Washington State Department of HEALTH

THE SCIENCE OF ADDICTION

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About the Author

Trisha Duerr is a nurse and emergency medical services educator, currently practicing as a critical care ground transport nurse and serving as adjunct nursing faculty. She holds board certifications in emergency, pediatric emergency, trauma, and transport nursing. As a prehospital provider, she maintains her National Registry EMT certification and is an EMS evaluator. Her extensive emergency experience spans roles in prehospital 911 response, critical care transport, charge nursing, preceptorship, trauma care coordination, clinical education, and department leadership. In addition, she is an active member of her local Critical Incident Stress Management team.

Objectives

By the end of this lecture, the learner will be able to:

- Define the term "substance use disorder".
- Describe how drugs affect the brain and why is it so hard to quit.
- Explain why do some people become addicted while others don't.
- Recognize the difference between dependence and addiction.
- Understand how drug addiction can be treated or prevented through a combination of medications, behavioral therapy, education, and outreach.

Case Study

- You and your partner are dispatched to a local bus station with reports of a "possible overdose, unresponsive female".
- The scene is safe.
- A bystander engages you and points to an alcove, where a person is laying on the ground in the recovery position. The bystander reports that the person appeared to be "nodding off" and is now unresponsive.
- Upon assessment, the female patient is unresponsive, has shallow and irregular respirations with a rate of six breaths per minute, and a weak and slow radial pulse.
- There is a piece of tinfoil with brown residue and an empty naloxone nasal spray container nearby.

Case Study, cont.

- You open the airway (which is patent) and place an oropharyngeal airway.
- You begin to support respirations utilizing a bag-valve-mask with high-flow oxygen.
- Your partner administers 4 mg of naloxone intranasally.

Overview and How Drugs Affect the Brain

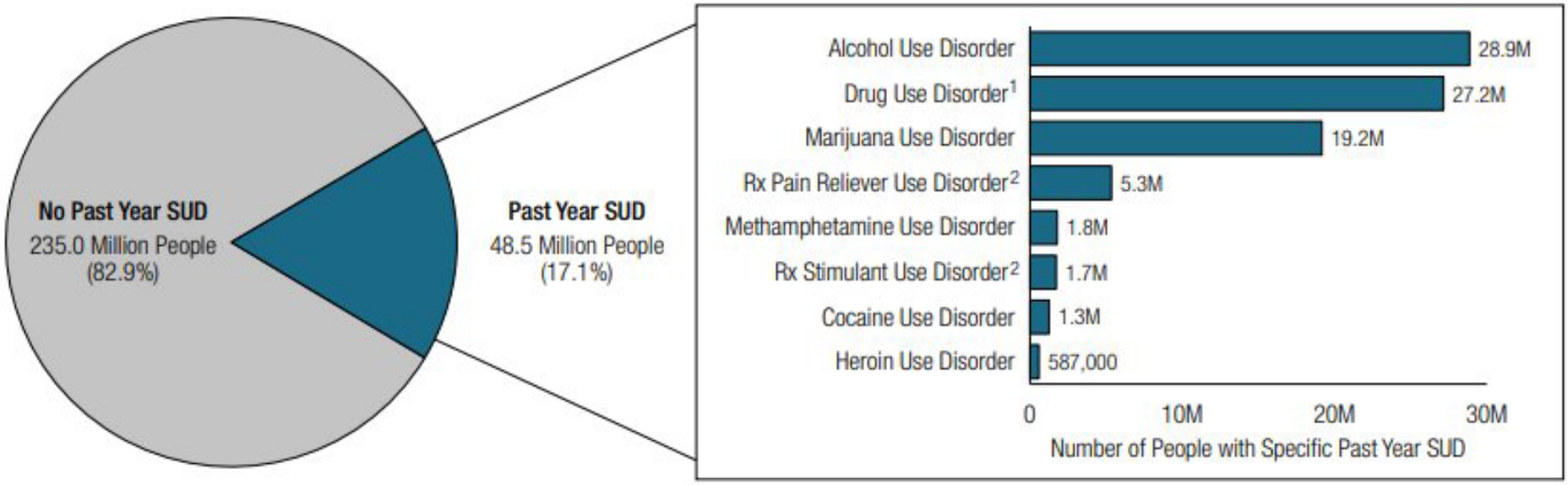
By Definition:

- Substance use disorder (SUD) is a treatable mental disorder that affects a person's brain and behavior.
- SUD leads to an inability for a person to control their use of substances like legal and illegal drugs, alcohol, or medications.
- Symptoms can be mild to severe, with addiction being the most severe form of SUD.[1]

Commonly Misused Substances

- Alcohol
- Caffeine
- Cannabis
- Hallucinogens
- Inhalants
- Opioids
- Sedatives
- Stimulants (e.g., cocaine, methamphetamine)
- Nicotine[10]

Figure 28. Past Year Substance Use Disorder (SUD): Among People Aged 12 or Older; 2023



Rx = prescription.

Note: The estimated numbers of people with SUDs are not mutually exclusive because people could have use disorders for more than one substance.

[1] Includes data from all past year users of marijuana, cocaine, heroin, hallucinogens, inhalants, methamphetamine, and prescription psychotherapeutic drugs (i.e., pain relievers, tranquilizers, stimulants, or sedatives).

Figure 1

How do Drugs Affect the Brain?

- Addictive substances activate the reward center of the brain, producing intense feelings of excitement, happiness, and/or pleasure.
- These feelings motivate people to use again and again, despite the potential for harmful consequences.

How do Drugs Affect the Brain? Cont.

