

**Adolescent and Young Adult  
Outcomes of ADHD:  
New Findings from the Pittsburgh  
ADHD Follow-up Study**

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**Disclosures**

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Cephalon

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I don't think that drugs are bad--just  
overused



## ADHD: Importance to Professionals

Children dealt with by:

- Health Care Professionals
- Mental Health Professionals
- Allied Health Professionals
- Educators

Most common behavioral referral to health care professionals

Most common referral/diagnosis in special education

Most common behavior problem in regular education classrooms

Most common diagnosis in child mental health facilities

## Core Symptoms

Inattention

Impulsivity

Hyperactivity

## Domains of Impairment in ADHD Children

- Relationships with **parents, teachers, and other adults**
- Relationships with **peers and siblings**
- **Academic** achievement
- Behavioral functioning at school
- Family functioning at home
- Leisure activities

## Prognosis for ADHD Children

Chronic disorder extending into adolescence and adulthood

One-third: **Tolerable outcome**; appear to have mild problems but must constantly work to adapt to their difficulties

One-third: **Moderately poor outcome**; continue to have a variety of moderate to serious problems, including school difficulties (adolescents) or vocational adjustment difficulties (adults), interpersonal problems, general underachievement, problems with alcohol, etc.

One-third: **Bad outcome**; severe dysfunction and/or psychopathology, including sociopathy, repeated criminal activity and resulting incarceration, alcoholism, drug use

## The Pittsburgh ADHD Longitudinal Study (PALS)

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## Project Aims

Starting in childhood and moving through adolescence and into adulthood

- Prevalence of alcohol and other drugs in ADHD vs nonADHD comparisons.
  - Onset and course of alcohol and other drug use (quantity, frequency) and abuse (deviant use, associated problems)
- Functional outcomes in multiple other domains
  - Education
  - Interpersonal adjustment (peers, biological family, close relationships)
  - Vocational functioning
  - Psychopathology, personality, and other psychological dimensions
  - Delinquency and criminal activity
  - Burden to self and family
- Theoretical models for predictors, mediators, and moderators of substance use
  - Proband psychopathology, personality, and attitudes
  - Parental psychopathology, personality, and history of substance abuse
  - School and cognitive functioning
  - Peer relationships
  - Family functioning

## PALS ADHD Sample

**363 with childhood ADHD** recruited into longitudinal study with annual interviews starting in 1998.

### In childhood

- Diagnosed in childhood (5-12 yrs old).
- ADD Summer Treatment Program, Univ. Pittsburgh Medical Center (1987-1996).
- Standard diagnostic workup including parent and teacher rating scales and structured interview with PhD clinician.

### In adolescence and adulthood

- 70% participation rate (M = 8.7 years later).
- Approximately two years to accrue most of the ADHD sample.
- Little difference between participants and non-participants.

## PALS Comparison Sample

**240 adolescents and young adults without ADHD**

- **Recruited at initial follow-up of ADHD Ss**
- **Recruited in Allegheny County (same as probands)**
  - Adolescents recruited from pediatric practices that overlap with probands' pediatricians.
  - Young adults from advertisements (e.g., local newspapers, hospital staff bulletins, university/community colleges, etc.)
- **Matched by age, gender, ethnicity and parent education**
- **No ADHD**

## PALS Sample Characteristics at Wave 1

	nonADHD	ADHD
Age (mean)	17.17 (3.16)	17.62 (3.35)
N: Adolescents (11-17)	120	161
N: Young Adults (18-25)	120	188*
Males	88.8%	89.2%
White/Caucasian	84.6	81.8
Parent Education		
High School or less	8.1%	8.7%
Some College	30.2%	39.5%
College	61.7%	51.8%

## Methods

- Large dataset on probands in childhood.
- Comprehensive battery (4-5 hours--clinic visit with probands and parents) on all at follow-up.
- For school-aged participants, teacher ratings, grades, disciplinary records.
- Parent report including comprehensive, interview-assisted, treatment and educational histories.
- Lab measures of aggression and HR (resting and in response to provocation)
- Comprehensive substance use questionnaires, hair and urine samples.

## Assessment Issues

Age Range of Participants  
 Informant (Self-Ratings versus Parent Ratings)  
 Domains to Assess (Sx and multiple areas of functioning)  
 Single versus Repeated Measurements  
 Participant Burden  
 Chronology/History Measures  
 Cost Issues  
 Accuracy of Data from Lapsed Interval (plan ahead for possibility of longitudinal study)

## Data Collection

Combination of computer-administered, paper and pencil, and interview measures  
 Computer-administration with internet link for cross-site data management and fast data entry and verification  
 Paper and pencil measures used for out-of-clinic assessments (e.g., long-distance interviews, home visits) and complex chronology instruments  
 Standardized instruments when possible (e.g., SCID, DISC) but modified or developed when necessary  
 Measures taken to assure confidentiality in all data collection and management  
 Guide subjects through complicated measures to minimize misinterpretation and incomplete data

## Data Collection

- Ensure adequate reading level of participants
- Select/develop measures that yield identical or comparable scales/scores across the wide age range
- Ensure core battery gathered at least once in adulthood (age 18)
- Separate staffs for (a) data verification, entry, and management, and (b) recruitment, subject running, and retention
- Ensure rapid checking of data and rapid follow-up of missing data (means stay up-to-date on data entry)
- Run subjects 7 days per week all year long
- Never stop trying to enroll a participant

## Effort to Schedule/Retain Clinical Sample in Longitudinal Study

- Sample characterized by disorganization, forgetfulness, etc.
- Wide range of schedules and living arrangements
- Huge effort to recruit and retain--dramatic difference between probands and controls
- Tremendously important to have highly skilled staff to maintain rapport with probands
- With experience, staff skills increase dramatically in ability to be resourceful, creative, persistent yet not coercive
- Offer excellent clinical service at baseline to maximize participation in follow up

## Average Number of Attempts to Contact for Visit

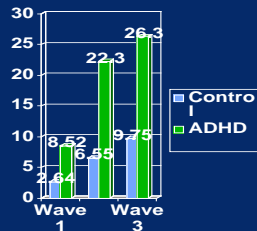
Based on random sampling of 50 cases

Dramatically more attempts needed to contact and schedule ADHD participants for visits 9 (not counting their parents).

