Drug and suicide deaths in California: Leveraging ‘Big Data’ to identify vulnerable populations and inform policy solutions

Sidra Goldman-Mellor, Ph.D., M.P.H.
University of California, Merced
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US trends in suicide rates, 1999-2017

- Overall: 33% increase
- Males: 26% increase
- Females: 53% increase

U.S. trends in drug poisoning rates, 1999-2017

* Note: Some drug deaths are suicides.

Males: 255% increase

Females: 264% increase

255% increase overall

# 10 Leading Causes of Death, United States (2018, all races, both sexes)

<table>
<thead>
<tr>
<th>Rank</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65+</th>
<th>All Ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Congenital Anomalies</strong> 4,473</td>
<td><strong>Injury</strong> 1,226</td>
<td><strong>Unintentional</strong> 734</td>
<td><strong>Injury</strong> 692</td>
<td><strong>Unintentional</strong> 24,614</td>
<td><strong>Unintentional</strong> 22,667</td>
<td><strong>Malignant Neoplasms</strong> 37,301</td>
<td><strong>Malignant Neoplasms</strong> 113,947</td>
<td><strong>Heart Disease</strong> 526,509</td>
<td><strong>Heart Disease</strong> 655,381</td>
<td><strong>Heart Disease</strong> 655,381</td>
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<tr>
<td>2</td>
<td><strong>Short Gestation</strong> 3,679</td>
<td><strong>Congenital Anomalies</strong> 384</td>
<td><strong>Malignant Neoplasms</strong> 393</td>
<td><strong>Suicide</strong> 596</td>
<td><strong>Suicide</strong> 9,211</td>
<td><strong>Suicide</strong> 8,020</td>
<td><strong>Malignant Neoplasms</strong> 10,640</td>
<td><strong>Heart Disease</strong> 32,220</td>
<td><strong>Heart Disease</strong> 81,042</td>
<td><strong>Malignant Neoplasms</strong> 431,102</td>
<td><strong>Malignant Neoplasms</strong> 599,274</td>
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<tr>
<td>3</td>
<td><strong>Maternal Pregnancy Comp.</strong> 1,358</td>
<td><strong>Homicide</strong> 353</td>
<td><strong>Congenital Anomalies</strong> 201</td>
<td><strong>Malignant Neoplasms</strong> 450</td>
<td><strong>Homicide</strong> 4,607</td>
<td><strong>Homicide</strong> 5,234</td>
<td><strong>Heart Disease</strong> 10,532</td>
<td><strong>Unintentional</strong> 23,856</td>
<td><strong>Unintentional</strong> 23,693</td>
<td><strong>Unintentional</strong> 167,127</td>
<td><strong>Unintentional</strong> 167,127</td>
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<tr>
<td>4</td>
<td><strong>SIDS</strong> 1,334</td>
<td><strong>Malignant Neoplasms</strong> 326</td>
<td><strong>Homicide</strong> 121</td>
<td><strong>Congenital Anomalies</strong> 172</td>
<td><strong>Malignant Neoplasms</strong> 1,371</td>
<td><strong>Malignant Neoplasms</strong> 3,684</td>
<td><strong>Suicide</strong> 7,921</td>
<td><strong>Suicide</strong> 8,345</td>
<td><strong>Injury</strong> 15,600</td>
<td><strong>Cerebrovascular Disease</strong> 135,560</td>
<td><strong>Cerebrovascular Disease</strong> 135,560</td>
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<tr>
<td>5</td>
<td><strong>Unintentional Injury</strong> 1,168</td>
<td><strong>Influenza &amp; Pneumonia</strong> 122</td>
<td><strong>Influenza &amp; Pneumonia</strong> 71</td>
<td><strong>Homicide</strong> 168</td>
<td><strong>Heart Disease</strong> 905</td>
<td><strong>Heart Disease</strong> 3,561</td>
<td><strong>Homicide</strong> 3,304</td>
<td><strong>Liver Disease</strong> 8,157</td>
<td><strong>Diabetes Mellitus</strong> 14,941</td>
<td><strong>Alzheimer’s Disease</strong> 120,658</td>
<td><strong>Cerebrovascular Disease</strong> 147,810</td>
</tr>
<tr>
<td>6</td>
<td><strong>Placenta Cord Membranes</strong> 724</td>
<td><strong>Heart Disease</strong> 115</td>
<td><strong>Chronic Low. Respiratory Disease</strong> 68</td>
<td><strong>Heart Disease</strong> 101</td>
<td><strong>Congenital Anomalies</strong> 354</td>
<td><strong>Liver Disease</strong> 1,008</td>
<td><strong>Liver Disease</strong> 3,108</td>
<td><strong>Diabetes Mellitus</strong> 6,414</td>
<td><strong>Liver Disease</strong> 13,945</td>
<td><strong>Diabetes Mellitus</strong> 60,182</td>
<td><strong>Alzheimer’s Disease</strong> 122,019</td>
</tr>
<tr>
<td>7</td>
<td><strong>Bacterial Sepsis</strong> 579</td>
<td><strong>Perinatal Period</strong> 62</td>
<td><strong>Heart Disease</strong> 68</td>
<td><strong>Chronic Low. Respiratory Disease</strong> 64</td>
<td><strong>Diabetes Mellitus</strong> 246</td>
<td><strong>Diabetes Mellitus</strong> 837</td>
<td><strong>Diabetes Mellitus</strong> 2,282</td>
<td><strong>Cerebrovascular Disease</strong> 12,789</td>
<td><strong>Cerebrovascular Disease</strong> 57,213</td>
<td><strong>Diabetes Mellitus</strong> 84,946</td>
<td><strong>Diabetes Mellitus</strong> 84,946</td>
</tr>
<tr>
<td>8</td>
<td><strong>Circulatory System Disease</strong> 428</td>
<td><strong>Septicemia</strong> 54</td>
<td><strong>Cerebrovascular Disease</strong> 34</td>
<td><strong>Cerebrovascular Disease</strong> 54</td>
<td><strong>Influenza &amp; Pneumonia</strong> 200</td>
<td><strong>Cerebrovascular Disease</strong> 567</td>
<td><strong>Cerebrovascular Disease</strong> 1,704</td>
<td><strong>Chronic Low. Respiratory Disease</strong> 3,807</td>
<td><strong>Suicide</strong> 8,540</td>
<td><strong>Influenza &amp; Pneumonia</strong> 48,888</td>
<td><strong>Influenza &amp; Pneumonia</strong> 59,120</td>
</tr>
<tr>
<td>9</td>
<td><strong>Respiratory Distress</strong> 390</td>
<td><strong>Chronic Low. Respiratory Disease</strong> 50</td>
<td><strong>Septicemia</strong> 34</td>
<td><strong>Influenza &amp; Pneumonia</strong> 51</td>
<td><strong>Chronic Low. Respiratory Disease</strong> 165</td>
<td><strong>HIV</strong> 482</td>
<td><strong>Influenza &amp; Pneumonia</strong> 956</td>
<td><strong>Influenza &amp; Pneumonia</strong> 2,380</td>
<td><strong>Septicemia</strong> 5,956</td>
<td><strong>Nephritis</strong> 42,232</td>
<td><strong>Nephritis</strong> 51,386</td>
</tr>
<tr>
<td>10</td>
<td><strong>Neonatal Hemorrhage</strong> 375</td>
<td><strong>Cerebrovascular Disease</strong> 43</td>
<td><strong>Benign Neoplasms</strong> 19</td>
<td><strong>Benign Neoplasms</strong> 30</td>
<td><strong>Complicated Pregnancy</strong> 151</td>
<td><strong>Influenza &amp; Pneumonia</strong> 457</td>
<td><strong>Septicemia</strong> 829</td>
<td><strong>Influenza &amp; Pneumonia</strong> 2,339</td>
<td><strong>Influenza &amp; Pneumonia</strong> 5,858</td>
<td><strong>Parkinson’s Disease</strong> 32,988</td>
<td><strong>Suicide</strong> 48,344</td>
</tr>
</tbody>
</table>
California trends in suicide rates, 2001-2018