- Drugs interfere with the way that neurons send, receive, and process signals via neurotransmitters [2]

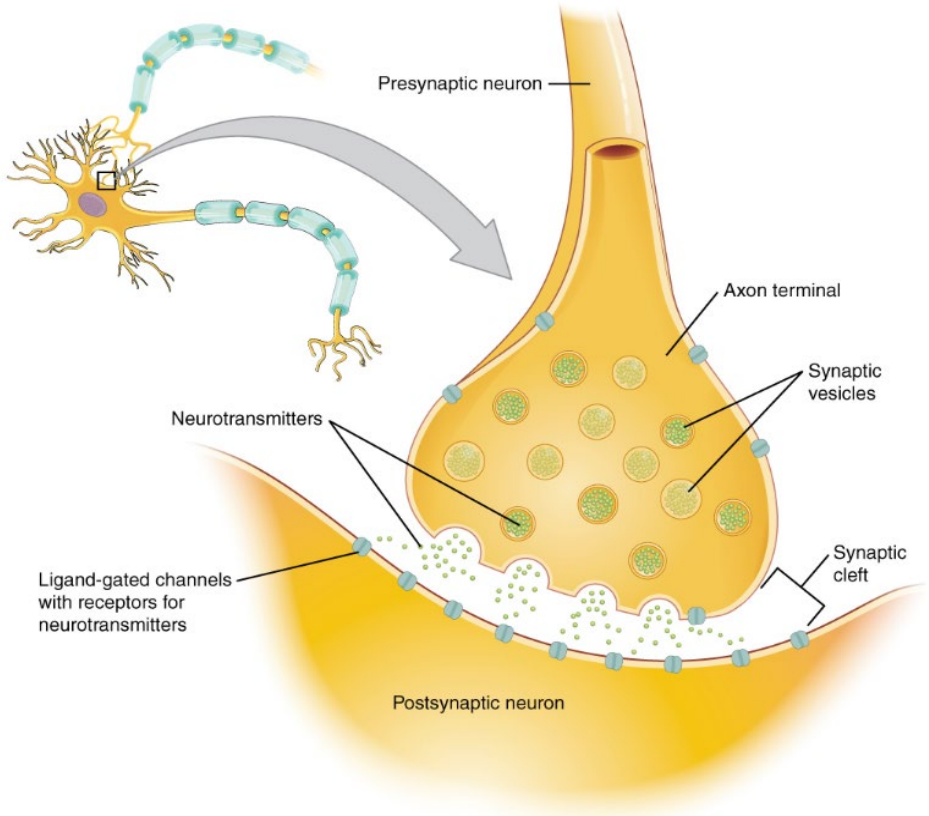


Figure 2

How do Drugs Affect the Brain? Cont.

- Some drugs mimic natural neurotransmitters in the brain.
  - Examples are nicotine, marijuana, and opioids.
  - These drugs activate neurons on their own!
  - Messages may be sent abnormally.

How do Drugs Affect the Brain? Cont.

- Other drugs cause neurons to release an abnormally large amount of natural neurotransmitters, or prevent the neurotransmitters from being removed from the synapse.
- Messages between neurons may be amplified or disrupted due to this.
- Examples are cocaine and methamphetamine.

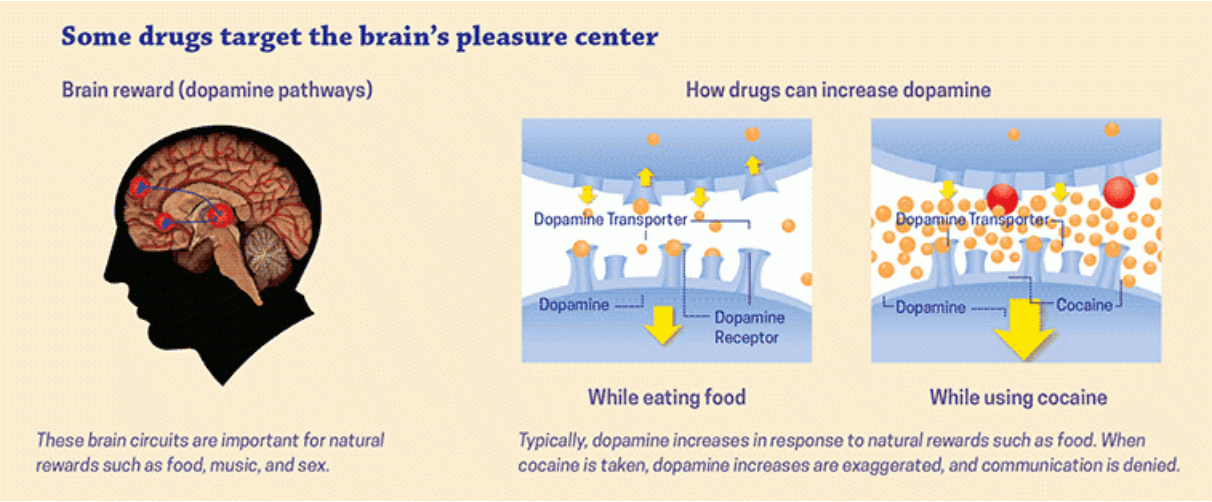


Figure 3

How do Drugs Affect the Brain? Cont.

- As people continue to misuse substances, long term changes begin to occur in the brain.
- These are referred to as **neuroadaptations[3].**
- Occur in 3 primary areas:
  - Basal ganglia
    - Controls rewarding, pleasurable effects
    - Forms habits associated with substance use
  - Extended amygdala
    - Controls stress responses
    - Responsible for unease, anxiety, and irritability associated with withdrawal
  - Prefrontal cortex
    - Executive tasks, such as making decisions, organizing thoughts, and taking control over substance use.

