

Non-Fatal Patient Journey Task Force Presentation

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January 8th, 2025

Introduction

- We know quite a bit about fatal overdoses and the decedent victims due to Maine's SUDORS (State Unintentional Drug Overdose Reporting System)
 - Federal CDC – over 600 variables for all unintentional overdoses using medical examiner and law enforcement data, 2016-present
- We know much less about non-fatal overdoses, and especially about the course of SUD over years

Non-fatal Overdoses

- We thought we could use EMS data to fill in some of the knowledge gaps about non-fatal overdoses
 - The trajectory of SUD illness over years
 - The service burden of EMS response to overdoses
 - Characteristics of patients experiencing non-fatal overdoses, including “frequent flyers”
 - What data gaps do we face using EMS data

Linking SUDORS with EMS data

- Phase I: linking of SUDORS with EMS data with focus on following patients longitudinally (thank you, Darren)
 - Prianka Sarker and Eric Miller will present results of this phase – explore what can & cannot be learned about these patients focusing on EMS data contributions
- Phase II will be discussed at the end of this presentation
- **We invite your input**

Project Overview

- By merging SUDORS data with EMS data, we are able to fill in gaps of non-fatals and decedents' health history and allow for more robust analyses to inform policymakers.
- Population of interest: individuals that experience an overdose with EMS present at least once.
- The goal of this project is to better understand the illness trajectory of individuals with substance use disorder (SUD) in Maine and how they interact with EMS.

Data Sources & Data Linkage

- Datasets merged for this study:
 - (a) Maine Emergency Medical Services Data: 2010 - 2023
 - (b) Maine Office of Chief Medical Examiner Decedent Data: 2010 - 2015
 - (c) State Unintentional Drug Overdose Reporting System (SUDORS): 2016 - 2022
- Maine EMS merged these datasets using patient's PII (first name, last name, and date of birth).
- All analyses are conducted using de-identified linked patient data.
- Study timeline: 2010 - 2022

Data Linkage: Decedents with and without EMS Interactions

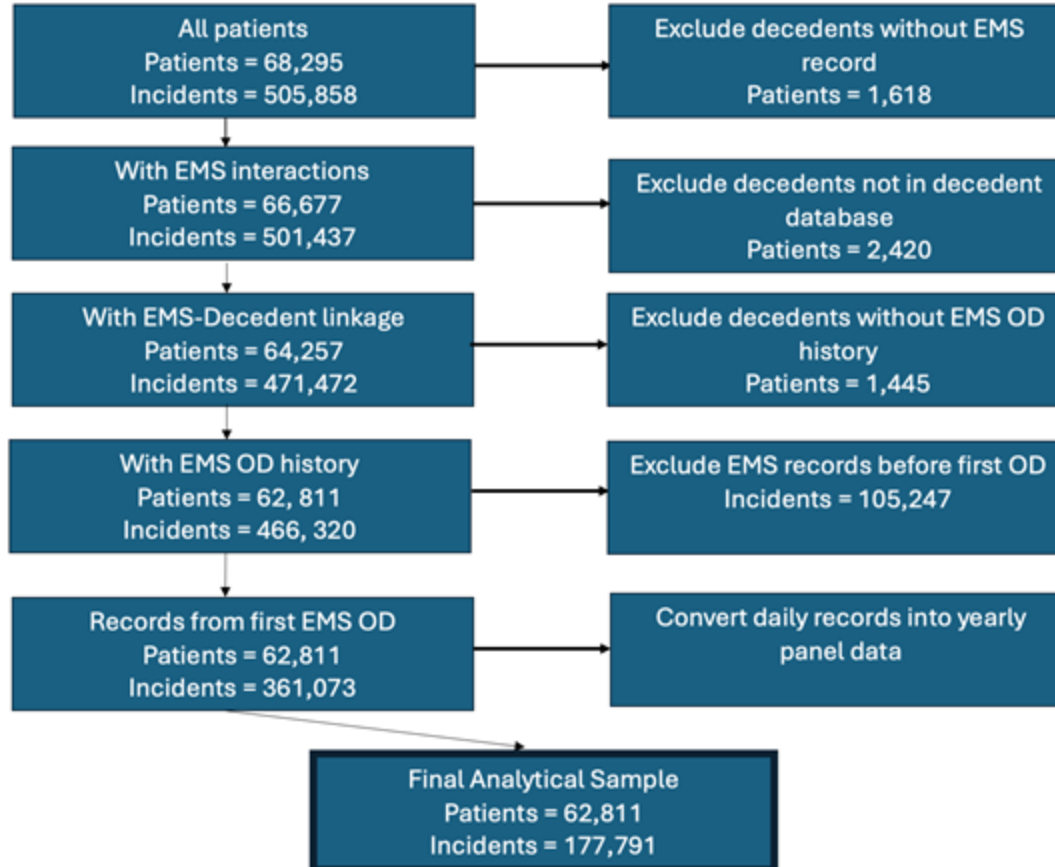
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total	167	155	163	176	208	272	375	417	354	380	504	635	615
W/ EMS	121	115	142	149	179	237	323	363	302	338	432	56	47
No EMS	46	40	21	27	29	35	52	54	52	42	73	579	568

- This is the group that initially was matched in EMS data from SUDORS.

Important Data Notes

- EMS began asking “Is patient homeless?” in 2019.
- It is difficult for EMS responders to capture all of the data elements for each encounter, which leads to missing data.
- Many people encountering someone experiencing a non-fatal overdose do not contact 911.

