Overview of Add Health Study and Design
National Longitudinal Study of Adolescent to Adult Health

• On-going program project that began in 1994.
• Developed in response to a congressional mandate to fund a study of adolescent health.
• Funded by the National Institute of Child Health and Human Development (NICHD) with co-funding from 23 other federal agencies and foundations.
• Fifth follow-up wave 2015-2018.
Key Features of Add Health

- Nationally representative study that explores the causes of health and health-related behaviors of adolescents and their outcomes in young adulthood.
- Multi-survey, multi-wave inter-disciplinary design.
- Direct measurement of the social contexts of adolescent life and their effects on health and health behavior.
- Unprecedented racial and ethnic diversity and genetically informed sibling samples.
Initial Goal: Putting the Individual Into Context
Sampling Structure

School Sampling Frame = QED

Sampling Frame of Adolescents and Parents  N = 100,000+  (100 to 4,000 per pair of schools)

Genetic Samples
- Identical Twins
- Fraternal Twins
- Full Sibs
- Half Sibs
- Unrelated Pairs in Same HH

Disability Sample

Ethnic Samples
- High Educ Black
- Puerto Rican
- Chinese
- Cuban

Feeder Feeder Feeder Feeder Feeder
HS HS HS HS HS

Saturation Samples from 16 Schools
Add Health Contextual model

Cultural & Policy Environment

PEER

SCHOOL

NEIGHBORHOOD

FAMILY
The Social Structure of “Countryside” School District

Unique Features of Study Design

- Ethnic oversamples produce
  - unprecedented diversity in race and ethnicity in a representative population of adolescents
  - large numbers of youth in immigrant families
- Embedded genetic sample enables researchers to sort out genetic from environmental effects and explore gene-environment interactions.
# Race and Ethnic Diversity in Add Health

## Race/Ethnicity

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>1,767</td>
<td>8.5</td>
</tr>
<tr>
<td>Cuba</td>
<td>508</td>
<td>2.5</td>
</tr>
<tr>
<td>Central-South America</td>
<td>647</td>
<td>3.1</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>570</td>
<td>2.8</td>
</tr>
<tr>
<td>China</td>
<td>341</td>
<td>1.7</td>
</tr>
<tr>
<td>Philippines</td>
<td>643</td>
<td>3.1</td>
</tr>
<tr>
<td>Other Asia</td>
<td>601</td>
<td>2.9</td>
</tr>
<tr>
<td>Black (Africa/Afro-Caribbean)</td>
<td>4,601</td>
<td>22.2</td>
</tr>
<tr>
<td>Non-Hispanic White (Eur/Canada)</td>
<td>10,760</td>
<td>52.0</td>
</tr>
<tr>
<td>Native American (non-Hispanic)</td>
<td>248</td>
<td>1.2</td>
</tr>
<tr>
<td>Total N</td>
<td>20,686</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Missing on race/ethnicity=59
### Diversity in Add Health: Immigrant Status

<table>
<thead>
<tr>
<th>Immigrant Status</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st generation</td>
<td>1707</td>
<td>8.34</td>
</tr>
<tr>
<td>2nd generation</td>
<td>2987</td>
<td>14.59</td>
</tr>
<tr>
<td>3rd generation +</td>
<td>15,774</td>
<td>77.07</td>
</tr>
<tr>
<td>Total N</td>
<td>20,468</td>
<td></td>
</tr>
</tbody>
</table>
Diversity of Family Forms at Wave I

- Two biological parents
- Two adoptive parents
- Bio Mom, Step Dad
- Bio Dad, Step Mom
- Two step/foster parents
- Single Mom
- Single Dad
- Surrogate parent(s)
Wave I 1994-1995 (79%)
- Students 90,118
- School Admin 144

Wave II 1996 (88.6%)
- School Admin 128

Wave III 2001-2002 (77.4%)
- Partners 1,507
- Young Adults Aged 18-26 15,197

Wave IV 2008-09 (80.3%)
- IIV Study ~100
- Adults Aged 24-32 15,701

Wave V 2015-18
- Adults Aged 31-42 Target: 19,831
Scientific Goals in Wave IV

• Bring together social and behavioral data with biological data relevant to the current and future health concerns of Add Health cohort at ages 24-32;