30% to 50% higher no-show rate for ADHD

Maximum # attempts to contact for

- ADHD (Wave 2): 124
- Control (Wave 2): 22



## Sample Retention

Wave 2: 98%

Wave 3: 98%

Wave 4: in process--75% complete

Only 8 refusers out of 604 individuals (plus their families) run at Wave 1

## Study Measures

### Study Measures-Childhood

1. Parent marital status, education, income
2. Parent and sibling MH diagnosis/history
3. Standard achievement and IQ testing
4. Structured maternal interview for DBD Sx
5. Parent and teacher rating scales (DBD, Conners, CBCL, IRS)
6. Family History checklists of psychological & physical problems
7. STP behavioral records--rec. and clsm settings

### Study Measures--Follow up

#### Demographics and Treatment History

1. Demographics
2. Subject/family information and tracking
3. Medication and Treatment Chronology
4. Perceived effects of ADHD Diagnosis
5. Contact information and Consent
6. Family History checklists of psychological & physical problems

### Study Measures--Follow up

#### Parent-Child/Family Relationships

1. Discipline Scale  $\leq 18$
2. Parent Awareness of Child's Activities and Interests
3. Parent Involvement in Child's Activities and Interests
4. Parent Monitoring of Child's Activities and Interests
5. Conflict Behavior Questionnaire
6. Children's Perception of Interparental Conflict-Conflict Properties
7. Parents and Peers
8. Conflict Tactics Scale--Parent Report on Child's Behavior
9. Family Environment Scale
10. PINS Questionnaire

### Study Measures--Follow up

#### Peer & Romantic Relationships

1. Peer Involvement
2. Peer Substance Use/Tolerance of Substance Use
3. Friendship Quality
4. Conventional activities of Friends
5. Victimization by Peers
6. Romantic Relationship Timeline
7. Romantic Relationship Quality
8. Short form (conflict and happiness items) of Dyadic Adjustment Scale for current romantic relationship
9. Conflict Tactics Scale for current romantic relationship
10. Positive and Negative Relationship Qualities

### Study Measures--Follow up

#### Parent Marital Satisfaction and Conflict

1. Short form (conflict and happiness items only) of Dyadic Adjustment Scale
2. Conflict Tactics Scale
3. Positive and Negative Relationship Qualities

### Study Measures--Follow up

#### Adolescent Personality/Psychopathology

1. Eysenck Impulsivity Scale
2. Irritability Scale
3. NIMH DISC; all sections except alcohol and drug
4. SCID NP
5. SCID ASP Module
6. Impairment Rating Scale
7. Loeber Self-Reported Delinquency
8. Adult ADHD Scale
9. Retrospective DBD completed for time first in STP or elementary age for controls
10. Disruptive Behavior Disorders (DBD)-current

### Study Measures--Follow up

#### Adolescent Personality/Psychopathology

1. Penn State Worry Questionnaire
2. NEO Five Factor Inventory
3. Pittsburgh Modified Conners Rating Scale
4. CBCL
5. Child Psychopathy Scale
6. CES-D
7. Anxiety Sensitivity Index
8. Fear of Negative Evaluation
9. Laboratory Provocation Task

## Study Measures--Follow up

### Parent Psychopathology/Personality

1. SCID-NP, DSM IV version about self
2. Antisocial Personality, SCID II, for self and other parent
3. Retrospective DBD Rating for self
4. NEO Five Factor Inventory about self
5. Eysenck Impulsivity Scale about self
6. Irritability Scale about Self
7. Beck Depression Inventory about self
8. Penn State Worry Questionnaire
9. Adult ADHD Scale about self
10. CES-D
11. Anxiety Sensitivity Index
12. Fear of Negative Evaluation

## Study Measures--Follow up

### Adolescent Risky Behavior

1. Health and Sex Behavior Questionnaire
2. Driving Questionnaire
3. Sports Questionnaire

### Life Events and Environment

1. Adolescent Perceived Events Scale (APES)
2. Life Experiences Survey
3. Inventory of Small Life Events
4. Your Neighborhood

## Study Measures--Follow up

### Attitudes/Beliefs/Values

1. Intolerance of Deviance
2. Intolerance of Deviance about Parent
3. Comprehensive Effects of Alcohol
4. Comprehensive Effects of Marijuana
5. Motives for Drinking
6. Self-Perception Profile for Adolescents
7. Rosenberg self-esteem Scale
8. Religiosity Scale
9. Adult Self-Perception Profile

### Cognitions/Perceptions/Competence

1. COPE Scale
2. Behavioral and Coping Subscales about child

## Study Measures--Follow up

### Intelligence/Achievement

1. WISC -3rd Edition; Block design and vocabulary
2. WAIS - 3rd Edition; Block design and vocabulary
3. WRAT-III

### Other Measures of Current Functioning

1. Work History Questionnaire
2. Finances Questionnaire
3. School History Questionnaire
4. Positive Activity Involvement
5. Mental health/health resource Use
6. Barriers to Mental Health Services
7. Caregiver Strain Questionnaire
8. Responsibility for Care Questionnaire

### Study Measures--Follow up

#### Adolescent Substance Use/ Abuse

1. Substance Use Questionnaire
2. Drug Use Questionnaire (drug combinations)
3. Context Specific Alcohol Use Questions
4. Attitudes Toward Ritalin
5. Nicotine Dependence Scale
6. Exposure to Drug Use
7. Hair Sample and Urine Sample
8. Highly Structured version of SCID - Alcohol Abuse, Marijuana Abuse and Additional Drug Abuse
9. SCID II alcohol/substance module
10. Parent Report of Adolescent Substance Use
11. Motives for Smoking
12. Reasons for Stopping Stimulant Medication

