Adolescent Brain Cognitive Development®

Teen Brains. Today's Science. Brighter Future.

Preview of the ABCD Study® Data Release 3.0

Sean Hatton, UC San Diego

Presentation

- Overview of ABCD Study®
- What's new in Data Release 3.0
- What's next?

Acknowledge the 1000s of people involved in the collection, analysis, sharing and educational support of the ABCD data.

Overview of the
Adolescent Brain Cognitive Development Study

abcdstudy.org

- 11,878 children aged 9-10, across 21 USA sites.
- Including 2,100 twins and 30 triplets
- 3-6 month assessments for ten years.
- Biennial MRI, biospecimens
- Data publicly available: https://nda.nih.gov/abcd

Baseline assessments
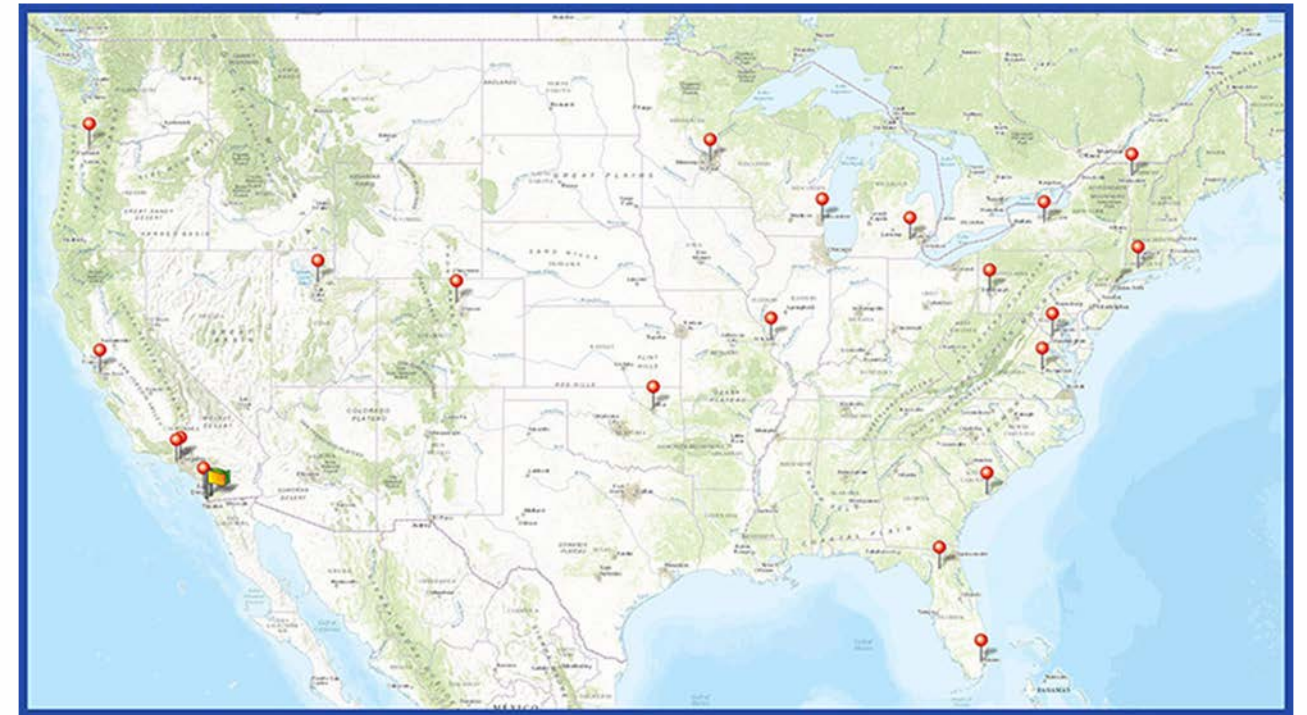
Physical Health

PhenX Anthropometrics (height/weight/waist measurements)

Snellen Vision Screener

Edinburgh Handedness Inventory

Youth Risk Behavior Survey - Exercise

Pubertal Development Scale and Menstrual Cycle Survey

Screen Time Survey

Brain Imaging

Structural MRI
- 3D T1 - Weighted
- 3D T2 - Weighted
- Diffusion Tensor Imaging

Functional MRI (fMRI)
- Resting State
- Monetary Incentive Delay Task
- Stop Signal Task
- Emotional N-Back Task

Biospecimens

Subset of participants:
Breathalyzer (alcohol screen)
Oral fluids (drug screen)
Blood (DNA)

Oral Fluids (DNA, pubertal hormones)

Hair (substance use metabolites)

Baby Teeth (substance and environmental toxin exposure)