13% increase overall
California trends in drug death rates, 2001-2018

* Note: Some drug deaths are suicides.
Good news and bad news for California

Lower-than-average drug overdose death and suicide rates

Both rates are rising
How to address these dual challenges?

Multi-faceted public health approach

- **Primary prevention**
  - Help entire population avoid development of suicidal distress & addiction

- **Secondary prevention**
  - Uncover potentially harmful levels of distress & drug use in vulnerable individuals

- **Tertiary prevention**
  - Treat individuals presenting with suicidal behavior/drug overdose; facilitate entry into treatment to prevent further harm
Role of healthcare settings

Promising but under-utilized context for secondary & tertiary prevention efforts

>80% of suicide decedents and opioid overdose decedents had ≥1 healthcare contact in year prior to death

(Ahmedani et al. 2014, Olfson et al. 2018)
What’s missing?

“Follow-up” data on healthcare patients:
How common is death by suicide or drug overdose?
Who is most at risk?
Why is this important?

• Understanding mortality outcomes among patients could:
  • Help clinicians make treatment decisions
  • Support risk-stratification efforts
  • Inform – and generate demand for – healthcare quality improvement efforts

• Longitudinal tracking of mortality outcomes is routine in parts of health care (e.g., cancer)…
  • But not for individuals with mental/behavioral health issues!