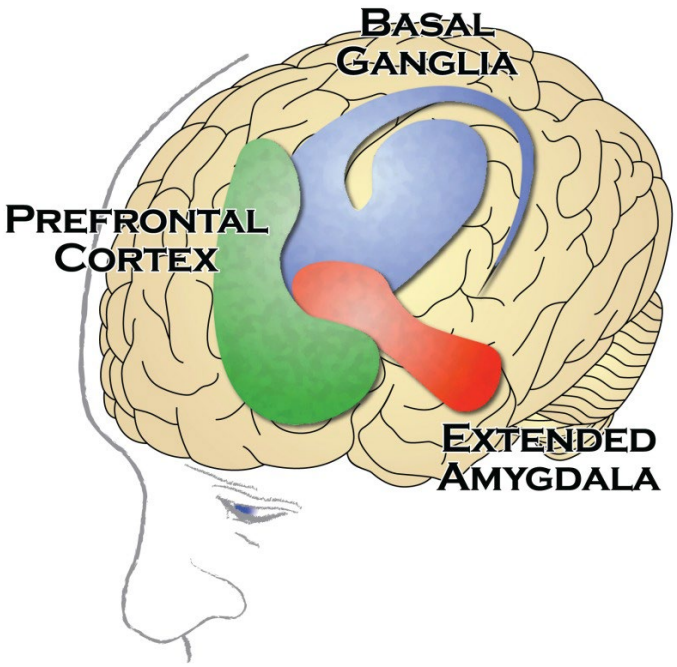


Figure 4

How do Drugs Affect the Brain? Cont.

- Neuroadaptations can lead to the development of addiction.
- **Addiction** is a chronic, relapsing disorder defined by compulsive drug seeking and use despite adverse consequences[4]

The Addiction Cycle and Why it's Hard to Quit

The 3-Stage Addiction Cycle

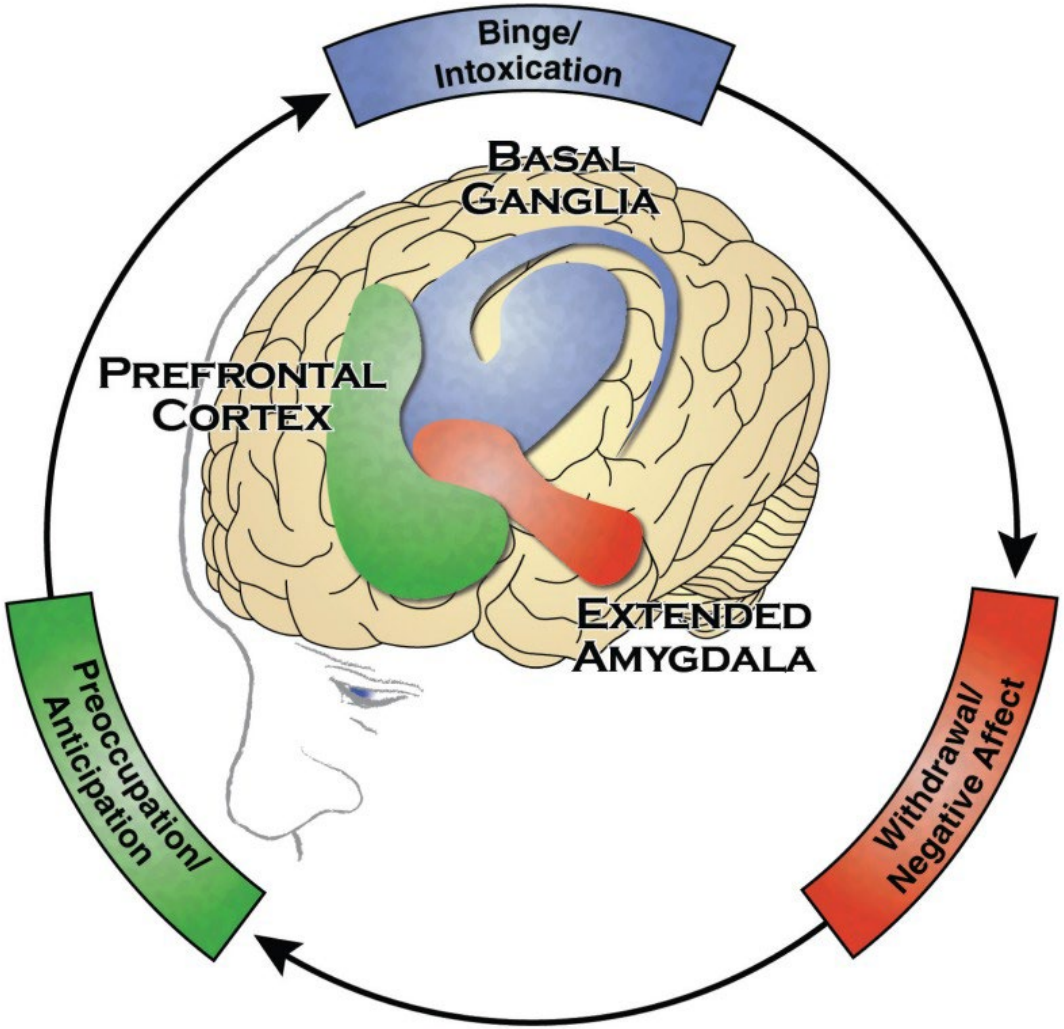


Figure 5

The 3-Stage Addiction Cycle

- Stage 1: Binge/Intoxication
  - The person uses a substance and experiences its rewarding or pleasurable effects.
    - The person might start to connect people, places, or things around them during substance use with the pleasurable feelings that the substance gave them.
    - Connections create cravings for the substance, even when people are in recovery.
    - Medications that are receptor antagonists are effective in this stage of the addiction cycle (e.g., naloxone, naltrexone).