Mental Health

Kiddie Schedule for Affective Disorders and Schizophrenia
- Background Items Survey
- Diagnostic Interview for DSM-5 (Mood, Social Anxiety, Generalized Anxiety Disorder, Suicide, and Sleep modules)

UPPS-P for Children - Short Form (ABCD version)

PhenX Behavioral Inhibition/Behavioral Approach System (BIS/BAS) Scales

Prodromal Psychosis Scale

Youth Resilience Scale

Neurocognition

NIH Toolbox Tasks:
- Picture Vocabulary
- Flanker Inhibitory Control & Attention
- List Sorting Working Memory
- Dimensional Change Card Sort
- Pattern Comparison Processing Speed
- Picture Sequence Memory
- Oral Reading Recognition

Rey Auditory Verbal Learning Task

Cash Choice Task

Little Man Task

Matrix Reasoning Task

RAVLT Delayed Recall

Substance Use

For most participants*:

Participant Last Use Survey (PLUS) for substance use within the last 24 hrs

PhenX Peer Group Deviance Survey

PATH Intention to Use Tobacco Survey

Timeline Follow-Back Survey

Caffeine Intake Survey

Culture & Environment

Prosocial Behavior Survey

PhenX Acculturation Survey

Parental Monitoring Survey

Acceptance Subscale from Children's Report of Parental Behavior Inventory - Short

PhenX Family Environment Scale - Family Conflict

PhenX Neighborhood Safety/Crime Survey

PhenX School Risk & Protective Factors Survey

Physical Health

PhenX Demographics Survey

Medical History Questionnaire

Developmental History Questionnaire

PhenX Medications Survey

Pubertal Development Scale and Menstrual Cycle Survey

Sleep Disturbances Scale for Children

Sports and Activities Involvement Questionnaire

Screen Time Survey

Ohio State TBI Screen - Short

Mental Health

Kiddie Schedule for Affective Disorders and Schizophrenia
- Background Items Survey
- Diagnostic Interview for DSM-5 (all modules)

Child Behavior Checklist

General Behavior Inventory - Mania

Adult Self Report Survey

Family History Assessment Survey

Substance Use

Participant Last Use Survey (PLUS) for substance use within the last 24 hrs.

Parent Rules Survey

PhenX Community Risk and Protective Factors

Culture & Environment

Vancouver Index of Acculturation - Short Survey

Multi-Group Ethnic Identity Measure-R Survey

Prosocial Behavior Survey

Mexican American Cultural Values Scale

PhenX Acculturation Survey

PhenX Family Environment Scale - Family Conflict

PhenX Neighborhood Safety/Crime Survey

Native American Acculturation Scale

Other Data Sources

Geocoding from Residential History

School Records

Brief Problem Monitor - Teacher Form

https://abcdstudy.org/scientists/protocols/
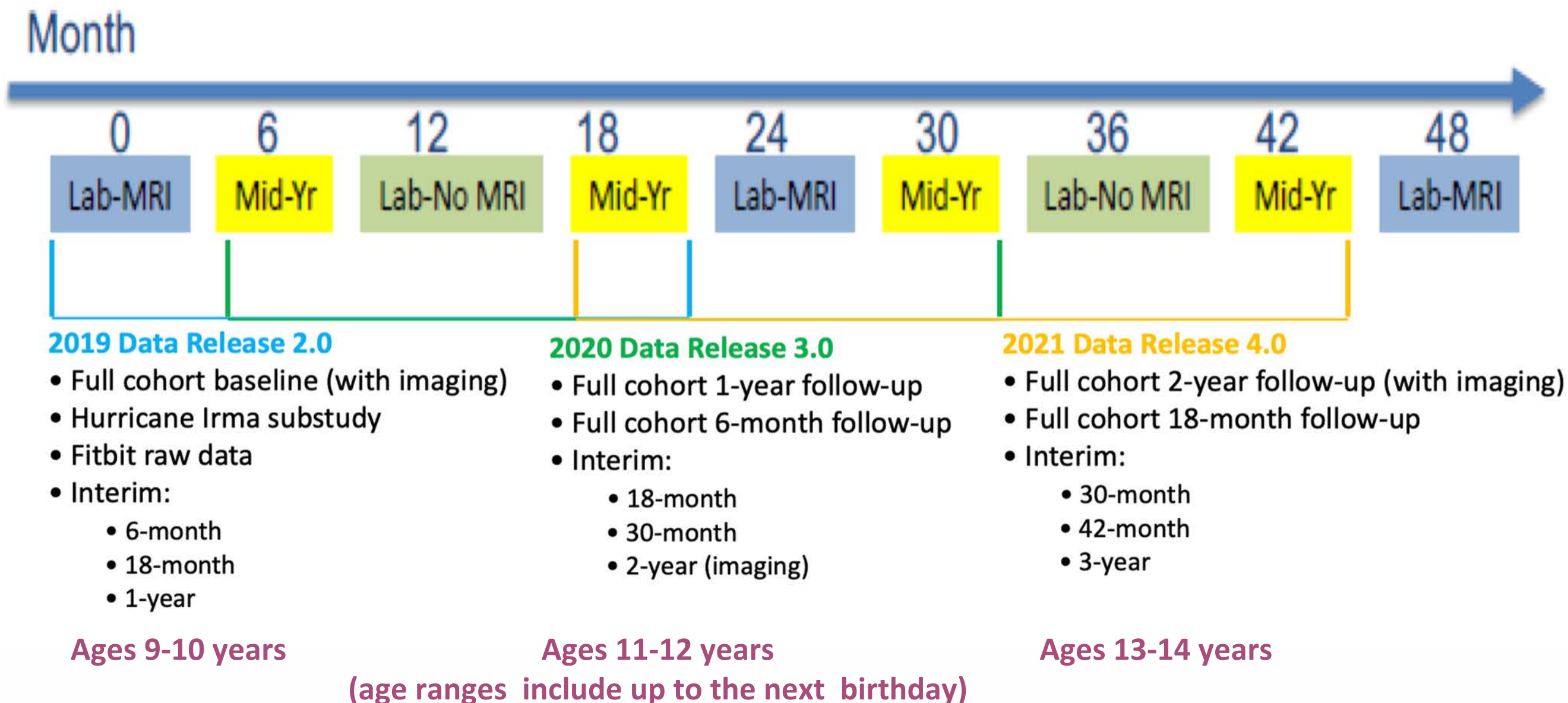
ABCD Study® Primer