Steps in Preparing Data for Analysis

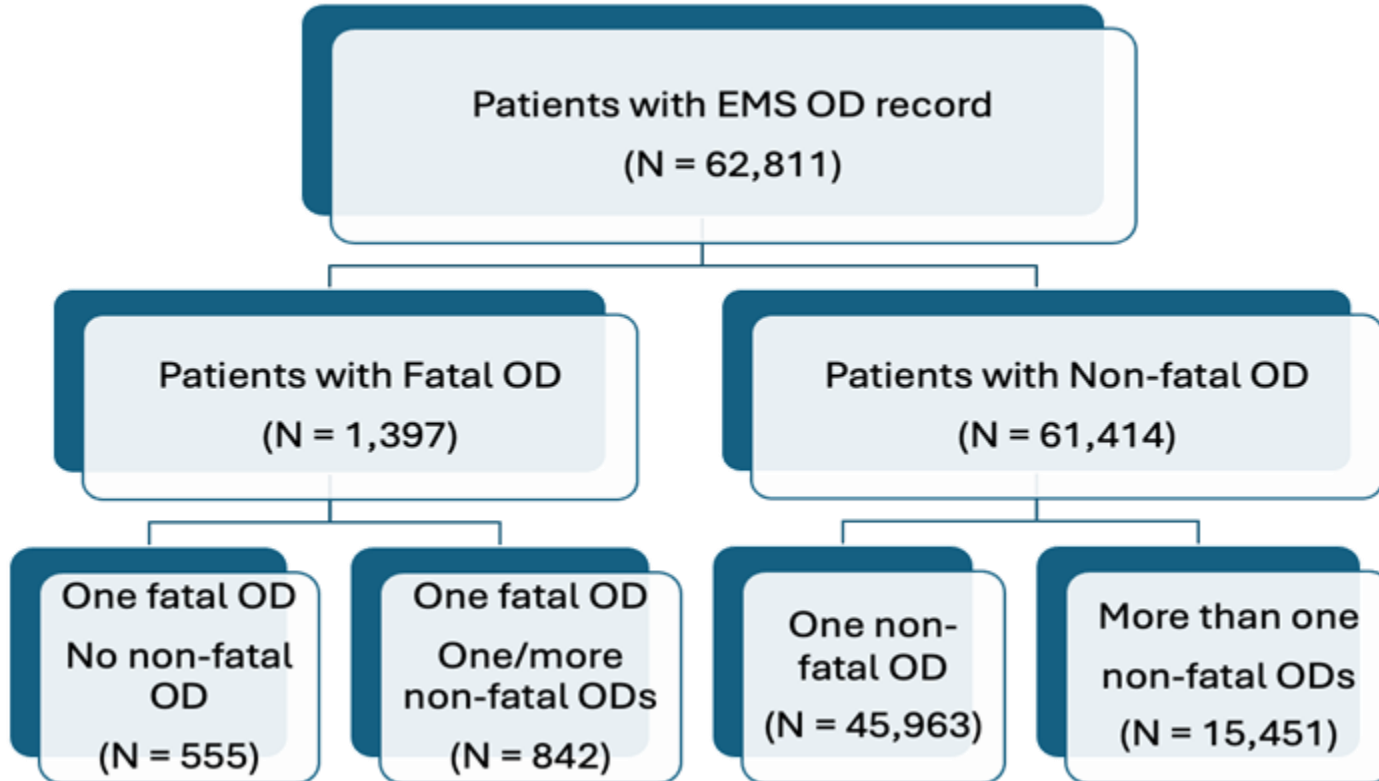


Some Data Information at a Glance

For a total of 62,811 unique patients, Maine EMS had the following number of interactions during 2010 - 2022.

Total EMS interactions	361,073
Overdose interactions	103,180
Opioid overdose interactions	17,791
Fatal overdose interactions	1,397
Non-fatal overdose interactions	101,783
Non-overdose emergency interactions	257,893

Patient Cohorts



Study Design: Patient Journey Reconstruction

For each patient:

- First interaction year: First OD with EMS
- Final interaction year: Patient died or had last interaction with EMS

Study Design: Patient Journey Reconstruction

- Patient journey timeline is **a maximum of 13 years** from the first year of overdose interaction to the last year of interaction.
- A large number of patients have only one year of history with EMS.

Patient Journey Timeline (Number of Individuals)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Alive at the start of the year	62,811	25,654	20,139	16,348	13,193	10,674	8,526	6,663	5,149	3,795	2,607	1,568	664
Died during the year	665	213	135	97	69	63	59	41	25	18	10	1	1
Presumed alive but had no more interactions	36,492	5,302	3,656	3,058	2,450	2,085	1,804	1,473	1,329	1,170	1,029	903	663
Alive with future interactions	25,654	20,139	16,348	13,193	10,674	8,526	6,663	5,149	3,795	2,607	1,568	664	—

Patient Journey Timeline (Percentage Change)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Alive at the start of the year	100%	41%	32%	26%	21%	17%	14%	11%	8%	6%	4%	2%	1%
Died during that year	1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Presumed alive but had no more interactions	58%	8%	6%	5%	4%	3%	3%	2%	2%	2%	2%	1%	1%
Alive with future interactions	41%	32%	26%	21%	17%	14%	11%	8%	6%	4%	2%	1%	_____

Patient Journey Timeline (Number of Fatal and Non-fatal OD Incidents)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
No. of Fatal ODs	665	213	135	97	69	63	59	41	25	18	10	1	1
No. of Non-fatal ODs	73,314	7,491	4,515	3,574	2,856	2,178	1,811	1,667	1,390	1,225	1,024	601	358

Study Variables

Demographic

- Age
- Birth gender
- Race

Socio-economic

- Rural/urban/mixed indicator
- Housing instability

Comorbid conditions

- Alcohol use disorder
- Cardiovascular
- Chronic pain
- Diabetes
- HIV
- Liver
- Lung
- Mental health problem
- Obesity
- Sleep apnea
- Substance use disorder
- Traumatic brain injury