The 3-Stage Addiction Cycle

- Stage 2: Withdrawal/Negative Affect
  - The person experiences withdrawal symptoms, including negative emotions and symptoms of physical illness.
    - Symptoms vary in intensity and duration
  - Symptoms come from two sources:
    - Decreased activation of the reward system in the basal ganglia
    - Activation of the stress response in the extended amygdala

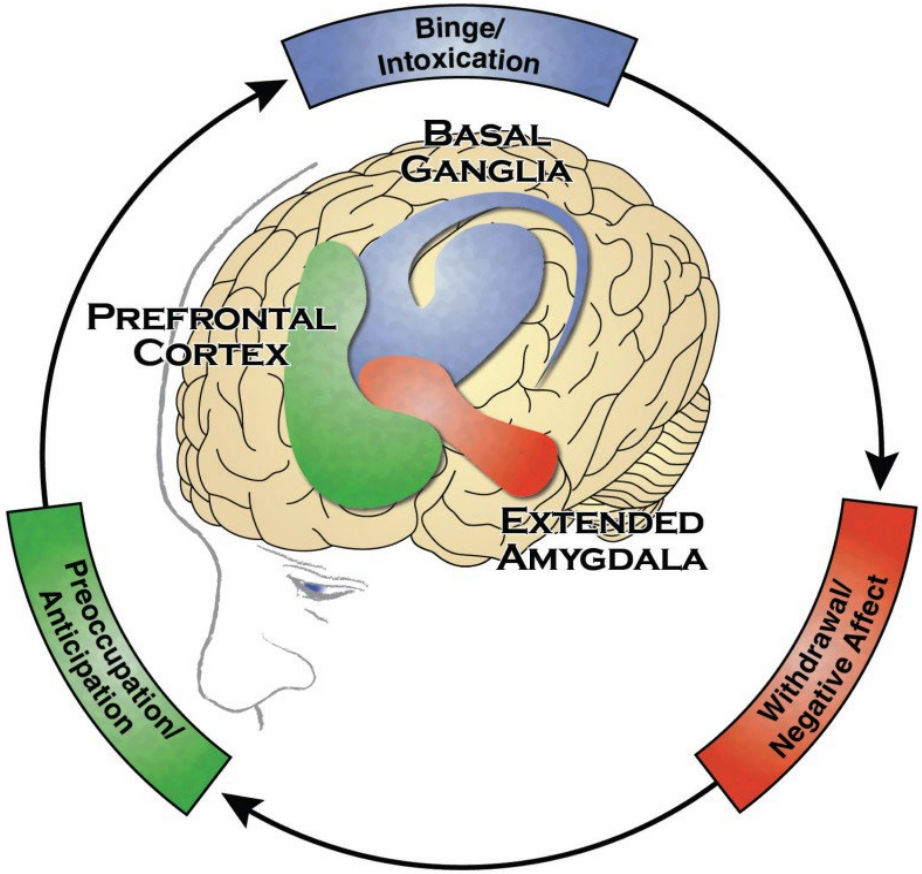


Figure 5

The 3-Stage Addiction Cycle

- Stage 3: Preoccupation/Anticipation Stage
  - The person begins craving the substance.
  - Occurs in the prefrontal cortex where decisions are made and impulses are controlled.
  - Those who use alcohol, opioids, or cocaine have increased risk of dysfunction in this area of the brain.

Why is Quitting so Hard?

- Initially, using a substance feels good!
- The brain is wired to seek out pleasurable activities and repeat them so that habits are formed.
- Substances may be used to:
  - Cope with anxiety, depression, or stress
  - Increase performance in school or sports
  - Increase energy or focus at home or work
- Peer pressure may interfere with attempts to decrease use or quit using.
- As the cycle continues, a person uses substances to avoid negative feelings and symptoms associated with withdrawal

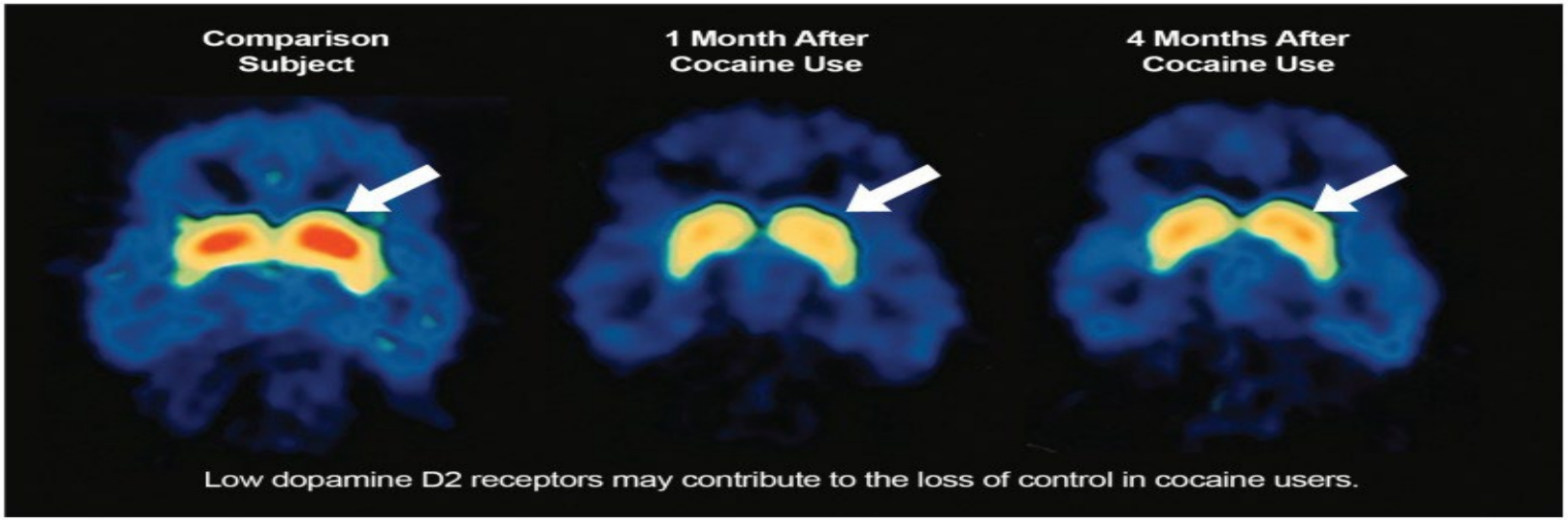
Why is Quitting so Hard?

