potent non-specific behavioral risk for substance abuse (El-Sheikh and Flanagan, 2001; Loukas et al., 2001). Family conflict is also a moderator of risk development because high conflict family environments, particularly in the late elementary and middle school years, are more likely to encourage the child to spend more time away from home, and hence have more opportunity to meet deviant peers who have already started using drugs.

In order to assess this content, the ABCD protocol is utilizing the 9 − item **Family Conflict subscale of the Moos Family Environment Scale** (FES) (Moos and Moos, 1994) for the baseline protocol, with repeated assessment planned every 2 years. The measure is widely used, has a binary response self-report format, and is also a part of the PhenX Toolkit. For scoring, each true/false item is assigned a value of 0 or 1, with appropriate reverse coding for those 4 items that negate conflict instead of describing the direct presence of it (e.g., family members hardly ever lose their temper). Higher scores indicate a more-conflictual family environment.

At time of analysis, data were available from 4091 youth, and 4097 parents (84.8% were children's biological mothers) (See Table 3 for basic psychometric data and lower vs. higher risk group contrasts.) Lower risk youth had a mean score of 1.81 (SD = 1.84); higher risk youths' score was 2.18 (SD = 2.02). Parents in lower risk families had a mean score of 2.24 (SD = 1.77); the mean of those in higher risk families was 2.78 (SD = 1.97). Both of these differences are strongly significant ($p < 0.0001$), and in the direction one would anticipate based on a good deal of other work (e.g., Loukas et al., 2003; Keller et al., 2008; Marsiglia et al., 2009). In addition, parents were reporting substantially more conflict in their families than were their children. Given the young age of the children, this also would be anticipated.

There are only two anomalies in these data. One is that despite the higher scores among the parents, these overall sample scores are significantly lower ($p < 0.01$) than those reported both in the Moos and Moos (2009) normative parent sample, where mean conflict score is 3.18 (SD = 1.91), and in the Boyd et al. (1997) normative youth sample of 11–15 year olds (mean = 3.39; SD = 2.27; $p < 0.001$). These differences may, at least in part, also be a function of the younger age of the ABCD sample of families. The other is that the correlation between parent and child reports, although significant, is quite low. One possibility is that the young age of the children leads them to interpret family interaction differently than their parents. We will continue to monitor this as the families grow older. Given that the study ultimately will be a sample that is demographically representative of the US population, the values of this important parameter are of considerable interest.

2.3.3. Parental monitoring

As elucidated in prior work (Karoly et al., 2016), the overarching conceptual model for the **Parental Monitoring Scale** follows the ecodevelopmental theory (Szapocznik and Coatsworth, 1999; Pantin et al., 2004). The model proposes that interactive risk and protective factors across multiple levels of adolescents' social environment interact to exacerbate or insulate youth from risk. In addition, positive connections between an adolescent's microsystems (i.e., social contexts like family, school, and peer relationships in which the adolescent participates directly), can protect against involvement in risk behavior (Pantin et al., 2003). Parent monitoring and oversight are especially salient (Ozer et al., 2011; King and Vidourek, 2010; Mongro-Wilson, 2008), as their influence cuts across these three social systems, e.g., by decreasing poor academic performance (Hill and Taylor, 2004). Moreover, given the additional stressors associated with being a minority in the U.S., parent monitoring may serve an especially important protective role in reducing risk behavior among youth of color (e.g., Salvador et al., 2015; Borawski et al., 2003; Huang et al., 2011).