- Researchers' Guide to the ABCD Study was presented at the Human Brain Mapping Conference in Rome, June 2019.
https://www.pathlms.com/ohbm/courses/12238/sections/15846/video_presentations/138326
- Over 3.5 hours on Data Release 2.0:
  - The ABCD Study Cohort
  - Physical, behavioral and environmental phenotypes
  - Neuroimaging processing pipeline and baseline data
  - Statistical inferences
  - Integrating genetics and neuroimaging
  - Twins and Structural Equation Modeling
- OHBM June 2020: Researchers' Guide to ABCD Study Data Release 3.0

Data Release Schedule

Curated data are released annually via the NIMH Data Archive (https://nda.nih.gov/abcd)

Month

0	6	12	18	24	30	36	42	48
Lab-MRI	Mid-Yr	Lab-No MRI	Mid-Yr	Lab-MRI	Mid-Yr	Lab-No MRI	Mid-Yr	Lab-MRI

2019 Data Release 2.0
- Full cohort baseline (with imaging)
- Hurricane Irma substudy
- Fitbit raw data
- Interim:
  - 6-month
  - 18-month
  - 1-year

2020 Data Release 3.0
- Full cohort 1-year follow-up
- Full cohort 6-month follow-up
- Interim:
  - 18-month
  - 30-month
  - 2-year (imaging)

2021 Data Release 4.0
- Full cohort 2-year follow-up (with imaging)
- Full cohort 18-month follow-up
- Interim:
  - 30-month
  - 42-month
  - 3-year

Ages 9-10 years

Ages 11-12 years

Ages 13-14 years

(age ranges include up to the next birthday)

What's new in
ABCD Data Release 3.0

General Questionnaires

- School Attendance and Grades
  - Asks youth/parent about number of excused and unexcused school absences, grades, and participation in an Individualized Education Program (parent/guardian only).
- Mexican American Cultural Values
  - Family support subscale, the family obligation subscale, and the independence and self-reliance subscale.
- Occupation Survey
  - Asking the caregiver about their own and their partner's occupation and job category according to the ACS job classifications.

Mobile Technology Assessments

- Passive assessment of mobile phone use patterns (pilot)
  - Effortless Assessment of Risk States (EARS)
  - Vibrent
- Youth Mobile Phone Usage
- Youth Mobile Phone Usage Summary Scores
- Parent/Guardian Mobile Phone Usage

