ROCKY MOUNTAIN POISON & DRUG SAFETY
Saving lives with answers.™

DENVER HEALTH
est. 1860
FOR LIFE'S JOURNEY

Understanding stimulant use in the general population

Prevalence and patterns of non-medical use

Joshua Black PhD

Janetta Iwanicki MD (Co-PI)

Rocky Mountain Poison & Drug Safety

RADARS® System

13 May 2021 – RADARS® System Annual Meeting

Funding Disclosures

Funding provided by FDA BAA #75F40120C00151, 2020-2021.

This work was performed by the Researched Abuse, Diversion and Addiction-Related Surveillance (RADARS®) System. The RADARS System operations are supported by subscriptions from pharmaceutical manufacturers, government and non-government agencies for surveillance, research, and reporting services. RADARS System is the property of DHHA, a political subdivision of the State of Colorado.

No other competing conflicts of interest are declared.

Outline and Acknowledgements

1. Study 1: Describe characteristics of stimulant non-medical use and trends in situational indicators
2. Study 2: Identify heterogeneous subpopulations of adults who non-medically use

Acknowledge the full team effort in this work:
Elise Amioka, ellie bau, Alyssa Forber, Dean Garibaldi, Tanner Gardiner, David Grundy, Marie Gurrola, Zach Margolin, Heather Olsen, Rick Olson, Kari Rockhill

Study 1:
Describe characteristics of stimulant non-medical use and trends in key indicators

Objective of Study 1

- Understanding the individuals' characteristics and behaviors involving stimulant NMU
  - Leads to understanding health burdens & disparities within society
- Used a mosaic approach with multiple data sources
  - General population survey characterizes overall use
  - Additional data sources characterize specific indicators related to NMU

Data Source Descriptions

Data Source	Description	Timeframe
Survey of Non-Medical Use of Prescription Drugs (NMURx) Program	Cross-sectional survey of adult general population via online survey panel company	3rd quarter 2018 1st & 3rd quarters 2019
Poison Center Program	Exposure cases recorded by regional poison centers	2011-2019
Drug Diversion Program	Cases of diverted controlled substances recorded by law enforcement officials	2011-2019
IQVIA™ US-Based Longitudinal Prescription Data	Projected prescriptions dispensed from retail pharmacies (chain, independent, food store, etc)	2011-2019

Drug Groups and Outcomes

Four drug groups are included (where possible):

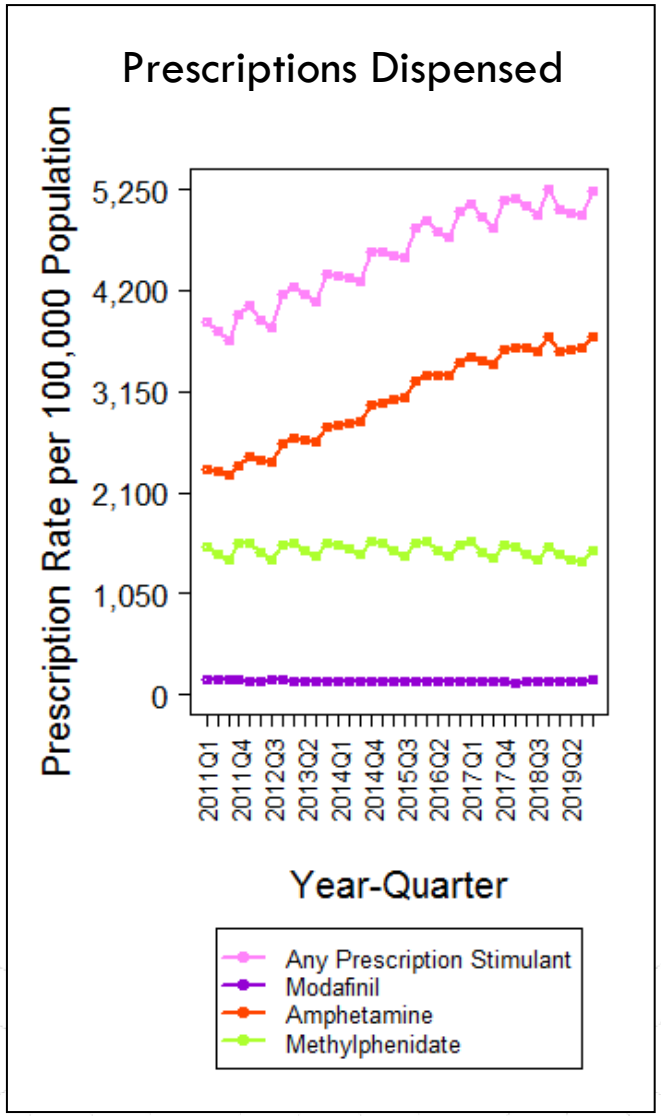
- Amphetamine
- Methylphenidate
- Modafinil
- Atomoxetine

Three Situational Indicators:

- Prescriptions dispensed
- Diversion cases
- Intentional misuse & abuse exposures

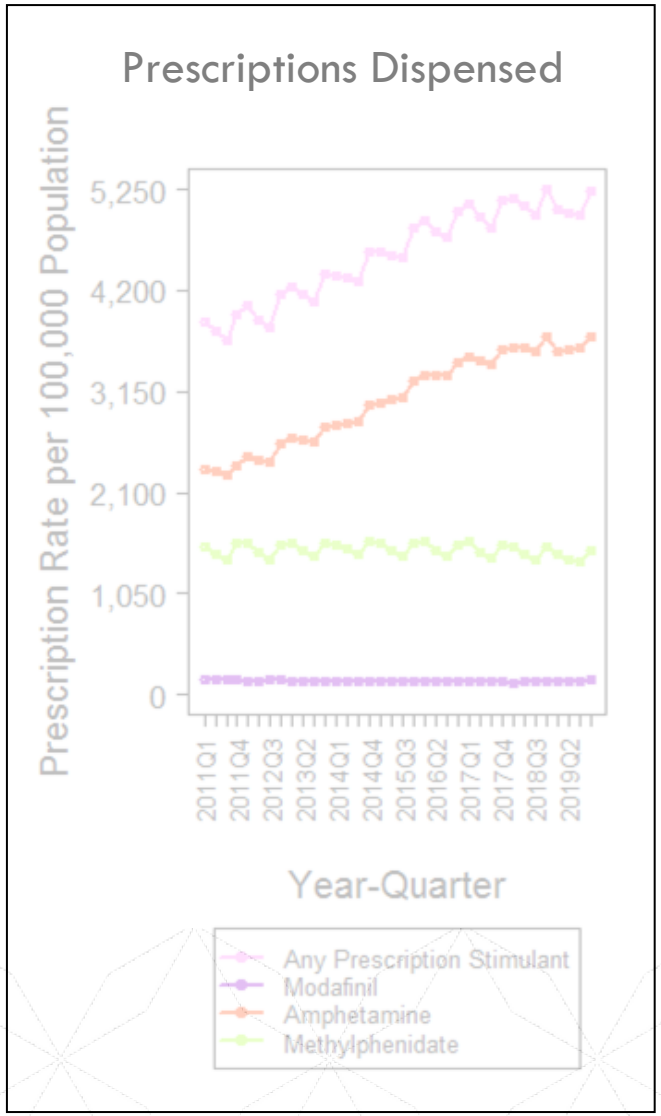
Main Outcomes	Definition
Non-Medical Use (NMU)	Use in a way not directed by your healthcare provider
Reason for NMU	• Treat a medical condition or symptom • To get high • To stay awake or be alert • Etc
Route of administration	• Swallowed • Crushed then swallowed • Inhaled • Etc
Source of drug	• One's own prescription • Friend or family member • Dealer • Etc

