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Women's Health Clinical Education Series:

Neonatal Abstinence Syndrome

Neonatal Opioid Withdrawal Syndrome

Where are we today?

Monica Hajdena-Dawson, MD
November 2025

NAS/NOWS rates increased by 75% since 2010

jamanetwork.com

Opioid related overdoses are now a leading cause of death associated with pregnancy and postpartum period

nida.nih.gov

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Agenda

1. **Substance Use Disorder**
   a. Substance Use in Pregnancy
2. **NAS/NOWS**
3. **Treatment Options**

Objectives

- Understand Neonatal Abstinence Syndrome (NAS) and Neonatal Opioid Withdrawal Syndrome (NOWS) by defining these conditions, identifying their clinical manifestations, and exploring both pharmacological and non-pharmacological treatment options.

- Compare the ESC (Eat, Sleep, Console) approach with the traditional Finnegan scoring system and morphine treatment for managing Neonatal Abstinence Syndrome (NAS). This includes understanding the principles and methodologies of each approach, evaluating their effectiveness, and exploring their impact on clinical outcomes.

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Disclosures

- I have nothing to disclose

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Dr Monica Hajdena-Dawson

- Neonatologist for over 25 years
- NRS Medical Director, Women's Health team lead
- Optum since 2013
- Clinical Interest: NAS, Integrated Health, Women's Health
- Reside in Dover, Idaho
- Married with 4 adult children and two pets

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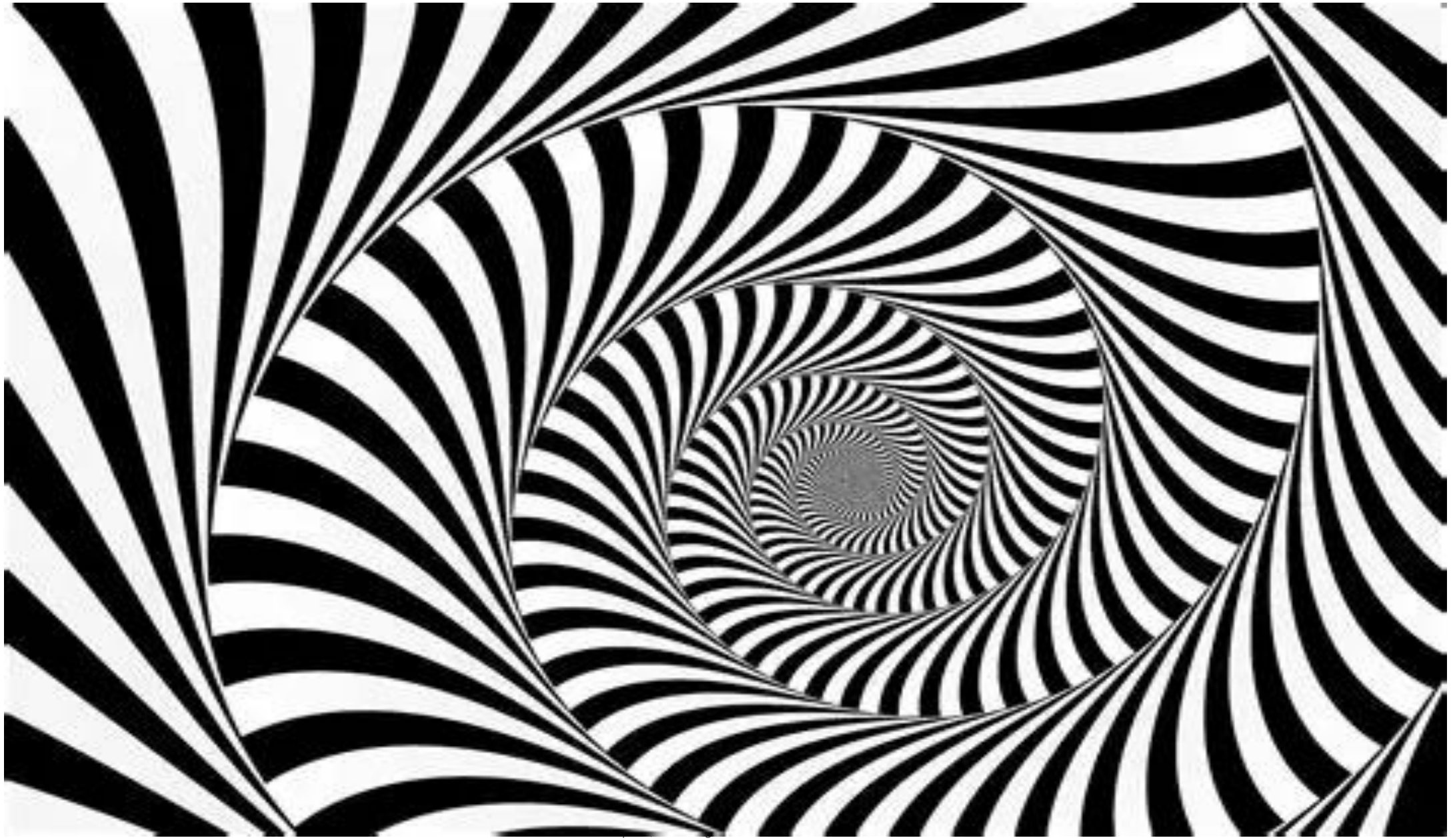
Substance Use Disorder

SUBSTANCE USE DISORDER



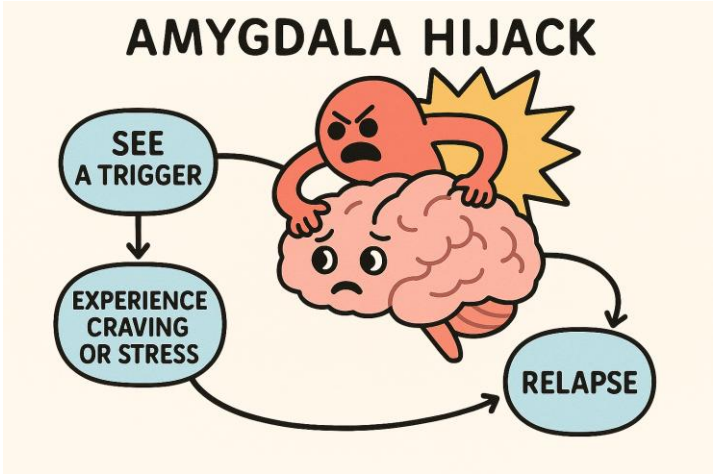
wallpapercave.com

SUBSTANCE USE DISORDER

- Substance Use Disorder (SUD) or addiction→chronic medical condition of the brain

- Repeated exposure to substances triggers changes to portions of the brain

- An addicted brain reacts with a type of Amygdala Hijack
  - Responds more to drug cues and less to non-drug rewards
  - Increased sensitivity to stress
  - Weakened self regulation



- Brain changes→difficult to stop using substances despite recognizing the harm

EFFECTS OF ADDICTION ON THE BRAIN

Prefrontal Cortex Dysfunction

The prefrontal cortex loses effectiveness, causing poor judgment and reduced impulse control in addiction.

Reward System Overstimulation

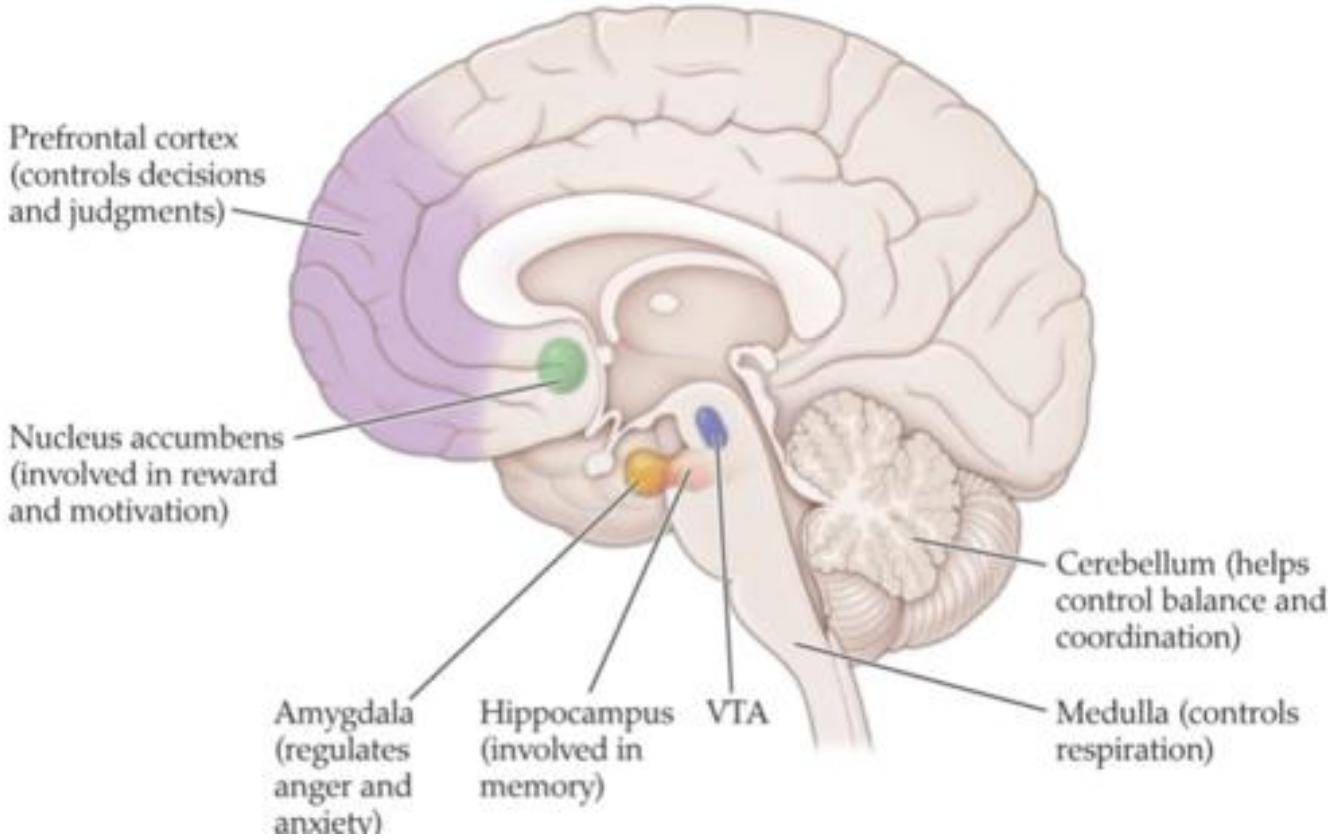
The nucleus accumbens is overstimulated by addictive substances, reinforcing drug-seeking behaviors.

Emotional Reactivity

The amygdala becomes highly reactive to drug-related cues, increasing cravings and stress response.

Memory Associations

The hippocampus strengthens memory links between drug use and environmental cues contributing to addiction.