Fitbit Activity Data

- Parent/Guardians Fitbit Pre/post-assessment Survey
- Youth Fitbit Pre/post-assessment Survey
- Youth Fitbit Daily Physical Activity/Sleep Summaries
- Youth Fitbit Weekly Physical Activity/Sleep Summaries
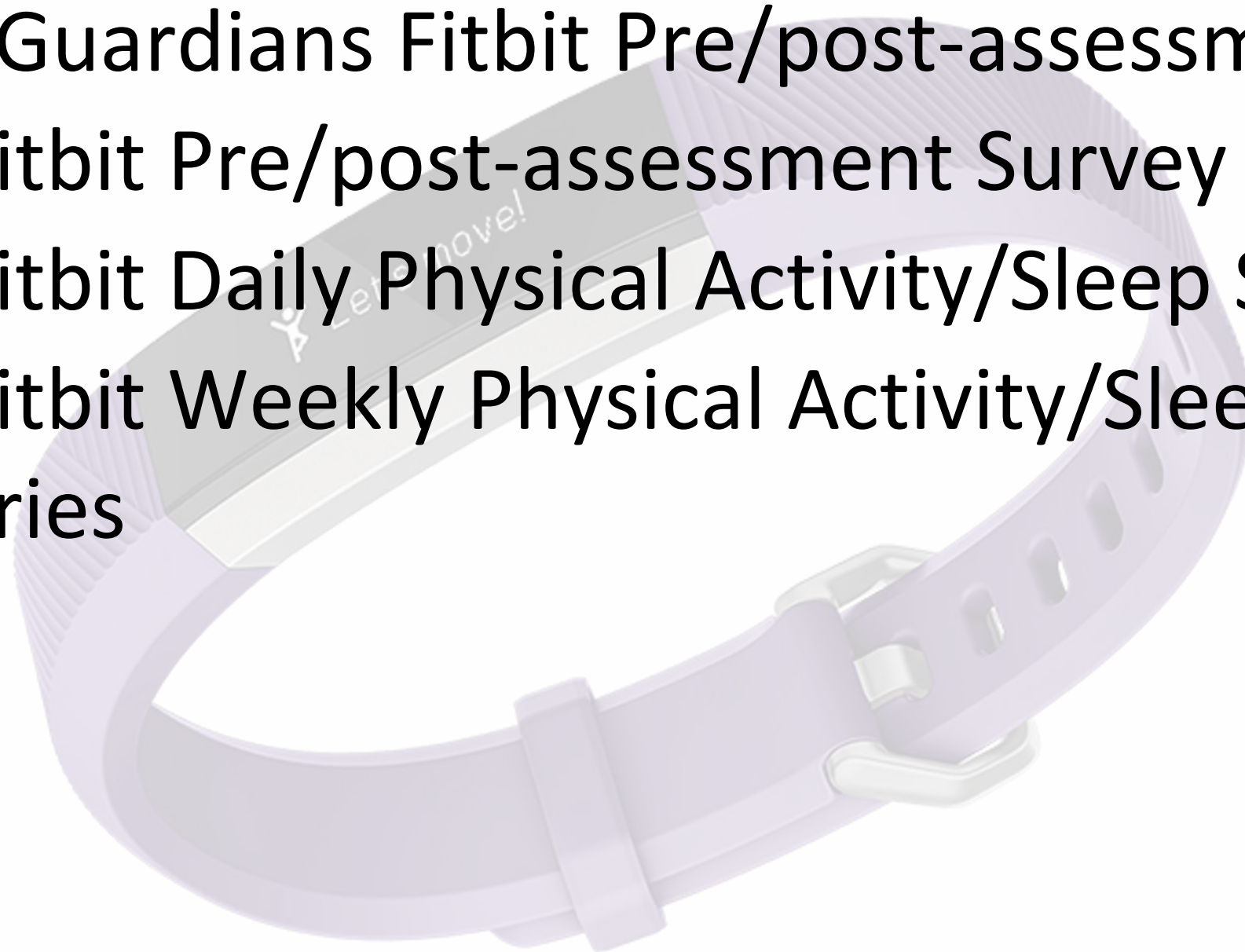
Sleep Questionnaire