At the same time, there is debate about what parental monitoring is, what it represents, and how it should be measured. Many studies have evaluated parent monitoring via frequency ("how often") parents know where their children are, with whom they spend time, and what they are doing (Shillington et al., 2005). These more supervisory measures of parent monitoring focus on parents' knowledge of their children's whereabouts and companions, and do not assess whether parents engage in active surveillance of their children (Stattin and Kerr, 2000; Smetana, 2008). Numerous studies have shown that the supervisory aspect of parent monitoring, on its own, has a robust protective relationship against risk-taking (Buhi and Goodson, 2007; DiClemente et al., 2001). However, other investigators emphasize degree of child disclosure to parents as the important aspect of parent monitoring (Kerr et al., 1999). Still another type of monitoring that has received significant attention involves family time spent together, particularly during family dinners (Hair et al., 2008). Specifically, family meals provide an opportunity for parents to monitor their children's activities, whereabouts and moods (Fulkerson et al., 2006; Eisenberg et al., 2008). This simultaneously facilitates opportunities for child disclosure, thereby encompassing several key aspects of parental involvement, viz, supervision, and oversight (Griffin et al., 2000). In prior evaluations, family dinner frequency has been inversely correlated with youth risk taking (Fulkerson et al., 2006), with particularly robust outcomes for adolescent girls (Griffin et al., 2000). All three of these perspectives have been covered in the measure we used in the ABCD protocol. Specifically, the version of the Parental Monitoring questionnaire used is a subset of 5 questions that assess parents' active efforts to keep track of a child's whereabouts, both at home and when they are not at home (e.g., who they are with; what they are doing). The measure is derivative from a considerable amount of prior empirical work (Chilcoat and Anthony, 1996; DiClemente et al., 2001; Karoly et al., 2016; Shillington et al., 2005; Stattin and Kerr, 2000). Following this literature, our parent monitoring items assess three constructs: Parent monitoring of location "How often do your parents know where you are?"; Parent monitoring of who children are spending time with "How often do your parents know who you are with when you are not at school and away from home?"; Parent/child contact "If you are at home and your parents or guardians are not, how often do you know how to get in touch with them? Child disclosure is assessed with 'How often do you talk to your mom/dad or guardian about your plans for the coming day, such as your plans about what will happen at school or what you are going to do with friends?' Finally, parent monitoring via family dinner frequency is assessed with "In an average week, how many times do you and your parents/guardians eat dinner together?" For all items, response is by way of a Likert-type scale ranging from never (1), to almost always (5). Correlations among the variables in prior work (Karoly et al., 2016), have ranged from $r = 0.20$ to $r = 0.56$ (average $r = 0.33$), and the moderate magnitude of these correlations supports examining these items as separate dimensions.

In the data currently collected for ABCD, the measure is only administered to the children. Mean scores on each of the items were as follows: Parent monitoring of location, 4.74 (SD = 0.54); Parent monitoring of who children are with, 4.64 (SD = 0.76); Parent/child contact, 4.59 (SD = 0.84); Child disclosure, 3.73 (SD = 1.21); Family dinner frequency, 4.37 (SD = 0.94). Range on all items was 1–5. The mean monitoring score based on all five items was 4.41 (SD = 0.49). Analyses of differences at the item level between higher and lower risk youth showed all items in the expected direction (higher risk youth reporting experiencing a lower level of monitoring (Chilcoat and Anthony, 1996)), and all differences significant. On the 5-item summary score, lower risk youth had a mean score of 4.46 (SD = 0.47); higher risk youth, score was 4.36 (SD = 0.52), $p < 0.0001$. Data available as of July 2017 showed some evidence of skewness (M skew across items = −1.11.; range of skew = −0.715 to −2.612). The negative value is to be expected given that the more typical child endorsement pattern is closer to the "almost always" end. Item range for all items (1–5) indicates a reasonable range of reporting.

2.3.4. Prosocial behavior

Prosocial Behavior, or the tendency to engage in behaviors to help others, has been studied as part of social competence and resilience in many studies of adolescent development. Prosocial behavior is associated with multiple indicators of mental health and well-being, and has been found to be a protective factor against the development of problem behavior and aggression (for a review, see Eisenberg et al., 2009). In the ABCD study, prosocial behavior (e.g., being nice, helping, caring) is assessed using the **Prosocial Behavior Scale,** a subscale from the "Strengths and Difficulties Questionnaire" (SDQ; Goodman et al., 1998; Goodman and Scott, 1999). The original subscale has 5 items, and we retained three items with the highest factor loadings. Both parents and youth report on the youth's prosocial behavior (e.g., being considerate of other people's feelings, often offering to help others). They rate these behaviors over the past 6 months on a three-point scale ("0 = Not True" to "2 = Certainly True").