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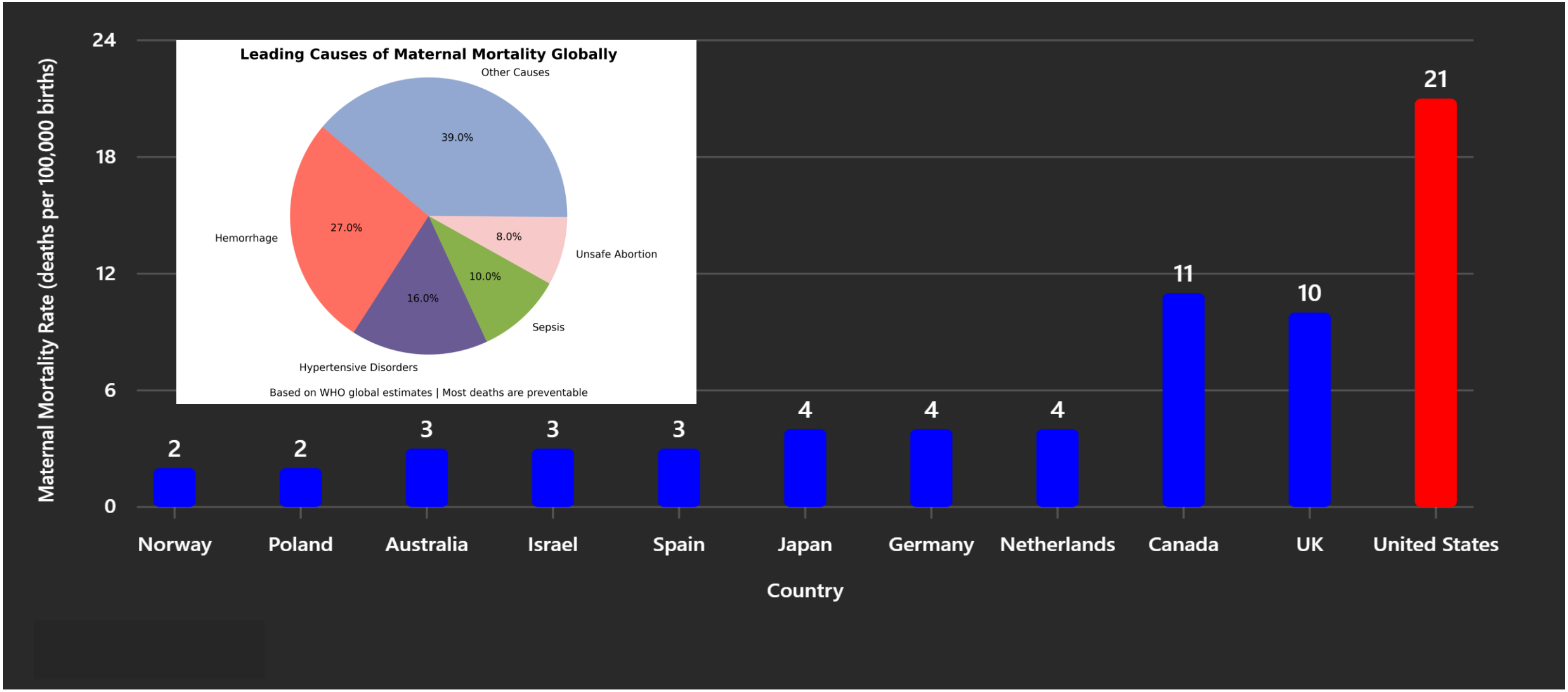
Substance Use Disorder in Pregnancy

Maternal Mortality Rates in Developed Countries 2025



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•World Health Organization (WHO). *Maternal Mortality Fact Sheet*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/maternal-mortality
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•Centers for Disease Control and Prevention (CDC). *Maternal Mortality Rates in the U.S. (2023)*. Retrieved from https://www.cdc.gov/nchs/data/hestat/maternal-mortality/2023/maternal-mortality-rates-2023.htm
•Commonwealth Fund. *Maternal Mortality in the United States (2025)*. Retrieved from https://www.commonwealthfund.org/publications/issue-briefs/2025/jul/maternal-mortality-united-states-2025

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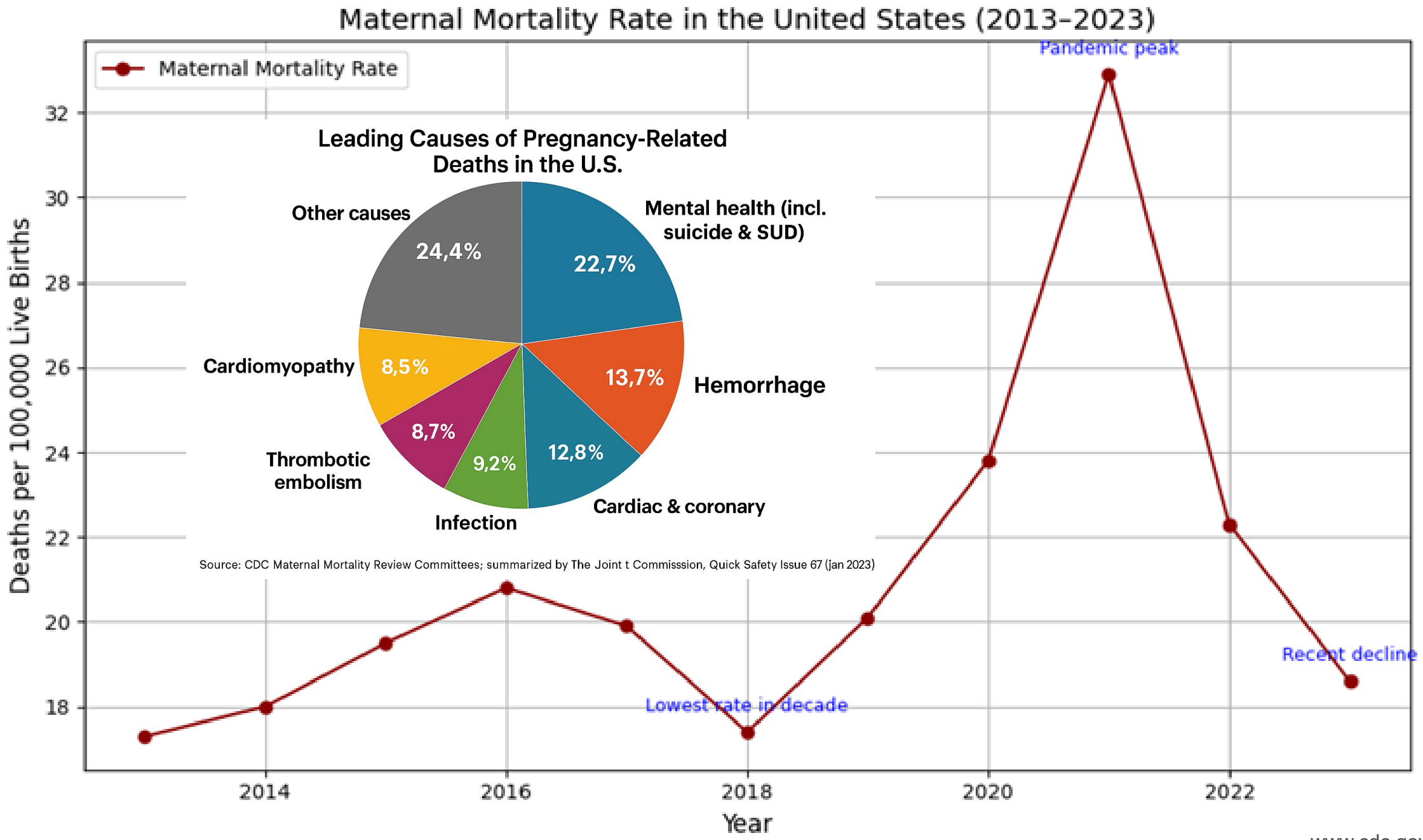
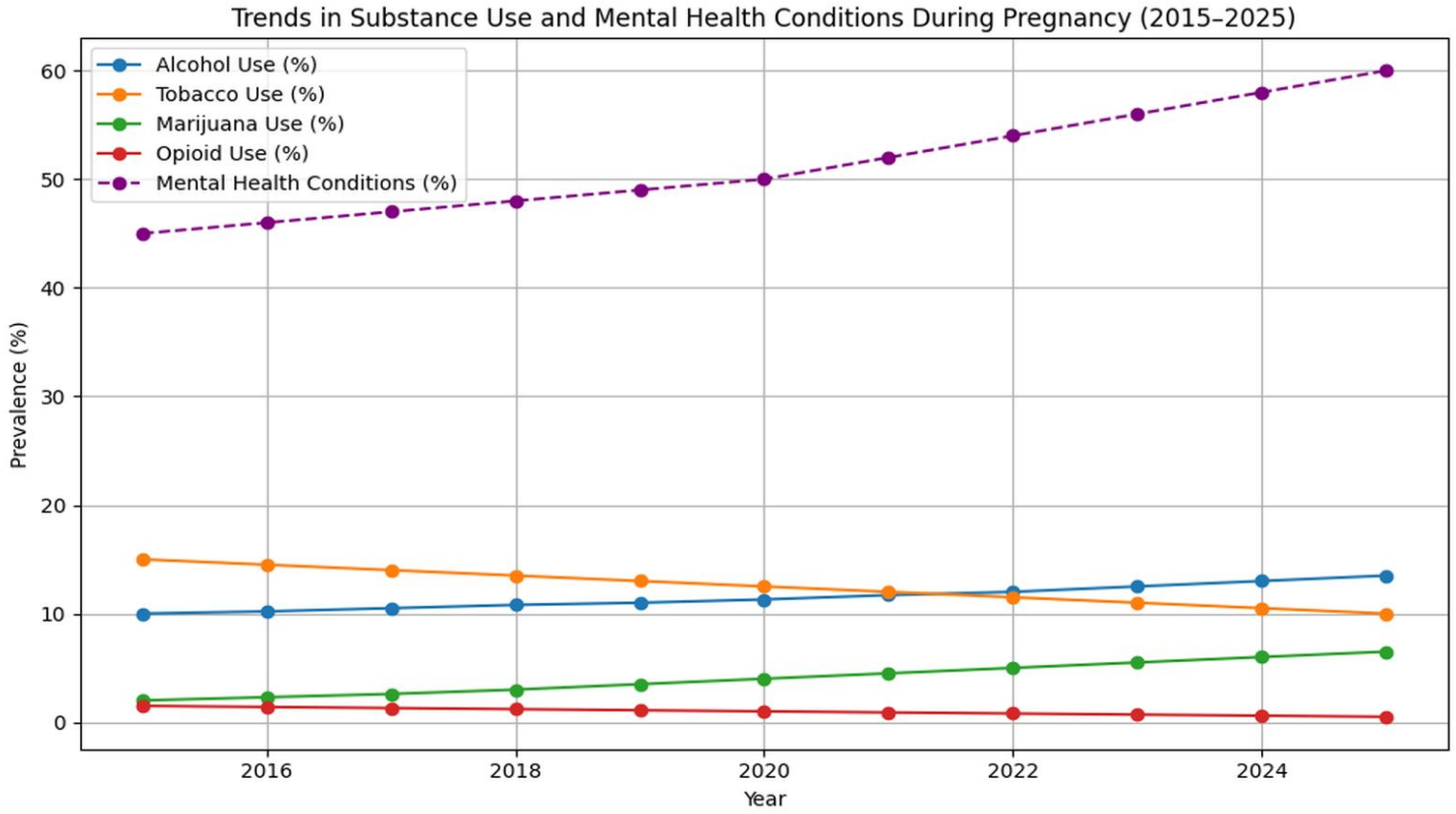

Maternal Mortality Rate in the United States (2013–2023)
Maternal Mortality Rate
Deaths per 100,000 Live Births
Year
Pandemic peak
Lowest rate in decade
Recent decline
Leading Causes of Pregnancy-Related Deaths in the U.S.
Other causes
24,4%
Mental health (incl. suicide & SUD)
22,7%
Cardiomyopathy
8,5%
Hemorrhage
13,7%
Thrombotic embolism
8,7%
Infection
9,2%
Cardiac & coronary
12,8%
Source: CDC Maternal Mortality Review Committees; summarized by The Joint t Commisssion, Quick Safety Issue 67 (jan 2023)

www.cdc.gov

SUBSTANCE USE DISORDER IN PREGNANCY

- 8-14% of pregnant women in the US report substance use
- Up to 60% suffer from mental health conditions—particularly depression and anxiety.
- 75% of affected women remain untreated
- 84% of birthing aged women live in areas with maternal mental health provider shortages