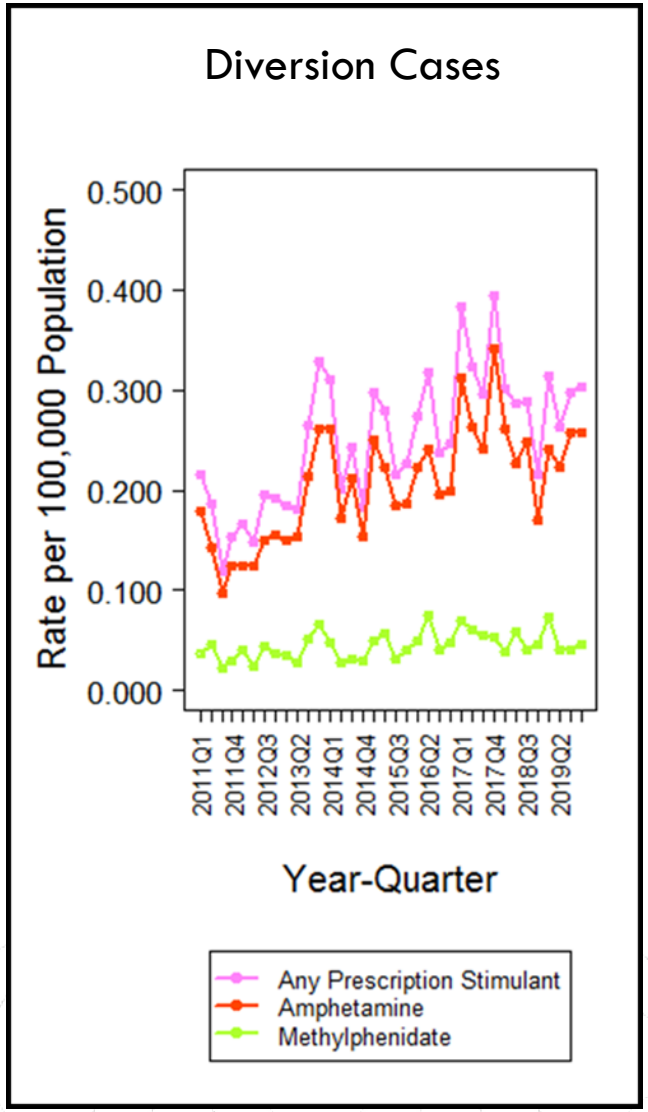
Trends in Situational Indicators



- Amphetamine prescriptions increasing (6% per year)
- Methylphenidate & modafinil decreasing (<1% per year)