Here also, basic psychometrics are reported in Table 3. The parent's report of prosocial behavior indicates higher rated child prosocial behavior (M = 1.81, SD = 0.437) among lower risk youth compared to higher risk youth (M = 1.67, SD = 0.44, $p < 0.0001$). Parallel mean differences were present for the youth ratings on their own behavior: Lower risk youth, M = 1.70 (SD = 0.35), higher risk youth, M = 1.67 (SD = 0.38), p = 002. Overall mean for parents across the entire sample = 1.75 (SD = 0.41); overall mean for youth = 1.69 (SD = 0.36). The correlation between parent reports and youth reports is quite low, and the magnitude of the p is undoubtedly attributable to the large sample size.

3. ABCD follow-up protocols

The ABCD Study design calls for a repeated measures protocol at two-year intervals assessing all the variables assessed at baseline, and also including the custodial parent. The design also includes a one year, face-to-face protocol to assess those variables that have the potential to change over that length of time, and that are relevant to the developmental processes being tracked that pertain to the emergence of a use/abuse. A six-month phone contact is also planned for assessment of only those key variables that are sufficiently sensitive such that measurement at a longer interval would leave critical developmental variance uncharacterized.

The nature of the Culture and Environment variable network was judged to be sufficiently stable so that a six-month characterization was not necessary. This is not the case for family life change and environmental variation over the twelve-month interval, given that it is not uncommon for network characteristics, ranging from neighborhood safety to family conflict, to sense of cultural identity to change significantly over that period of time (Buu et al., 2007; Gottman, 1993). Tables 5A and 5B provide the final list of measures that the Culture and Environment Workgroup decided to re-assess for the One-Year Follow-Up assessment of the youth and their parents. This protocol is currently in the very early stages of data collection. The Two-Year protocol has not yet been finalized.

Table 5A
Domains and Measures assessed at Year One for Youth.

Cultural/ Ethnic Group Membership Domain
PhenX Acculturation
Discrimination Measure[a]
Proximal Social Environment Domain
PhenX Neighborhood Safety/Crime
PhenX School Risk & Protective Factors
Social Interaction Domain
Prosocial Tendencies
Acceptance Subscale from CRPBI-Short Parental Monitoring
Family Environment Scale (Family Conflict subscale) Wills Problem Solving[a]

[a] Measure is being administered for the first time at the Year One Assessment.

Table 5B
Domains and Measures assessed at Year One for Parents.

Cultural/ Ethnic Group Membership Domain
PhenX Acculturation
Mexican American Cultural Value Scale
Native American Acculturation Scale
Proximal Social Environment Domain
PhenX Neighborhood Safety/Crime
Social Interaction Domain
Prosocial Tendencies
Family Environment Scale (Family Conflict subscale)

4. Concluding comments and summary

The Culture and Environment component of the ABCD protocol evaluates the multi-faceted influences of culture/ethnic group membership, the proximal social environment, and its social interactional components which relate to the development of substance use among youth. We have discussed the rationale for selecting these three components, and summarized the research justification for use of each of the eleven measures in the protocol. We also have provided early performance data on the workability and basic psychometric properties of each of the measures. Early data collection indicates the protocol is quite viable and with the exception of the youth form of two measures, all scales are psychometrically sound. For those two, both were short (5 item) indicator components from the PhenX toolkit which had never been formally validated scales on their own. With those two exceptions, despite the very high volume of data collection, currently including approximately 4100 respondent youth and an approximately equal number of their primary caretaker parents, data quality remains uniformly high.

At the same time, the protocol's ability to differentiate higher from lower risk youth is modest, even within areas where prior work would suggest there should be robust differentiation. Although 64% of the tests of difference between the higher and lower risk groups are significant (80% of the Youth measures and 53% of the measures completed by parents), only four make the cut-off for a meaningful effect size, 0.20, which is typically the lowest level at which it makes sense to regard a difference as practically significant (Cohen, 1988; McGraw and Wong, 1992). That having been said, on all the measures where significant differences occur, the direction of effects–even ones of very small magnitude—is in the direction one would plausibly expect. Moreover, the direction of endorsement of the measures with the largest effect sizes indicates a more socially engaged, pro-social child adaptation for the lower risk group (parent reports of higher prosocial behavior and lower family conflict; child reports of greater parental monitoring). In other words, there appears to be a greater connection between child and parent, and more positive engagement with school environment and its activities. These differences will need to continue to be monitored as study enrollment reaches the half-way point, with the possibility that the high/low risk criteria will need to be adjusted to produce a more clearly demarcated, albeit smaller higher risk group.