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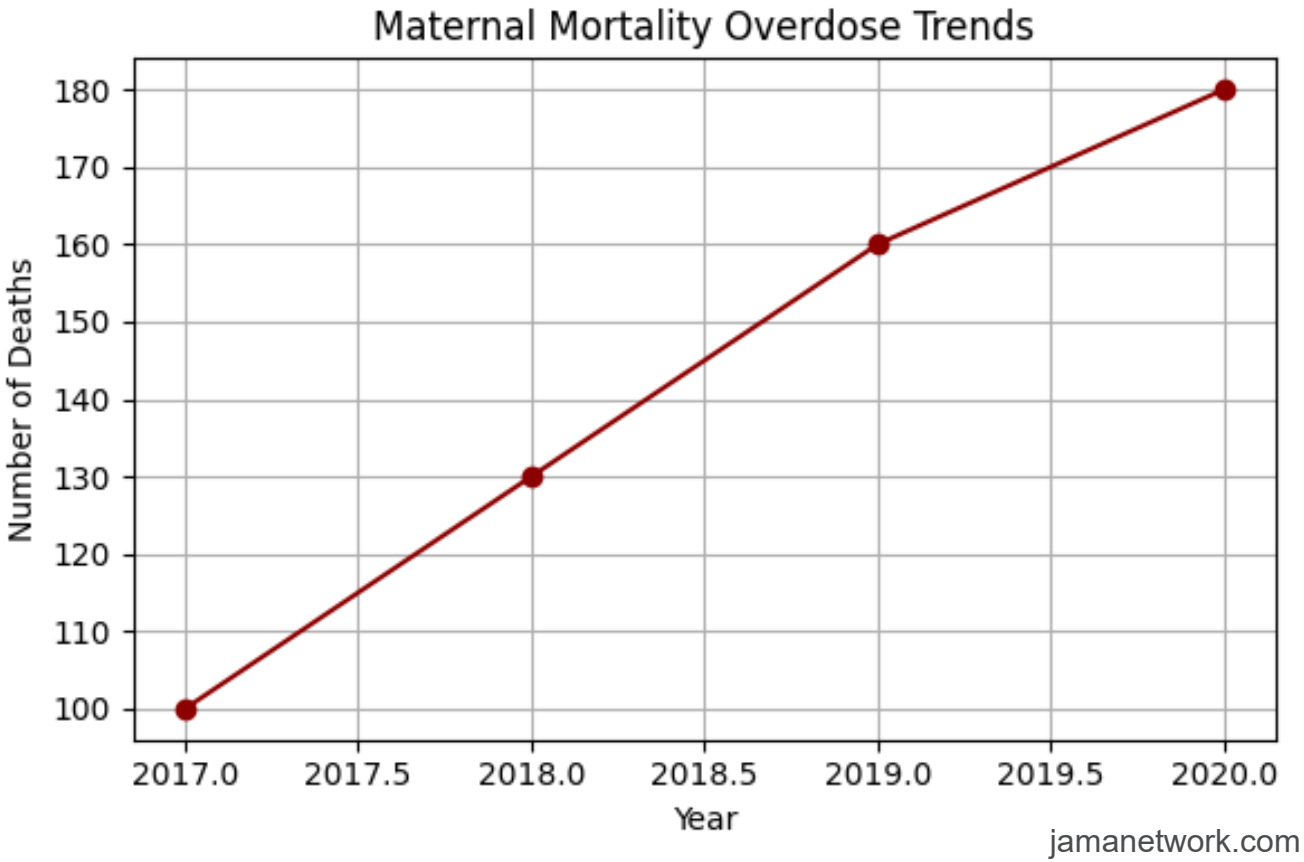
SUBSTANCE USE DISORDER (SUD) IN PREGNANCY



jamanetwork.com

- Substance use is a leading cause of maternal death, especially opioid-related overdoses
- Maternal mortality from overdoses rose by over 80% between 2017 and 2020
- Maternal morbidity is 1.5x higher and neonatal complications 2x higher with substance use
- Fentanyl and heroin are major contributors

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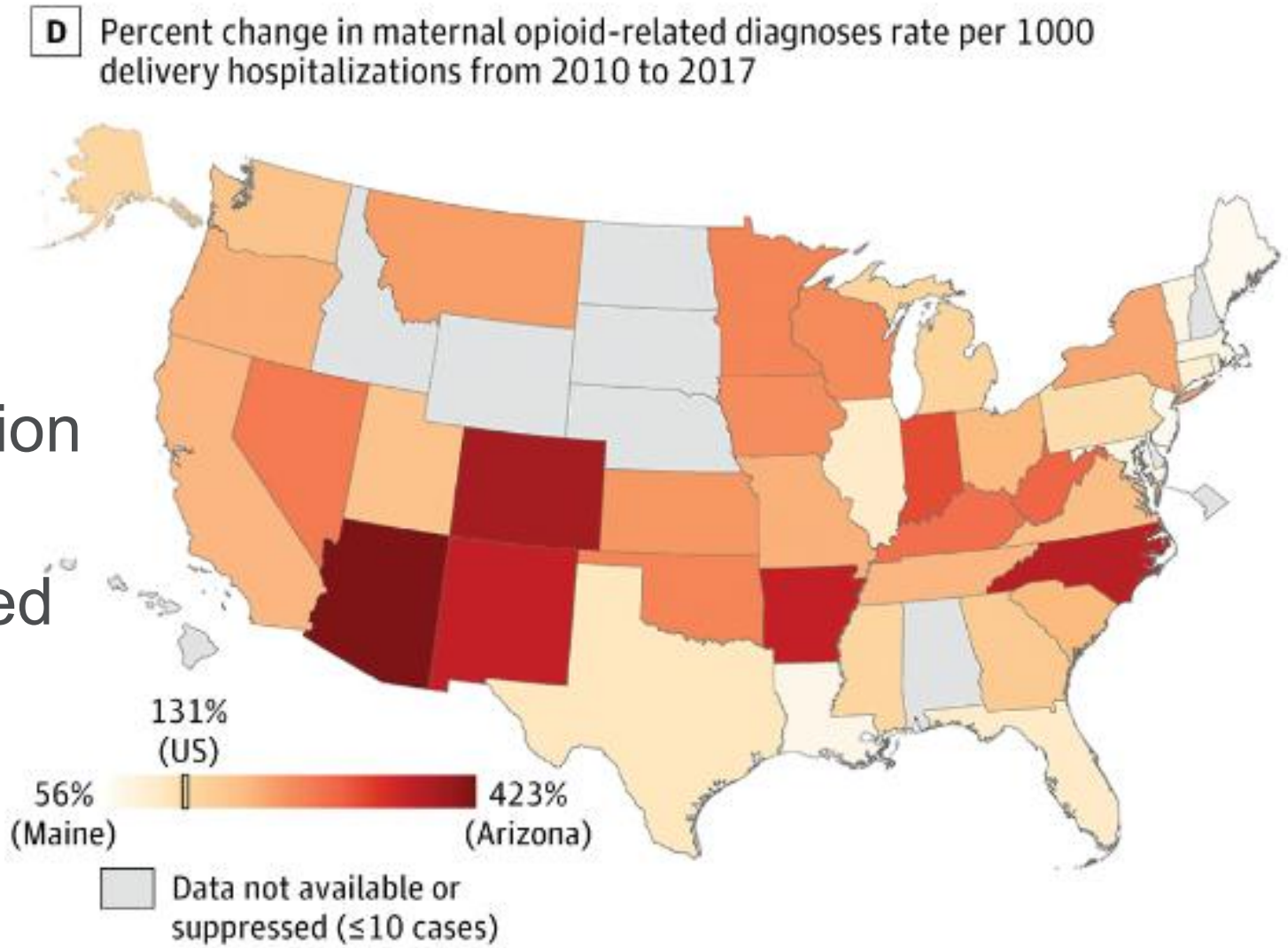
Opioid Use in Pregnancy

2019 self-reported data:

- 7% of women used prescription opioids during pregnancy
- 1 in 5 of those women reported Misuse
  - ➢ Opioid obtained from non-healthcare provider



Vital Signs: Prescription Opioid Pain Reliever Use During Pregnancy — 34 U.S. Jurisdictions, 2019 | MMWR

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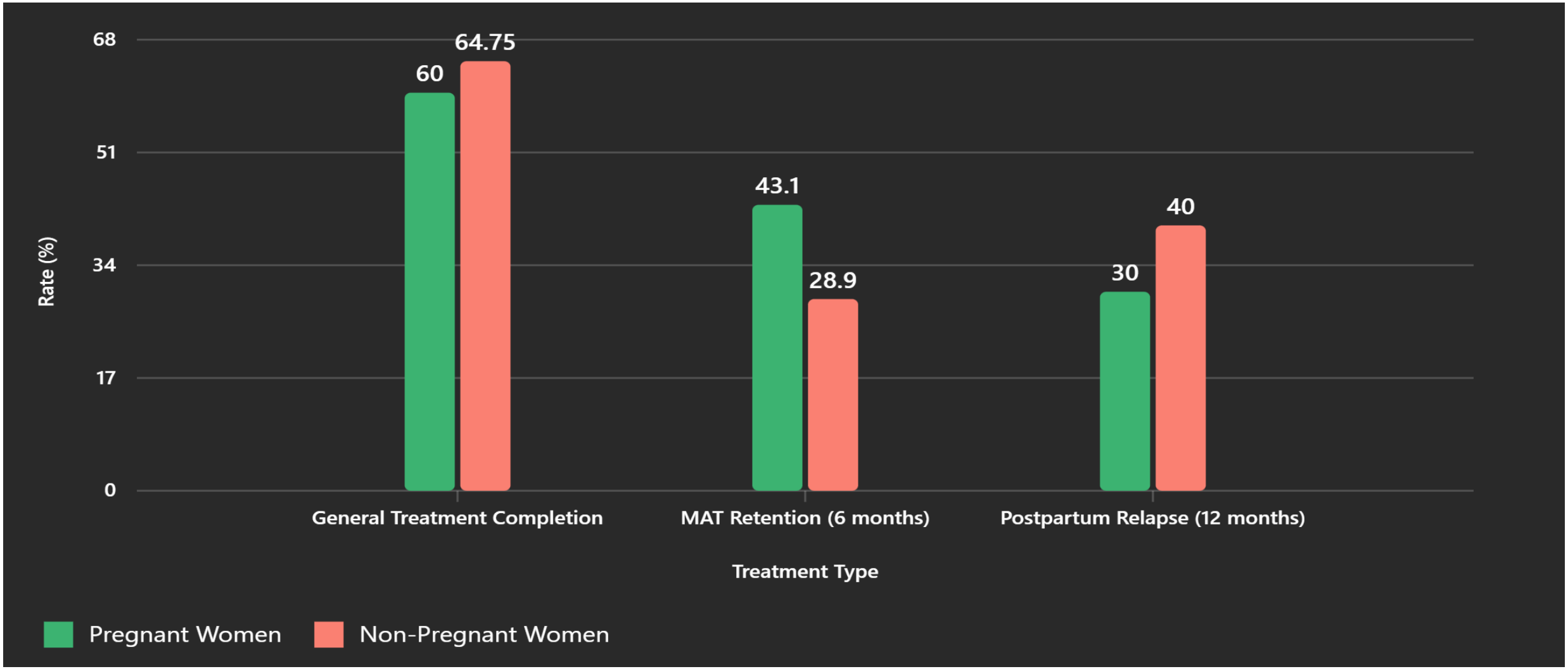
Success Rates of Recovery in Pregnant versus Non-Pregnant Women



