DRUG ABUSE & ADDICTION
Preventable Brain Diseases

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National Institute on Drug Abuse
ADDICTION IS A DISEASE OF THE BRAIN as other diseases it affects the tissue function.

Decreased Brain Metabolism in Drug Abuse Patient

Decreased Heart Metabolism in Heart Disease Patient

Sources: From the laboratories of Drs. N. Volkow and H. Schelbert
Many Factors Lead to Drug Abuse and Addiction

Biology/Genes

Environment

Brain Mechanisms

Addiction
Addiction Tends to Start at a Young Age: When the brain is less developed.
Children in an orphanage who experienced deprivation had fewer connections between the parts of brain that regulate emotions and the parts that control thinking.

Govindan et al., Cereb Cortex 2009
Adverse Childhood Experiences (ACE) Affect Illicit Drug Use

### Odds Ratio

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>2.0</td>
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<tr>
<td>2</td>
<td>4.0</td>
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<tr>
<td>3</td>
<td>8.0</td>
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<tr>
<td>4</td>
<td>16.0</td>
</tr>
<tr>
<td>5</td>
<td>32.0</td>
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</tbody>
</table>

Preventive Interventions Can Have Long-term Effects on Drug Use and Abuse
### EXAMPLES OF RISK AND PROTECTIVE FACTORS

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Domain</th>
<th>Protective Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Aggressive Behavior</td>
<td>Individual</td>
<td>Self-Control</td>
</tr>
<tr>
<td>Poor Social Skills</td>
<td>Individual</td>
<td>Positive Relationships</td>
</tr>
<tr>
<td>Lack of Parental Supervision</td>
<td>Family</td>
<td>Parental Monitoring and Support</td>
</tr>
<tr>
<td>Substance Abuse</td>
<td>Peer</td>
<td>Academic Competence</td>
</tr>
<tr>
<td>Drug Availability</td>
<td>School</td>
<td>Anti-Drug Use Policies</td>
</tr>
<tr>
<td>Poverty</td>
<td>Community</td>
<td>Strong Neighborhood Attachment</td>
</tr>
</tbody>
</table>

- **Prevention Approaches Should**
  - Enhance Protective Factors & Reduce Risk Factors
How Prevention Interventions Work

**Background Factors**
- Age
- Gender
- Race/ethnicity
- Poverty level
- Genotype

**MODIFIABLE RISK and PROTECTIVE FACTORS**
- Early aggression
- Social skills deficits
- Academic problem
- Misperceived drug use norms
- Association with deviant peers
- Neighborhood availability
- Media glamorization
- Parental monitoring and support

**INTERVENTIONS**
- Parent skills training
- Social skills training
- Self-regulation
- Impulse control
- Tutoring
- Norms training
- Refusal skills
- Community policing
- Health literacy
Nurse Home Visiting during pregnancy and first two years impacts substance use, mental health and academics

Percent of Children Who Used Tobacco, Alcohol, or Marijuana (Last 30 Days)  
Child Age 12

Percent of Children with Internalizing Problems  
(Borderline or Clinical)  
Child Age 12

PIAT Scores - Reading & Math – Age 12  
(Born to Low-Resource Mothers)

Percent of Mothers with Role Impairment due to Alcohol or Drug Use – Child Age 12

Arch Pediatr Adolesc Med, 164(5) 412-418, 2010
PROSPER (Community/University Partnership) Reduces Illicit Substance Use

Reduced Increase in Use Through 6½ Years Past Baseline

Sum of six lifetime illicit use measures (methamphetamines, Ecstasy, inhalants, Vicodin, prescription drug misuse overall, other illicit drug use); Intervention vs. Control difference in slope is statistically significant, as are differences at multiple time points, including 11th and 12th grades.

Higher Risk = Lifetime initiation of alcohol, cigarette or marijuana use at baseline; Lower Risk = No initiation at baseline.

Intervention effects are significantly stronger for the Higher-Risk subgroup, as compared to the Lower-Risk Subgroup.

Strengthening Families Program 10-14 during Grade 6 Leads to Greater Academic Success in Grade 12

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Universal Drug Abuse Prevention
Reduces Prescription Drug Misuse

In this study, for 100 young adults in general population starting Rx abuse, only 35 young adults from an intervention community started.