### Study Measures--Follow up

#### Parental Substance Use

1. Alcohol Use Questionnaire
  2. Alcohol/Substance Use during pregnancy
  3. Comprehensive Effects of Alcohol (CEOA)
  4. Comprehensive Effects of Marijuana (CEOM)
  5. Motives for Drinking
  6. Cigarette Use
  7. Context Specific Alcohol Use Questions
  8. Nicotine Dependence Scale
  9. SCID II alcohol/substance module
- #### Perceived Parental Drinking and Motives
1. Parent Alcohol Consumption
  2. Michigan Alcohol Screening Test on parents
  3. Parent Motives for Drinking

### Study Measures--Follow up

#### Family History of Alcohol Problems

1. Mann Family Tree (alcohol)
2. Michigan Alcoholism Screening Test on self, parents, and child's other biological parent
3. Mann Family Tree-Modified for Substance Use Report on Siblings of Proband
  1. DBD on other children in family
  2. Parent Report of Adolescent Substance Use
  3. Sibling Report of Alcohol Use
  4. Parent Report of Sibling Substance Use
  5. Sibling Report of Substance Use
  6. Mann Alcohol Screener Questions on sibs

### Study Measures--Follow up

#### Teacher ratings (adolescents only)

1. Disruptive Behavior Disorders Rating Scale
2. Impairment Rating Scale
3. Pittsburgh Modified Conners Rating Scale
4. Teacher Report Form
5. Classroom Performance Survey
6. Grades for Current or Last Marking Period
7. Disciplinary records for Last 12 Months

## Outcomes

- Persistence of ADHD
- Psychopathology
- Self- and mother-rated impairment
- Academic outcomes
- Risky Behavior
- Delinquency and Criminal Activity
- Substance use and abuse
- Life Stressors for the individual
- Stress on the family: Burden of Care
- Responsibilities in daily life
- Effects of stimulant medications on these outcomes

## Persistence of ADHD

## ADHD Persistence

### Adolescents (ages 11-17)

- 75% continue to meet DSM-IV diagnostic criteria, based on DBD ratings from parent, teacher and self.

### Young Adults (ages 18-21)

- 24% continue to meet DSM-IV diagnostic criteria, based on ratings from parent and self.

## Symptoms Endorsed

Number	INAT-A	INAT-Y	HYIM-A	HYIM-Y
0	4%	42%	11%	49%
1	6%	9%	8%	16%
2	6%	9%	10%	10%
3	6%	7%	6%	8%
4	5%	4%	10%	4%
5	3%	6%	8%	2%
6	7%	7%	15%	1%
7	11%	7%	8%	2%
8	19%	4%	12%	4%
9	35%	5%	11%	4%

### Self-report vs. Parent Report of ADHD

Small but significant correlations between child and parent ADHD rating scale scores:

Adolescent: inattention  $r=.18$   
hyp-imp  $r=.24$

Young adult: inattention  $r=.29$   
hyp-imp  $r=.23$

### Self-report vs. Parent Report of ADHD

More adolescents and young adults met diagnostic criteria by parent report than by self report:

Adolescents: 12% (self) vs. 50% (parent)

(additional 25% from teacher report)

Young adults: 8% (self) vs. 24% (parent)

### Retrospective Recall of ADHD

- Adolescents and young adults in the ADHD sample provided retrospective ratings of ADHD for the age at which they were diagnosed in childhood.
- Based on these reports, 30% of young adults and 26% of adolescents would meet DSM-IV diagnostic criteria.

### Psychopathology

### Comorbid ODD/CD/ASP

42% of adolescents and 22% of young adults meet DSM-IV ODD criteria at follow-up

30% of adolescents and 17% of young adults meet DSM-IV CD criteria at follow-up

27% of young adults meet Antisocial Personality Disorder criteria at follow-up (35% of these young adults also meet CD criteria but are diagnosed with ASP).

### Other Psychopathology

SCID was administered to all young adults (18 or older).

- No differences between ADHD and control groups on **lifetime presence of bipolar disorder**, depression/dysthymia, anxiety disorders
- Significant group difference for lifetime presence of primary psychotic symptoms (delusions, hallucinations), 5% of ADHD vs. 1% of controls;  $\chi^2 < .05$ .

### Impairment

### Impairment

ADHD adolescents and young adults rate themselves as significantly less impaired than do their parents.

ADHD adolescents and young adults experience significantly greater impairment (as reported by parents) than do controls.

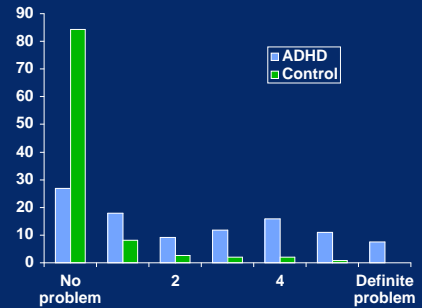
## Impairment Rating Scale

Raters (parents, teachers, self) describe what they see as the child's primary problems in narrative format. Raters then rate how the child's symptoms have affected each of the following domains:

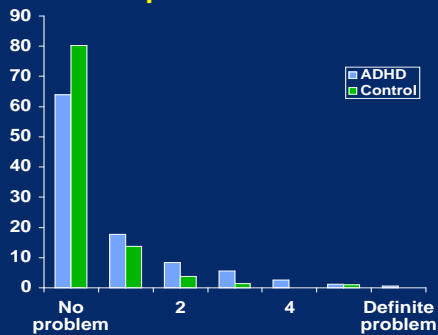
- (1) relationship with peers/siblings
- (2) relationship with parents or teachers,
- (3) his or her academic progress,
- (4) your classroom/family in general
- (5) his or her self-esteem , and
- (6) overall problem/need for treatment