MAT: Medication-Assisted Treatment

Sources: General Treatment Completion: Journal of Substance Abuse Treatment (2018)MAT Retention (6 months): JAMA Network Open (2025)Postpartum Relapse: SAMHSA & Maternal Health Studies

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Commonly Abused Substances

Category	Substance	Street Names
Alcohol	Alcohol	Booze, Juice, Hooch, Sauce, Rotgut
Cannabis	Marijuana	Weed, Pot, Mary Jane, Ganja, Chronic, Trees, Herb, Bud, Skunk
	Hashish	Hash, Boom, Dabs, Gangster, Hemp
	Synthetic Cannabinoids	Spice, K2, Black Mamba, Bliss, Fake Weed, Moon Rocks
Stimulants	Cocaine	Blow, Coke, Snow, Charlie, Yayo, Nose Candy
	Crack Cocaine	Rock, Candy, Nuggets, Moon Rocks
	Methamphetamine	Ice, Crystal, Tina, Crank, Glass, Go Fast, Pookie, Scooby Snacks
	MDMA	Ecstasy, Molly, E, X, Disco Biscuits, Beans
	Prescription (Adderall, Ritalin)	Addys, Smart Pills, Study Buddies, Bennies, Black Beauties
Depressants	Benzodiazepines (Xanax, Valium)	Bars, Xannies, Benzos, Downers, Tranks, Blue Vs
	Barbiturates	Reds, Yellow Jackets, Goof Balls, Phennies
	Sleep Meds (Ambien, Lunesta)	Zombie Pills, Sleep Easy, Forget-Me Pill
Opioids	Heroin	Smack, H, Dope, Horse, Brown Sugar, China White, Tar
	Fentanyl	Apache, China Girl, Murder 8, Tango & Cash, Jackpot
	Oxycodone	Oxy, Percs, Hillbilly Heroin, Roxy, Kickers
	Hydrocodone	Vikes, Hydros, Watson-387
	Methadone	Dolls, Amidone, Fizzies
	Codeine	Cody, Schoolboy, Lean, Purple Drank, Sizzurp
	Tramadol	Chill Pills, Trammies
Hallucinogens	LSD	Acid, Tabs, Sugar Cubes, Yellow Sunshine
	Psilocybin (Magic Mushrooms)	Shrooms, Boomers, Caps, Pizza Toppings
	DMT	Dimitri, The Spirit Molecule
	PCP	Angel Dust, Rocket Fuel, Peace Pill
	Ketamine	Special K, Cat Valium, Jet, Vitamin K
	Salvia	Sally-D, Magic Mint, Diviner's Sage
	Mescaline	Peyote, Buttons, Cactus, Mesc

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Commonly Used Drugs Charts | National Institute on Drug Abuse (NIDA) (nih.gov)

Commonly Abused Substances

Category	Substance	Street Names
Inhalants	Nitrous Oxide	Whippets, Laughing Gas, Sweet Air, Hippy Crack
	Amyl Nitrite	Poppers, Pearls, Aroma of Men
	Household solvents	Rush, Snappers, Dusters, Gluey
OTC Medications	Dextromethorphan (DXM)	Robo, Skittles, Triple C, Poor Man's PCP
	Diphenhydramine (Benadryl)	DPH, Zombie Pills
	Pseudoephedrine	Suds, Chalk, Speed
	Loperamide	Lope
	Dimenhydrinate	Dime Tabs, Substance D
Herbal Substances	Kratom	Biak-Biak, Ketum, Herbal Speedball
	Khat	Abyssinian Tea, African Salad, Chat, Qat
	Ayahuasca	Aya, Yagé, Hoasca
	Peyote	Black Button, Green Button, Shaman
Steroids	Anabolic Steroids	Juice, Roids, Gym Candy, Stackers
Caffeine	Energy drinks, pills	No common street names; sometimes referred to as "uppers"

Commonly Used Drugs Charts | National Institute on Drug Abuse (NIDA) (nih.gov)

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Neonatal Abstinence Syndrome (NAS)

Neonatal Opioid Withdrawal Syndrome (NOWS)

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Onset, Duration,and Frequency of NAS Caused by Various Substances

Drug	Onset, h	Frequency, %	Duration, d
Opioids			
Heroin	24–48	40–80[27]	8–10
Methadone	48–72	13–94[37]	Up to 30 or more
Buprenorphine	36–60	22–67[46,48]	Up to 28 or more
Prescription opioid medications	36–72	5–20[56,60]	10–30
Nonopioids			
SSRIs	24–48	20–30[64]	2–6
TCAs	24–48	20–50[64]	2–6
Methamphetamines	24	2–49[101]	7–10
Inhalants	24–48	48[70]	2–7

•*Pediatrics* (2014) 134 (2): e547–e561.
•https://doi.org/10.1542/peds.2013-3524

HOW DID WE GET HERE?

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN®

From: **Neonatal Abstinence Syndrome**

Pediatrics. 2014;134(2):e547-e561. doi:10.1542/peds.2013-3524

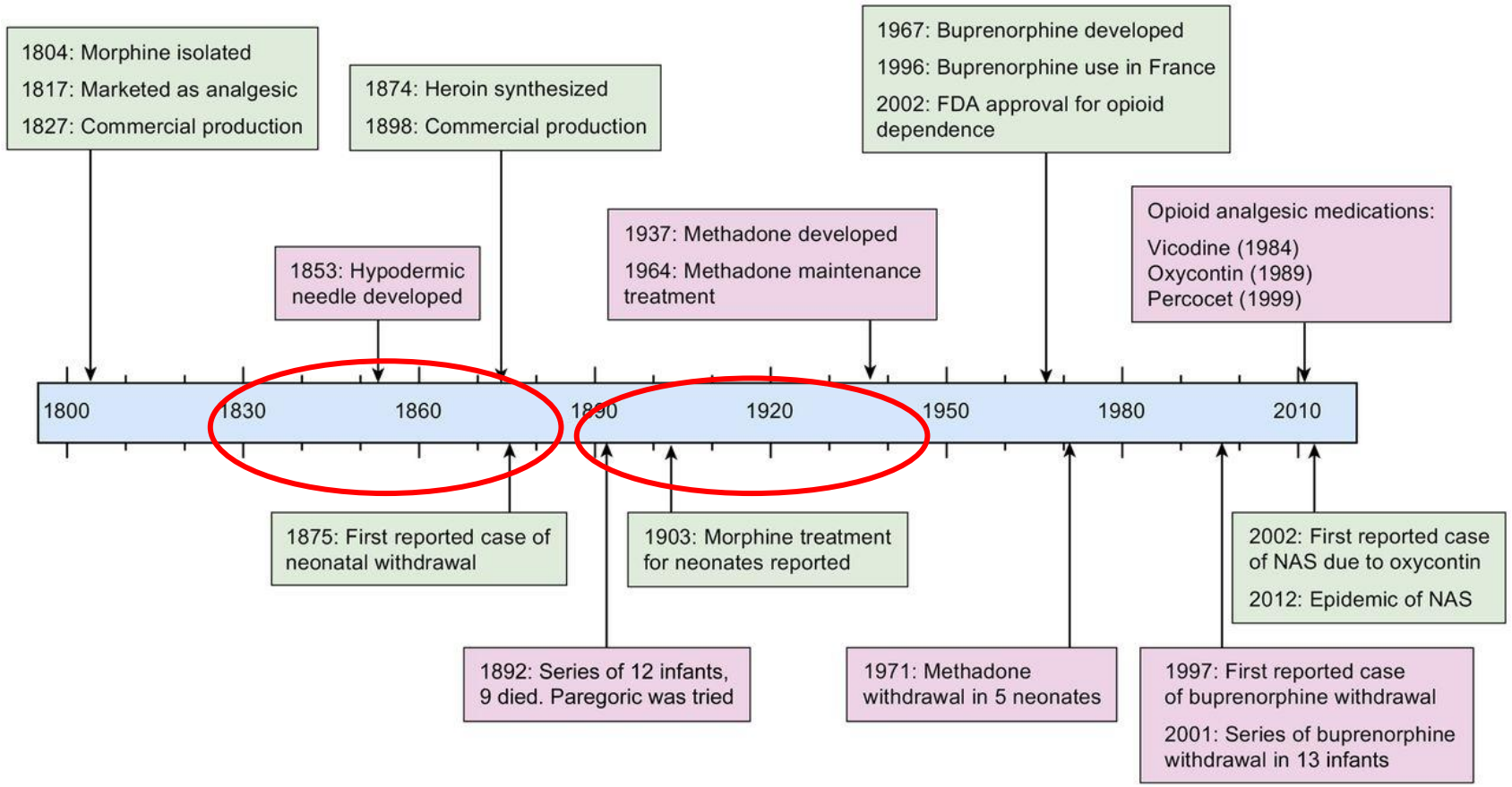
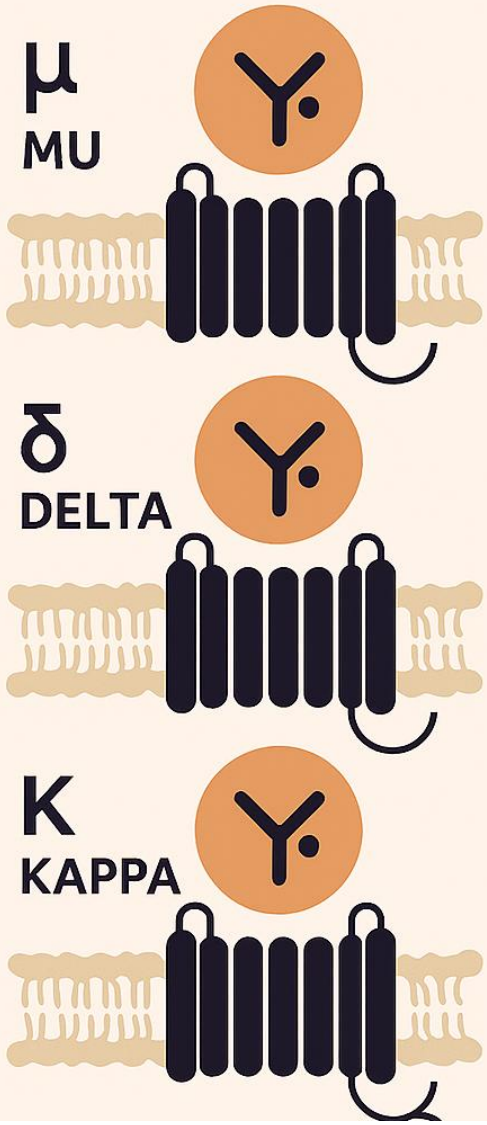


Figure Legend:

Time line of NAS. FDA, Food and Drug Administration.

