Heroin Addiction and Overdose: What Can We Do to Address This Growing Problem?
Prescription Drug Misuse/Abuse is a Major Problem in the US

**Current Drug Use Rates in Persons Ages 12+**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illicit Drugs</td>
<td>24.6</td>
</tr>
<tr>
<td>Marijuana</td>
<td>19.8</td>
</tr>
<tr>
<td>Psychotherapeutics</td>
<td>6.5</td>
</tr>
<tr>
<td>Cocaine</td>
<td>1.5</td>
</tr>
<tr>
<td>Hallucinogens</td>
<td>1.3</td>
</tr>
<tr>
<td>Inhalants</td>
<td>0.5</td>
</tr>
<tr>
<td>Heroin</td>
<td>0.3</td>
</tr>
</tbody>
</table>

**Past Year Nonmedical Use of Psychotherapeutic Drugs Persons Ages 12+**

- Pain Relievers: 4.7, 4.9, 5.1, 5, 4.8, 4.9, 4.8, 4.3, 4.2
- Tranquilizers: 2.1, 2.2, 2.1, 2.1, 2, 2.2, 2.2, 2, 2.3, 2
- Stimulants: 1.2, 1.1, 1.4, 1.2, 1.2, 1.2, 1.1, 1, 1.3, 1.3
- Sedatives: 0.3, 0.3, 0.4, 0.3, 0.2, 0.3, 0.4, 0.2, 0.2, 0.2

High Levels of Opioid Prescriptions have Facilitated Diversion & Contributed to Overdose Deaths

Oxycodone & Hydrocodone Prescriptions

Rx Opioid Overdose Deaths

Source: CDC Wonder
Abuse of Opioid Medications has led to a Rise in Heroin Abuse and Associated Deaths from Overdoses

Past Month & Past Year Heroin Use Persons Aged 12 or Older

Heroin Overdose Deaths

Source: CDC Wonder

Respondents Who Endorsed Past-Month Use of OxyContin or Heroin Before and After Introduction of an Abuse-Deterrent Formulation (ADF)

Drugs Used to Replace OxyContin After the Introduction of the Abuse-Deterrent Formulation (ADF)

Cicero TJ and Ellis MS. JAMA Psychiatry. Published Online March 11, 2015.
Analgesic Mechanisms of Mu Opiate Drugs (Heroin, Vicodin, Morphine)
How Can Research Help?

• **PAIN**: Develop Less Abusable Analgesics and Alternative Therapeutics

• **OVERDOSES**: User Friendly Naloxone

• **ADDICTION**: New Medications and Immunotherapies

• Pharmacogenomics (Precision Medicine)

• Implementation Science
Develop Less Abusible Drugs: Prodrugs

- **Problem:** changing method of taking opioids – i.e., crushing, injecting – increases euphoria; abuse
- **Challenge:** develop drugs that resist tampering; abuse
- **Research response:** oxycodone prodrug
  - Inactive compounds metabolized in the body to produce active drug
PAIN: Alternative Therapeutics
Non-Medication Strategies for the Treatment of PAIN and ADDICTION

Transcranial Magnetic Stimulation (TMS)

Deep Brain Stimulation (DBS)
Stereotaxtic implantation of electrodes that emit electrical stimulation to a targeted neuronal region

Transcranial Direct Current Stimulation (tDCS)

High-Definition transcranial Direct Current Stimulation (HD-tDCS)


Improving OD Treatments: Naloxone for Overdose

- Lay-friendly administration: intranasal naloxone

- *AntiOp*, developing disposable naloxone nasal spray. Product could be on the market 2015

- *Lightlake Therapeutics*, conducting clinical trials with intranasal naloxone for binge eating disorder will test this for opioid overdose
Improving Implementation of Medication Assisted Treatments: Addiction

% Treatment Programs Offering FDA-approved SUD medications

% OTP patients receiving methadone, buprenorphine, or vivitrol


2012 N-SSATS Data, SAMHSA
Opioid Agonist Treatments Decreased Heroin OD Deaths
Baltimore, Maryland, 1995-2009

Buprenorphine Implants vs Placebo & Sublingual Buprenorphine/Naloxone

Challenge: Compliance with daily intake
Solution: develop long acting medications

Probuphine is designed to release sustained therapeutic drug levels in patients with opioid addiction for up to six months

% of Patients Failing to Exceed Each Possible Criterion of Success
% of Urines Negative (out of 72) for Opioids Across Weeks 1 to 24

Antibodies reduce amount of drug in the brain

Treating Opioid Addiction: Vaccines

Targets drugs, not receptors
Implementation Science

Strategies that Can Help Address the Dangers of Opioid Overdose and Addiction in the US

- Responsible Prescribing and Management of Chronic Pain, which requires enhanced Education on Pain and its Treatment
- Availability of Naloxone
- Mandatory Addiction Education in Medical, Nursing and Pharmacy Schools
National Pain Strategy

"HHS Secretary should develop a comprehensive, population health-level strategy for pain prevention, treatment, management, education, reimbursement and research ..."

NIH Pain Consortium Centers of Excellence in Pain Education
NIDA CoEs established in 2007 to help fill gaps in medical education curricula related to both illicit drugs and Rx drug abuse

- Medical schools at CoEs have developed a diverse portfolio of innovative curriculum resources about how to identify and treat patients struggling with SUD

Resources for Medical Students, Resident Physicians & Faculty
Opioid Overdose Death Rates Were Reduced In Communities Where Overdose Education & Nasal Naloxone Distribution Program (OEND) Was Implemented

Unadjusted Unintentional Opioid-Related Overdose Death Rates

Unadjusted Opioid-Related Acute Care Hospital Utilization Rates

Walley AY et al., BMJ 2013; Published 31 January 2013.
Which Drug is the First Opioid Used in Addicts?
Shifting Pattern of Heroin vs. Rx Opioid First

Percentage of Heroin-Addicted Treatment Admissions that Used Heroin or Prescription Opioid as First Opioid

Source: Cicero et al. JAMA Psychiatry. 2014;71(7):821-826

1960s: more than 80% started with heroin

2000s: 75% started with prescription opioids

2010-2013: Increasing initiation with heroin
Age-Adjusted Rates for Drug-Poisoning Deaths Involving Heroin, By Census Region: US

Deaths per 100,000 population

Northeast Midwest South West

2000 2007 2013

Rates for Drug-Poisoning Deaths Involving Heroin, By Selected Age & Race & Ethnicity Groups

Deaths per 100,000 population

18-44 45-64 18-44 45-64 18-44 45-64

2000 2013

Non-Hispanic White Non-Hispanic Black Hispanic

CDC, NCHS Data Brief, No 190, March 2015.
Possible Consequences of Heroin Use

Increased Risk of Contracting Infectious Diseases including:
- HIV/AIDS
- Hepatitis B and C

Incidence of acute hepatitis C by age group, U.S., 2000-2011

Source: National Notifiable Diseases Surveillance System (NNDSS), CDC