Raters would rate 0 if a problem was not present or the following

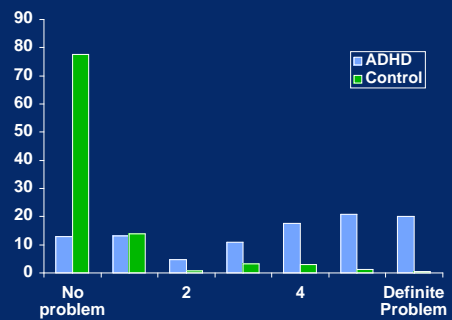
## Relationship with Peers-Parent Rated



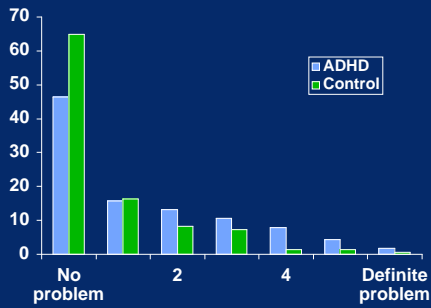
## Relationship with Peers-Self Rated



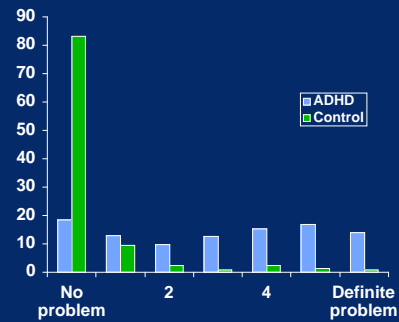
## Academic Progress-Parent Rated



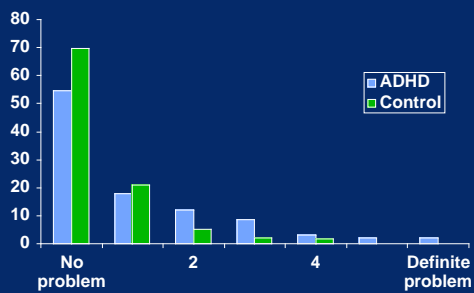
### Academic Progress-Self Rated



### Overall Impairment-Parent Rated



### Overall Impairment-Self Rated



### Overall Impairment

By mothers' reports, **69%** of the ADHD adolescents and young adults are above the 90th percentile of the controls' mother ratings of overall impairment.

By self reports, only **28%** of the ADHD adolescents and young adults are above the 90th percentile of the controls' self ratings of overall impairment.

### Financial/social Functioning

- No group differences on holding a current paying job, monthly earnings, or current savings
- ADHD adults have been turned down for a credit card significantly more often than controls (1.35 times vs. 0.5 times)
- 18-20 year old ADHD adults are less likely than controls to have had a romantic partner (76% vs. 89%); no differences for other age groups

### Academic Outcomes

### Academic Functioning

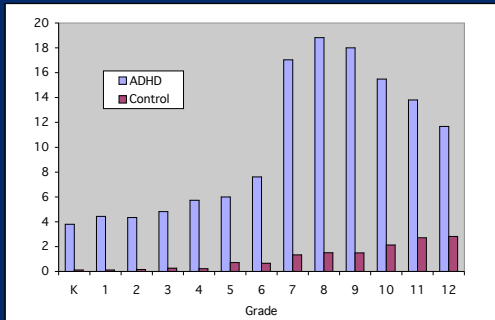
- 33% of ADHD have academic problems (special ed., academic probation, dropped out, or held back) every year, vs. 2% of controls
- 48% of ADHD children have at least one year of special education placement vs. 3% of controls
- 12% of ADHD vs. 5% of controls have been held back a grade
- 9% of ADHD adolescents drop out of school vs. 1% of controls
- ADHD adolescents a full letter grade lower than controls, with twice the rate of absences

### School Discipline Problems

Discipline Problems (sent to principal, serious warnings, detention, suspension, expulsion) per Year:

	ADHD	Control
None	20%	41%
< Quarterly	34%	51%
Quarterly	17%	7%
Monthly	19%	1%
Weekly	10%	0%

## Average Discipline Problems By Grade



## Academic Outcomes

### For young adults (18 and over):

- 21% of ADHD vs. 10% of controls complete vocational training in high school
- 44% of ADHD vs. 92% of controls have ever been on academic honor roll
- 52% of ADHD vs. 83% of controls have received education post high-school

## Academic Achievement

ADHD sample has significantly lower standardized WRAT scores than controls:

Reading: 99 (12) vs 108 (10)

Spelling: 94 (16) vs 107 (10)

Math: 92 (14) vs 106 (16)

## ADHD Young Adults (18 and older) Have Lower Academic Attainment

	ADHD	Control
Partial High School	13%	2%
H.S. or G.E.D.	37%	20%
Partial community college or vocational training	22%	7%
Partial college	20%	59%
2 year degree or vocational training	1%	1%
4 year degree or greater	4%	11%

## Risky Behavior

- ADHD adolescents and young adults (ages 11-25) were almost 25% more likely than controls to engage in sexual intercourse prior to age 13.
- ADHD subjects were 30% more likely than controls to have had multiple sexual partners in their lifetime.
- ADHD subjects were almost 40% more likely to have had one or more unwanted pregnancies than non-ADHD youth.

## Delinquency and Criminal Activity

## Delinquency

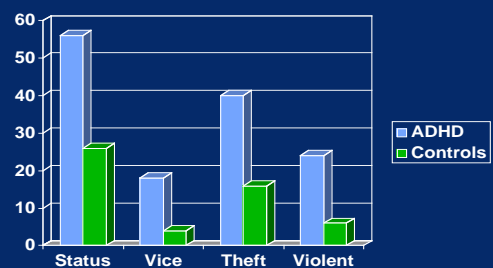
Current delinquency was computed by counting numbers of different delinquent acts in several major categories: theft, vice, status offenses (for adolescents), violent offenses, and overall delinquency.