OPIOID RECEPTORS

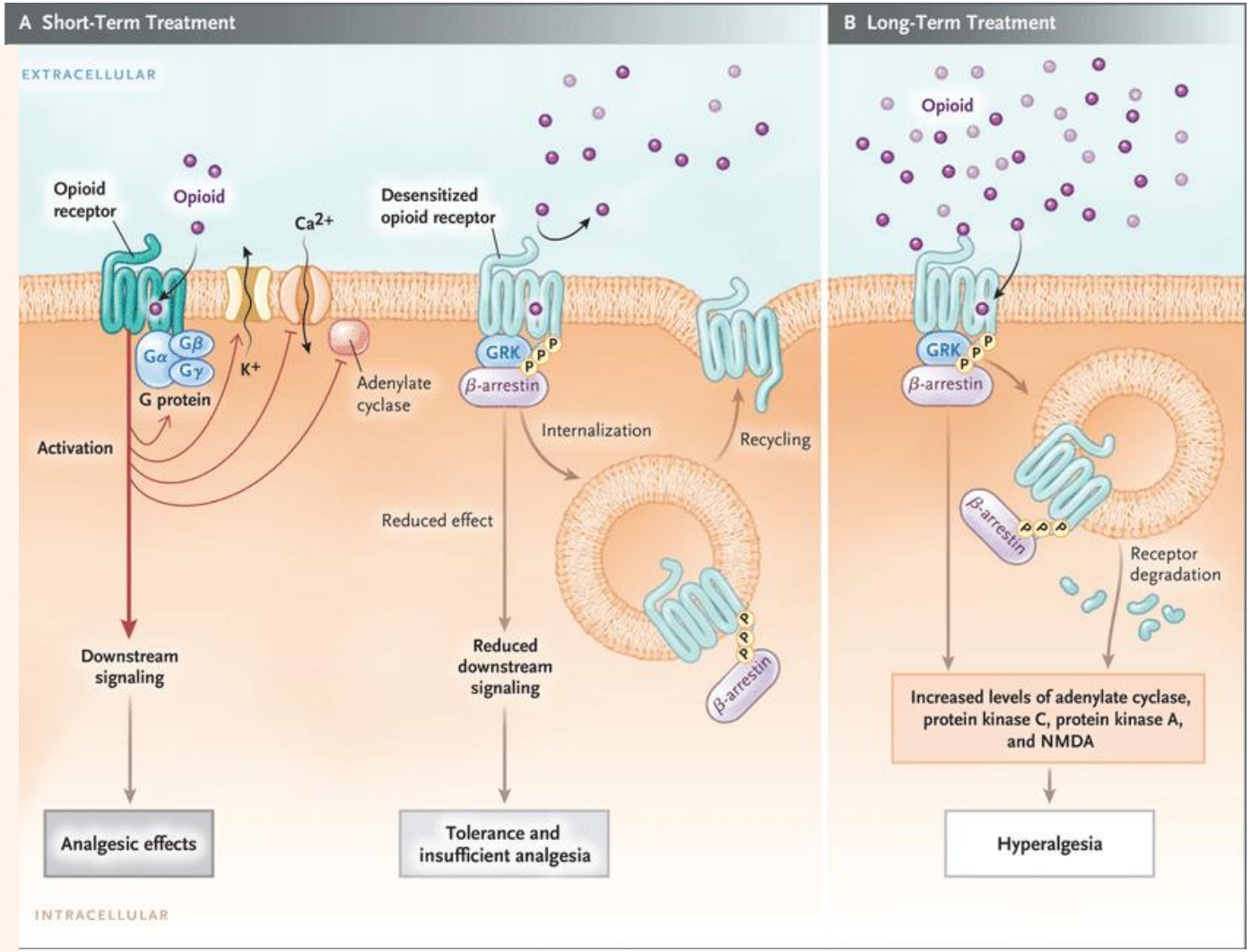


SECOND MESSENGERS

- CAMP
- K^+ CONDUCTANCE

BIOLOGICAL EFFECTS

- ANALGESIA
- SEDATION
- RESPIRATORY DEPRESSION
- EUPHORIA



Martyn, J.A. & Mao, Jianren & Bittner, Edward. (2019). Opioid Tolerance in Critical Illness. New England Journal of Medicine. 380. 365-378. 10.1056/NEJMra1800222.

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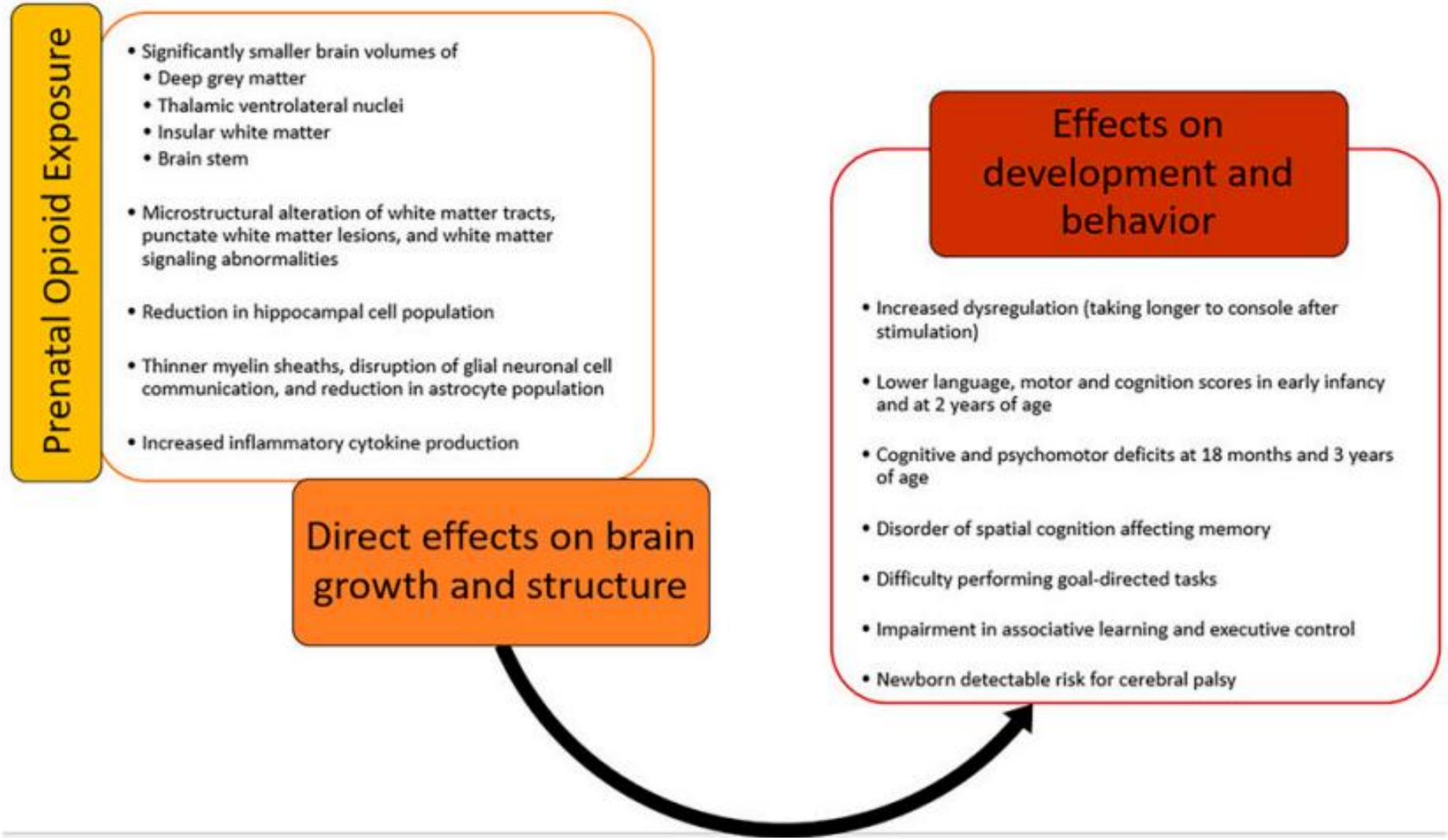
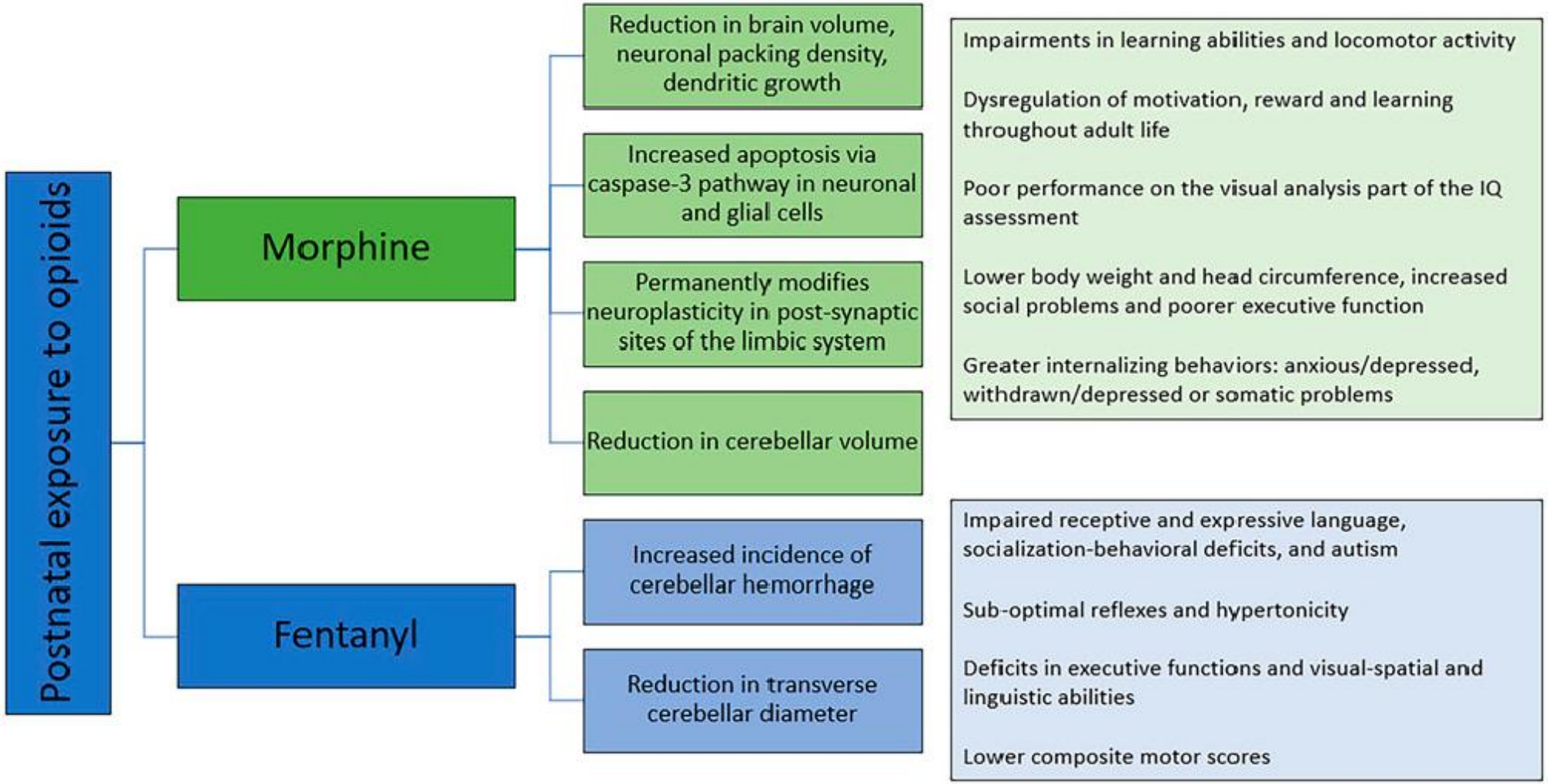
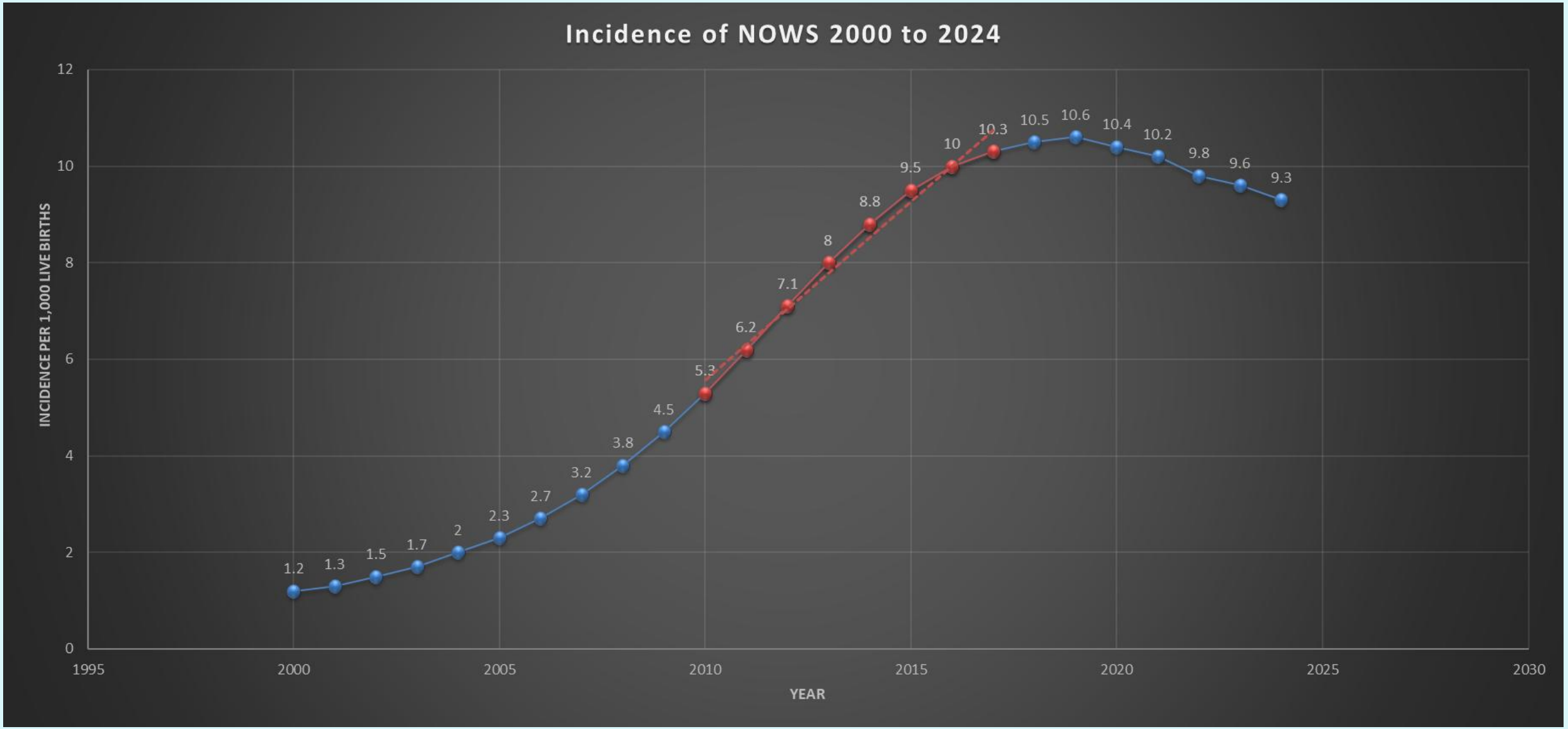
Prenatal Exposure to Opioids



