Methods and materials

**Participants**

All participants were originally recruited as part of the Adolescent Brain Cognitive

Development (ABCD) study currently ongoing in the US. The review and approval of the

ABCD research protocol was handled by a central Institutional Review Board at the

University of San Diego, California (Auchter et al., 2018), and the study follows established

federal and state regulations regarding biomedical ethics in the U.S. (Clark et al., 2018).

Informed consent was given by parents or guardians and assent was given by children before

participation. While the initial goal of the ABCD study was to assess substance use, it evolved

into a longitudinal cooperative developmental study which tracks children from ages ~10-20

and contains a wide range of data on observable phenotypes (Volkow et al., 2018). A total of

11,877 participants between the ages of 9 and 10.99 years were included at baseline (ABCD

4.0 Data Release, 2022), recruited from 21 data collection sites across the US, representing a

wide range of socioeconomic strata. Participants had to be able to complete all baseline

measurements, including MRI scanning, to participate. Exclusion criteria from the ABCD

study include sensorimotor impairments, persistent major neurological disorders, severely

premature birth, birthweight of less than 1200 grams, current diagnosis of psychiatric

disorder, and traumatic brain injury. For the present study, participants will have a varying

amount of MRI- and neurocognitive data due to exclusions based on quality control and task

responses across the two timepoints. An overview of the final sample is displayed in table 1.

See data acquisition for further elaborations on participant exclusions.(INA)

**Data acquisition**

Data for the present study was specifically collected from the ABCD release 4.0 (doi:

10.15154/1523041), with the exception of MRI data from the two-year follow up obtained

from the ABCD fast-track imaging data release (see https://abcdstudy.org/scientists/data-

sharing/fast-track-imaging-data-release/). My access to the data material was granted through

Request #7474 (PI: Westlye), and local approval for handling of data is registered as REK

2019/943 (Regional Committees for Medical and Health Research Ethics). All data handling

was performed on the TSD (Tjeneste for Sensitive Data) facilities, a secure server

environment owned by the University of Oslo.

*Structural MRI*

Participants were scanned at 21 data collection sites across the US, acquiring structural

T1w images from a total of 28 different scanner types from Siemens, General Electric (GE)

and Philips (ABCD Data Release 4.0, 2022). Images from Siemens scanners were obtained

with 176 slices, TE: 2.88 ms, and acquisition time: 7:12. Philips scanners had the following

parameters: 225 slices, TE: 2.9 ms, and acquisition time: 5:38. Finally, images obtained from

GE scanners had 208 slices, TE: 2, and acquisition time: 6:09. All scanners shared a14

resolution of 1.0 x 1.0 x 1.0. and a TR of 2500 ms for the T1w images. Due to a large amount

of missing MRI data from the 2-year follow up, unprocessed images from this timepoint were

obtained from the ABCD Fast-track Imaging Data Release. Here, several participants had

more than one T1w image, likely due to movement by the participant causing insufficient

image quality. Images for each of these participants were matched with - and selected based

on timestamps documented in an additional file provided by ABCD regarding subsequent

quality control. Participants were excluded from a timepoint if the T1w data did not meet all

criteria for inclusion, as recommended by ABCD (ABCD Data Release 4.0, 2022). Further

exclusions were made if the data did not pass the initial post processing quality control. (INA)

**MRI data acquisition**

Image processing and analysis methods corresponding to ABCD Release 2.0.1 are described Hagler et al., 2019, NeuroImage. Image processing and analysis methods for the Adolescent Brain Cognitive Development Study (doi: [10.1016/j.neuroimage.2019.116091](https://doi.org/10.1016/j.neuroimage.2019.116091)). Changes to image processing and analysis methods in Release 3.0 and Release 4.0 are documented below. No significant changes were made to the processing pipeline for Release 5.0.

https://wiki.abcdstudy.org/release-notes/imaging/structural-mri.html

From caregiver and youth perspective, information is obtained about both current and lifetime mental health diagnoses of the youth using a validated and computerized Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS) for DSM-5 (KSADS-COMP), developed by Dr. Joan Kaufman and Dr. Ken Kobak with NIH Small Business Innovation Research support (Kobak et al., 2013; Kobak and Kaufman, 2015). This is a self-administered, computerized version that does not involve a clinician for either the caregiver or the youth, though the youth are supported in completing the KSADS-COMP by trained research assistants. In Section 3.2 below, we provide more information about changes in this measure over assessment waves and known issues or considerations in the use of data from the KSADS-COMP (Barch et al., 2021)

KSADS Questionnaire:

https://www.youtube.com/watch?v=fGDGWXWc16M

Components:

1. Introductory interview
   1. Includes:
      1. Demographics
      2. Health history
      3. Prior psychiatric treatment
      4. Family history of psychiatric illness
      5. Adaptive functioning (e.g. school, peers, activities)
      6. Additional Questions (e.g. guns in home, gender identity, sexual orientation)
2. Diagnostic Screening Interview
   1. Surveys the primary symptoms of the different diagnosis assessed in the KSADS-COMP
   2. Two to four symptoms are surveyed in each diagnostic area
   3. Current symptoms are rated for severity over the past two weeks using a uniform 0-4 point dimensional scale
   4. The threshold required for clinical significance response varies depending on the symptom being assessed
      1. E.g. symptoms for MDD vs alcohol use disorder
3. Supplements
   1. The skip out criteria in the screen interview specify which, if any, supplements will be administered
   2. In general, the supplements are administered in the order that symptoms for the different diagnoses appeared (e.g., ADHD/MDD)
   3. When the time course of disorders overlap, supplements for disorders that may have influenced the course of other disorders are administered first (e.g. Substance use/Mania)
   4. The order for supplement administration (ordering of supplement) is programmed automatically

The self-administered KSADS-COMP was designed to emulate the probing done by a trained clinician.

1. ADHD/MDD = if the child endorsed difficulties with concentration when completing the depression supplement, the child would be presented with a question that asks whether the concentration difficulties got worse with the onset of the depressed mood. If not, then concentration problems is NOT rated as present in the depression supplement
2. Youth version has video clips