- Youth Munich Chronotype Questionnaire
  - Assess chronotype (circadian typology), the individual differences in activity and alertness in the morning and evening, including sleep and wake schedules on school and free days.
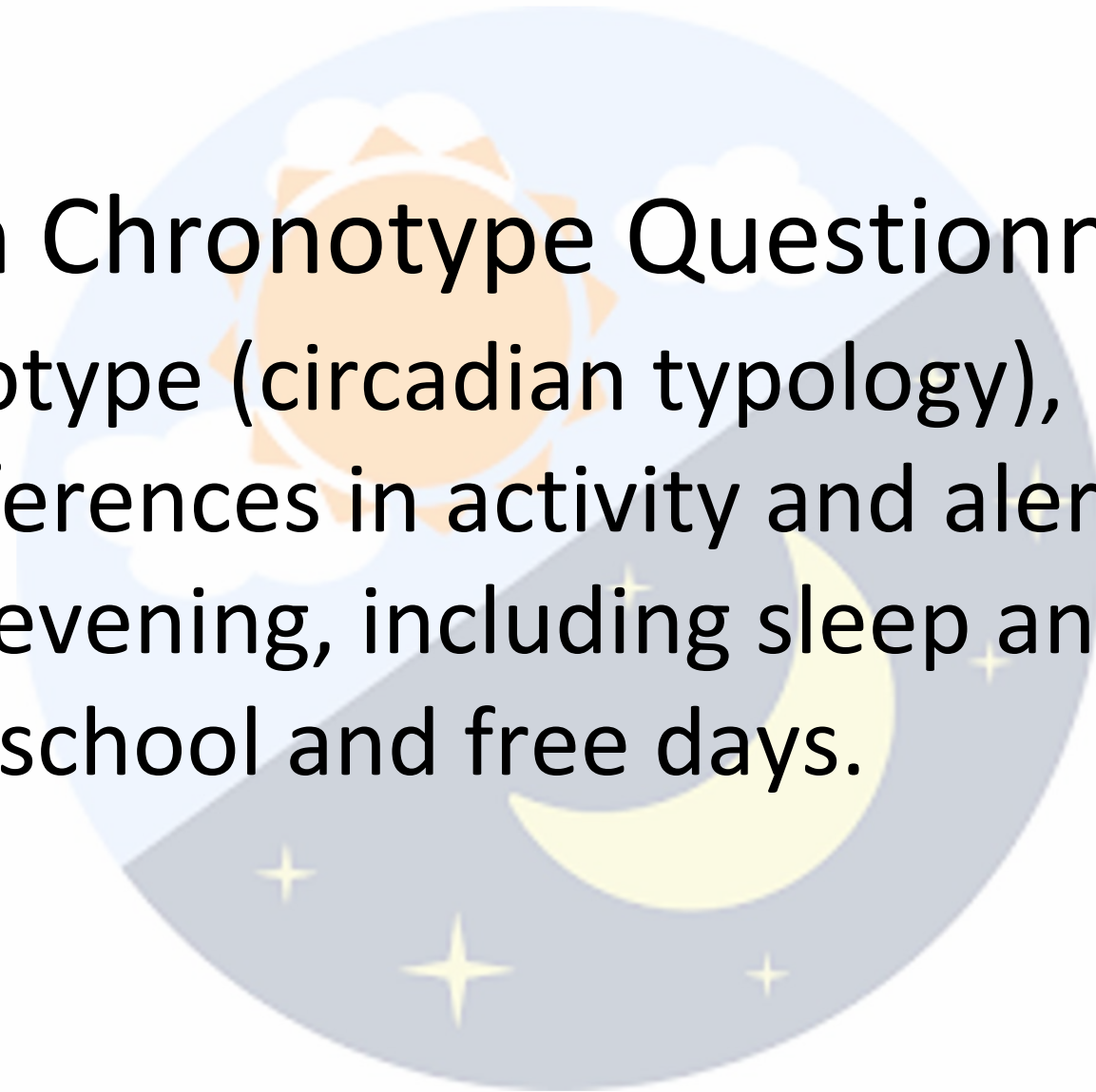
Social Adjustment

- Social Influence Summary Scores
  - Summary scores for the Social Influence Task that measures peer influence on risk perception (youth).
- PhenX Community Cohesion (parents/guardians)
  - Whether people in a participant's neighborhood are close-knit, willing to help, get along with each other, share the same values and can be trusted.
- Peer Experiences Questionnaire
  - Whether the youth has either experienced or perpetrated victimization from/towards peers (youth).

Social and Sexual Behavior

- Youth Peer Behavior Profile
  - Prosocial Peer Involvement subscale and the Rule Breaking/Delinquent Peer Involvement subscale.
- Summary scores of Game of Dice
  - Assesses risk taking (youth)
- Youth Peer Network Health Protective Scaler
  - Youth report on three of their close friends' protective behaviors against substance use
- Cyber Bullying (youth)
  - Whether a youth has experienced or perpetrated cyberbullying over the past year
- Gender Identity and Sexual Health (GISH)
  - Youth assessment of sexual attraction and behavior
  - Parent/guardian assessment of sexual attraction and behavior

Physical Health

- Youth Blood Pressure
  - 3 consecutive blood pressure and pulse measurements.
- Youth Blood Analysis
  - Whole blood analysis from two tubes for hemoglobin, A1C, CBC, total cholesterol, HDL cholesterol, and Ferritin.
- Child and Adolescent Pain Questionnaire
  - Assessing pain intensity over the past month.
- Youth Block Food Screen
  - Assesses children's intake by food group.
- Anthropometrics
  - Height, weight, waist circumference, BMI etc.