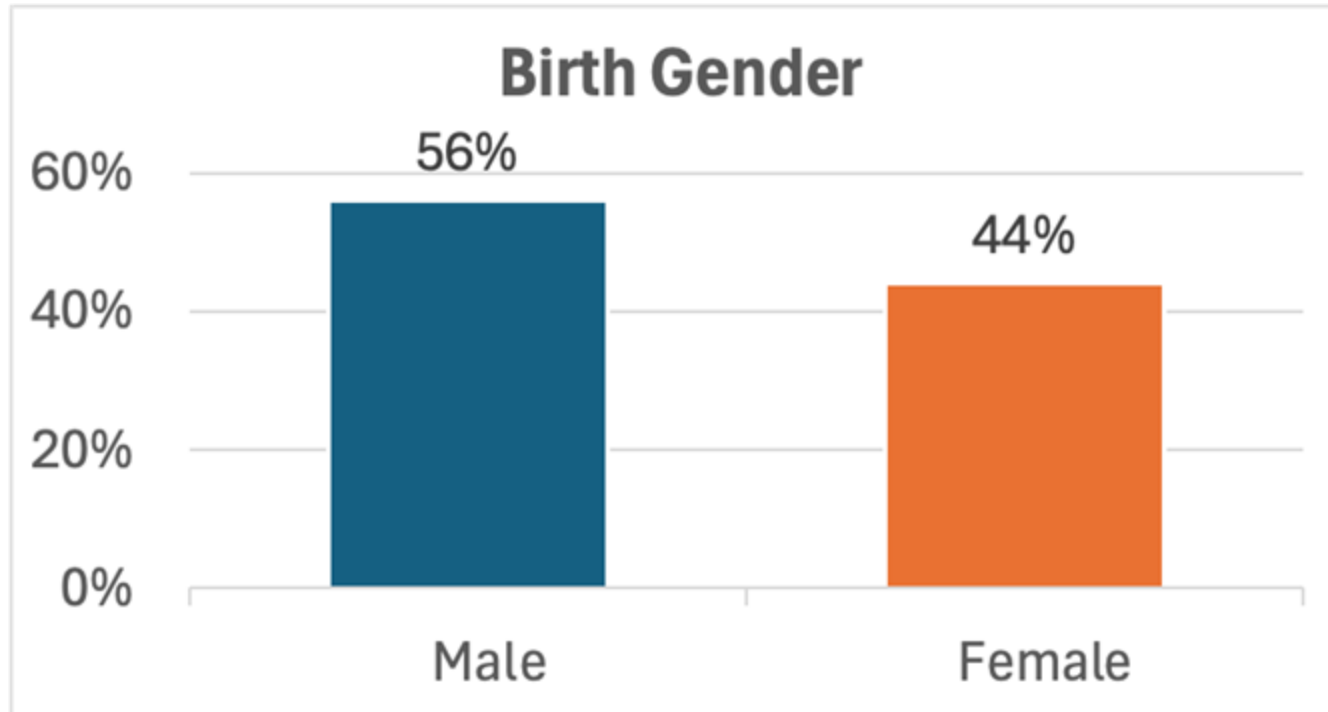
Definition of Study Variables

- **Age:** Age from EMS data
- **Birth gender:** Birth gender from EMS data
- **Race:** White or Non-White (if EMS recorded patient at least once as American Indian/Asian/African American/Hispanic/Native Hawaiian)
- **Rural/urban/mixed indicator:** Rural (includes super rural), urban, or mixed

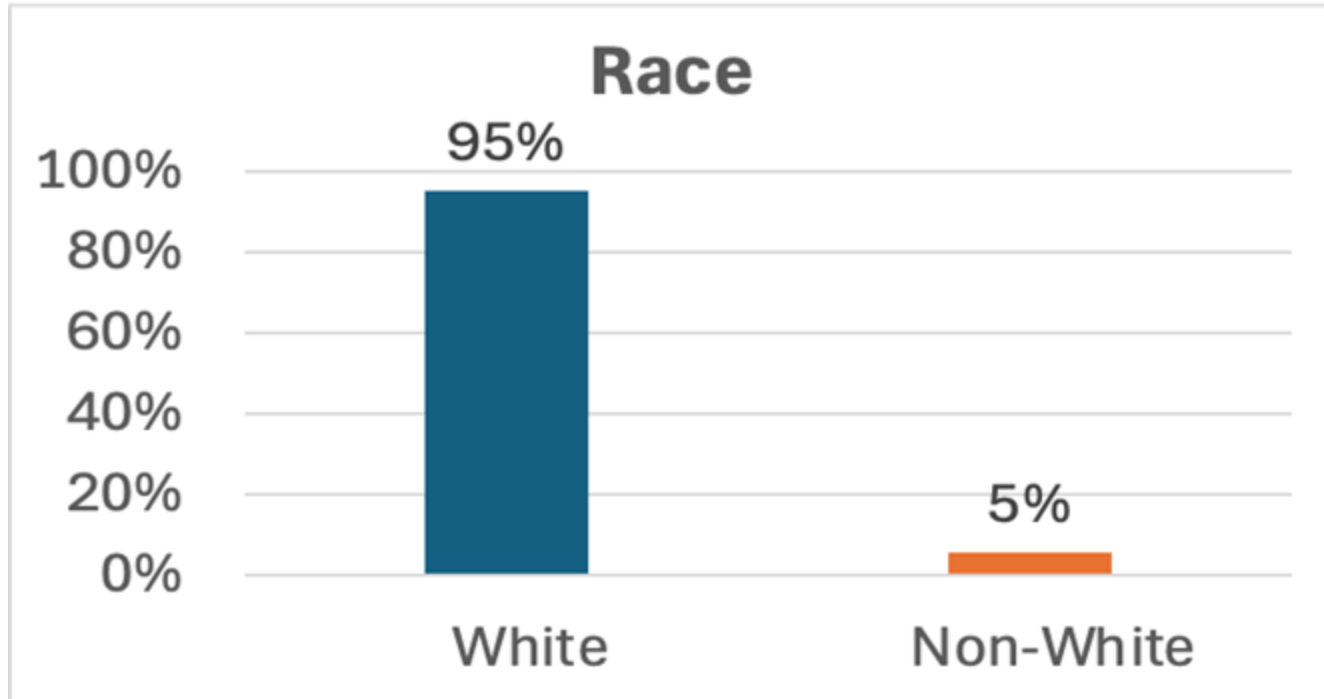
Definition of Study Variables (Continued)

