Surveillance of Fentanyl Use in Denver and Colorado from Three Different Data Perspectives

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RADARS® System
A Division of Denver Health and Hospital Authority

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  • Participating Poison Centers (50 of 55)
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Presentation Outline

1. Introduction and Background

2. Analysis of:
   1. The General Adult Population using Fentanyl
   2. Poisonings from Fentanyl
   3. Patients in Treatment using Fentanyl

3. Overall conclusions
Who Am I?

• Joshua C. Black
  • Senior Research Scientist with Rocky Mountain Poison and Drug Safety, a division of DHHA
  • PhD from University of Denver, Natural Sciences & Mathematics, 2013

• Biostatistician and interdisciplinary scientist studying pharmacoepidemiology

• Research interest is to study drug use as a complex, interwoven system of factors so we might improve precision of medicine, public health, and daily life when using drugs
Fentanyl Overdose has Continually Increased over Multiple Years

Nonpharmaceutical fentanyl presents a sustained public health concern, with little signs of abating. From CDC, Colorado overdose rates have increased\(^1\), mainly due to fentanyl\(^2\).

<table>
<thead>
<tr>
<th>Colorado Year</th>
<th>All Drug Overdose Mortality Rate Age Adjusted (per 100k)</th>
<th>Change from previous year (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>16.6</td>
<td>--</td>
</tr>
<tr>
<td>2017</td>
<td>17.6</td>
<td>+6.0</td>
</tr>
<tr>
<td>2018</td>
<td>16.8</td>
<td>-4.6</td>
</tr>
<tr>
<td>2019</td>
<td>18.0</td>
<td>+7.1</td>
</tr>
<tr>
<td>2020</td>
<td>24.9</td>
<td>+38.3</td>
</tr>
</tbody>
</table>
Sub-State Data on Use Patterns is Challenging to Acquire

Intervention strategies need to be data-driven.

Yet identifying opportunities for intervention is challenging when local data are incomplete or biased.

Triangulation of data (i.e., analyzing multiple data sources) can fill in gaps to give a more comprehensive picture.

Study Goal: Analyze surveillance data on fentanyl use in Colorado using multiple data perspectives, providing sub-state estimates when possible.
RADARS System for Drug Surveillance

- The Researched Abuse, Diversion and Addiction-Related Surveillance (RADARS®) System
- Pharmacoepidemiologic research into drug use from many different approaches
  - Diversity in data is a strength
  - Each provides unique perspective on drug use
- Data are timely, geographically specific
Each Data Source Investigates Different Populations

• For each data source, we will discuss:
  • Surveillance design
  • Study-specific methods
  • Results

• Present conclusions based on totality of evidence
Geographic Divisions

• All data sources divided based on 3-digit ZIP codes reported by respondents or patients
  • Aggregations preserve privacy according to HIPAA compliance
Fentanyl Use in the General Population
Overview: NMURx Program

• Survey of Non-Medical Use of Prescription Drugs (NMURx) Program

• Study Objective: Provide accurate estimates of drug use and associated behaviors among the general adult population

• Utilizes an online survey to ask about drug use behaviors
  • ~50% desktop, ~50% tablet/mobile

Source: RADARS® System Survey of Non-Medical Use of Prescription Drugs Program
Surveillance period: 2021
Design: NMURx Program

• Semi-annual survey waves (Spring & Autumn)
• Cross-sectional
• Self-administered and confidential
• Recruitment
  • Online survey panel recruitment
  • Volunteer survey takers
  • Modest compensation for ~10-minute survey
Design: NMURx Program

Advantages

• Large sample size
• Geographically inclusive
• Diverse respondents
• Real people with proactive panel maintenance

Disadvantages

• Self-reported
• Selection bias
  • Self-selection into panel
• Measurement bias
  • Disinterested answering patterns
**Design: NMURx Program**

- Two key methods to mitigate disadvantages
- Calibration weighting
  - Statistical adjustment for selection bias, including demographics and health
  - Panel is generally “less healthy”, which biases estimates without correction
- “Careless response” exclusion
  - Removes individuals showing patterns of inattentive answering (e.g., straight-lining)
- Detailed validity\(^3\) and reliability\(^4\) published
Colorado-Specific Validity: Comparison of Cannabis Use Data

Estimates from NMURx Program are very similar to BRFSS and NSDUH, generally within the uncertainty of the estimates.

NMURx Program estimates tend to be slightly higher, possibly because there is no interviewer.