**Overall, three studies now suggest the impact of universal prevention on prescription drug abuse.**

**p<.01; ***p<.001;** Relative Reduction Rates (RRRs) = 65-93%

Notes: General=Misuse of narcotics or CNS depressants or stimulants.
Prescription Drug Abuse: It’s NOT What the Doctor Ordered!
Near Tripling of Opioid Prescriptions Dispensed by U.S. Retail Pharmacies, Years 1991-2013

IMS Health, National Prescription Audit, Years 2012-2013, Data Extracted 2014
Marked Increases in Opioid-related Deaths (parallel to opioid sales and Rx opioid treatment admits), USA

2013 OD Deaths:
- 43,982 Any Drug
- 16,235 Rx opioid
- 8,257 Heroin

Sources: National Vital Statistics System, DEA Automation of Reports and Consolidated Orders System, SAMHSA TEDS
Overlap of Benzodiazepines and Opioids in USA
Opioid Analgesic ED Visits and OD Deaths Involving Benzodiazepines & Benzodiazepine ED Visits and OD Deaths Involving Opioids

People Abusing Analgesics DIRECTLY & INDIRECTLY Obtain Them by Prescription: *Most Recent Pill Source*

Source Where Respondent Age 12+ Obtained Analgesics:

![Pie chart]

- One Doctor (17.3%)
- More than One Doctor (2.1%)
- Other¹ (4.6%)
  - Bought on Internet (0.4%)
- Drug Dealer/Stranger (4.4%)
- Bought/Took from Friend/Relative (16.2%)

Source Where Friend/Relative Obtained:

![Pie chart]

- One Doctor (79.4%)
- More than One Doctor (3.6%)
- Free from Friend/Relative (6.3%)
- Bought/Took from Friend/Relative (6.5%)
- Drug Dealer/Stranger (2.3%)
- Bought on Internet (0.2%)
- Other² (1.7%)

¹Other category includes Wrote Fake Prescription, "Stole from Doctor’s Office/Clinic/Hospital/Pharmacy," and "Some Other Way."

Source: SAMHSA, 2009 and 2010 National Survey on Drug Use and Health
Prescription Drug Abuse: What can be done?

- Primary Prevention
- Less abusable analgesics
- Overdose Intervention
- Better Access to Effective Addiction Treatments (especially medications for opioid addiction)
- Public and Clinician Education
Multi-pronged approaches can save lives: Staten Island Case Study

1. data brief
2. opioid Rx guidelines
3. PSAs
4. PDMP law
5. ED opioid Rx guidelines
6. town halls and detailing campaign to promote guidelines
7. PDMP mandated use
8. PSAs

Source: MMWR, May 15, 2015 64(18):491-494


*Per 100,000 population. Based on Florida Department of Health resident population estimates.

+ The source of overdose death data is the Florida Medical Examiners Commission.

Source: CDC, MMWR Vol 63, July 1, 2014.
Fewer High School Seniors Reporting Use of Narcotics Other than Heroin, in USA

SOURCE: University of Michigan, 2014 Monitoring the Future Study
Recent Slight Reductions in Rx Opioid-Related Deaths but *Marked Increases in Heroin*

2013 OD Deaths:

- 16,235 Rx opioid
  - (16,007 in 2012 and 16,917 in 2011)
- 8,257 Heroin
  - (5,927 in 2012 and 4,397 in 2011)

Sources: National Vital Statistics System, CDC
Past Year Heroin Use among Persons Aged 12 or Older, 2003-2014

Numbers in Thousands

Source: SAMHSA, 2014 National Survey on Drug Use
Electronic Nicotine Delivery Systems—E-cigarettes: Promise and Peril

How an electronic cigarette works

The electronic cigarette contains a battery that activates a heating device, atomizing liquid nicotine inside a cartridge and producing a vapor that is inhaled.

PROMISING for tobacco cessation? PERILOUS for new onset addiction?
More Youth Use E-Cigarettes Than Tobacco Cigs

Past Month Use of E-Cigs vs. Traditional Cigarettes in the 2014 Monitoring the Future Study of 8th, 10th and 12th Grade Students in USA

- 8th Grade: 4.0% E-Cigarettes, 8.1% Tobacco Cigarettes
- 10th Grade: 7.2% E-Cigarettes, 16.2% Tobacco Cigarettes
- 12th Grade: 13.6% E-Cigarettes, 17.1% Tobacco Cigarettes

Monitoring the Future Study 2014, University of Michigan
Large Numbers of Youth in USA Using E-Cigarettes Without Prior Use of Tobacco

Past Month Use of E-Cigarettes Among Youth with/without Any Lifetime Use of Tobacco Cigarettes or Smokeless Tobacco in the 2014 Monitoring the Future Study of 8th, 10th and 12th Grade Students in USA