- ***Housing unstable:*** If EMS ever recorded “Homeless”.
- ***Comorbid conditions:*** Present or absent for all comorbid conditions mentioned in the primary impression, secondary impression, or medical history.

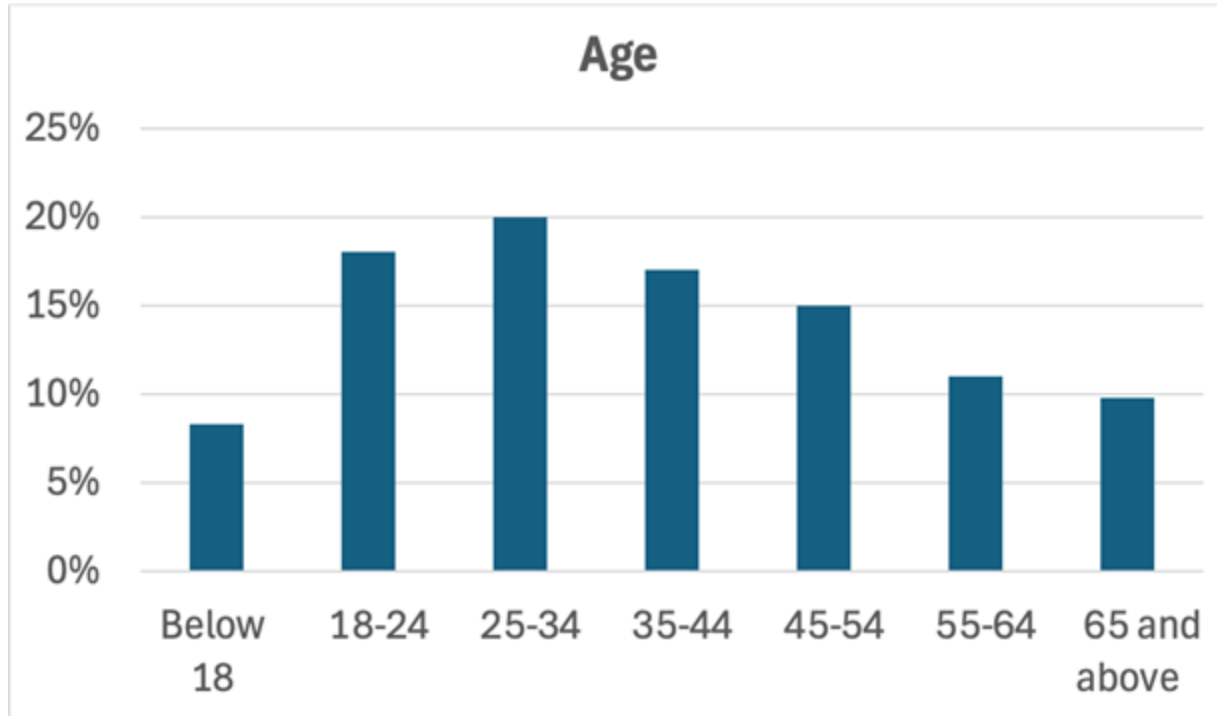
Patients Characteristics at Study Baseline (N = 62,811)