Both subjects and their parents completed measures; highest reports across raters were used.

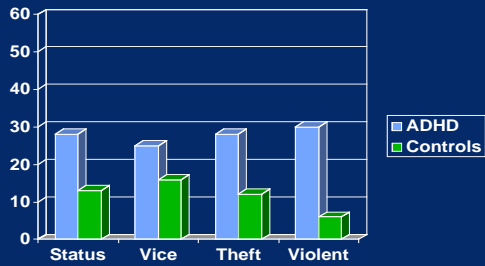
For young adults, the Self-Reported Delinquency measure (Loeber et al., 1998) was used.

In adolescents, ratings of DSM-IV conduct disorder were used along with supplemental items derived from the SRD.

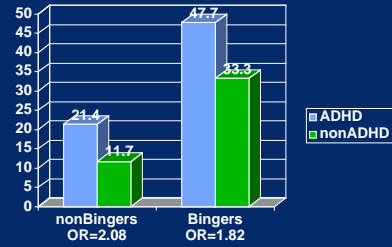
## Self Reported Offenses: Past Year/Adolescents



### Self Reported Offenses: Lifetime/Young Adults



### Percent of Adults Reporting 5+ Delinquent Acts in Past Year



*Delinquent/antisocial behavior is associated with weekly binge drinking, but half of ADHD weekly bingers are not delinquent.*

### Cost of Adverse Outcomes for an ADHD/ODD Child: Present Value Cost of An Average Offender

OJJDP 1999

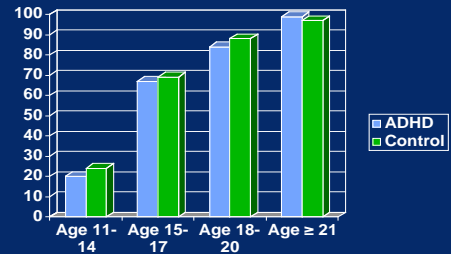
- Juvenile Career (4 years @ 1-4/year)
- Adult Career (6 years @10 crimes/year)
- Drug Abuse
- High School Dropout
- Total Cost: \$1.7- 2.3 million

### Substance use and Abuse

## Alcohol and Substance Use

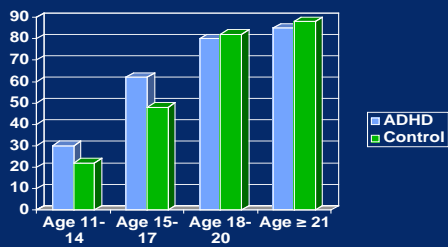
Participants completed self-report measures of quantity and frequency of use for all major licit and illicit substances. Measures included lifetime and current use.

## Percentage Reporting Any Lifetime Alcohol Use

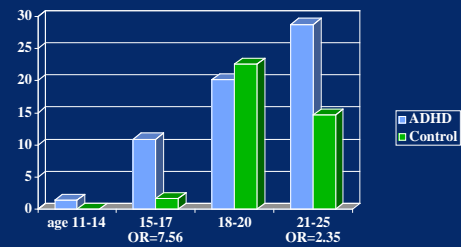


\*No significant ADHD/Control differences

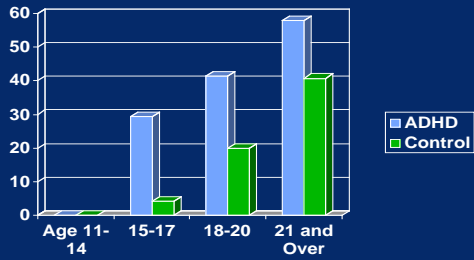
## Percentage Reporting Ever Been Drunk



## % Reporting Weekly Binge Drinking (≥5 Drinks Per Occasion)

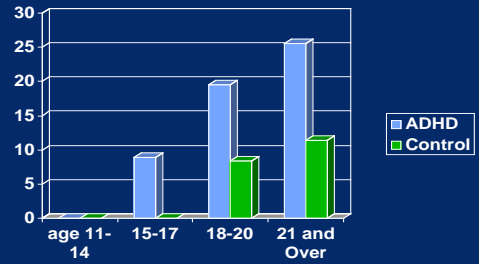


### Percentage Smoking At Least 1/2 Pack a Day



N = 201 ADHD and 109 control subjects who report ever smoking

### Percentage Using Marijuana Daily



N = 184 ADHD and 92 Control subjects who report ever using marijuana

### Life Stressors and Worry

ADHD young adults had lower positive Life Events scores than controls; no difference on negative Life Events

ADHD young adults reported significantly fewer weekly stressors in the School domain of the Index of Small Life Events than controls; no significant group differences on other domains.

No group differences on Penn State Worry Questionnaire.

### ADHD Effects on the Family: Burden of Care and Daily Life Responsibility

## Caregiver Strain Questionnaire

Assesses the impact on parents of having a child member with ADHD (Branna, Heflinger, & Bickman, 1997).

3 subscales:

Objective caregiver strain (e.g., loss of personal time, trouble in neighborhood, disruption of family relationships)

Internalized subjective caregiver strain (feelings internalized by caregiver; e.g., worry, guilt, tired)

Externalized subjective caregiver strain (negative feelings directed at the child; e.g., anger, embarrassment, resentful toward child)

## Caregiver Strain Questionnaire

	ADHD	Control
Objective caregiver strain	28.1 (10.5)	14.1 (5.6)
Internalized subjective strain	19.7 (5.4)	10.4 (5.5)
Externalized subjective strain	10.3 (2.7)	8.4 (2.3)

Significant group differences ( $p < .01$ ) on all scales

-Parents rated strain over their child's lifetime; adolescents and young adults are included in analysis

## Caregiver Strain Questionnaire-Past Year

	ADHD	Control
Objective caregiver strain	19.3 (9.4)	13.0 (4.4)
Internalized subjective strain	15.2 (6.3)	9.7 (4.7)
Externalized subjective strain	9.2 (2.5)	8.1 (2.1)

Significant group differences ( $p < .01$ ) on all scales after controlling for age, which was significantly associated with lower past-year CSQ ratings.