Geocoded Data

- Geocoding on current address complete
- Air pollutants: NO^2, O^3, traffic counts
- Census defined urban categories
- Geocode is not shared!
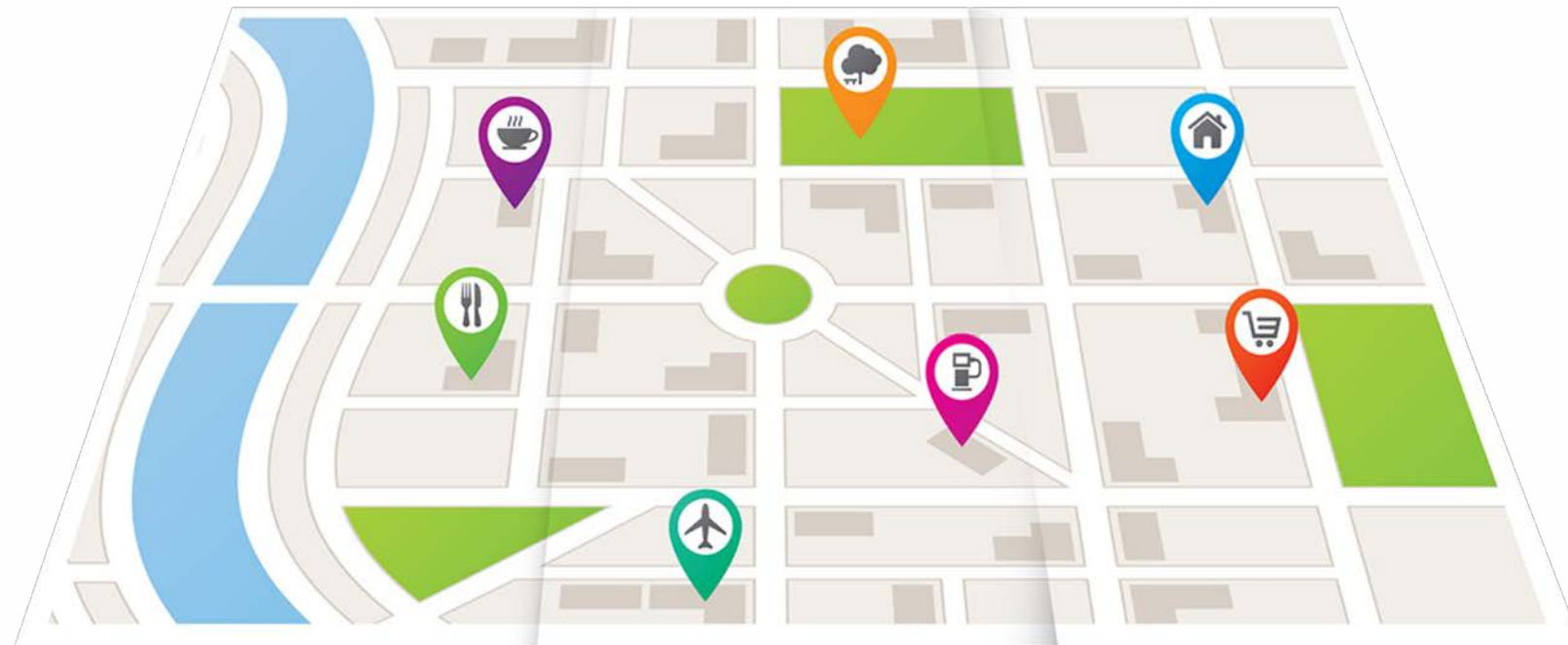
Genetics