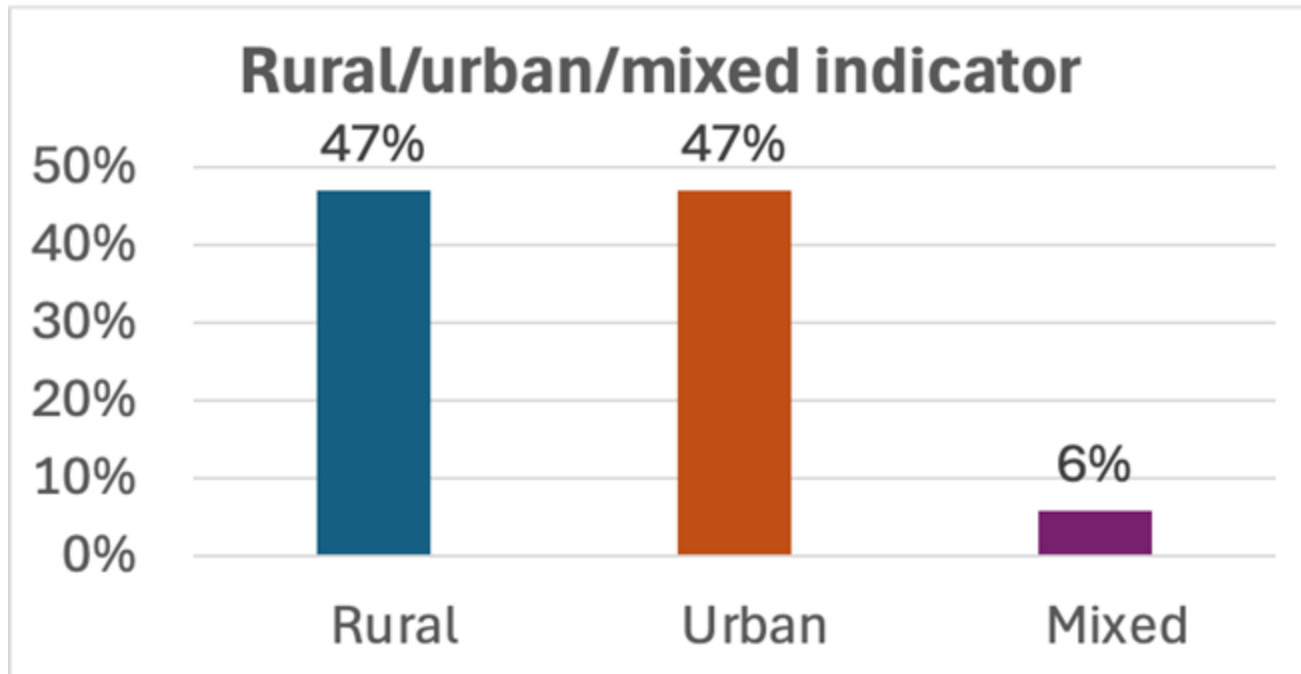
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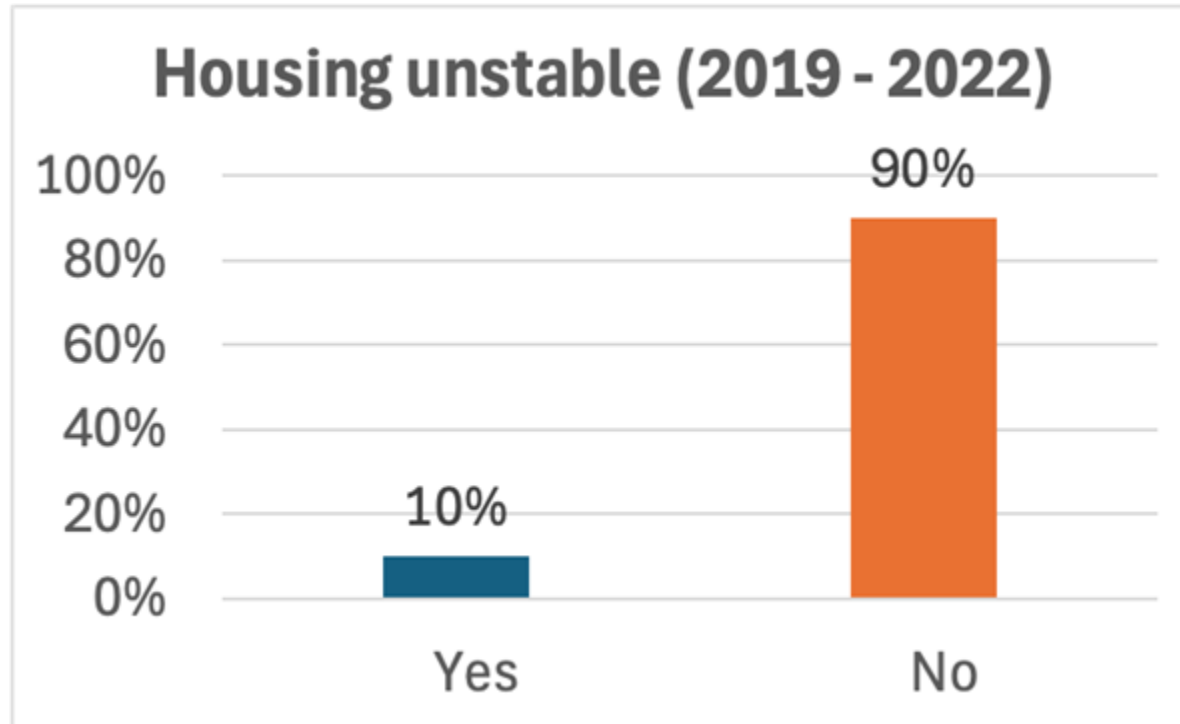