Cannabis estimate shown for NMURx Program 2018 is only 3rd quarter data.
Study Specific Analysis

• Analyzed use of nonpharmaceutical fentanyl in Colorado regions
• Cumulative data from 2019 to 1st half of 2022 (n=3,597 in CO)
• Compared to use of any of nonpharmaceutical drugs:
  • Heroin, cocaine, crack, methamphetamine, amphetamine
• Weighted estimates and 95% confidence intervals calculated using complex survey design
• Weighted logistic regression to compare likelihood of fentanyl use in Denver vs other sub-state regions
Colorado ranks lower in fentanyl use compared to heroin or methamphetamine use.
Fentanyl use in Denver vs other regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Weighted Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>REF</td>
</tr>
<tr>
<td>Front Range</td>
<td>0.36 (0.12, 1.07)</td>
</tr>
<tr>
<td>Eastern</td>
<td>1.10 (0.19, 6.35)</td>
</tr>
<tr>
<td>Western</td>
<td>Not estimated (no cases)</td>
</tr>
</tbody>
</table>

Fentanyl use in Denver may be elevated relative to rest of front range, but low prevalence widens uncertainty.

Estimated prevalence of past 12 MO fentanyl use in CO was 0.4%, or ~19,000 adults.
Characteristics of Adults Using Fentanyl

Relative to other drug use, adults who use fentanyl may be...

• Equally likely to be male
Relative to other drug use, adults who use fentanyl may be...

- Equally likely to be male
- More likely to be aged 18-24
Characteristics of Adults Using Fentanyl

Relative to other drug use, adults who use fentanyl may be...

- Equally likely to be male
- More likely to be aged 18-24
- Similar income profile
Characteristics of Adults Using Fentanyl

Relative to other drug use, adults who use fentanyl may be...

- Equally likely to be male
- More likely to be aged 18-24
- Similar income profile
- Similar self-assessment of health
Characteristics of Adults Using Fentanyl

Problematic Drug Use – DAST$^5$ Measure

Relative to other drug use, adults who use fentanyl may be...

- Equally likely to be male
- More likely to be aged 18-24
- Similar income profile
- Similar self-assessment of health
- More likely to report more severe problematic drug use
Summary of General Population Data

• Fentanyl use in Colorado overall is relatively low prevalence, compared to other states
  • Limits statistical assessment of subgroup characteristics
• Fentanyl use in Denver might be more likely than rest of Front Range
• Suggests adults using fentanyl may be more likely to be young (aged 18-25), middle income, and more severe problematic drug behaviors than adults using other drugs
Poisonings Involving Fentanyl
Overview: Poison Center Program

- Study Objective: Provide improved accuracy on reporting of drug exposures
- Utilizes calls made to poison centers across the country
Design: Poison Center Program

• Spontaneous reporting
  • Calls from general public and healthcare professionals seeking expert toxicologic advice on drugs

• Drug involved, reason for exposure, route, and medical outcome are recorded by participating poison center
  • RMPDS staff review case notes to improve accuracy of electronic record
  • Exposures to prescription fentanyl removed
Design: Poison Center Program

Advantages

• Specialist assisted drug identification

• Geographically inclusive

• Reliable trend analysis, as coding is standardized over time

Disadvantages

• Primary inference is to calls made to poison centers

• Bias toward more severe exposures
Study Specific Analysis

• Analyzed exposure to nonpharmaceutical fentanyl in Colorado regions
• Trend data from 2016 to 1st quarter 2022 (n=142 in CO)
• Analyzed rates over time
  • “Projected” 2022 data to 4 quarters by multiplying 1st quarter data by 4
• Poisson model with population offset to test rate differences between regions (cumulative)
• Descriptive comparison of medical outcome and route used by region
### Exposure Origin and Reasons

<table>
<thead>
<tr>
<th>Region</th>
<th>Intentional, N, (%)</th>
<th>Unintentional, N, (%)</th>
<th>Unknown/Other, N, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>32 (72.3)</td>
<td>6 (13.6)</td>
<td>6 (13.6)</td>
</tr>
<tr>
<td>Front Range</td>
<td>53 (75.7)</td>
<td>11 (15.7)</td>
<td>6 (8.6)</td>
</tr>
<tr>
<td>Eastern</td>
<td>10 (83.3)</td>
<td>1 (8.3)</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>Western</td>
<td>9 (56.2)</td>
<td>5 (31.2)</td>
<td>2 (12.5)</td>
</tr>
</tbody>
</table>

Most exposures are intentional, which is similar across regions. Potentially higher unintentional rate in Western region.
Fentanyl Exposures in Denver Vs Other Regions

Cumulatively, rate of fentanyl exposure in Denver is an estimated ~2x higher than other regions.

Rate of fentanyl exposure increased sharply in 2020.

*Indicates projected value. Western and Eastern Colorado based only a single case.
Characteristics of Exposures

Distribution of routes is broadly similar across regions.

~50-60% result from ingestion.

~25% from inhalation.