- New genotype calls
  - Genotyping calls were re-performed to improve the quality of the data (n=11101).
  - Release in plink binary format.
- Imputed genetic data
  - Imputation with TOPMed reference panel (multi-ethnic reference panels with better calls on hispanic groups). Release in vcf file format.
- CNV calls
  - The AB allele calls and intensity ratios will be included in the release to enable copy number variation calls.
- Genetic Ancestry
  - Genetic ancestry factors are calculated based on the Bayesian clustering results with 1000 genome reference panel. The proportion of genetic ancestry can be used for controlling confounds or stratified analysis. Will be in the tabulated data release.
- Zygosity calls for twin site samples
  - The whole genome genotyping inferred zygosity status will be included for twin samples from the twin sites. Will be in the tabulated data release.
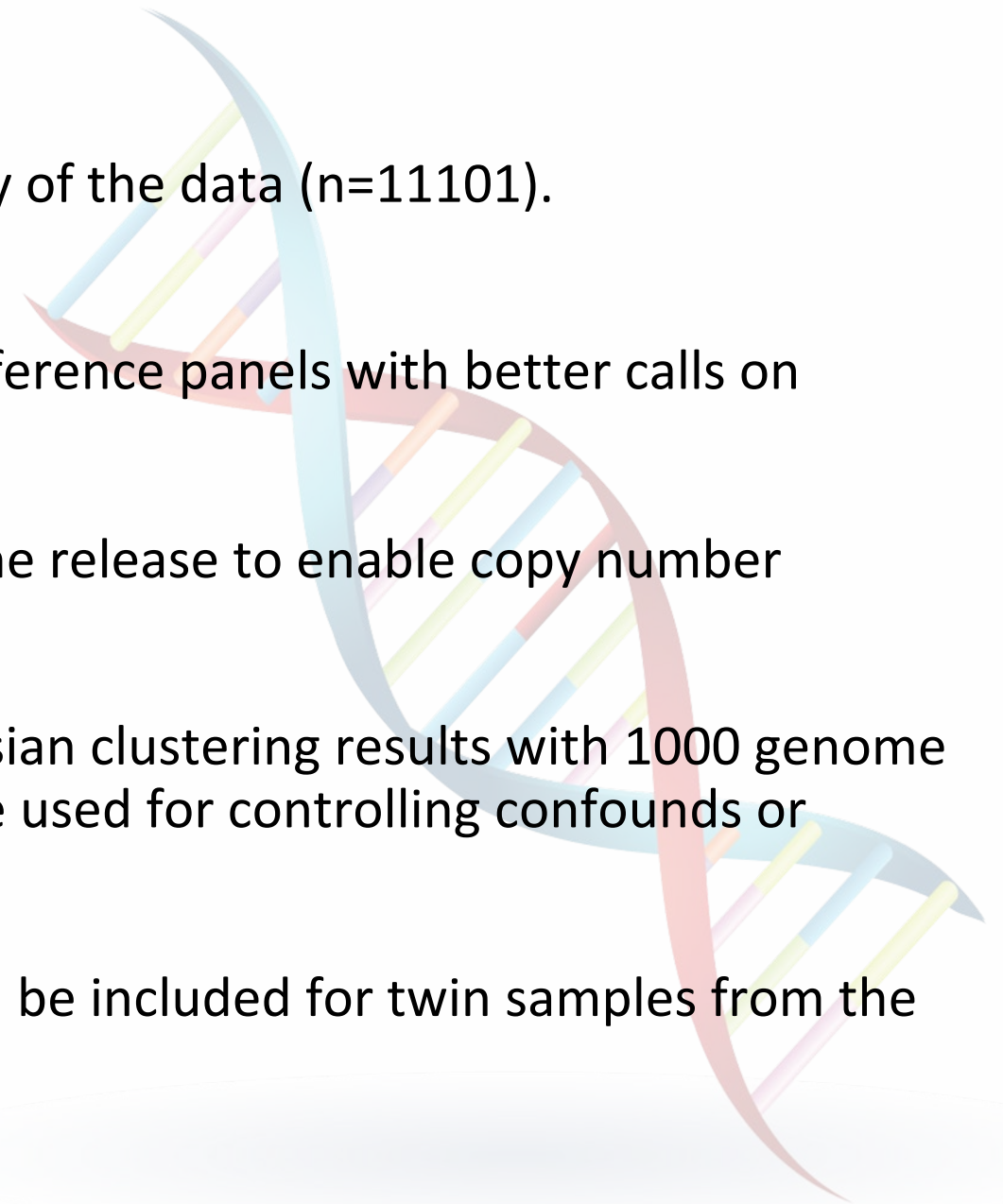
Neuroimaging Data

- Addition of 1/2 of 2 Year neuroimaging data (n~6000)
- Improved dMRI/fMRI B0 correction using TOPUP
- Corrected Philips fMRI field maps
- ePrime time mismatch exclusion
- Automated post-processing QC metrics for FreeSurfer, fMRI and dMRI
- Manual post-processing QC for fMRI
- Easier Recommended Image Inclusion flag