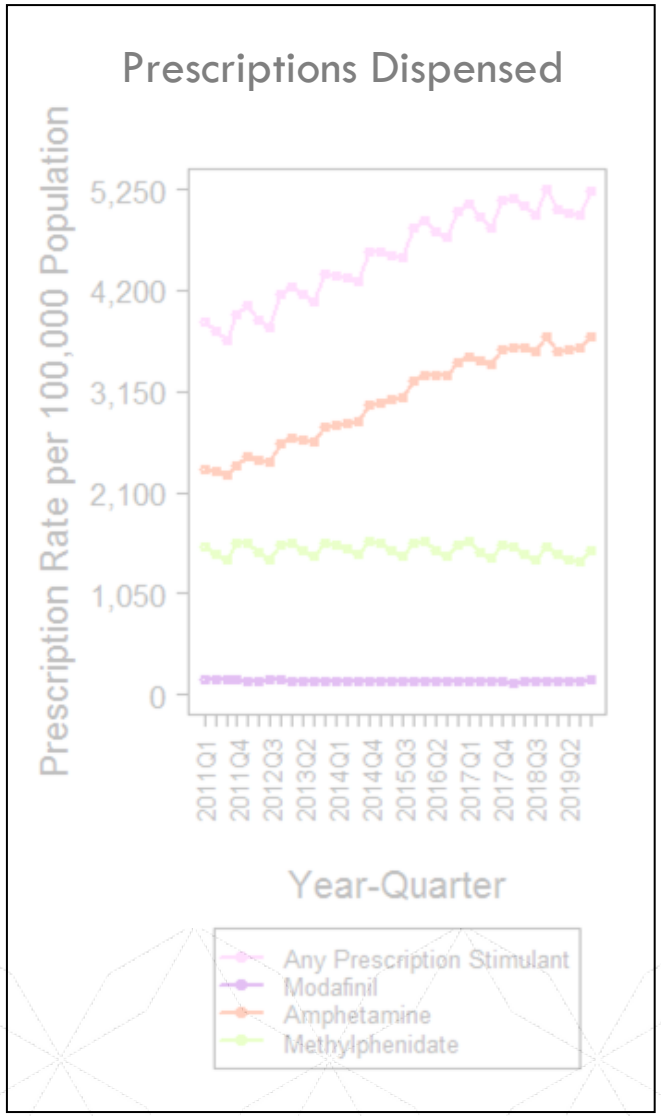
Trends in Situational Indicators

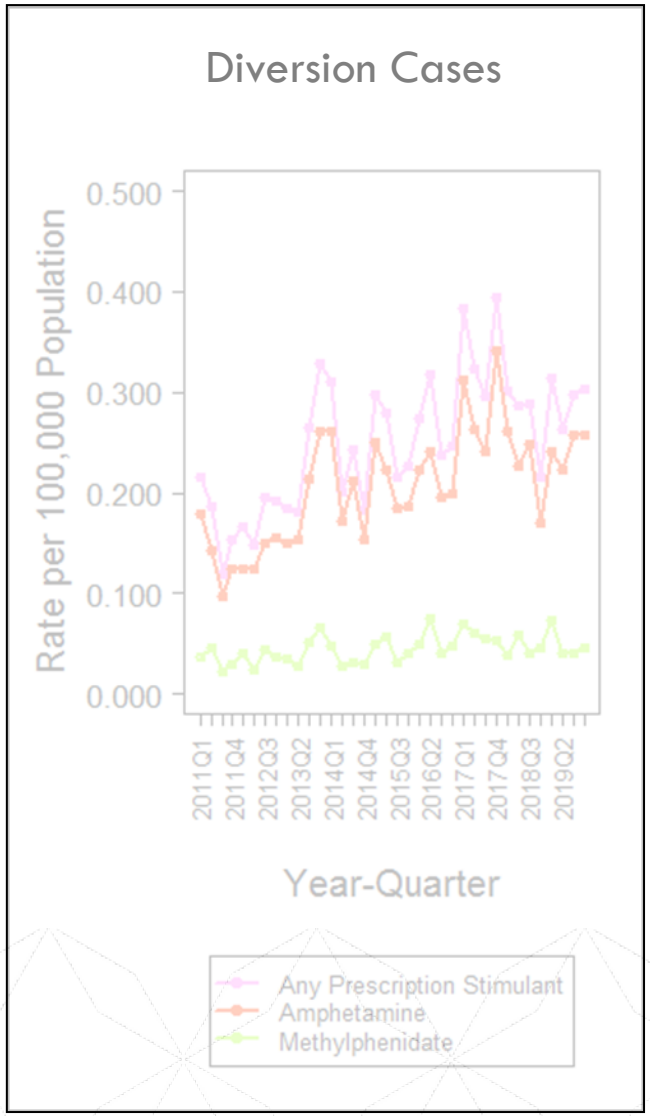


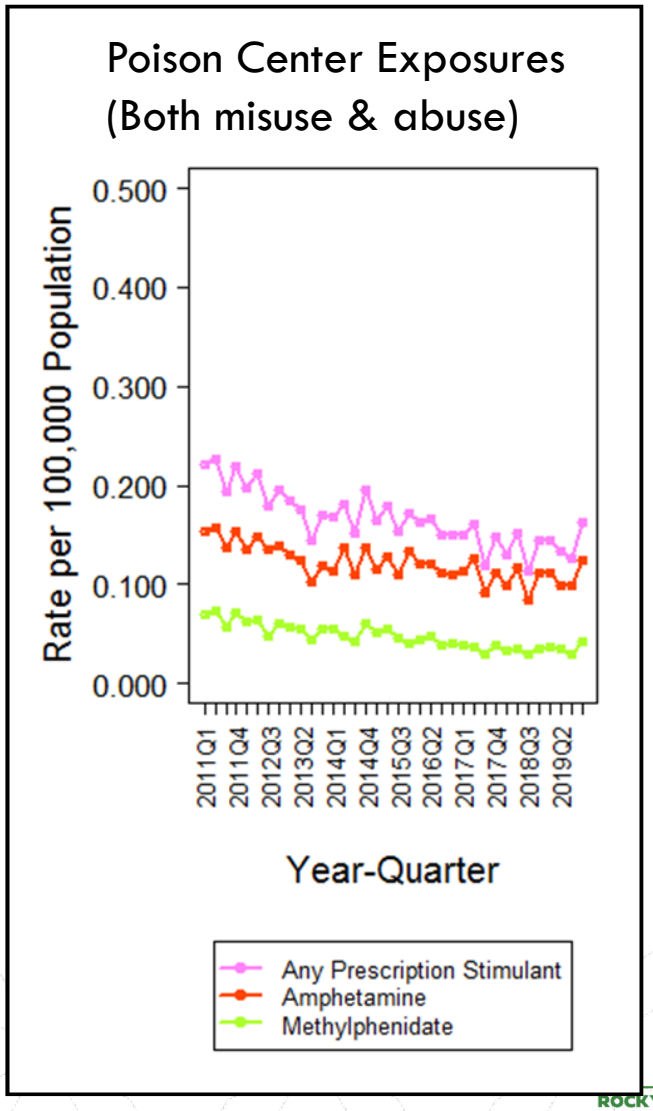


- Diversion Cases increasing
- Amphetamine: 8%
- Methylphenidate: 6%

Trends in Situational Indicators





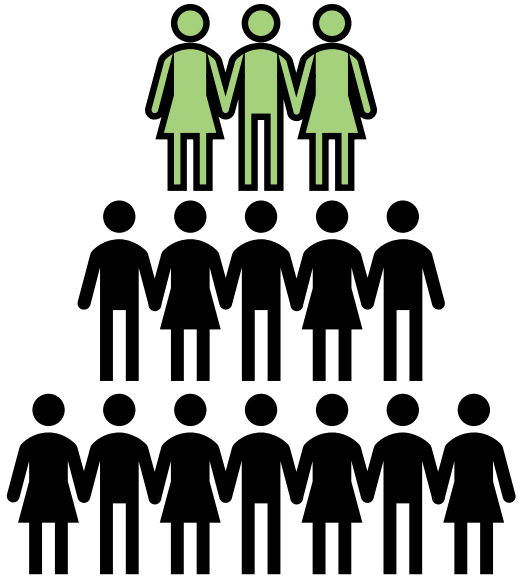


- Misuse/abuse exposures decreasing
- Amphetamine: -4%
- Methylphenidate: -8%

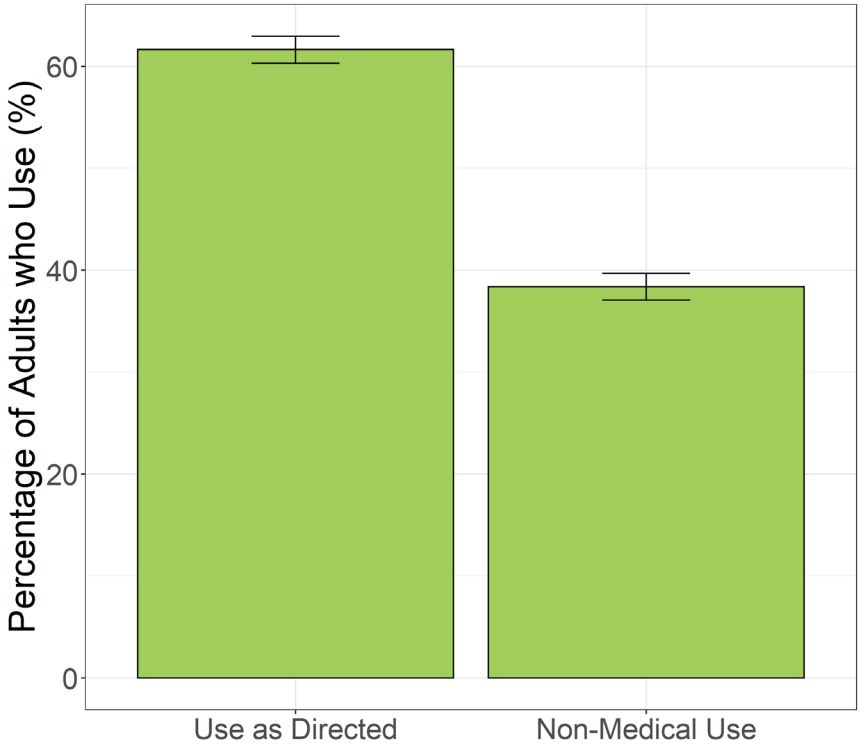
ROCKY MOUNTAIN POISON & DRUG SAFETY
Saving lives with answers.™

DENVER HEALTH
est. 1860
FOR LIFE'S JOURNEY

Prevalence of Use and NMU



~13M adults use stimulants annually
(5.2% of US adult population)



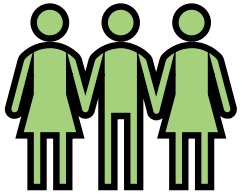
38.4% of adults using stimulants do so in a way not directed by a healthcare provider

~5M adults non-medically use stimulants annually
(1.89% of US adult population)

Similar results in Canadian adult population:

- 4.3% of Canadian adults use
- 39.8% of adults who use will NMU

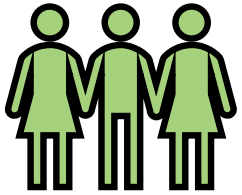
Characteristics of Adults



Demographic or Characteristic	Adults who NMU any Rx Stimulant	Adults who Only Use as Directed	General Population‡
Sex: Male	61% (59-63)	53% (52-55)	49%
Age, mean	32.7 (32.1-33.2)	37.2 (36.7-37.6)	47 years
Past Year Treatment (any drug)	19% (17-22)	7% (6-9)	2%
ADHD/ADD†	28% (26-30)	42% (40-44)	5%
High Problematic Drug Use (DAST Score 3+)	41% (39-44)	16% (15-17)	5%

†Respondents were asked if they were diagnosed with each mental health disorder by a healthcare professional
‡General population values are estimates from NMURx; uncertainty is less than 1% for all
ADHD/ADD: Attention Deficient, Hyperactivity Disorder / Attention Deficit Disorder

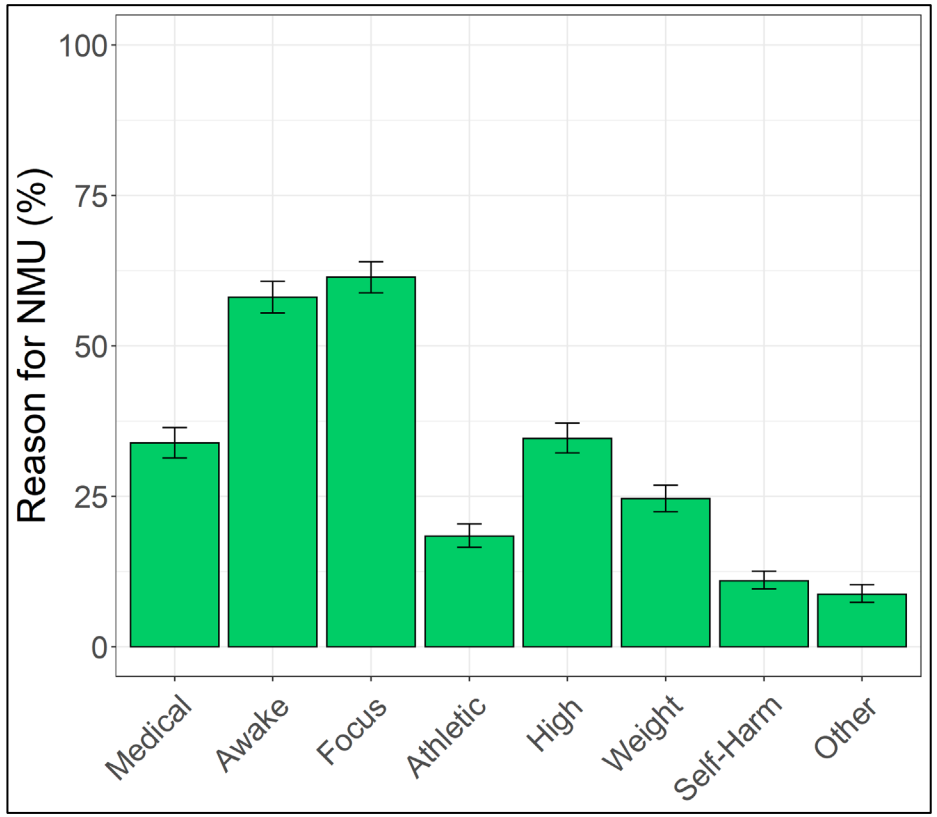
NMU Prevalence by Ingredient



Drug	National Prevalence of Last 12 Mo NMU % (95% CI)	Approximate Number of Adults	Approximate Percentage of Any Rx NMU†
Any Prescription Stimulant	1.89 (1.80, 2.00)	4,800,000	--
Amphetamine	1.54 (1.45, 1.64)	3,900,000	81%
Methylphenidate	0.33 (0.29, 0.37)	830,000	17%
Modafinil	0.21 (0.18, 0.24)	530,000	11%
Atomoxetine	0.20 (0.17, 0.23)	510,000	11%

†Respondents can endorse more than one drug; percentages will not sum to 100%

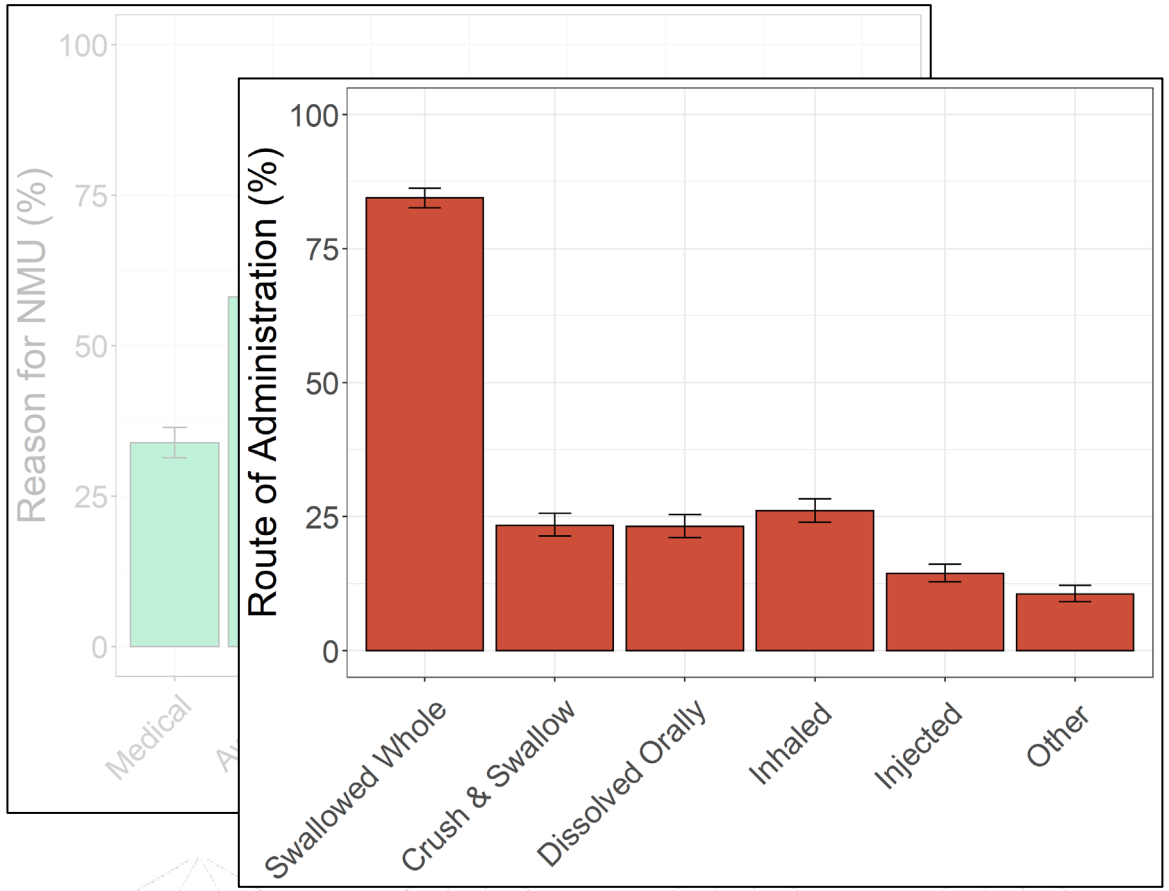
Motivations and Behaviors



Most adults who NMU are *not* using to treat medical symptoms.