Injection uncommon.
Characteristics of Exposures

Distribution of outcomes is broadly similar across regions.

More than half of exposures result in moderate or major medical outcomes.

- **Moderate**
  - More pronounced symptoms
  - Treatment often recommended
  - Not life threatening

- **Major**
  - Life threatening
Summary of Poisoning Data

• Rate of fentanyl exposure in Denver is higher than other regions of Colorado

• Fentanyl exposures are frequently...
  • Intentional
  • High severity
  • Either ingested or inhaled

• Fentanyl exposures increased sharply starting in 2020
Fentanyl Use Among Patients Entering Treatment
Overview: Treatment Center Programs Combined

• Study Objective: Provide drug use information from individuals entering treatment for opioid use disorder (OUD)

• Combined data from both publicly funded and private treatment centers

• Utilizes survey of patients entering treatment
Design: Treatment Center Programs Combined

- Continual data collection, analyzed quarterly
- Cross-sectional among adults
- Self-administered and anonymous
- Paper survey taken either in office during intake or afterwards
- Careless response exclusion applied to remove inattentive responses
Design: NMURx Program

Advantages
• Confirmed OUD population
• Geographically inclusive
• Diverse respondents
• Differentiates Rx fentanyl from nonpharmaceutical fentanyl

Disadvantages
• Self-reported
• Convenience sample
Study Specific Analysis

• Analyzed reports of nonpharmaceutical fentanyl use to get high in the past month in Colorado regions

• Trend data from 2016 to 1st quarter 2022 (n=774 in CO)

• Logistic model to test differences in odds of use across region
  • Adjusted by age and sex

• From 4th quarter 2020 to 1st quarter 2022 (n=71 in CO) analyzed frequency of overdose and naloxone availability
Fentanyl Endorsement Origin

Fentanyl endorsements are concentrated in Denver and surrounding ZIP code.
Fentanyl Exposures in Denver Vs Other Regions

- In all of Colorado, percentage of entrants using fentanyl increased from 5.6% to 32.6% from 2018-2021
- In combined 2020-2021
  - All CO, 27.1% (49/181)
  - Denver, 31.8% (28/88)
### Fentanyl Exposures in Denver Vs Other Regions, 2016-2022Q1

<table>
<thead>
<tr>
<th>Region or Covariate</th>
<th>Unadjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>REF</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Front Range</td>
<td>0.34 (0.20-0.59)</td>
<td>0.33 (0.19-0.58)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Eastern</td>
<td>0.33 (0.16-0.67)</td>
<td>0.33 (0.16-0.68)</td>
<td>0.003</td>
</tr>
<tr>
<td>Western</td>
<td>0.15 (0.06-0.39)</td>
<td>0.14 (0.05-0.36)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (1-year units)</td>
<td>--</td>
<td>0.97 (0.94-0.99)</td>
<td>0.020</td>
</tr>
<tr>
<td>Sex (Male REF)</td>
<td>--</td>
<td>0.91 (0.57-1.45)</td>
<td>0.682</td>
</tr>
</tbody>
</table>

Cumulatively among entrants with OUD, odds of fentanyl use in Denver is ~3x higher than other regions, even after adjustment.
Among all respondents in Colorado, 35.2% reported an overdose in their lifetime.
Approximately a third reported their last overdose was fentanyl
Fewer than half reporting overdose were administered naloxone.
Do you own naloxone?

Among those using fentanyl in the past month, 25% own naloxone.
Among those using fentanyl in the past month, only 55% know where to get naloxone.
Summary of Patients in Treatment Data

• Odds of fentanyl use in Denver is higher than other regions of Colorado
• Steady increase in use since 2018
• Naloxone is underutilized and knowledge of it is limited
Summarizing Multiple Data Sources
Key Points from Each Data Source

**General Population**
- Total prevalence of fentanyl use is lower relative to other states
- Data suggestive that use is more likely in Denver
- More severe problematic drug use markers than those using other drugs

**Poisoning Exposures**
- Rate of exposure in Denver higher than other regions
- Exposures in Denver on track to continue rise
- Most exposures are intentional and high severity
- Ingestion and inhalation are prominent routes

**Patients in Treatment**
- Odds of use in Denver higher than other regions
- Naloxone availability is limited among those knowingly using fentanyl
Combined Conclusions

- Triangulation of data sources indicate:
  - While state-wide prevalence of use seems low, use is increasing among unique subpopulations
  - Fentanyl use is more likely in Denver than other Colorado regions
- Patterns of exposures (routes, reasons, severity) do not seem to differ between regions
- Naloxone as an intervention is both underutilized and unknown
- Data presented here could be used as benchmarks to assess the effectiveness of future intervention strategies
References


Thank you!
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RADARS® System