Data Exploration and Analysis Portal (DEAP)
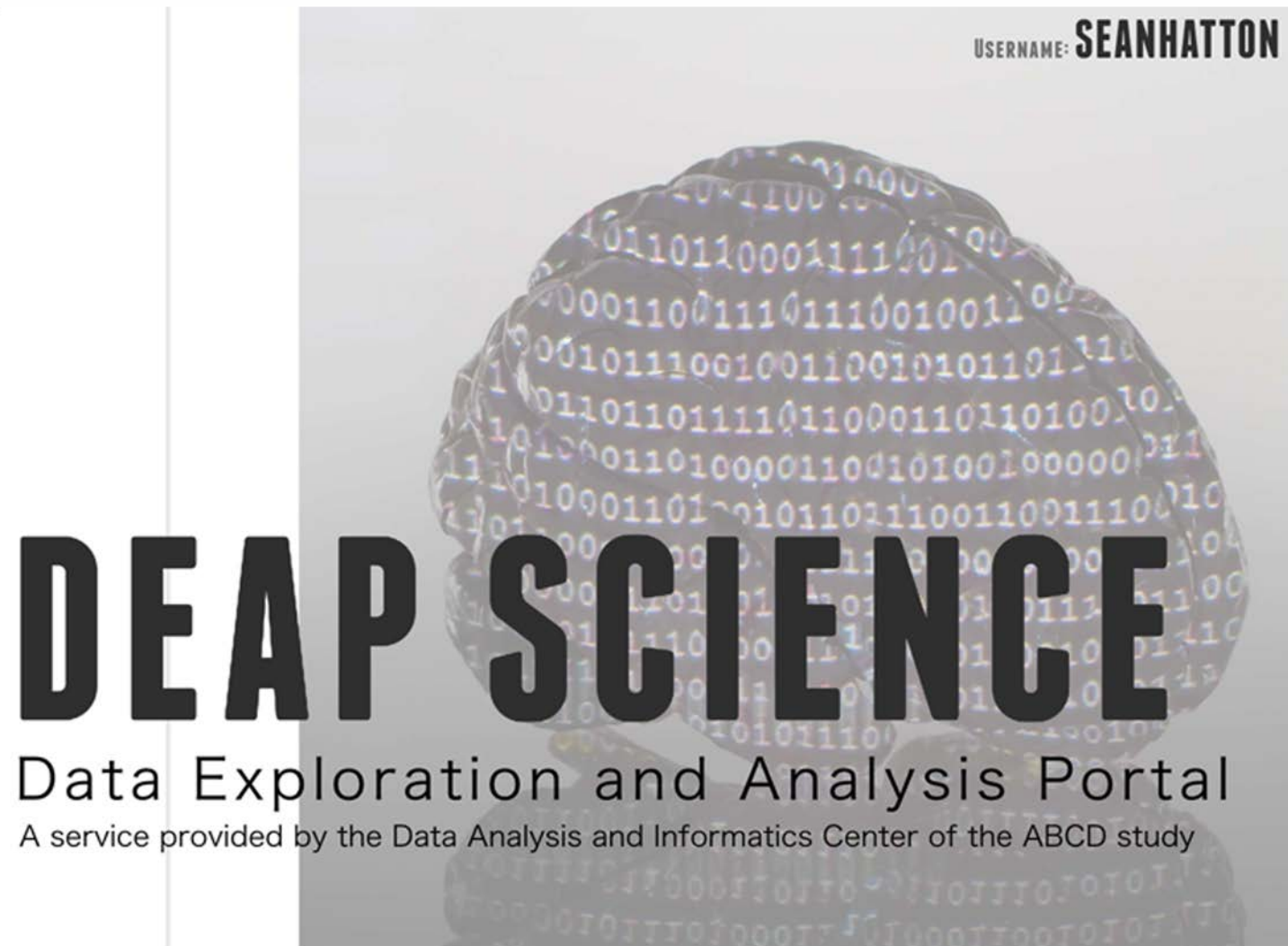
- Population Weighting
- Download data files easier
- Batch analyses (simultaneously submit multiple variables for analyses)

DEAP Enhancements in late-2020

- Univariate and Bivariate Twin analyses (SEM/OpenMX)
- Longitudinal analyses and display (Mixed Models and GEEs)
- ROI analyses and display

What's next?

What's Next?

- COVID-19 and adolescent development survey
- Magnetic Resonance Spectroscopy substudy
- ABCD Science Communication Forum (Wiki)
- Data Release 4.0 July/August 2021
  - Imaging data from baseline → 2 Year Followup
  - Non-imaging data from baseline → 42 month Followup
  - Substudies
- DEAP vertex-wise/voxel-wise analysis

Thank you and Acknowledgements

We greatly appreciate the engagement of our ABCD Families and Child participants!

National Institute on Drug Abuse
National Institute on Alcohol Abuse and Alcoholism
National Cancer Institute
National Institute of Mental Health
Eunice Kennedy Shriver National Institute of Child Health and Human Development
National Heart, Lung, and Blood Institute
National Institute of Neurological Disorders and Stroke
National Institute on Minority Health and Health Disparities
NIH Office of Behavioral and Social Sciences Research
NIH Office of Research on Women's Health
Centers for Disease Control and Prevention – Division of Violence Prevention
National Institute of Justice
Center for Disease Control and Prevention – Division of Adolescent and School Health
National Science Foundation
National Endowment for the Arts

Learn more about the ABCD Study at https://abcdstudy.org/