Postnatal Exposure to Opioids





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Sources Referenced:

- American Academy of Pediatrics (AAP)
- CDC MMWR Surveillance Report
- Pennsylvania Department of Health NAS Report

Treatment:

Traditional versus Eat Sleep Console

Rose is 28 yo G3P2 mom with history of substance use

- 14 yo when she started using alcohol
- Her mom is a substance user and a chaotic home environment
- Drug history includes alcohol, fentanyl and amphetamines
- Previous children are in foster care.

Rose decided this time to make a change for her and her unborn child

- Goes to her OB for prenatal care
- Discusses her substance use with her OB and her desire to go into treatment
- Warm hand off to a behavioral health care provider at first OB visit
- Rose enrolled in a recovery program

Rose delivers vaginally a healthy term newborn

- MAT (medication-assisted treatment) with buprenorphine during pregnancy
- Fully engaged with her providers and substance recovery program
- Has good family support
- Baby initially in newborn nursery but at 12 hours showing signs of withdrawal
  - Tachypnea
  - Elevated temperature
  - Irritability

Traditional Treatment

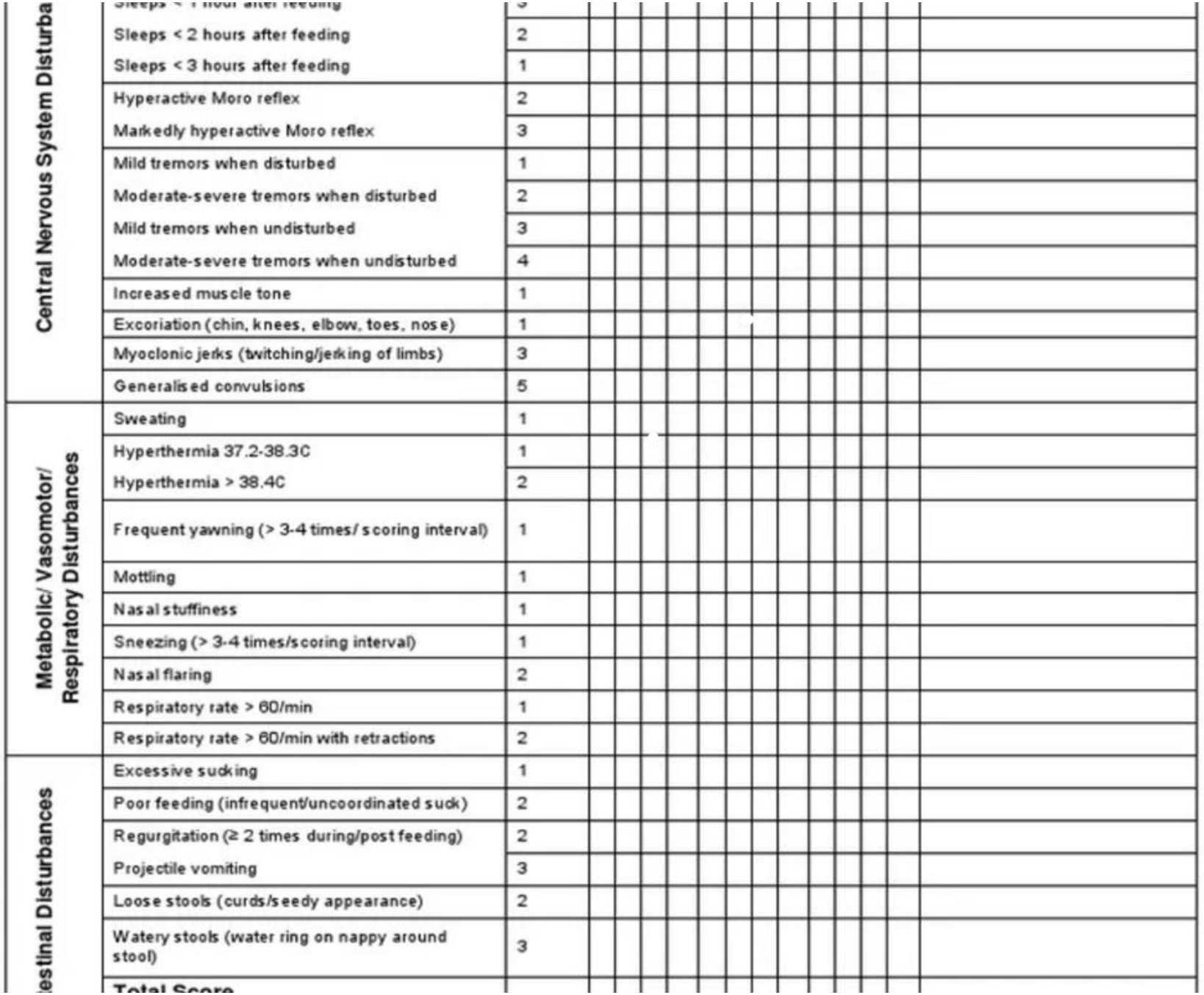
- Baby taken to neonatal intensive care nursery for Finnegan scoring
- Baby with scores >12 on next 2 assessments and baby started on morphine
- Morphine dose increased due to continued high scores until baby's symptoms stabilize 48 hours later
- Baby unable to eat well and started on gavage feedings
- Mom visits but is not encouraged to engage with baby
- Staff does all cares for the baby
- Mom feels disconnected and unwelcome and ultimately stops visiting
- Baby requires 6 weeks of hospitalization
- Baby discharges to foster care

NOWS Traditional Approach

NICU admission

Finnegan Scoring or Modified Finnegan Scoring

Finnegan Scoring Tool



Central Nervous System Disturba	Sleeps < 2 hours after feeding	2
	Sleeps < 3 hours after feeding	1
	Hyperactive Moro reflex	2
	Markedly hyperactive Moro reflex	3
	Mild tremors when disturbed	1
	Moderate-severe tremors when disturbed	2
	Mild tremors when undisturbed	3
	Moderate-severe tremors when undisturbed	4
	Increased muscle tone	1
	Excoriation (chin, knees, elbow, toes, nose)	1
	Myoclonic jerks (twitching/jerking of limbs)	3
	Generalised convulsions	5
Metabolic/ Vasomotor/ Respiratory Disturbances	Sweating	1
	Hyperthermia 37.2-38.3C	1
	Hyperthermia > 38.4C	2
	Frequent yawning (> 3-4 times/ scoring interval)	1
	Mottling	1
	Nasal stuffiness	1
	Sneezing (> 3-4 times/scoring interval)	1
	Nasal flaring	2
	Respiratory rate > 60/min	1
	Respiratory rate > 60/min with retractions	2
estinal Disturbances	Excessive sucking	1
	Poor feeding (infrequent/uncoordinated suck)	2
	Regurgitation (≥ 2 times during/post feeding)	2
	Projectile vomiting	3
	Loose stools (curds/seedy appearance)	2
	Watery stools (water ring on nappy around stool)	3
	Total Score	

“The infant with a score of “7” or less was not treated with drugs for the abstinence syndrome because, in our experience, he would recover rapidly with swaddling and demand feedings. Infants whose score was “8” or above were treated pharmacologically”

Finnegan LP, et al. Assessment and treatment of abstinence in the infant of the drug-dependent mother. IntClinPharmacolBiopharm. 1975;12(1–2):19–32

NOWS Traditional Approach

NICU admission

Finnegan Scoring or Modified Finnegan Scoring

Initiation of Medications/Medication Adjustments

Pharmacological Treatments of Choice

TABLE 4 Pharmacologic Agents for Treatment of NOWS

Medication Name	Morphine	Methadone	Buprenorphine	Clonidine	Phenobarbital
Preferred use as primary or secondary agent	Primary	Primary	Primary	Secondary	Secondary
Standing dosing	0.3–1.0 mg/kg per d PO divided every 3–4 h	0.2–0.9 mg/kg per d PO divided every 6–12 h	13–40 mcg/kg per d SL divided in 3 doses	1 mcg/kg PO q4 h	Loading: 10–20 mg/kg per dose PO. Standing dosing: 5–8mg/kg per d PO in 1–2 divided doses
PRN dosing	0.03–0.05 mg/kg per dose PO every 3–4 h	0.07 mg/kg per dose PO q6–8 h	N/A	N/A	N/A
Weaning	10% per d down to 10%–20% of max dose	10% per d down to 10%–20% of max dose, or space interval	10% per d until at 10% of the max dose	Increase from q4 to q8 to q12 to off	20% every 3–7 d starting 2–3 d after primary opioid treatment has been weaned off
Monitoring levels	N/A	N/A	N/A	N/A	Therapeutic range: 15–30 mcg/mL
Advantages	Shorter half-life; more frequent dosing tailored to symptoms	Longer half-life, which may be better for more severe withdrawal	May be more advantageous for buprenorphine-exposed infants	No known risk for neurodevelopmental delays; no risk for infant sedation	May be better for polysubstance exposure; outpatient weaning is possible
Disadvantages	Longer length of treatment compared with methadone in several randomized controlled trials	Longer half-life makes it more difficult to tailor toward symptomatic dosing	Sublingual administration with high ethanol (30%) content	Blood pressure and heart rate monitoring during clonidine treatment because of risk of hypertension and arrythmias	Risk of neurodevelopmental delays with prolonged exposure; high ethanol content in some preparations

N/A, not applicable; PO, by mouth; PRN, pro re nata - as needed; SL, sublingual.