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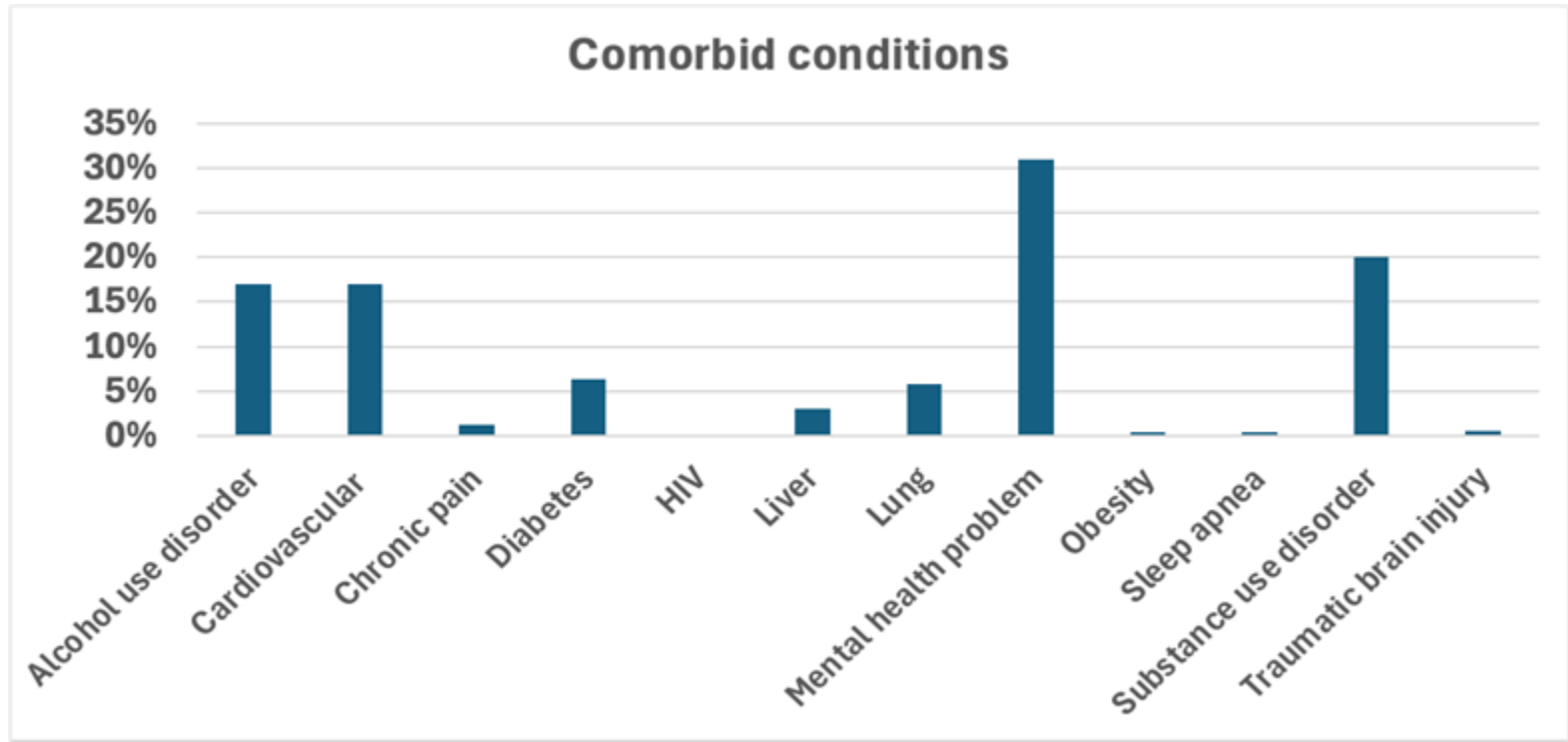
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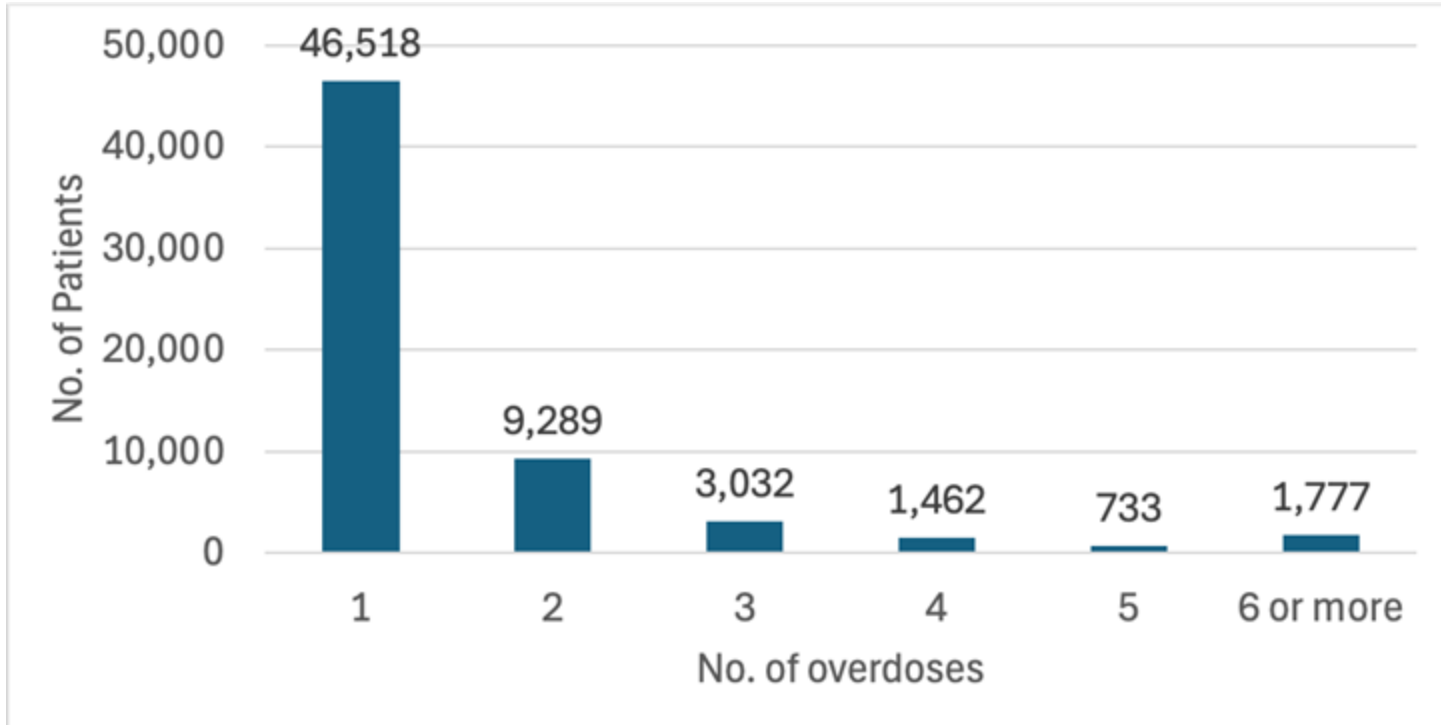