## Adolescent Responsibility of Care

Adolescents (11-15 years old) and mothers provided ratings on a number of domains for the following:

“As children grow into adolescence, they begin taking responsibility for their own care and activities. How well have you been able to take on these responsibilities?”

## Adolescent Responsibility of Care

Significant ADHD/control differences on the following *adolescent*-rated domains:

Household (chores, cleaning, etc.)

Getting involved in activities (sports, clubs, youth groups)

Overall responsibility

## Adolescent Responsibility of Care

Significant ADHD/control differences on the following *mother*-rated domains:

- Nutrition (eating regularly, packing lunch, eating healthy)
- Household (chores, cleaning, etc.)
- School (getting to school on time, homework, etc.)
- Friendships (making/maintaining friends)
- Getting involved in activities (sports, clubs, youth groups)
- Planning for the future
- Time management
- Overall responsibility

## Adolescent Responsibility of Care

Overall responsibility:

	ADHD Adol.	ADHD Mother	Control Adol.	Control Mother
Very poorly or poorly	2.7%	17.1%	0%	0%
Average	37.8%	37.1%	10.0%	23.1%
Well or very well	59.4%	45.7%	90.0%	76.9%

## Young Adult Responsibility of Care

Young Adults and their mothers provided ratings on a number of domains on two items:

- 1) How much parents helped the young adult in that domain in the past year
- 2) How well the young adult managed his or her responsibilities in the past year

## Young Adult Responsibility of Care

Significant ADHD/control group differences in the following domains for amount of parental help, as reported by *young adults*:

- Domestic (finding residence, cooking, laundry, shopping, etc.)
- Financial
- Physical health (making appointments, eating healthy, etc.)
- Mental health (making appointments, taking medications)
- Occupational
- Educational
- Legal (finding legal consultants)
- Relationships (time with family/friends, resolving conflicts)
- Transportation
- Time management
- Planning for the Future

## Young Adult Responsibility of Care

Significant ADHD/control group differences in the following domains for amount of parental help, as reported by *mothers*:

- Occupational
- Educational
- Relationships (time with family/friends, resolving conflicts)
- Time management

## Young Adult Responsibility of Care

Significant ADHD/control group differences in the following domains for management of responsibility, as reported by *young adults*:

- Financial
- Physical health (making appointments, eating healthy, etc.)
- Mental health (making appointments, taking medications)
- Occupational
- Educational
- Legal (finding legal consultants)
- Family care (taking care of own children, babysitting)
- Time management
- Overall responsibility

## Young Adult Responsibility of Care

Significant ADHD/control group differences in the following domains for management of responsibility, as reported by *mothers*:

- Domestic
- Financial
- Physical health
- Dental care
- Mental health
- Occupational
- Educational
- Relationships
- Transportation
- Family care
- Participation in religious activities
- Time management
- Planning for the future
- Overall responsibility

## Young Adult Responsibility of Care

Overall responsibility:

	ADHD Adult	ADHD Mother	Control Adult	Control Mother
Very poorly or poorly	7.3%	28.0%	2.3%	5.1%
Average	39.3%	43.2%	22.1%	27.3%
Well or very well	53.4%	28.8%	75.7%	67.7%

## Resource Need and Use

Participants and their mothers rated how much they needed a number of services/resources, and how often they used those services, in the past year.

Percentages of subjects who indicated need (greater than 3 on a 6-point scale) are summarized below.

## Resource Need-Self Report

	ADHD	Control
Educational Support	24.1%	10.5%
Career Counseling/Job training or placement	21.6	13.2
Legal services	6.3	2.6
Credit counseling/money mgt.	14.7	6.6
Counseling for self esteem, depression, etc.	11.5	7.5
Counseling for anger mgt, aggression	5.8	1.3
Counseling for interpersonal problems	4.8	3.1
Counseling for drug/alcohol	3.4	2.7
Safe driver training	13.9	6.2
Nutrition, fitness, weight loss	15.0	8.8
Unemployment, welfare, food stamps	4.8	2.2
Parenting skills	3.5	0.8

## Resource Need-Mother Report

	ADHD	Control
Educational Support	56.5%	16.3%
Career Counseling/Job training or placement	55.0	16.8
Legal services	8.2	1.5
Credit counseling/money mgt.	31.5	7.2
Counseling for self esteem, depression, etc.	40.4	5.8
Counseling for anger mgt, aggression	29.8	2.9
Counseling for interpersonal problems	31.1	2.5
Counseling for drug/alcohol	14.0	4.8
Safe driver training	30.6	13.9
Nutrition, fitness, weight loss	20.9	6.7
Unemployment, welfare, food stamps	8.2	1.0
Parenting skills	4.3	0.5

## Resource Need and Use

Subjects indicated how often they used each service listed above in the past year. Percentages who used the service sometimes or regularly are summarized below.