- Substance use creates a link between:
  - Using the substance
  - The euphoria caused by the substance
  - The cues that are present when the substance is being used
- Cues may include:
  - The environment where the substance is obtained/used
  - The people present
  - Routines associated with drug use
  - Visual, olfactory, or gustatory
- The cues may trigger substance use or produce cravings, even years after a person has been in recovery.

Figure 6

Why is Quitting so Hard?

- All addictive substances cause long-term changes in the dopamine reward system, which include:
  - Decreases in dopamine receptors
  - Decreases in the amount of dopamine released
- Changes effect experiences that would normally produce dopamine in the brain as well, such as exercise, eating, and hobbies.
- May result in a person escalating behaviors (such as increasing their using substances) to activate the reward system.



Risk Factors for Addiction

Risk Factors for Addiction

- Risk factors vary from one person to the next and vary across the person's lifespan.
- The more risk factors a person has, the more likely they are to develop addiction.
- Risk factor categories:
  - Genetics
  - Biological factors
  - Age of first substance use
  - Environmental
  - Concurrent mental health disorders

Genetic Risk Factors for Addiction

- Responsible for ~50% of a person's risk for addiction[3].
- Genes influence:
  - Metabolism of alcohol and nicotine
    - Example: faster metabolism of alcohol may lead to use more often and in larger amount than someone with a slower metabolism.
  - Production, release, and metabolization of neurotransmitters
  - Forming habits related to substance abuse

Biological Risk Factors for Addiction

- Stage of Development
  - Adolescents are at risk due to peer pressure and continued development of the frontal cortex.
- Race and Ethnicity
  - Smoking produces more activation in the brains of African Americans than in Whites.
  - ~1/3 of East Asians have a gene that alters alcohol metabolism and results in build-up of toxins producing nausea, headache, and tachycardia[3].

Biological Risk Factors, cont.

- Sex
  - Males have greater risk of alcohol use disorder (AUD).
  - Females have more withdrawal symptoms from nicotine and have higher levels of stress hormones[3].
- The route of administration
  - Inhalation and intravenous injection routes offer quick onset, but the duration of effect is shorter.

The Risks of Using Substances at an Early Age

- 75% of patients in treatment programs began using substances before age 17[3]
- Alcohol and drug use changes the brain:
  - Alterations in brain maturation, specifically the frontal cortex
  - Cognitive impairments
  - Increases short and long-term chances of developing addiction[5]
- Marijuana decreases cognitive functions, such as attention, learning, and memory[6]
- Opiates (particularly overdoses) and alcohol use reduce the size of the hippocampus, which affects learning and memory[7,8]

Environmental Risk Factors for Addiction

- Home and family factors[3, 11]:
  - Family management problems
    - Lack of child supervision
    - Inconsistent and/or abusive punishment practices
  - Physical and/or sexual abuse
  - Emotional and/or physical neglect
  - Parental divorce
  - Parental approval of substance use
  - Family history of substance misuse

Environmental Risk Factors for Addiction

- Additional home and family factors[3]:
  - Easy access to substances
  - Community reinforcement of substance use amongst youth
  - Low socioeconomic status
  - Living in a community with high rates of crime, limited safe public spaces, and lack of connection to the area and neighbors

Environmental Risk Factors for Addiction

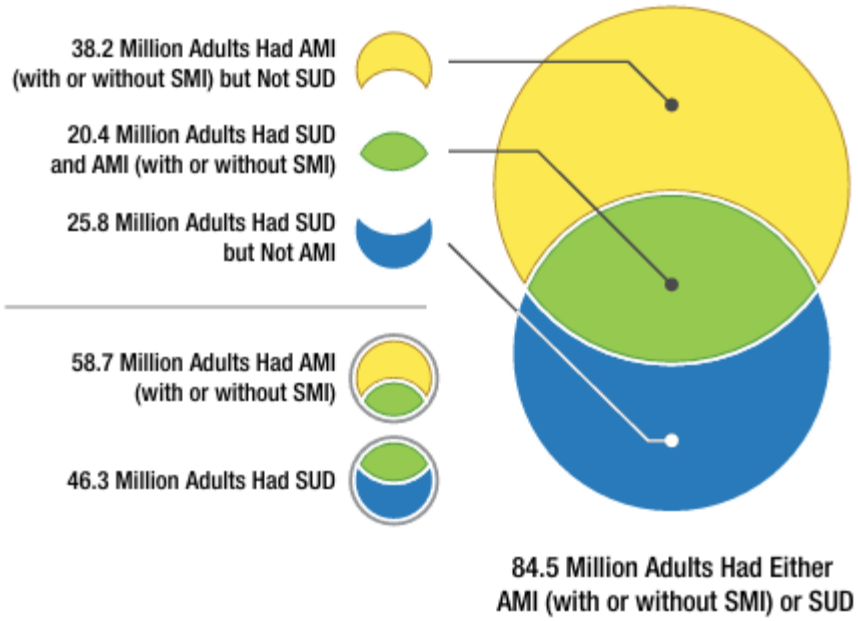
- Peers and school[3]:
  - Peer substance use or peers providing access to substances
  - Peer pressure to use substances
  - Poor grades in school
  - Lack of commitment to school
  - Social isolation[9]

Figure 7

Concurrent Mental Health Disorders

- Mental health disorders and substance use disorders have a two-way relationship.
- Why do these occur together?
  - Substance use may mask symptoms
  - Certain substances may trigger the development or exacerbation of a mental health disorder
  - Both mental health disorders and SUDs can be caused by overlapping factors, such as genetics, biology, and the environment[3]

Concurrent Mental Health Disorders



- In 2023, 1/3 of adults with any mental illness (AMI) also had a substance use disorder (SUD)[10].