• Expand collection of biological data to understand genetics and pre-disease pathways, with a focus on obesity, stress, and health risk behavior;

• Broaden our trans-disciplinary reach into biomedical sciences to map health and developmental trajectories across the life course.
Integrative Life Course Theoretical Framework
## Questionnaire Content Across Waves

### Waves I, II
- Demographic
- Family, siblings, friends
- Education, work
- Physical and mental health
- Daily activities and sleep
- Relationships
- Sexual, & fertility histories
- Substance use
- Delinquency and violence
- Attitudes, religion
- Economics, expectations
- Psychological, personality

### Wave III
- Demographic
- Family, siblings, friends
- Education, work, military
- Physical and mental health
- Daily activities and sleep
- Relationships
- Sexual, & fertility histories
- Substance use
- Involvmt w/criminal justice sys
- Attitudes, religion
- Economics, expectations
- Psychological, personality
- Children and parenting
- Civic participation
- Gambling
- Mentoring

### Wave IV
- Demographic
- Family, siblings, friends
- Educ, work, military (records)
- Physical and mental health
- Daily activities and sleep
- Relationships
- Sexual, & fertility histories
- Substance use and abuse
- Involvmt w/criminal justice sys
- Work attitudes and chars, relig
- Economics, expectations
- Big 5 Personality, stressors
- Children and parenting
- Civic participation
- Cognitive function
- Psychosocial factors
Physical and Social Contextual Data

- Census
- CDC (STD prevalence)
- FBI crime statistics
- National Center for Health Statistics
- National Council of Churches

- Questionnaire-based social context data
  - In-School Network Data
  - Adolescent Romantic Pair Data
  - In-School Friendship Nominations
  - In-Home Friendship Nominations
  - Family Context (Parent Interview, sibling information)
  - Wave III Married, cohabiting, and dating couples (“couple context”)
Physical and Social Contextual Data

• Ancillary studies
  – ONEdata - Obesity & Neighborhood Environment Database
    • Waves I, III, and IV
    • E.g., parks, street connectivity, sidewalks, presence of fast food restaurants
  – The Adolescent Health and Academic Achievement Study
    • Analysis of respondents’ high school transcripts
    • Detailed measures of academic progress and high school curriculum
# Biological Data Across Waves

<table>
<thead>
<tr>
<th>Adolescence</th>
<th>Transition to Adulthood</th>
<th>Young Adulthood</th>
<th>Adulthood</th>
</tr>
</thead>
</table>

- Embedded genetic sample of ~3,000 pairs

## Physical development

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Height, weight, waist</td>
</tr>
<tr>
<td>III</td>
<td>Height, weight, waist</td>
</tr>
<tr>
<td>IV</td>
<td>Height, weight, waist</td>
</tr>
<tr>
<td>V</td>
<td>Height, weight, waist</td>
</tr>
</tbody>
</table>

- STI tests (urine)
- HIV test (saliva)
- Genetic (buccal cell DNA)
- Inflammation
- Cardiovascular
- Medications
- Renal

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Metabolic</td>
</tr>
<tr>
<td>III</td>
<td>Metabolic</td>
</tr>
<tr>
<td>IV</td>
<td>Metabolic</td>
</tr>
<tr>
<td>V</td>
<td>Metabolic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Immune function</td>
</tr>
<tr>
<td>III</td>
<td>Immune function</td>
</tr>
<tr>
<td>IV</td>
<td>Immune function</td>
</tr>
<tr>
<td>V</td>
<td>Immune function</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Inflammation</td>
</tr>
<tr>
<td>III</td>
<td>Inflammation</td>
</tr>
<tr>
<td>IV</td>
<td>Inflammation</td>
</tr>
<tr>
<td>V</td>
<td>Inflammation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Cardiovascular</td>
</tr>
<tr>
<td>III</td>
<td>Cardiovascular</td>
</tr>
<tr>
<td>IV</td>
<td>Cardiovascular</td>
</tr>
<tr>
<td>V</td>
<td>Cardiovascular</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Genetic (buccal cell DNA)</td>
</tr>
<tr>
<td>III</td>
<td>Genetic (buccal cell DNA)</td>
</tr>
<tr>
<td>IV</td>
<td>Genetic (whole blood)</td>
</tr>
<tr>
<td>V</td>
<td>Genetic (whole blood)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wave</th>
<th>Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>Medications</td>
</tr>
<tr>
<td>III</td>
<td>Medications</td>
</tr>
<tr>
<td>IV</td>
<td>Medications</td>
</tr>
<tr>
<td>V</td>
<td>Medications</td>
</tr>
<tr>
<td></td>
<td>Adolescence</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Wave I-II</strong></td>
<td>(12-20)</td>
</tr>
<tr>
<td><strong>Wave III</strong></td>
<td>(18-26)</td>
</tr>
<tr>
<td><strong>Wave IV</strong></td>
<td>(24-32)</td>
</tr>
<tr>
<td><strong>Wave V</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Social environmental data:**
- school
- family
- romantic rel
- neighborhood
- community
- peer
- college
- family
- romantic rel
- neighborhood
- community
- peer
- college
- family
- romantic rel
- neighborhood
- community
- work