Most report use to stay awake or focus.

Motivations and Behaviors

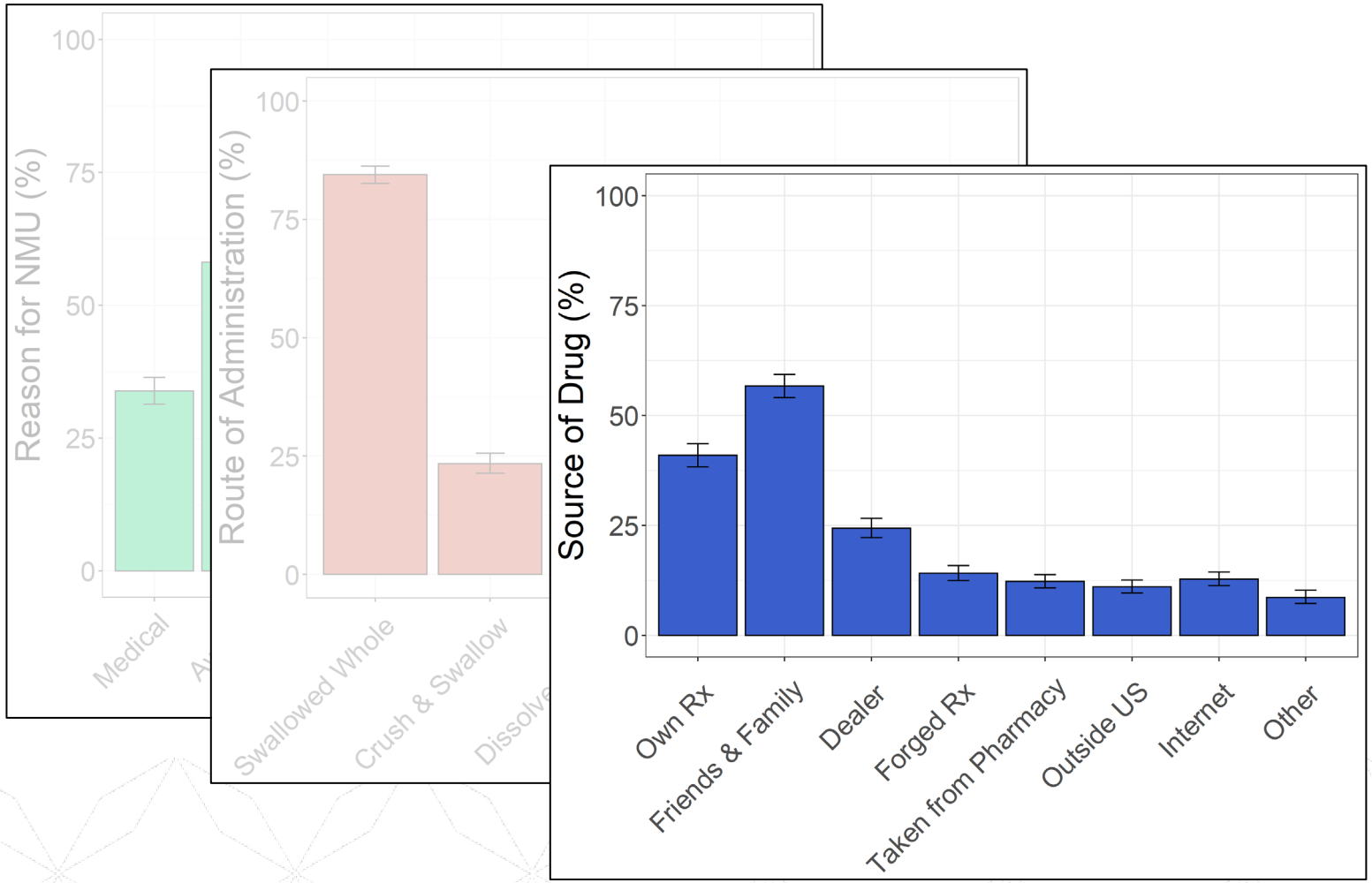


Most adults who NMU report swallowing…

…but are they using other routes?

Other routes are used by ~25% of adults who NMU

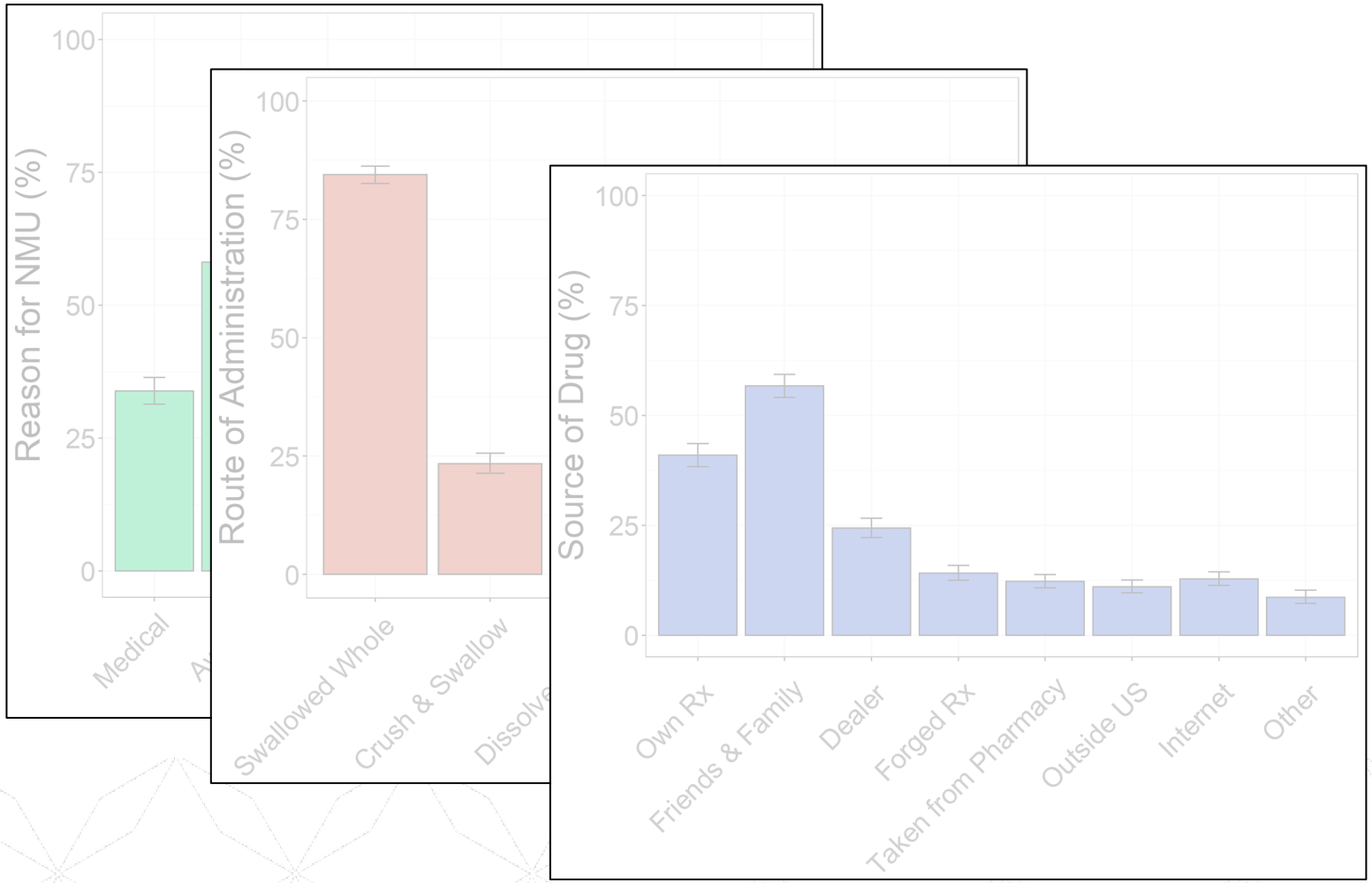
Motivations and Behaviors



Most adults who NMU are *not* obtaining it from their own prescription.