Figure 8

Risk Factors for Addiction, Summary

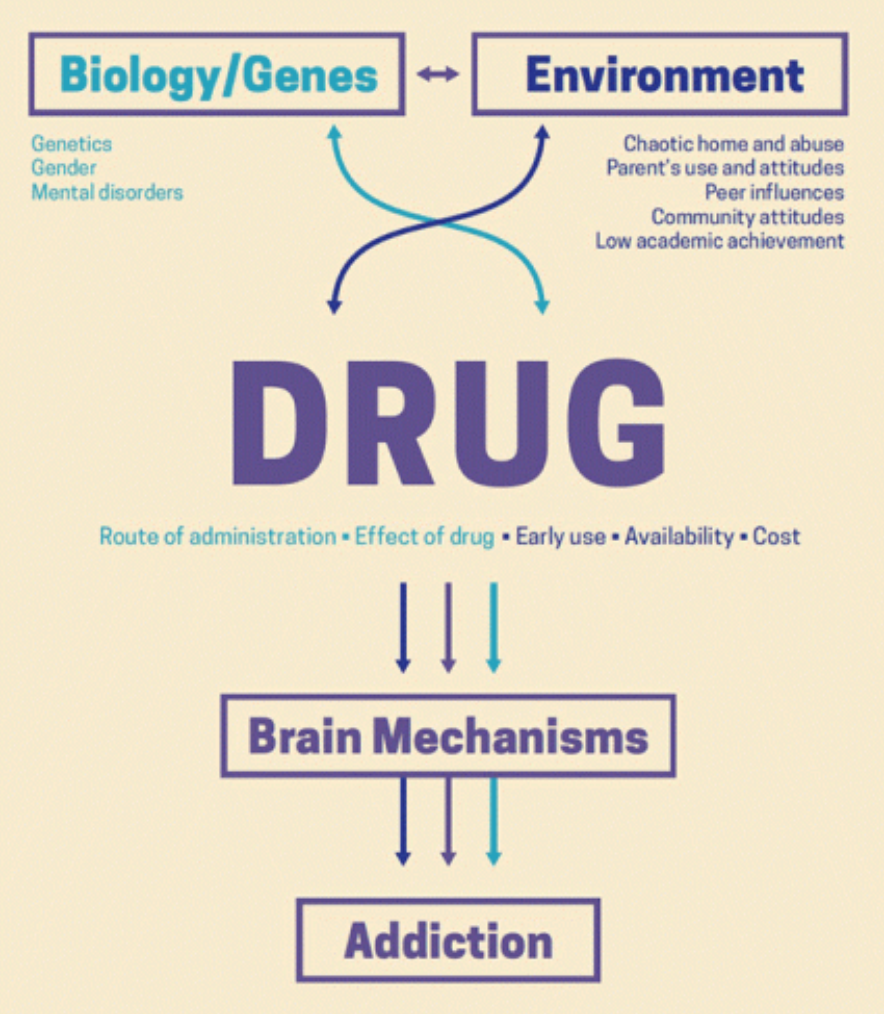


Figure 9

Drug Addiction versus Drug Dependence

Drug Addiction versus Drug Dependence

- **Drug dependence** is a condition that develops with the chronic use of a substance that causes a person to experience withdrawal symptoms if the substance is suddenly stopped[3].
- Also referred to as "physical dependence".
- Once patients withdraw, they do not crave these medications or feel the need to use them again.
  - Normal consequence of taking certain medications for weeks or years[12]
  - Examples of medications that cause dependence:
    - Antidepressants
    - Antihypertensives
    - Anticonvulsants
    - Corticosteroids

Drug Addiction versus Drug Dependence

- Recall that **addiction** refers to the loss of control over intense urges to use a substance despite negative consequences.
- People can feel withdrawal without being addicted, or may be addicted without feeling withdrawal symptoms.
- As part of the addiction cycle, the person will crave the substance and may re-use.
- Most patients prescribed opiates will develop dependence over time, but only 8% will develop addiction[12]

Case Study, cont.

- The patient has received an intranasal dose of naloxone, the respiratory rate and effort increase, and she begins to gag on the OPA.
- The patient is now responsive and able to provide additional history.
- History:
  - S: Smoked some fentanyl, felt "dizzy before passing out".
  - A: NKDA
  - M: Buprenorphine, when available
  - P: History of opioid use disorder and depression. New to the area.
  - L: "Maybe this morning."
  - E: "This came from a new dealer."
- Resistant to transport. Asks, "What are they going to do for me?"

The Role of EMS and Treatment Options

The Role of EMS in SUD Treatment

- We can use our unique role to support patients and their access to care.
- EMS providers may be the sole point of contact with the healthcare system for many patients.
- Transport/non-transport
- Discussing support and making referrals based on community resources

Figure 10

Why Don't People Seek Treatment?

- Not ready to stop using
- Do not have health care coverage or cannot afford it
  - 46% of SUD treatment facilities do not accept Medicaid
  - 38% of counties in the US do not have a SUD treatment facility that accepts Medicaid[13]
- Perceived negative effect on their job
- Perceived negative opinion from others (e.g., family, friends, neighbors)
- Do not know where to go for treatment
- Do not have transportation or the hours are inconvenient
- Complex medical needs

Screening as a Gateway for Treatment

- Screening
  - Simply ask about drug or alcohol use as it pertains to the chief complaint
  - Document drug paraphernalia or medication bottles on scene
  - Provide this information in a hand-off report to the ED
- SBIRT: Screening, Brief Intervention, and Referral to Treatment
  - Can be triggered by the EMS handoff
  - Required of all WA State Trauma-Designated hospitals
  - Interview includes the patient in a discussion of goals and values, assesses for motivation to decrease substance use, and sets goals to improve health.
  - Provides referrals to treatment.