With regard to sex differences, a general pattern is evident in the data. With the exception of the ratings of no differences for Neighborhood Safety, strong sex differences are present in all of the Youth Report measures of their experience of the proximal social environment (all ps 0.0003 or stronger). A similar pattern exists with regard to the Parent Reports on their children in the Social Interaction Domain (Family Conflict, Prosocial Behavior). There is one anomalous finding, however. In contrast to the children's lack of differentiation, parent reports for Neighborhood Safety significantly differ for their daughters and sons, albeit with a low absolute level of differentiation; they report their daughters have a lesser sense of safety in their neighborhoods than do their sons.

Overall, girls reported greater closeness to family (stronger Acceptance scores, being involved with and aware more of parents' presence, and in parallel with their parent reports, reporting less family conflict) than the boys. Consistent with this, the one significant Cultural Ethnic Group Membership Domain sex difference finding, with the Acculturation Questionnaire, indicates that although the absolute difference is small, girls were significantly less likely to speak English with friends than were the boys. These data also suggest that girls are a bit more likely to have friends whose language is the same as that of their family. The girls also reported more activity establishing closer social relationships outside the family. All of these findings are uniformly in parallel with the broader child development literature, indicating more prosocial behavior among the girls (cf Pasterski et al., 2011).

The potential scientific benefits of the ABCD data collection efforts are significant from a broader perspective, above and beyond their contribution in understanding relationships to the emergence of risky marijuana and other drug use, and their contributions to understanding the shaping of neural development. To illustrate this point, one such opportunity is the ability to better understand mechanisms that may explain over a decade's worth of research demonstrating increased rates of SU among Latino youth with higher levels of acculturation (De La Rosa, 2002; Gil et al., 2000; Vega et al., 2007). Approaches to measuring acculturation have oftentimes been limited (Lara et al., 2005), but studies examining multidimensional aspects have revealed far more complex associations between cultural factors and substance use risk behaviors among Latino youth (Schwartz et al., 2012). When immigrating to the US, Latino youth tend to acculturate faster than their parents, which results in acculturation discrepancies that can lead to conflictual parent-child relationships (Fuligni, 2012; Hwang et al., 2010; Unger et al., 2009). This parent-child acculturation gap negatively impacts family functioning and is recognized to precede risk behaviors, including SU, among Latino youth (Cordova et al., 2014; Cox et al., 2013; Marsiglia et al., 2014). Understanding bicultural orientations is important given that it has been linked with lower levels of risk behavior among Latino youth (Coatsworth et al., 2005). It may be that more rapid acculturation among Latino youth relative to their parents may be a strong risk factor for SU initiation and escalation. Conversely, growing biculturalism by both parent and child may be protective. Although most of this work has been conducted with Latino youth, the ABCD study will be able to extend these analyses and test if these relationships hold for other immigrant populations in the U.S. as well.

Another example of the ABCD study's potential utility and payoff is the possibility of evaluating the effects of massive natural disaster on short and longer term neural development. A protocol to collect secondary data on youth and parents residing in multiple sites exposed to Hurricane Irma would allow the evaluation of experienced stress level from this environmental event, and its short and long-term effects on brain. This protocol is currently under development at time of writing.

Most generally, it is essential to recognize that culture, and environment more generally, play major influencing roles in many components of child development, in domains well beyond those relating to the emergence and course of substance abuse (Schulenberg et al., 2016). Given that the ABCD project has a considerably broader focus than just characterizing the impact of substance involvement upon the developing brain, the importance of the measures in this segment of the protocol opens a window to understanding the course of other facets of adolescent behavior. Moreover, given the ABCD study's goal to characterize developmental variation in a way that has applicability to the entire US population, and given the major cultural variations that exist within American society, it is imperative that such effects be characterized so that their interactions with brain development may be understood.

Conflicts of interest

Robert A. Zucker, Raul Gonzalez, Sarah W. Feldstein Ewing, Judith Arroyo, Andrew Fuligni, Amanda Sheffield Morris, Mariana Sanchez, Thomas Wills: None.

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