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NOWS Traditional Approach

- NICU admission
- Finnegan Scoring or Modified Finnegan Scoring
- Initiation of Medications/Medication Adjustments
- Staff Cares for baby

Rose delivers vaginally a healthy term newborn

- MAT (medication-assisted treatment) with buprenorphine during pregnancy
- Fully engaged with her providers and substance recovery program
- Has good family support
- Mom is introduced to a program that specializes in care for substance exposed babies
- Baby initially in newborn nursery but at 24 hours of age by request of mom is transferred to a specialized facility for NOWS/NAS babies

Eat Sleep Console Management

- Baby is started on ESC scoring
- Mom is able to discharge at 36 hours after delivery and room in with baby
- The RN staff, trained in trauma informed care welcome mom and ask her to do routine cares and feed baby on demand
- Baby with some elevated scores but mom is able to hold baby, rock baby, feed baby and ultimately no medications are required
- Baby initially with some feeding difficulty and a gavage feeding is required but at 96 hours of life baby is improving and able to take all po feedings
- Social services ensures mom and home environment are stable and mom has adequate support at home
- Baby discharges home with mom and mom’s aunt at 6 days of age

NOWS ESC Approach

Admission to inpatient unit or specialized facility

ESC scoring and management based on functional abilities

Eat, Sleep, Console (ESC)

- Focuses on behavioral characteristics a baby requires to thrive in the home environment
  - Ability to EAT
  - Ability to SLEEP
  - Ability to be CONSOLED
- Emphasizes utilizing non-pharmacological methods first
  - Quiet environment
  - Holding/cuddling
  - Feeding on demand
- Utilizes mom/family/caregiver as the primary therapy

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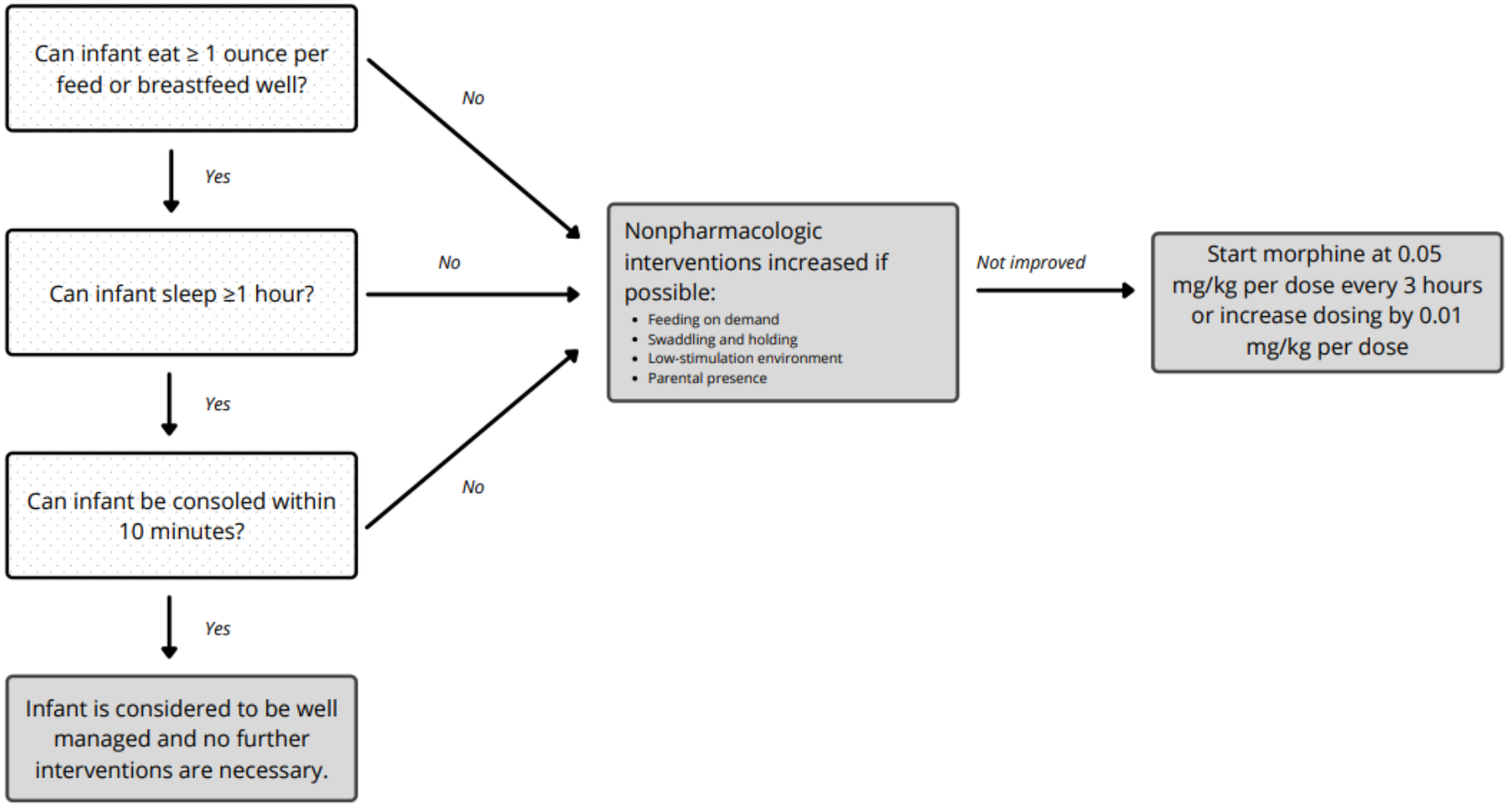
Eat, Sleep, Console (ESC) Algorithm

Grossman et al, *Pediatrics*, 2017



NOWS ESC Approach

- Admission to inpatient unit or specialized facility
- ESC scoring and management based on functional abilities
- On Demand Feeding schedule and cares
- Look at mom/caregiver as primary therapy—babies need to feel LOVE
- PRN medications

Trauma Informed Care (TIC)

Source: Trauma-Informed Care (Webpage) – SAMHSA

Understanding Trauma-Informed Care

Shifts focus from 'What is wrong?' to 'What happened to you?'

Core Principles of TIC

Six core principles

1. Safety
2. Trustworthiness
3. Peer Support
4. Collaboration
5. Empowerment
6. Cultural Awareness

Importance of TIC Implementation

Reduces re-traumatization

Improves patient outcomes

Supports staff wellness

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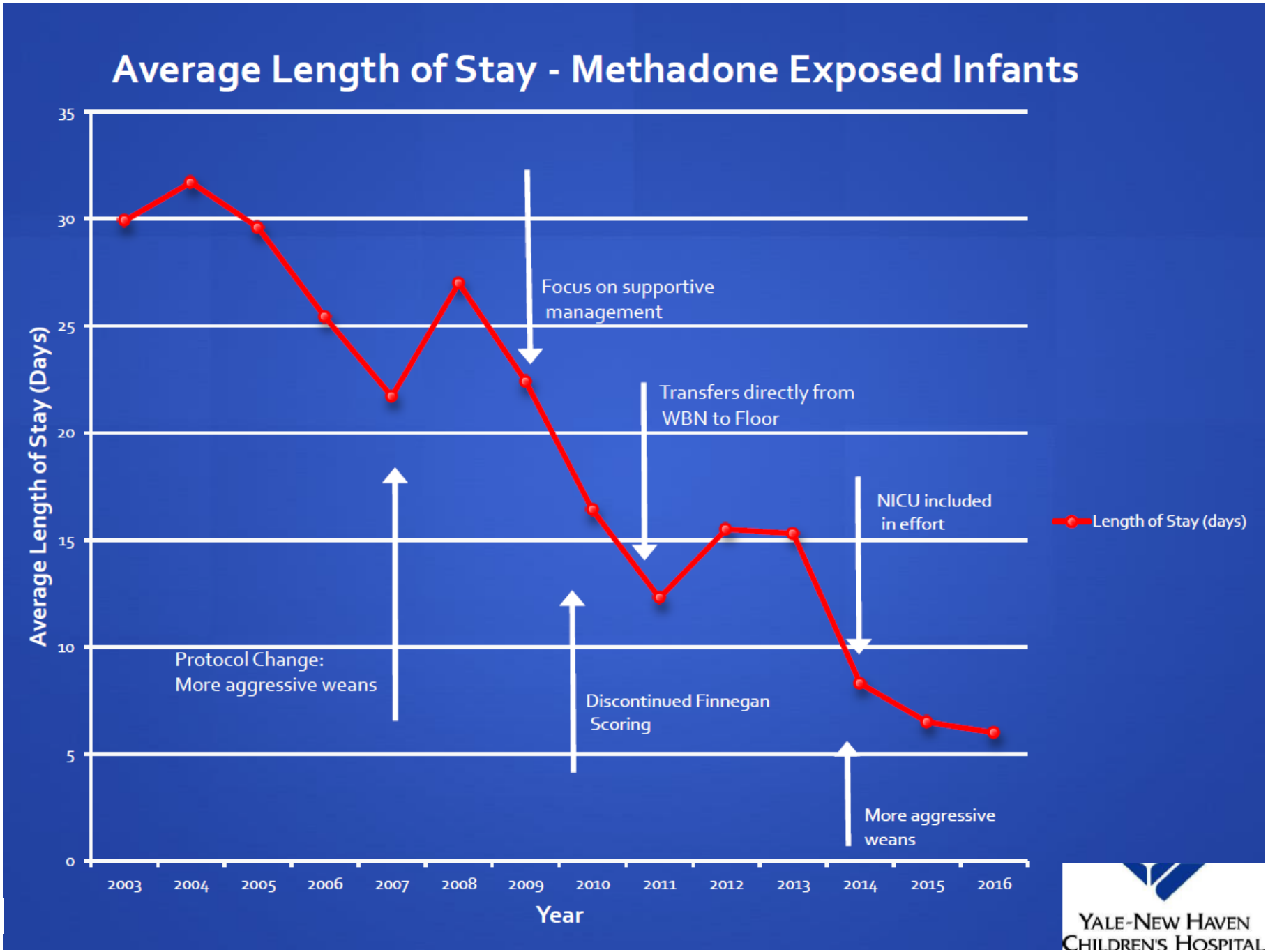
Yale/New Haven ESC results