Behavioral Therapies

- Help patients recognize the impact of their substance use on interpersonal relationships and ability to function in everyday life.
- Teaches and motivates patients to change their behaviors to control their substance use.
- Multiple models:
  - Individual versus family therapy
  - Once a week or multiple times per week
  - Range in length of time and may last several months or years
  - Inpatient, outpatient, or both

Treatment of SUD

- In WA, minors ages 13 and older can seek care for mental health and SUD services without parental consent[19].
  - This includes admission to both inpatient and/or outpatient programs.

Figure 11

Treatment of SUD, cont.

- "Ricky's Law" (HB 1713)
  - Passed in 2016
  - Patients who were at risk of harming themselves or others, or who were gravely disabled due to SUD, can be involuntarily committed under the Involuntary Treatment Act.
  - ITA patients are placed at a Secure Withdrawal Management and Stabilization facility (SWMS)
- Patients detained in SWMS facilities had:
  - Reduced hospitalizations
  - Greater engagement with treatment
  - Increased employment[20]

Treatment of Severe SUD

- Delivered in various settings depending on the treatment and how frequently it is needed.
- Can be inpatient, outpatient, or both.
- Levels of care:
  - Managed inpatient care
    - Intensive treatment, primarily for withdrawal management, frequent nursing care, and management of co-occurring physical and mental health conditions.
    - May occur in the hospital setting.
    - Treatment is 24-hours per day.

Figure 12

Treatment of Severe SUD, cont.

- Residential services
  - 24-hour setting outside of a hospital
  - Length of stay varies but may be months to years
  - Appropriate for those who:
    - Are medically stable
    - Need a living situation that supports recovery
    - Have a history of relapse
    - Have co-occurring physical and/or mental health conditions

Residential Services, cont.

- Services include:
  - Individual and group therapy
  - Medications
  - Physical and mental health treatment
  - Socialization
  - Vocational and legal support
  - Family counseling sessions
  - Facilitating participation in support groups

Treatment of Severe SUD, cont.

- Partial hospitalization and intensive outpatient services
  - For those who just completed a residential treatment program
  - Support is provided 6-8 hours a day
  - Provided short term (generally less than a month)
  - Clients can usually come and go from the building
  - Retain access to an interdisciplinary health care team
  - As an outpatient, may be visited frequently by mental health professionals for support and check-ins

Treatment of Severe SUD, cont.

- Outpatient services
  - Offered for groups and individuals
  - Hours may be variable to meet patient needs
  - Visitation by mental health professionals may be included
  - Virtual visits may be offered

Figure 13

Medications

- Buprenorphine – partial opiate agonist leading to decreased respiratory depression and euphoria[14].
  - Treats withdrawal symptoms and cravings
- Can be initiated in the ED and in some locations in the field.
- What do we know about starting buprenorphine in the ED?
  - Decreases:
    - Acute care visits
    - Hospital admissions
    - The use of non-prescribed opiates
    - All-cause mortality by 50%
  - Requires either prescription or close follow-up for additional doses

Medications, cont.

- Bup in the Field[15-17]
  - Patients experience decreased withdrawal symptoms
  - 6x greater chance of engagement with OUD treatment within 30 days of EMS encounter
  - No difference in repeat OD based on limited data available
  - Some patients linked with Substance Use Navigators who arranged and monitored follow-up
- In WA: Bup is now approved for paramedic administration.

Medications, cont.

- Methadone – synthetic opioid analgesic that is longer-acting with lower risk of overdose.
  - Used for withdrawal and long-term maintenance of abstinence of opioid addiction.
  - Dispersed only at state-approved opioid treatment centers.
- Naltrexone – opioid antagonist that blocks opioid receptors, reduces cravings, and diminishes reward-effect of opioids and alcohol.
  - Can be used to reduce heavy drinking
  - Available orally or as a once-monthly IM injection (Vivitrol)

Medications, cont.

- Acamprosate – synthetic amino acid and neurotransmitter analogue.
  - Used for the maintenance of alcohol abstinence and is usually started after someone has stopped drinking
  - Oral medication
- Disulfiram (Antabuse) - alcohol antagonist.
  - Causes severe physical reactions when alcohol is ingested, such as nausea, diaphoresis, and palpitations.
  - Works as a deterrent to avoid the unpleasant effects.
  - Oral medication

Reducing Harm Through Public Education

- EMS involvement in harm reduction strategies
  - Leave-behind naloxone
  - Needle exchanges
  - Medication-Assisted Treatment Program education
  - Proper disposal of unused/expired medications
  - Referrals for support
  - Removing barriers to accessing care
  - Training on recognizing overdose and administering naloxone
  - Mentoring and supporting SUD programs for youth