**Biological data:**
- Biological resemblance to siblings in household on 3,000 pairs
- height
- weight
- BMI
- height
- weight, BMI
- STI test results
- HIV test results
- DNA
- height, wt, waist, BMI
- BP, pulse
- immune
- inflammation
- diabetes
- DNA
- GWAS
- height, wt, waist, BMI
- BP, pulse
- immune
- inflammation
- diabetes
- kidney disease
Add Health Wave IV

- Map health and developmental trajectories over the life course
- Understanding interplay between environment, behavior, and biology
- Origins of health problems and markers of future disease in early adulthood
- Origins of health disparities and what factors cause disparities to persist or decline
Design Features of Wave IV

- 90 minute computer-based survey instrument
- 30 minute biomarker collection
  - Anthropometrics
  - Blood pressure
  - Blood spots
  - Saliva
- IIV (Intra-Individual Variation) Study
Domains of Biological Measures

- Anthropometric: height, weight, BMI, waist & arm circumference
- Cardiovascular: blood pressure, pulse
- Metabolic processes: lipids, glucose, glycosylated hemoglobin
- Immune function: Epstein-Barr Virus
- Inflammatory processes: C-Reactive Protein
- Genetic: various candidate loci in dopamine and serotonin pathways
Wave IV Locate and Interview Rates

- Data collection in 2008, ending February 2009
- Located 92% of sample members
- Interviewed 80% of eligible cases
- Wave IV sample size approximately 15,701
- Wave IV interview data released October, 2009
Wave IV Biospecimen Participation

• 96% of respondents consented to provide saliva for DNA
• 94% consented to provide blood spots
• For each specimen, 81% of those consenting to collection also consented to archiving
• Approx 12,200 DNA samples available for further testing
• Currently conducting GWAS genotyping on archived samples
  – Deposited into dbGaP by 2015.
Add Health Accomplishments

- Data made available to more than 10,000 investigators for analyses.
- Almost 650 grants awarded to analyze data.
- 2,000+ peer-reviewed publications (over 1,300 since 2006)
- 20 books, 100 reports, and 80 book chapters based on Add Health data
- 500 master’s theses and doctoral dissertations
Add Health Co-Funders

- National Institute of Child Health and Human Development*
- National Cancer Institute*
- National Center for Health Statistics, Centers for Disease Control and Prevention, DHHS
- National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, DHHS*
- National Center for Minority Health and Health Disparities*
- National Institute of Allergy and Infectious Diseases*
- National Institute of Deafness and Other Communication Disorders*
- National Institute of General Medical Sciences
- National Institute of Mental Health
- National Institute of Nursing Research*
- National Institute on Aging*
- National Institute on Alcohol Abuse and Alcoholism*
- National Institute on Drug Abuse*
- National Science Foundation*
- Office of AIDS Research, NIH*
- Office of the Assistant Secretary for Planning and Evaluation, DHHS*
- Office of Behavioral and Social Sciences Research, NIH*
- Office of the Director, NIH
- Office of Minority Health, Centers for Disease Control and Prevention, DHHS
- Office of Minority Health, Office of Public Health and Science, DHHS
- Office of Population Affairs, DHHS*
- Office of Research on Women's Health, NIH*

*Wave 4 co-funders