Opioids, The Brain, and Overdose Deaths

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80,391

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The number of overdose deaths in 2024 according to the CDC.
This is a 27% decrease from 2023!

Goals for this talk

🧠 How Opioids Affect the Brain:
Neurobiology and mechanisms of action

⚠️ The Pathophysiology of Substance Use Disorders:
Dependence versus “addiction”

🚨 Responding to Opioid Overdoses:
Recognition, intervention, and naloxone

Opioids and the Brain

Opioids and the brain

Key Receptors

Mu (μ) Receptors: Responsible for analgesia and euphoria
Delta (δ) Receptors: Modulate mood and pain perception
Kappa (κ) Receptors: Associated with dysphoria and hallucinations

Brain Regions

High opioid receptor density:

- Brainstem (breathing control)
- Limbic system (reward/emotion)
- Spinal cord (pain processing)

Effects

- Pain relief
- Cough suppression
- Reduced anxiety
- Respiratory depression
- Sedation
- Constipation
- Euphoria

The Brain's Reward System

Opioids influence the primary reward pathway in the brain, the mesolimbic pathway, by increasing dopamine release in the midbrain.

The Brain's Reward System

This pathway signals to the brain that an experience is good, leading to feelings of pleasure and promoting repetition of the behavior.

The Brain's Reward System

Substance use disorders are multifactorial and include the neurobiological hijacking of the most basic reward pathways in the brain.

Take Home Points

Drugs are chemical structures which do not carry any inherent moral value

Using drugs or having a substance use disorder is NOT a moral failing

Pathophysiology of Substance Use Disorders

What is a Substance Use Disorder?

Substance Use Disorder:

- Continued use despite negative consequences
- Complex biopsychosocial condition
- Involves functional changes in the brain

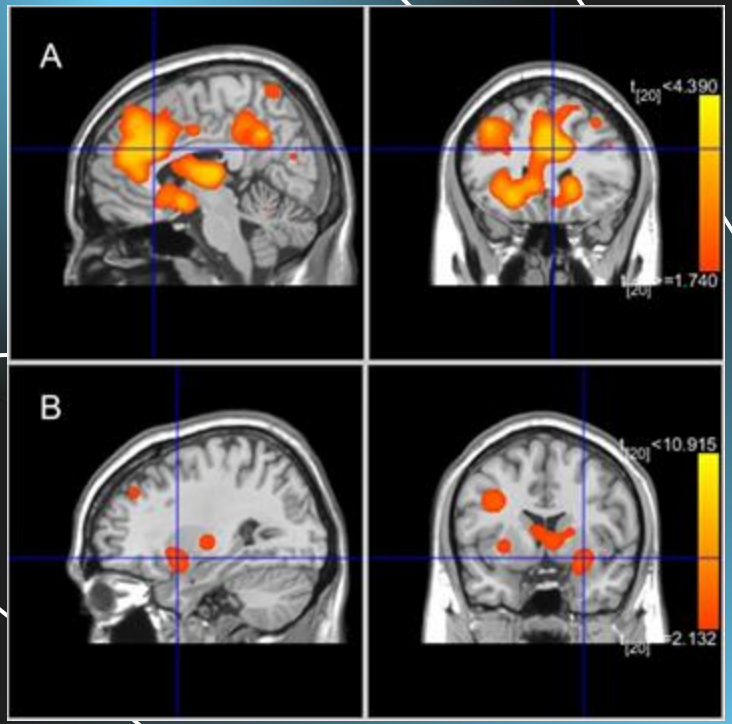
Dependence is NOT a Substance Use Disorder

Dependence:

- Tolerance and withdrawal can develop when taking opioids consistently over time - such as for pain management
- Develops over days to weeks

Long-Term Brain Changes in SUD

- **Prefrontal Cortex**: Reduced gray matter, impaired decision-making
- **Hippocampus**: Altered memory formation and retrieval
- **Amygdala**: Heightened stress response and craving triggers



Take Home Points

Recovery is possible! All pathways to recovery are valid!

These neurologic changes can be reversed with time and appropriate treatment!

Opioid Overdoses

Recognizing Opioid Overdose

"**Opioid Overdose Triad**"