## Resource Use-Self Report

	ADHD	Control
Educational Support	16.4%	7.9%
Career Counseling/Job training or placement	9.1	5.2
Legal services	5.2	2.6
Credit counseling/money mgt.	1.3	1.3
Counseling for self esteem, depression, etc.	8.3	3.5
Counseling for anger mgt, aggression	3.1	0.0
Counseling for interpersonal problems	3.1	0.4
Counseling for drug/alcohol	2.7	0.4
Safe driver training	2.9	6.1
Nutrition, fitness, weight loss	3.5	3.5
Unemployment, welfare, food stamps	3.5	0.8
Parenting skills	0.6	0.0

## Summary

- Higher rates of alcohol abuse
- Higher rates of marijuana abuse
- Higher rates of other illicit drug use
- Earlier start of alcohol, cigarettes, and marijuana
- Higher rates of special education use
- Very high rates of disciplinary problems in school
- Lower academic attainment
- Very high rates of delinquency
- Continued severe impairment in multiple domains into young adulthood, including work, finances, romantic and family relationships, and legal difficulties

## Summary

- Preliminary Findings:
  - Higher rates of heavy alcohol use
  - Higher rates of heavy marijuana use
  - Higher rates of heavy tobacco use
  - Earlier start of alcohol, cigarettes, and marijuana
  - Higher rates of special education use and very high rates of disciplinary problems in school
  - Lower academic attainment
  - Very high rates of ODD/CD/ASP, delinquency, and criminal acts
  - Not much other psychopathology (no bipolar)
  - Continued severe impairment in multiple domains into young adulthood, including work, finances, romantic and family relationships, and legal difficulties
  - Very heavy lifetime and current burden of care on family

## Prescribed Stimulant Medication: Effects on Outcomes

## Stimulant Treatment in ADHD Subjects

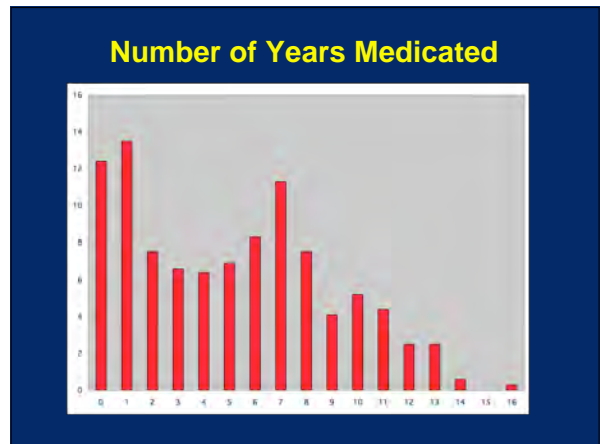
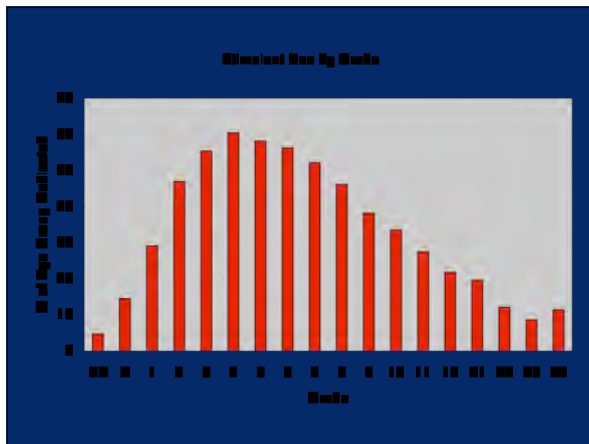
Parents reported use of medication treatment for their children throughout the school years.

91% of subjects have been medicated at some point for ADHD

34% are currently medicated

Subjects have been medicated for an average of 37% of their lives (SD = 28)

For those who have stopped medication, they stopped an average of 5 years (SD = 4) before follow-up assessment



## Diversion of Prescribed Stimulants

- 6% of ADHD subjects report having sold their medication (half of those have done it less than 5 times)
- 4% of ADHD subjects report having given away their medication (73% of those have done it less than 5 times)
- 18% say they have been asked to sell or give away their medication
- 24% of probands and 20% of controls say they personally know someone who has given away or sold medication

## Stimulant Prediction of Substance Use

Ordinal regressions performed for three major substances (alcohol, marijuana, cigarettes)

- Use categorized into none, <monthly, monthly to weekly, and weekly to daily for alcohol and marijuana
- Cigarette use categorized into none, <1/2 pack/day, 1/2 pack/day, and  $\geq 1$  pack/day for young adults; none to < 1/2 pack/day &  $\geq 1/2$  pack/day for adolescents (logistic regressions)
- Stimulant treatment characterized by the proportion of the subject's life he or she had been treated with stimulant medication for ADHD.

## Stimulant Prediction of Substance Use

All regressions controlled for age, SES as measured by parental education level, ethnicity, child IQ, and current stimulant use.

Four models tested:

1. Controlling for childhood functioning measures
2. Controlling for intervening school problems
3. Controlling for concurrent adult functioning measures
4. Controlling for all measures at once

## Covariates in Regressions

1. Parent/teacher rated childhood symptoms of ADHD and ODD/CD, parent/teacher-rated unpopularity with peers, achievement
2. Academic problems per year of school, discipline problems per year of school, current achievement
3. Parent-rated current symptoms of ADHD and ODD, parent-rated overall current impairment

## Stimulant Prediction of Substance Use

### Adolescents:

Across substances and models, lifetime stimulant treatment was unrelated to level of substance use in adolescence. The only consistent predictor of use in all analyses was the adolescent's current age.

## Stimulant Prediction of Substance Use

### Adolescents:

If analyses are run **without controlling for age**, current stimulant use predicts less heavy drinking (estimate = -1.39, p = .02, odds ratio = 2.45).

