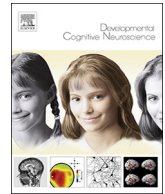




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Assessment of culture and environment in the Adolescent Brain and Cognitive Development Study: Rationale, description of measures, and early data

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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

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