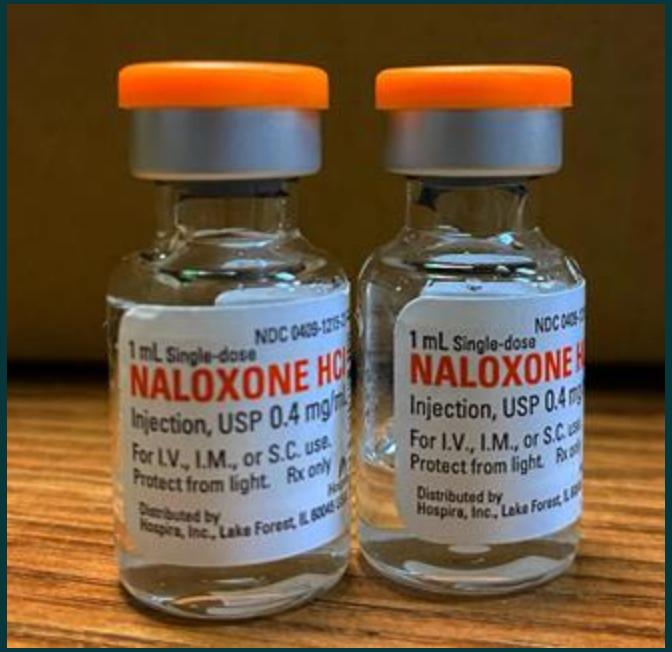
- Respiratory Depression = slow, shallow, or absent breathing (<12 breaths/min)

- Central Nervous System Depression = unresponsive or minimally responsive

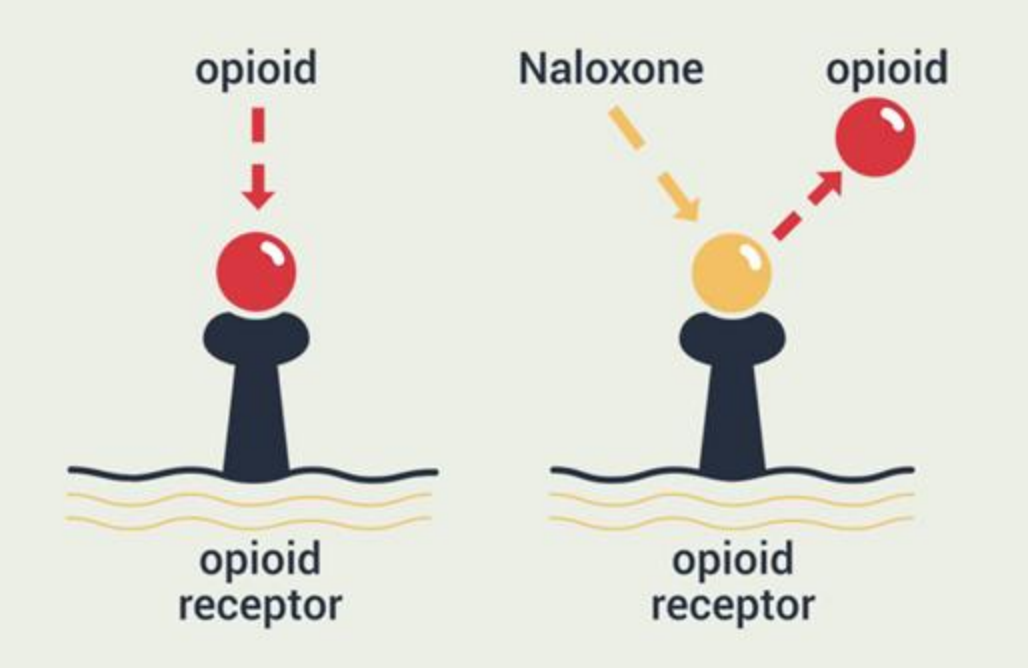
- Miosis = pinpoint pupils

Treating Opioid Overdose

Treating Opioid Overdose



Treating Opioid Overdose



- Naloxone enters the brain and knocks opioids off the receptors and stays there for 30-90 minutes.
- Does not eliminate opioids from the body
- Opioids can return to receptors after naloxone wears off.

https://www.overdoselifeline.org/about-naloxone/

Treating Opioid Overdose

Administration:

- Nasal = insert device, press firmly
- Auto-injector = Press against outer thigh
- Repeat every 2-3 minutes
- Rescue breaths in between if able

*****No harm if no opioids involved*****

Does not treat panic attacks

Treating Opioid Overdose

Immediate Overdose Response:

- Call EMS = Dial 911
- Check Responsiveness = shout name, sternum rub
- Position Patient = recovery position if breathing, flat on back if not breathing
- Administer naloxone if available
- Rescue Breathing = if trained and patient not breathing
  - Give 1 breath every 5 seconds
- Stay present until EMS arrives

Key Takeaways

🧠 **Brain Effects**:
Opioids hijack natural reward systems
Continuous use can lead to dependence, but dependence alone does not define a substance use disorder.

⚠️ **Drug Pathophysiology**:
Substance Use Disorders involve complex neurobiological and psychosocial conditions including neuroadaptation, and are NOT a moral failing.

🚨 **Overdose Response**:
Quick recognition and naloxone administration saves lives.

Key Takeaways

Understanding the science behind opioid effects helps reduce stigma and promotes evidence-based, compassionate responses to those affected by opioid use disorder.

What questions do you have?

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THANK YOU!

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