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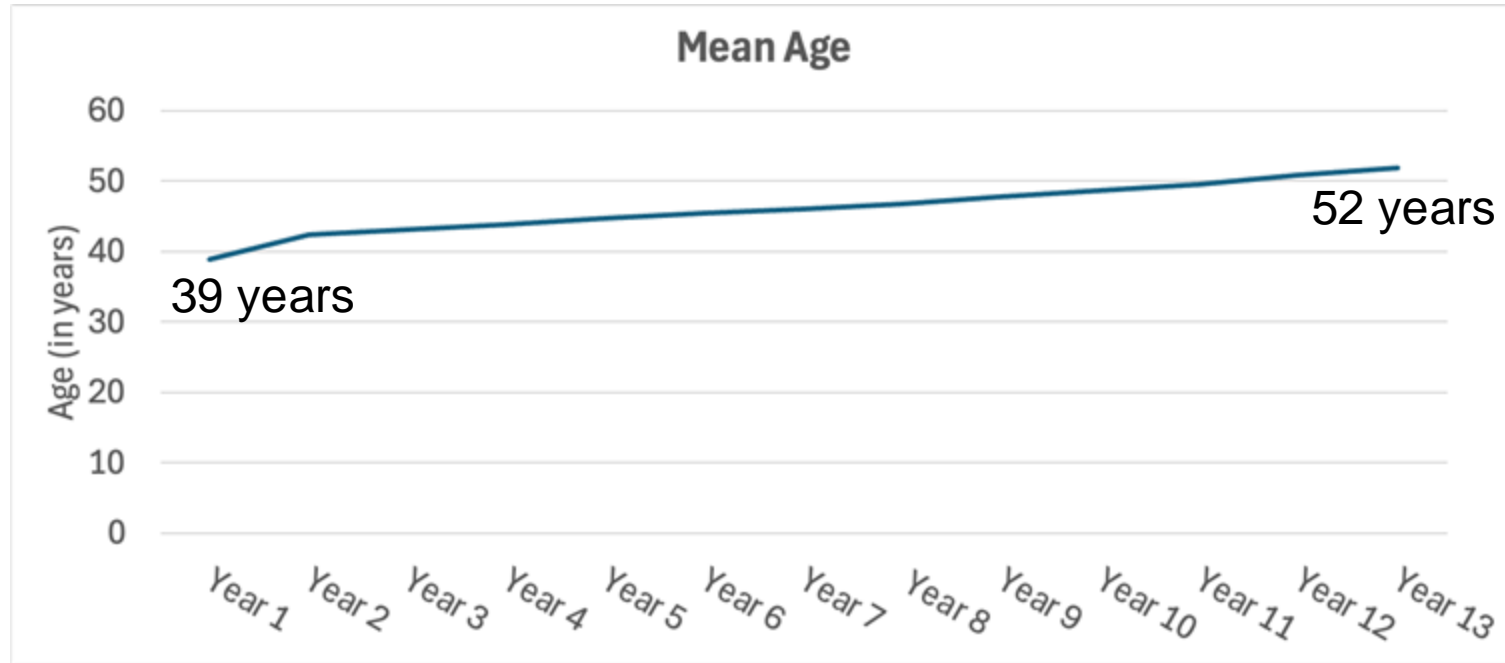
Patients Characteristics at Study Baseline (N = 62,811)