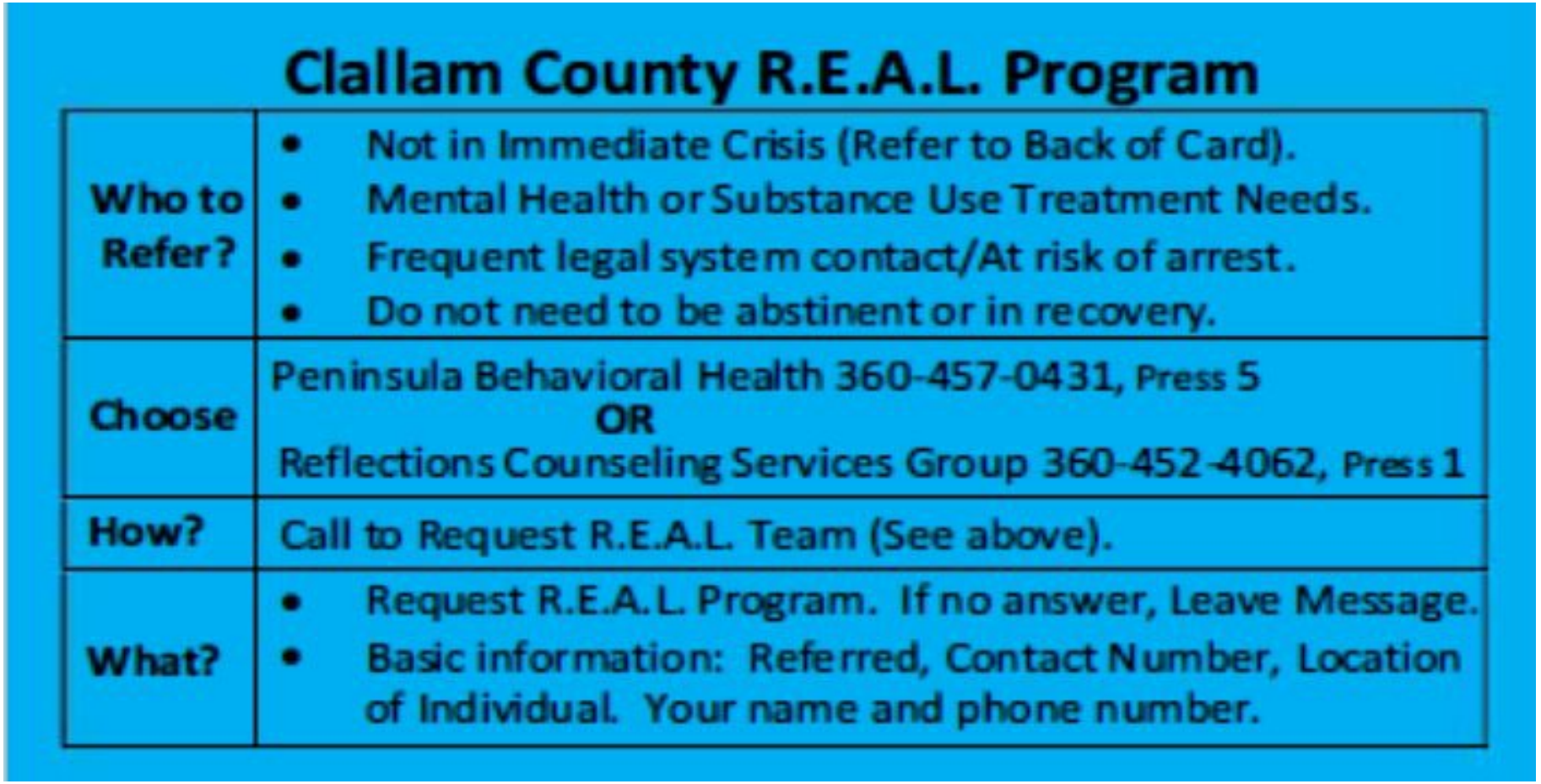
Outreach

- Post-Overdose Response Teams (PORT)
  - May respond directly to an overdose call, or respond afterwards
  - May be fire or law enforcement-based
  - Team members vary, but typically do not include law enforcement
    - Community Paramedics
    - Firefighter/Paramedic or Firefighter/EMT
    - Peer support
    - Mental health clinicians
    - Advance Practice Providers
  - Roles are to provide education, referrals, naloxone, family support

Outreach, cont.

- Recovery Navigator Programs
  - Requirement of every behavioral health organization in WA
  - Also referred to as a "R.E.A.L." Program
    - Recovery.Empowerment.Advocacy.Linkage
  - Intended to provide referral and response for patients presenting with substance use or co-occurring needs
  - Intended to be staffed by peer supporters with lived experience
    - Goal is 24/7 support
    - 15-minute response times
  - Trauma-informed and culturally inclusive
  - Not for ITAs

Outreach, cont.



Clallam County R.E.A.L. Program

Who to Refer?	• Not in Immediate Crisis (Refer to Back of Card). • Mental Health or Substance Use Treatment Needs. • Frequent legal system contact/At risk of arrest. • Do not need to be abstinent or in recovery.
Choose	Peninsula Behavioral Health 360-457-0431, Press 5 **OR** Reflections Counseling Services Group 360-452-4062, Press 1
How?	Call to Request R.E.A.L. Team (See above).
What?	• Request R.E.A.L. Program. If no answer, Leave Message. • Basic information: Referred, Contact Number, Location of Individual. Your name and phone number.

Figure 14

Outreach, cont.

- Community Paramedics/CARES Teams
  - Referrals do require consent
  - Composition of the team varies by department

Figure 15

Outreach, cont.

- Adult Protective Services
  - Their job is also to provide resources!
  - Connect with local services
  - 1-877-734-6277
  - Report online through DSHS
    - Can report anonymously

Outreach, cont.

- 988 Suicide & Crisis Hotline
  - Offers emotional support as well as support for alcohol and drug concerns
  - Free, confidential, 24/7
  - Call, text, chat feature online (988lifeline.org)
  - For veterans, call 988 and press 1
    - Text "938255"
    - Chat online at veteranscrisisline.net
- Medical support
  - Free clinics
  - SUD groups (e.g., AA, NA)

Washington Recovery Help Line

- Free for Washington residents
- Support for substance use, mental health, and gambling
- 24/7
- 866-789-1511
- Anonymous and confidential
- https://www.warecoveryhelpline.org/
  - Resources for MOUD
  - SUD
  - Mental Health
  - Harm Reduction
  - Marijuana
  - Gambling

Prevention

Most adults with SUD starting using during the teenage years.

Risk Factors	Prevention Strategies[18]
Early exposure and attitude regarding substances	Parental support and education
Experiences to trauma and concurrent mental health disorders	Access to counseling and psychiatric care
Low parental supervision	Parental support and neighborhood/community/school resources
Access to drugs in school	School anti-drug policies and education
Poverty and lack of access to healthcare	Economic programs

Case Study, Resolution

- Your patient is resistant to transport and wants to know how going to the hospital will benefit her.
- Based on what you know now, what resources could your hospital provide to the patient?
- Based on your community resources, are there alternatives to seeking hospital treatment?
- If you have alternate destinations in your protocols, where would you recommend taking this patient?

Questions?

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