## Stimulant Prediction of Substance Use

Young Adults-Model 1 (controlling for childhood vars)

Substance	Estimate	P	Odds Ratio	CI of Odds Ratio
Alcohol	1.10	.07	3.00	1.41-6.79
Marijuana	1.04	.10	2.85	0.82-9.89
Cigarettes	1.11	.07	3.02	0.90-10.15

## Stimulant Prediction of Substance Use

Young Adults-Model 2 (controlling for intervening vars)

Substance	Estimate	P	Odds Ratio	CI of Odds Ratio
Alcohol	1.55	.02	4.72	1.33-16.73
Marijuana	1.44	.03	4.23	1.12-15.91
Cigarettes	1.10	.10	2.99	0.82-10.90

### Stimulant Prediction of Substance Use

Young Adults-Model 3 (controlling for current functioning)

Substance	Estimate	P	Odds Ratio	CI of Odds Ratio
Alcohol	1.23	.05	3.00	1.02-13.20
Marijuana	1.37	.05	3.19	0.99-15.44
Cigarettes	1.34	.05	3.83	1.01-14.56

### Stimulant Prediction of Substance Use

Young Adults-Model 4 (controlling for all vars)

Substance	Estimate	P	Odds Ratio	CI of Odds Ratio
Alcohol	1.39	.08	3.99	0.84-18.97
Marijuana	1.52	.07	4.59	0.89-23.76
Cigarettes	1.39	.09	4.01	0.8-20.05

### Stimulant Prediction of Substance Use

**Summary:**

In ADHD adolescents, stimulant use is unrelated to substance use when age is controlled.

In ADHD young adults, there is a consistent, positive prediction from lifetime stimulant treatment to heavy use of alcohol, marijuana, and cigarettes.

### Stimulant Prediction of Other Outcomes

**Functional outcome measures in linear regressions:**

- Parent-rated impairment (IRS overall)
- Delinquent acts committed in past year
- Current achievement (WRAT total score)

**Controlling for ethnicity, SES, age, IQ, childhood symptom ratings, and current stimulant use**

## Stimulant Prediction of Other Outcomes

### Adolescents:

- Lifetime stimulant use is not related to impairment, delinquency, or achievement
- No relationship between current stimulant use and any outcome variable

## Stimulant Prediction of Other Outcomes

### Young Adults

- Lifetime stimulant use is not related to academic achievement, impairment or delinquency
- No relationship between current stimulant use and any outcome variable

## Possible Explanations of a Stimulant-Substance Use Connection

1. Behavioral sensitization
  - a. Stimulants sensitize the CNS to the effects of other drugs, increasing likelihood of later abuse
2. Stimulants alter reward mechanisms in the CNS, disrupting Stimulus -> Response -> Reward pathways
3. Genetic dopaminergic dysfunction
  - a. Causes both response to stimulants (and therefore continuation) and response to abusive drugs
4. Reliance on medication reduces parental, child, and school efforts to develop adaptive coping skills
  - a. Parents do not learn and apply parenting skills that are critical to positive outcomes (e.g., monitoring, positive interactions, consistent discipline)
  - b. School does not implement programs that remediate academics and behavior--adolescents eventually stop medication/drop out
  - c. Children are not taught adaptive skills that may mediate outcomes (e.g., social skills, sports competencies, study skills) so peer network path unaffected by stimulants

## Possible Explanations of a Stimulant-Substance Use Connection

5. Medication exacerbates preexisting positive illusory attributional style, which leads to substance use
6. Self medication
  - a. Adolescents stop taking medication--use substances (e.g., cigarettes) in place of prescribed stimulant
  - b. Mechanism could be mix of biological, cognitive, and environmental
7. Combinations of the above and other variables
  - a. E.g., peer network, family risk for substance use
8. Easier to explain negative effect or failure to have an effect than to explain a positive effect of stimulants on outcome
  - a. E.g., Stimulants have either an adverse effect (see above) or no effect on the major variables involved in the important pathways to development of substance use--parenting, academic/school achievement, peer relationships
  - b. What effect of stimulants could improve adolescent and adult substance use? Must be parsimonious (e.g., STP example).

## Relationship to Literature

- Consistent with existing literature regarding academic achievement--no effects on achievement of stimulants
- Not much literature on delinquency or other impairment--not aware of studies showing beneficial or negative effect on them
- Some other studies show no effect on substance use (Wilens, Biederman), a negative effect (Lambert), or mixed effects (Loney, Barkley)
- This study has a larger sample, more extensive measures of substance use, abuse, and variables thought to influence development

## Future Directions of Project

1. Currently at wave 4, after which we will have another 100 subjects in the adult (post school) sample. Currently funded for 6 more waves.
2. Will address many more questions examining outcomes and will begin to address longitudinal trajectories, other childhood predictors, and mediators/moderators of outcomes
3. Plan to add genetic information, measures of cognitive functioning, and adult laboratory challenge drug assessments
4. Examine lifetime costs and impact of ADHD for society, families, schools, and probands.

## Implications of Findings for ADHD

- Illustrates the chronicity of ADHD--Highlights the impact throughout the lifespan
- Documents the extensive impact of ADHD individuals on their families throughout the lifespan
- Emphasizes the importance of ADHD for clinicians who deal primarily with adults
- Demonstrates the importance of collateral reports of ADHD symptoms and impairment even in adulthood
- Range of negative outcomes highlights importance of interdisciplinary collaboration across professions, institutions, and agencies at the community level
- Shows importance of chronic disease model of care and of the need for effective early and ongoing intervention that includes more than medication alone and emphasizes family and school-based interventions

## Downloadable Materials (Free) on our Websites

### Instruments

Impairment Rating Scales (Parent and Teacher)  
Disruptive Behavior Disorder Symptom Rating Scale (Parent and Teacher)  
Pittsburgh Side Effect Rating Scale  
DBD Structured Interview  
Parent Application Packet and Clinical Intake Outline  
Initial Teacher Interview

### Information

What Parents and Teachers Should Know about ADHD  
Medication Fact Sheet for Parents and Teachers  
Psychosocial Treatment Fact Sheet for Parents and Teachers  
All of our reprints

### "How to" Handouts

How to Establish a School-Based Daily Report Card  
How to Conduct a School-based Medication Assessment  
How to Establish a Home-Based Daily Report Card  
How to Begin a Summer Treatment Program

<http://wings.buffalo.edu/adhd/>

<http://Summertreatmentprogram.com>