Number of Overdoses per Person



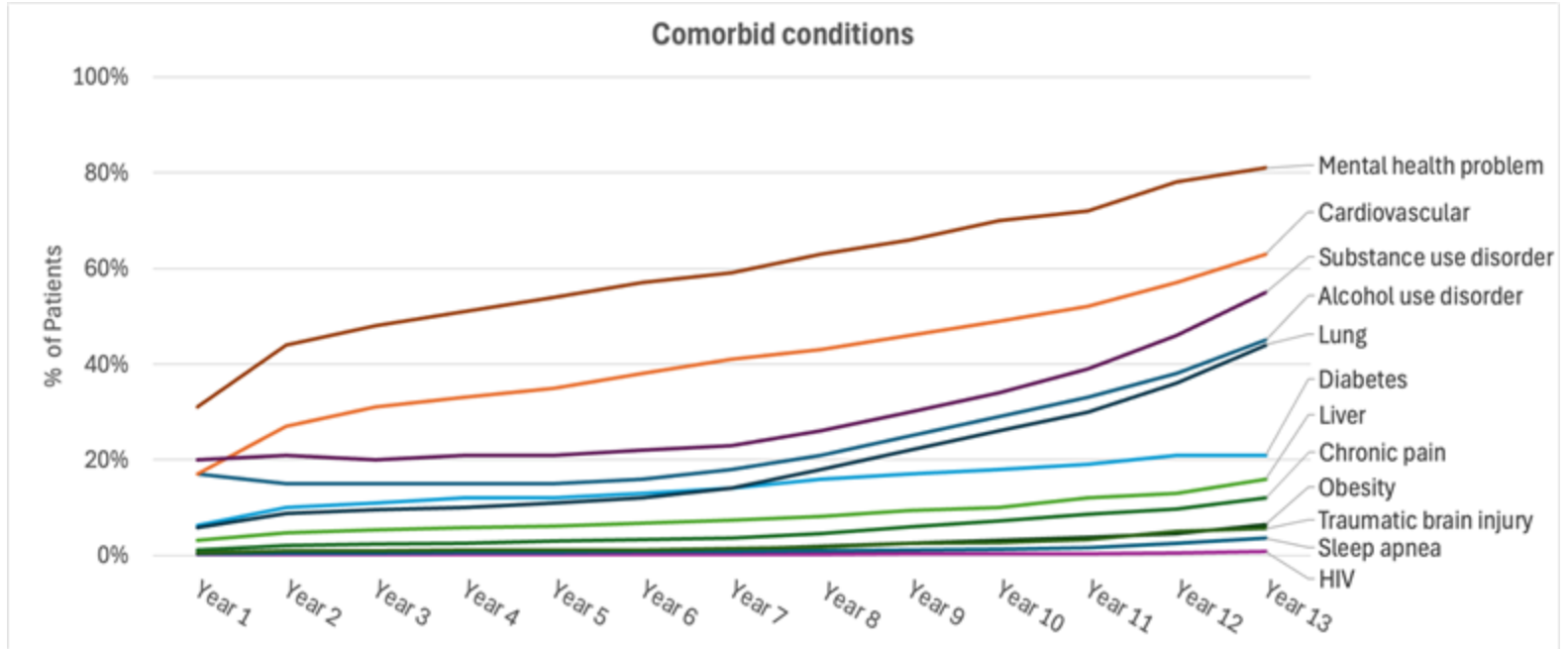
Study Cohort Aging Over Study Period



Cohort Racial, Housing Status, & Rural/Urban Distribution

- Racial distribution was steady across various EMS interaction histories (95% White).
- Similarly, rural/urban/mixed distribution also remain stable throughout the patient journey (47%/47%/6%).
- Share of patients with unstable housing increases over time (10%-16%).

Cohort Comorbidities Over Time



- The longer patients with SUD continue interacting with EMS, they accumulate other physical and mental health comorbidities as they age.

Cohort alive for 13 years (N = 663) : first, mid and final year of journey

Variables	Year 1	Year 7	Year 13
Male	358 (54%)		
Female	302 (46%)		
Below 18	43 (7%)	10 (2%)	8 (1%)
18-24	100 (15%)	47 (7%)	3 (1%)
25-34	111 (17%)	138 (21%)	98 (15%)
35-44	126 (19%)	110 (17%)	127 (19%)
45-54	161 (24%)	144 (22%)	119 (18%)
55-64	82 (12%)	135 (20%)	153 (23%)
65 and above	40 (6%)	79 (12%)	155 (23%)

Variables	Year 1	Year 7	Year 13
White	562 (96%)		
Non-White	22 (4%)		
Rural	263 (41%)	278 (44%)	274 (44%)
Urban	301 (47%)	306 (49%)	301 (48%)
Mixed	72 (11%)	43 (7%)	47 (7%)

Cohort alive for 13 years (N = 663) : first, mid and final year of journey

Comorbidities	Year 1	Year 7	Year 13
Alcohol use disorder	175 (26%)	177 (27%)	299 (45%)
Cardiovascular	138 (21%)	288 (43%)	417 (63%)
Chronic pain	0 (0%)	0 (0%)	80 (12%)
Diabetes	50 (8%)	83 (13%)	139 (21%)
HIV	1 (0%)	1 (0%)	5 (1%)
Liver	25 (4%)	54 (8%)	102 (16%)
Lung	16 (2%)	23 (4%)	289 (44%)
Mental health problem	278 (42%)	414 (62%)	538 (81%)
Obesity	0 (0%)	0 (0%)	43 (7%)
Sleep apnea	0 (0%)	0 (0%)	23 (4%)
Substance use disorder	241 (36%)	261 (39%)	366 (55%)
Traumatic brain injury	0 (0%)	0 (0%)	37 (6%)

Cohort alive for 13 years (N = 663) : first, mid and final year of journey

Overdose Count	Year 1	Year 7	Year 13
0	0 (0%)	570 (86%)	480 (72%)
1	505 (76%)	47 (7%)	113 (17%)
2	99 (15%)	28 (4%)	36 (5%)
3 or more	59 (9%)	18 (3%)	34 (5%)

Risk Analysis: Results from Regression Models

Factors significantly associated with fatal overdose	Factors significantly associated with having at least 2 non-fatal overdoses
Males compared to females (10% more likely)	Males compared to females (14% more likely)
People over 18 and younger than 65 compared to under 18	People over 18 and younger than 65 compared to under 18
Cardiovascular disease compared to no cardiovascular disease (70% more likely)	Cardiovascular disease compared to no cardiovascular disease (14% more likely)
Past SUD history compared to no past SUD history (30% more likely)	Respiratory disease compared to no respiratory disease (12% more likely)
	Mental health problems compared to no mental health problems (35% more likely)
	Past SUD history compared to no past SUD history (85% more likely)

Summary of Findings

- Over half of the patients (58%) do not encounter EMS after their first overdose with EMS presence.
- The older patients become, the more comorbidities accumulate.
 - Aside from substance use disorders, mental health disorder is the most common comorbidity followed by cardiovascular disease.
 - Patients with these comorbidities had a relatively higher risk of an overdose.

Summary of Findings

- Men make up greater share of fatal overdoses (67%), but the gender gap is closer among non-fatal overdoses (57% males and 43% females).
- EMS responds to approximately the same proportion of overdoses in urban (47%) and rural areas (47%).
- There is greater EMS documentation of comorbidities among patients that experience non-fatal overdoses than patients that ultimately experience a fatal overdose.

Study Limitations

- A substantial portion of patients do not interact with Maine EMS after the first year of their overdose with EMS presence.
 - We don't know if they are still dealing with their SUD or they have recovered.
- We cannot observe patients who experience a non-fatal overdose but never interact with Maine EMS.
- We excluded decedents who were in the SUDORS database, but never interacted with Maine EMS.

Study Limitations

- EMS data has limited information about patients' social determinants of health (e.g., household economic status, education status, employment, etc).
- “Not reported” responses are common in the EMS data.
- Housing instability information is available only for the period of 2019-2022.
- We are unable to analyze non-white subpopulations due small sample sizes.

Next Analytical Steps

- Focusing on other subgroups of patients, and incorporating SUDORS data
 - For example,
 - Decedents with unwitnessed overdose deaths
 - Decedents treated for SUD
 - Decedents with recent release from hospital
 - Subgroup of decedents with no history interacting with EMS for an overdose
 - First-time EMS callers versus “frequent flyers”
 - Patients with stable versus unstable housing

- **THANK YOU FOR YOUR ATTENTION**
- **QUESTIONS?**