Grossman, M. (2021, June 22). Eat, Sleep, Console: a family-centered approach to manage NAS w/Matthew Grossman. OPQIC: Oklahoma

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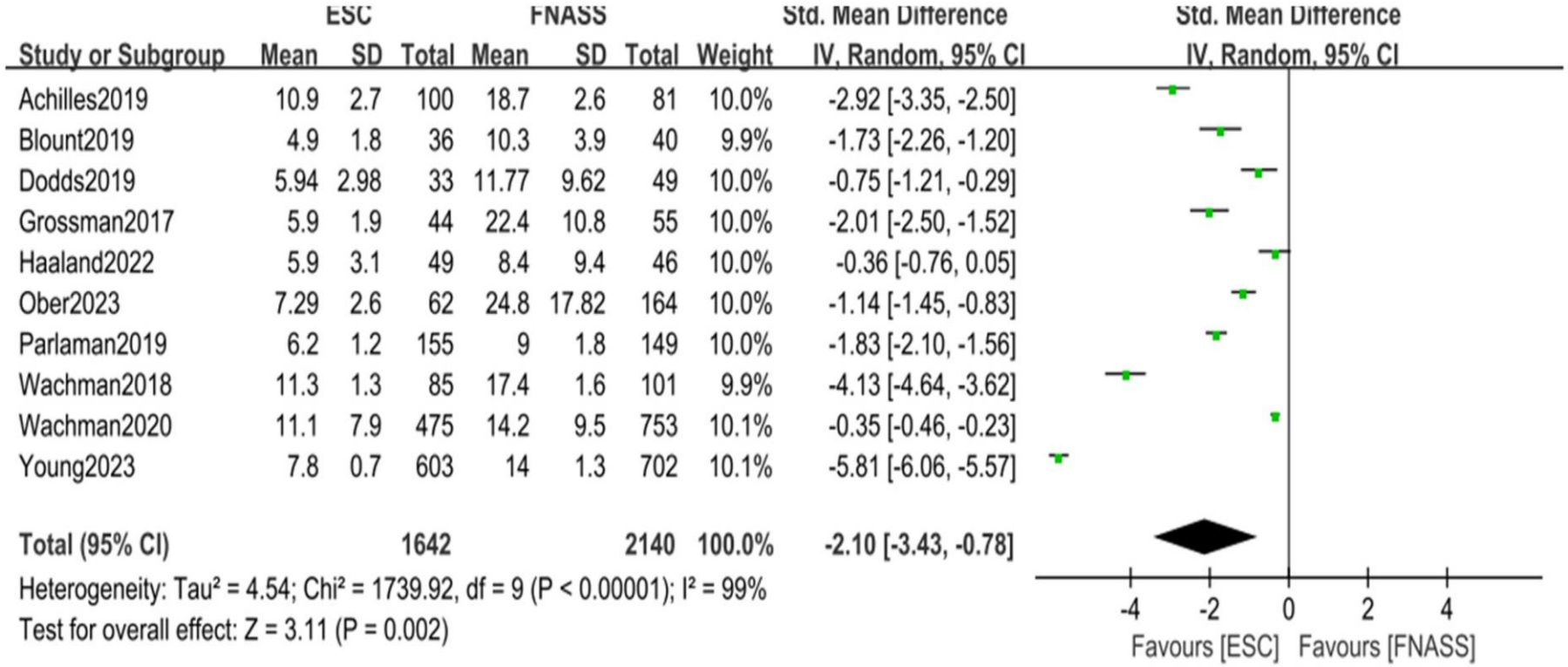
Yale-New Haven Children's Hospital



Eat, Sleep, Console (ESC) Outcomes

Chu L, Liu X and Xu C (2024) Eat, Sleep, Console model for neonatal opioid withdrawal syndrome: a meta-analysis. *Front. Pediatr.* **12**:1416383

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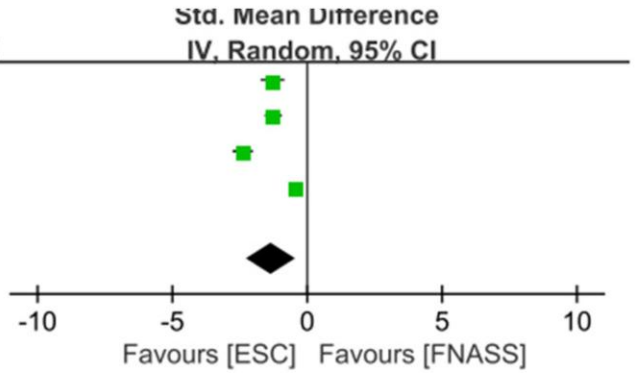
Study or Subgroup	ESC Mean	ESC SD	ESC Total	FNASS Mean	FNASS SD	FNASS Total	Weight	Std. Mean Difference IV, Random, 95% CI
Haaland2022	11.3	2	49	20.6	10.1	46	24.3%	-1.29 [-1.73, -0.84]
Ober2023	0.66	2.3	62	19.86	17.72	164	25.1%	-1.26 [-1.58, -0.95]
Wachman2018	12.7	1.1	85	16.2	1.7	101	24.7%	-2.39 [-2.77, -2.01]
Wachman2020	12.6	8.4	475	16.3	8.5	753	25.8%	-0.44 [-0.55, -0.32]
Total (95% CI)			**671**			**1064**	**100.0%**	**-1.33 [-2.22, -0.45]**

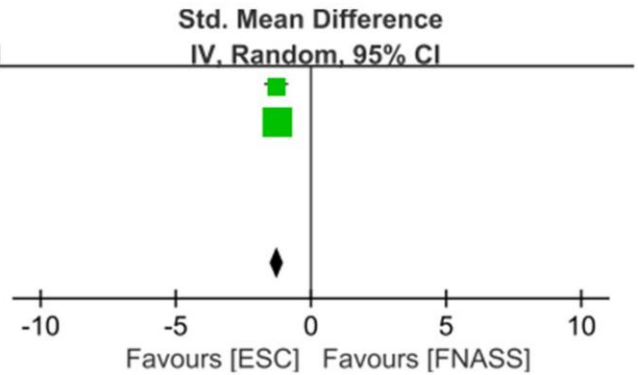
Heterogeneity: Tau² = 0.78; Chi² = 115.22, df = 3 (P < 0.00001); I² = 97%
Test for overall effect: Z = 2.96 (P = 0.003)



B

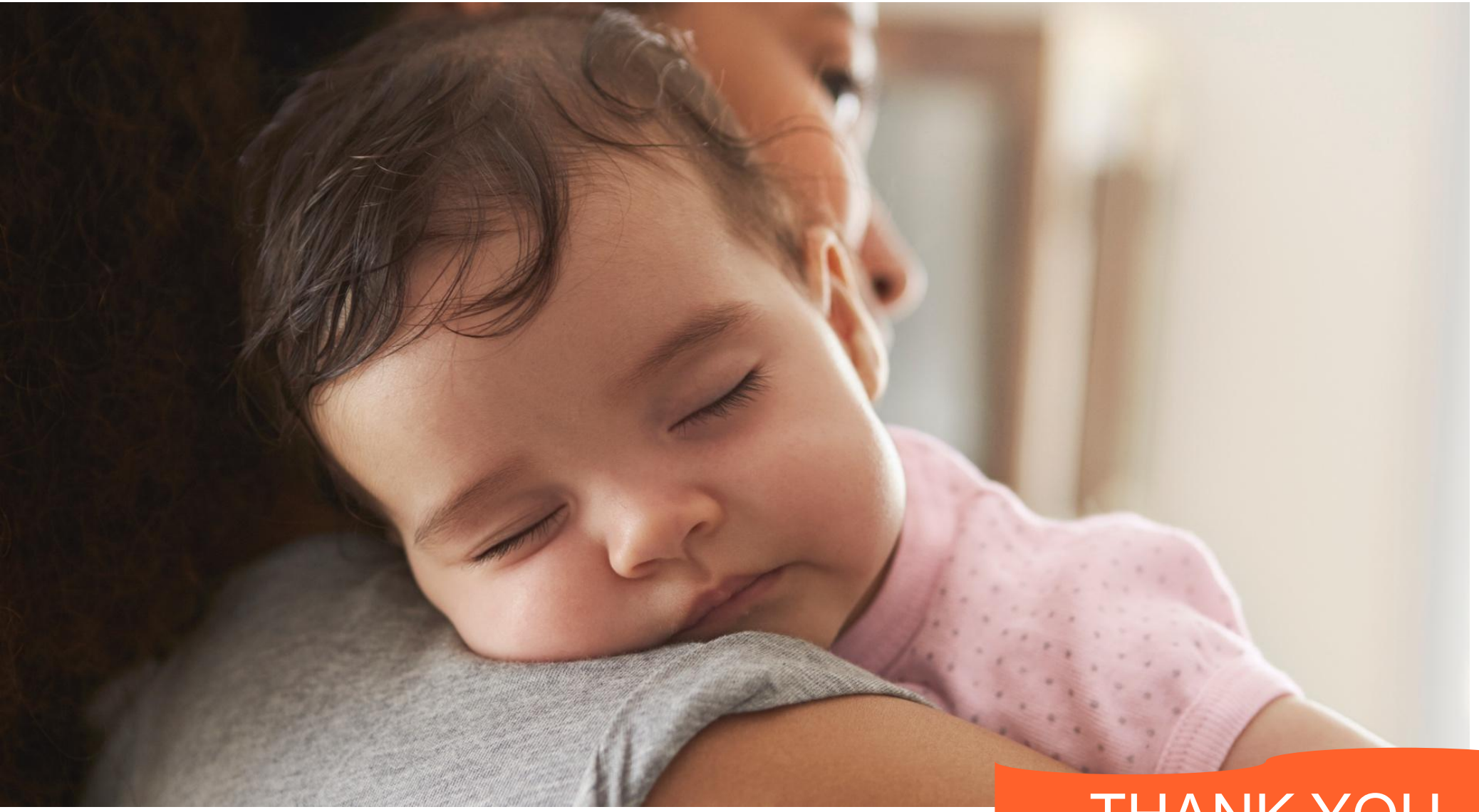
Study or Subgroup	ESC Mean	ESC SD	ESC Total	FNASS Mean	FNASS SD	FNASS Total	Weight	Std. Mean Difference IV, Random, 95% CI
Haaland2022	11.3	2	49	20.6	10.1	46	33.5%	-1.29 [-1.73, -0.84]
Ober2023	0.66	2.3	62	19.86	17.72	164	66.5%	-1.26 [-1.58, -0.95]
Wachman2018	12.7	1.1	85	16.2	1.7	101	0.0%	-2.39 [-2.77, -2.01]
Wachman2020	12.6	8.4	475	16.3	8.5	753	0.0%	-0.44 [-0.55, -0.32]
Total (95% CI)			**111**			**210**	**100.0%**	**-1.27 [-1.53, -1.01]**

Heterogeneity: Tau² = 0.00; Chi² = 0.01, df = 1 (P = 0.93); I² = 0%
Test for overall effect: Z = 9.69 (P < 0.00001)



Eat, Sleep, Console (ESC) Outcomes

Traditional Approach	ESC Approach
NICU Admission	Admission to inpatient unit or specialized facility
Finnegan or Modified Finnegan Scoring	ESC scoring and management based on functional abilities
Initiation of Medication ATC /Medication Adjustments	Non-pharmacological methods emphasized
Hospital Staff Cares for Baby	Mom/caregiver considered primary therapy and do cares
ATC medications	PRN medications



THANK YOU

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