Most report obtaining the drug from friends & family.

Motivations and Behaviors



This isn't the best way to understand motivations and behaviors…

How to understand multiple behaviors

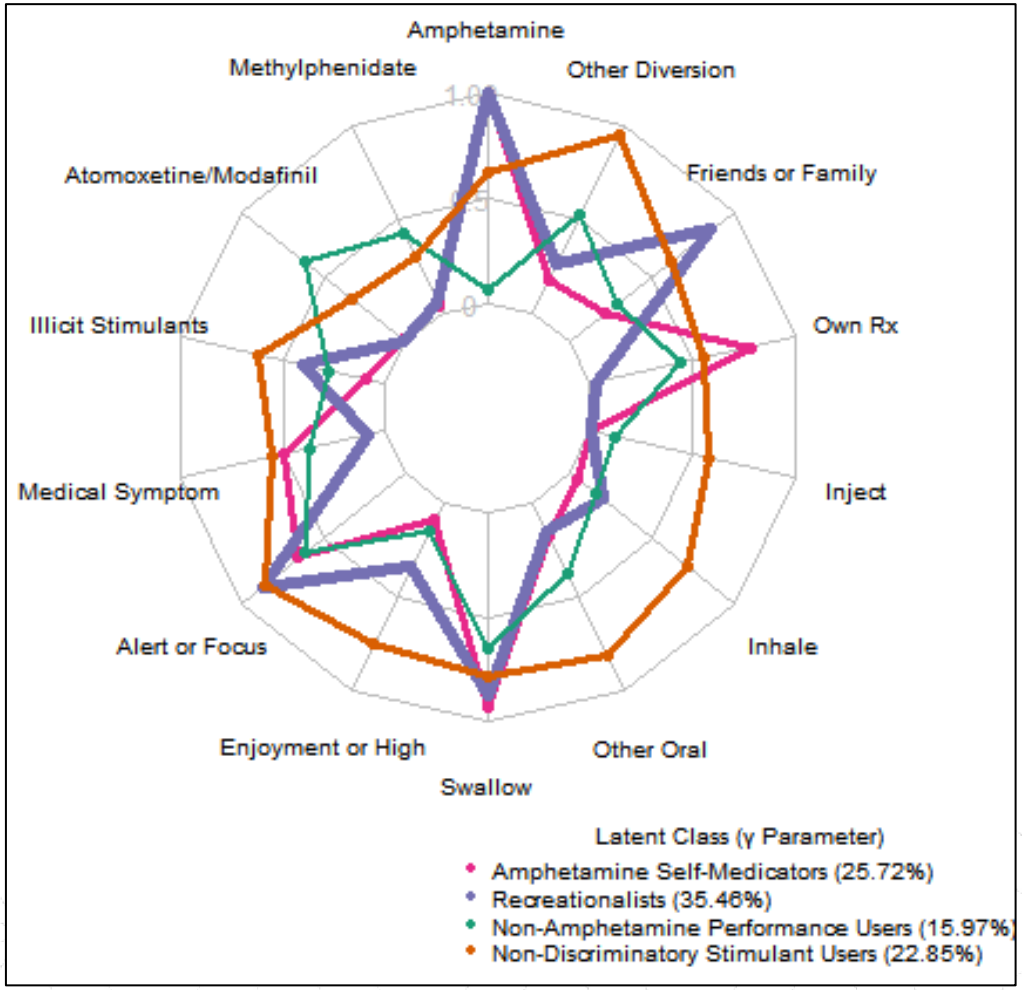
- Differences between drug groups could be present, but evaluating groups of individual behaviors is challenging
  - Respondents endorsing multiple drugs, reasons, routes, sources
  - Implicit multiple comparisons
- There are better ways to evaluate high dimensional data to answer these questions…
- Are adults who NMU a homogeneous group of people?
- Do behaviors group together in interpretable ways?

Heterogeneous subpopulations of adults who NMU

Latent Class Methodology

- Objective of Study 2: Identify subpopulations, if they exist
- Latent class analysis decomposes overlapping response patterns into distinct subpopulations
  - Determines the number of subpopulations needed to parsimoniously explain the set of behaviors
  - Assigns probability of each behavior within each subpopulation
- Subpopulations are interpreted based on the types of behaviors the subpopulation engages in

Four Subpopulations of Adults who NMU Rx Stimulants



How to interpret: The distance of the point from the center is the probability a person in the class engages in the behavior

-Important to know that naming groups is an interpretive process

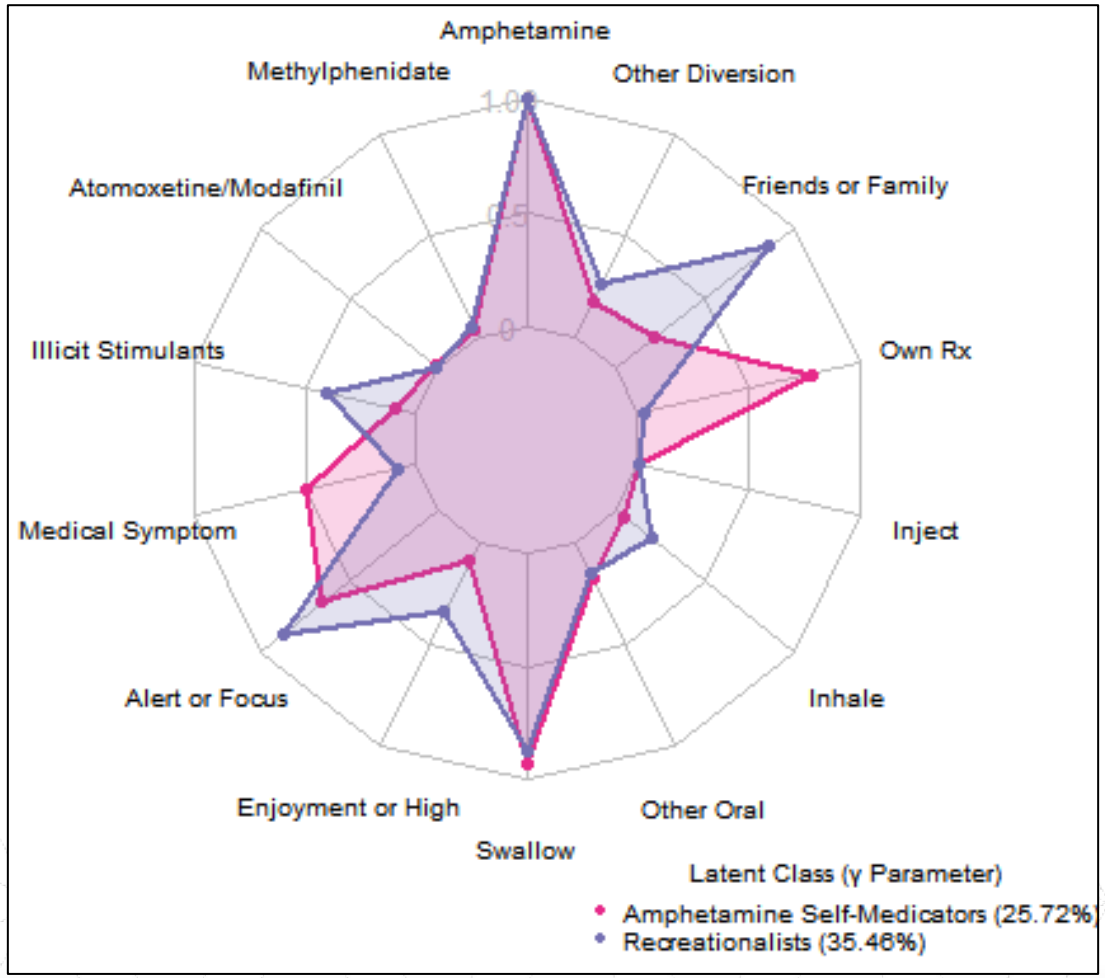
Purple Line: "Recreationalists", 35.5% of adults