Monitoring the Future Study 2014, University of Michigan
Another Key Emergent Drug Issue in the USA: The Shifting Marijuana Legal Environment: Linking Epidemiology and Neuroscience
Among Current Marijuana Users, Two In Five Are Daily or Almost Daily Users

Number of Days Used Marijuana in the Past Month

- 1 to 2 Days: 23%
- 3 to 5 Days: 17%
- 6 to 19 Days: 19%
- 20 or More Days: 41%

19.8 Million Past Month Users of Marijuana in 2013

Source: SAMHSA, 2013 National Survey on Drug Use and Health (September 2014).
Increasing Potency of Marijuana (% Δ-9 THC)

SOURCE: University of Mississippi Marijuana Project
Perceived Riskiness of Smoking Marijuana has Declined

Perceiving Great Risk of Smoking Marijuana Occasionally

Denotes significant difference between 2013 and 2014.

SOURCE: University of Michigan, 2014 Monitoring the Future Study
Perceived Risk is Correlated with Use of Marijuana

**12th Graders’ Use vs. Perceived Risk of Occasional MJ Use**

Denotes significant difference between 2013 and 2014.

SOURCE: University of Michigan, 2014 Monitoring the Future Study
Percentage of U.S. 12th Grade Students Reporting Past Month Use of Alcohol, Cigarettes and Marijuana

During the LAST TWO WEEKS, have you driven a car, truck, or motorcycle after ...

Since 2009, more high school seniors reported driving after smoking marijuana than driving after drinking alcohol.

Source: University of Michigan, 2014 Monitoring the Future study, Unpublished special tabulations (December 2014).
Persistent Marijuana Users Show A Significant IQ Drop between Childhood and Midlife

Followed 1,037 individuals from birth to age 38. Tested marijuana use at 18, 21, 26, 32 and 38. Tested for IQ at ages 13 and 38

Average Point Difference in IQ score (IQ at age 38 – IQ at age 13)

Source: Meier MH et al., PNAS Early Edition 2012
More Teenage Use of Cannabis Associated with Worse Outcomes in 20’s (3 Australia/New Zealand Studies)

Silins, et al., Lancet Psychiatry 2014;1:286-293
Cannabis Associated with Schizophrenia

**Risk (Odds Ratios) of hospital diagnosis of schizophrenia after prior registration for cannabis abuse in: (i) general population and (ii) co-relatives, allowing time from exposure to disease to vary by 1-7 years**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>After 1 Yr</th>
<th>After 5 Yrs</th>
<th>After 7 Yrs</th>
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<tbody>
<tr>
<td><strong>General Pop'n</strong></td>
<td>10.44</td>
<td>9.19</td>
<td>5.95</td>
<td>4.24</td>
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<tr>
<td><strong>Relative Pairs:</strong></td>
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<tr>
<td>1st Cousin</td>
<td>9.40</td>
<td>8.37</td>
<td>5.85</td>
<td>4.05</td>
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<tr>
<td>Paternal 1/2</td>
<td></td>
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<tr>
<td>Sib</td>
<td>9.15</td>
<td>8.42</td>
<td>6.12</td>
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<tr>
<td>Maternal 1/2</td>
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<tr>
<td>Sib</td>
<td>6.00</td>
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<tr>
<td>Full Sibs</td>
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<tr>
<td><strong>MZ Twins</strong>*</td>
<td>3.92</td>
<td>3.38</td>
<td>2.63</td>
<td>1.67</td>
</tr>
</tbody>
</table>

* Extrapolated

Giordano, Ohlsson, Sundquist, Sundquist, Kendler *Psychological Medicine* 2015
Adolescent Brain Cognitive Development
National Longitudinal Study
NIDA, NIAAA, NCI, NICHD, NIMHD, ORWH, NIMH, NINDS, OBSSR

Ten year longitudinal study of 10,000 children from age 10 to 20 years to assess effects of drugs on individual brain development trajectories
• Neuroscience reminds us of the importance of development and provides a background for prevention intervention development

• Current and emerging drug abuse issues require our creative and vigorous responses
Treatment Publication
Principles of Adolescent Substance Use Disorder Treatment: A Research Based Guide

Outlines thirteen principles and evidence-based approaches for treating adolescent substance use disorders (SUD).

Medical School Curriculum
The Substance Use Disorder in Adolescents: Screening and Engagement in Primary Care Settings
Provides a series of videos demonstrating effective screening techniques.

DRUGS + YOUR BODY: It Isn’t Pretty
Web interactive
www.drugabuse.gov

Drugs + Your Body: It Isn't Pretty
Includes graphics, videos, quizzes and much more on the wide-ranging harmful effects of drugs on the brain and body.