Pink Line: "Amphetamine Self-Medicators", 25.7% of adults

Orange Line: "Non-Discriminatory Stimulant Users", 22.9% of adults

Green Line: "Non-Amphetamine Performance Users", 16.0% of adults

Two Subpopulations Who Prefer Amphetamine



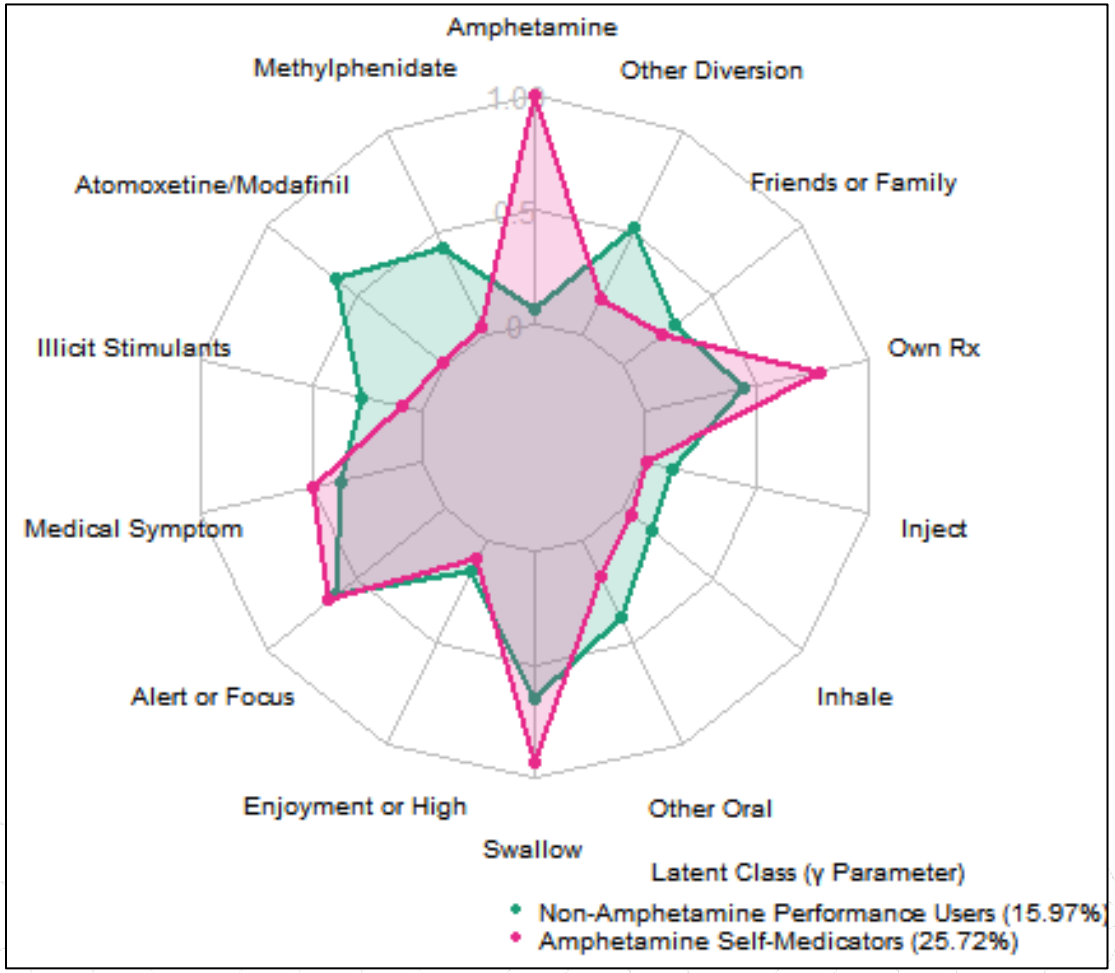
Amphetamine Self-Medicators (Pink, 25.7%)

- Exclusively use amphetamine
- Primarily obtain from own prescription
- Primarily swallowing
  - Infrequent inhalation or injection
- Frequently use to treat medical symptoms
  - Infrequent use to get high
- Infrequent illicit stimulant use

Recreationalists (Purple, 35.5%)

- Exclusively use amphetamine
- Primarily obtain from friends and family
  - Nearly no acquisition through own Rx
- Primarily swallowing
  - Some inhalation
- More use to get high or use to stay alert
  - Infrequent use to treat medical symptoms
- Some illicit stimulant use

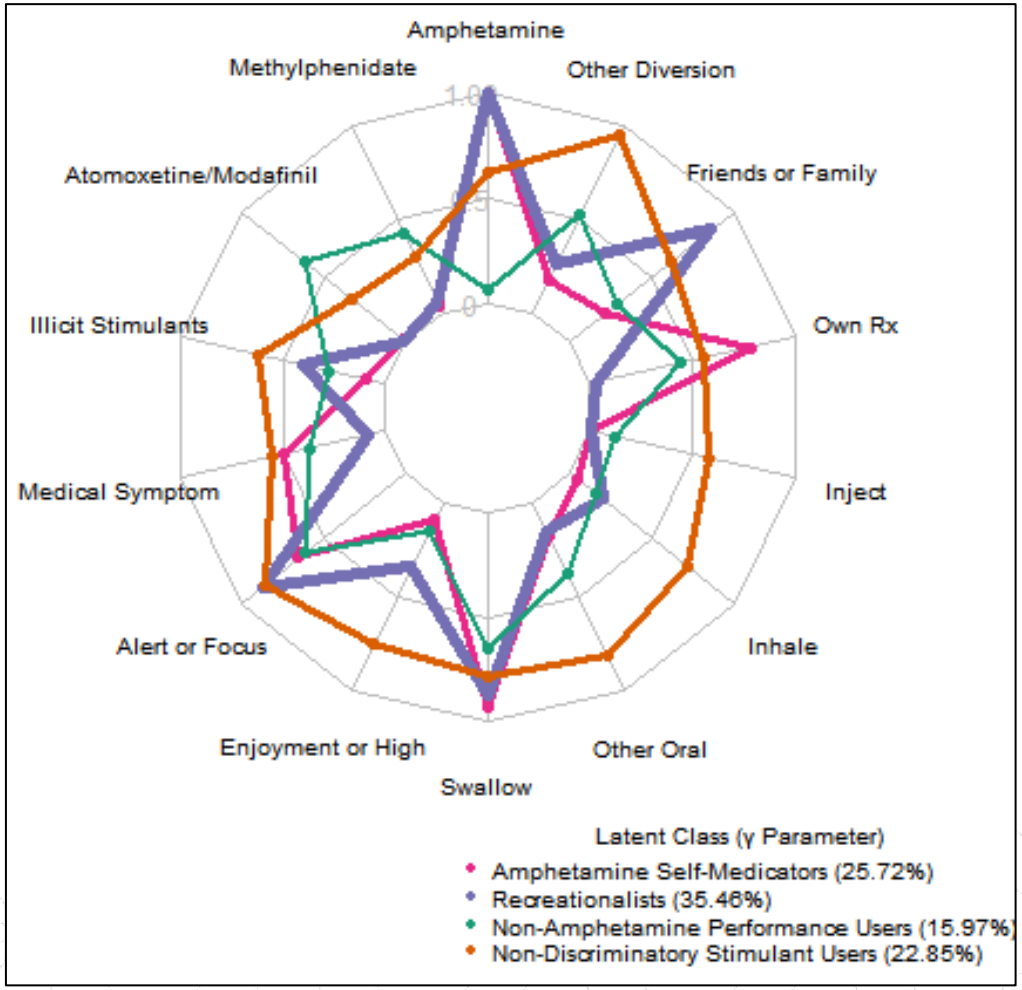
Different Subpopulation Who Prefer Non-Amphetamines



<u>Non-Amphetamine Performance Users (Green, 16.0%)</u>

- Prefer using methylphenidate, atomoxetine, & modafinil
- Elevated acquisition through other diversion
- Elevated non-oral use and manipulated oral use
- Primarily used to stay alert or focused
  - Infrequent use to get high
- Elevated illicit stimulant use

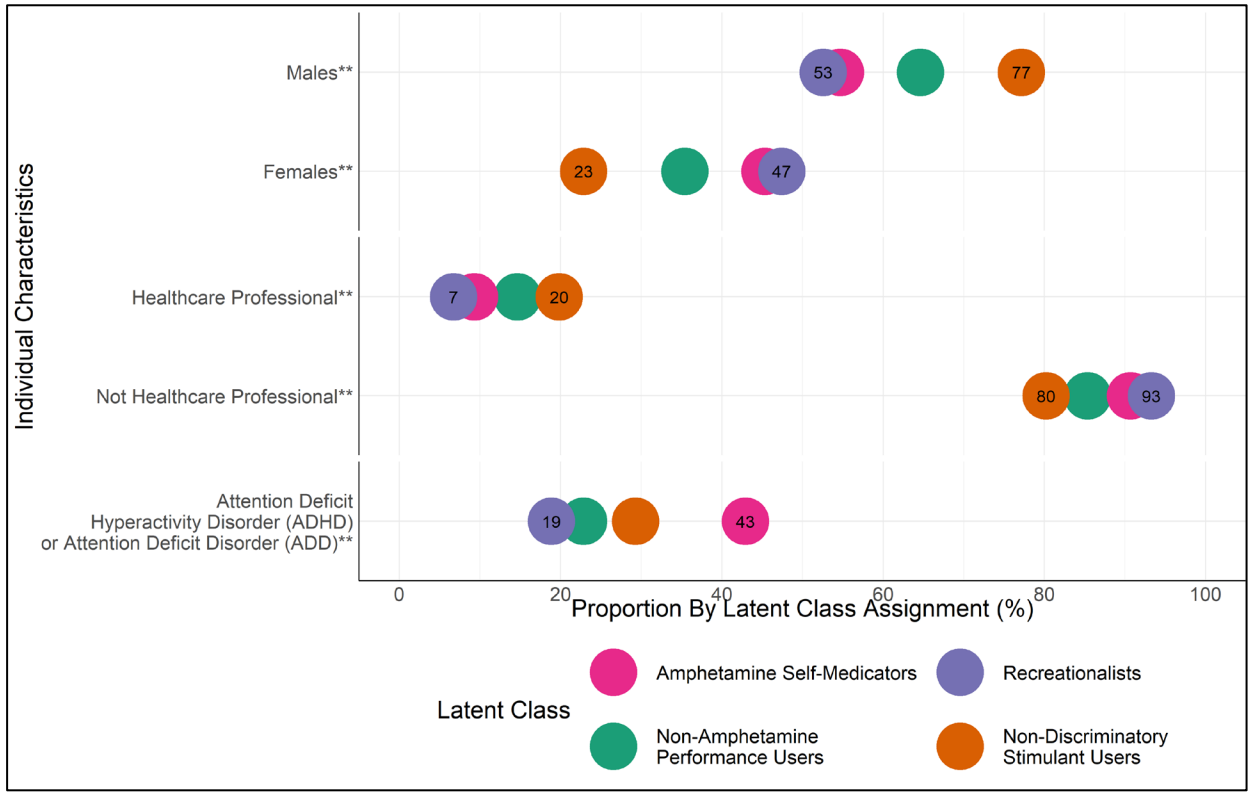
Those who engage in many behaviors



Non-Discriminatory Stimulant Users (Orange, 22.9%)

- Do not discriminate between drugs
- Primarily obtain drug through other diversion
- Multiple routes
- Multiple reasons for use
  - Highest use to get high
- Highest illicit use

Key Characteristics of Subpopulations



- Non-Discriminatory Users have more classic substance use profile: male, higher HCP, high DAST score, high use opioids & illicits
- Amphetamine Self-Medicators have a more modest profile: small sex disparity, highest ADHD disagnosis, low DAST
- Recreationalists have modest co-use profile: high cannabis use, modest co-use opioids & illicits

Conclusions

- 1.89% of the US adult population non-medically uses Rx stimulants
  - Situational indicators show stimulant drugs are increasingly available
- Patterns in subpopulations can be uniquely informative
  - Non-Discriminatory Users are at much higher risk of fentanyl-adulterated product due to more frequent other diversion and illicit use
  - Study recruitment through official channels (e.g., doctor offices, pharmacy registries) would completely exclude Recreationalists
  - Potential unmet need for mental health treatment in Amphetamine Self-Medicators due to <50% indicating ADHD diagnoses
  - Friends & Family networks could be extensive in many subpopulations
- Next step: Analyzing progression of behavior through time

ROCKY MOUNTAIN POISON & DRUG SAFETY
Saving lives with answers.™

DENVER HEALTH™
est. 1860
FOR LIFE'S JOURNEY

Thank you!

Joshua Black, PhD
RADARS® System