• **Challenge**: Suicide and drug mortality are relatively rare
Solution? Leverage “Big (Linked) Data”
Basic approach

Emergency department patients

Entire California population
Three example projects

1. Mortality outcomes among emergency department (ED) patients with suicidal behavior

2. Mortality outcomes among ED patients with drug overdose

3. Mortality outcomes among postpartum women
Three example projects

1. Mortality outcomes among emergency department (ED) patients with **suicidal behavior**

2. Mortality outcomes among ED patients with **drug overdose**

3. Mortality outcomes among **postpartum** women
Mortality outcomes among ED patients with suicidal behavior

- Self-harm patients
- Suicidal ideation patients
- Reference patients (5% random sample of all other patients)

2009 2010 2011 2012

Death
Suicide rates in year after discharge

Matching CA population: 12.3
Random sample of ED patients ("Reference patients"): 23.4

~2x higher

n=497,760

Suicide rates in year after discharge

Comparison group

~2x higher

<table>
<thead>
<tr>
<th>Group</th>
<th>Reference patients (n=497,760)</th>
<th>Suicidal ideation patients (n=67,379)</th>
<th>Self-harm patients (n=83,507)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suicide rate per 100,000</td>
<td>12.3</td>
<td>23.4</td>
<td>56x higher</td>
</tr>
<tr>
<td>Matching CA population</td>
<td></td>
<td></td>
<td>26x higher</td>
</tr>
</tbody>
</table>

Mortality from other causes

**SELF-HARM PATIENTS**

- Suicide: 31x higher
- Accident: 3x higher
- Homicide: 4x higher
- Natural causes: [Bar Graph]

**SUICIDAL IDEATION PATIENTS**

- Suicide: 13x higher
- Accident: 3x higher
- Homicide: 5x higher
- Natural causes: [Bar Graph]

Subgroups at even higher suicide risk

- Older men
- White patients
- Privately insured
- Psychiatric diagnoses

Summary

• ED patients presenting with suicidal behavior are at very high risk for suicide… especially:
  • Patients who have deliberately injured themselves
  • Patients who are older, male, NH white

• Suicide is not the only cause of death they’re at high risk for

• Even ED patients *without* suicidal behavior have elevated risk
Three example projects

1. Mortality outcomes among emergency department (ED) patients with suicidal behavior

2. Mortality outcomes among ED patients with drug overdose

3. Mortality outcomes among postpartum women
Mortality outcomes among ED patients with non-fatal drug overdose

- **Opioid overdose patients**
  - Prescription (e.g., oxycodone, methadone)
  - Illicit (e.g., heroin)

- **Sedative/hypnotic drug overdose patients**
  - Prescription (e.g., sleep aids like Ambien; anti-anxiety meds like Valium, Xanax)

Suicide rates in year after discharge

- Opioid patients: 18x higher
- Sedative/hyp patients: 9x higher

Accidental drug overdose mortality rates in year after discharge

- Opioid patients: 106x higher
- Sedative/hyp patients: 24x higher

Mortality from other causes

- Opioid overdose patients (N=21,080): Overdose (106x), Suicide (18x)
- Sedative/hypnotic overdose patients (N=75,391): Overdose (24x), Suicide (9x)
- Natural causes: 8.6x

Summary

• Opioid and sedative/hypnotic drug overdose patients seen in EDs experience drastically high rates of mortality
• Excess mortality is highest (in relative terms) for drug overdose, but highest (in absolute terms) for natural causes
Three example projects

1. Mortality outcomes among emergency department (ED) patients with suicidal behavior

2. Mortality outcomes among ED patients with drug overdose

3. Mortality outcomes among postpartum women
Deaths due to drugs and suicide may account for growing portion of pregnancy-associated deaths, yet have received less attention.

Context:
- Opioid use during pregnancy increased 4- to 8-fold, 2004-13.
- Opioid overdose & suicide deaths among reproductive-aged women also increased drastically during this time.

Information on incidence of & sociodemographic variation in drug-related and suicide pregnancy-associated deaths is scarce.

Mangla et al. AJOG 2019
Villapiano et al., JAMA Pediatr, 2017
Study objectives

1. Examine incidence of drug-related deaths and suicide in the 12 months after delivery among women with an index delivery in 2010-2012

2. Describe heterogeneity in death rates by key sociodemographic factors

3. Examine incidence of emergency department (ED) visits and hospitalization between delivery and post-partum death – could these health care encounters serve as opportunities to identify women at risk?
Study design

Women’s index deliveries in California hospitals (n=1,059,714)

12-month post-partum:

Goldman-Mellor & Margerison. AJOG 2019;221(5).
Postpartum 12-month mortality rates

Mortality rate per 100,000

Goldman-Mellor & Margerison. AJOG 2019;221(5).
Vulnerable subgroups for drug/suicide death

Incidence rate per 100,000

Age in years

Race/ethnicity

Insurance/payer

<20 years
20-35 years*
≥35 years
NH White*
NH Black
Hispanic
Asian/PI
NH other
Private*
Medicaid
Self-pay
Other

0
2
4
6
8
10
12
14
16
18
20
ED/hospital utilization between index delivery and death among women who died from a drug-related cause or suicide

74% of postpartum women dying from drugs or suicide made at least one hospital or ED visit between delivery and death.
Summary

- Drug-related deaths were 2\textsuperscript{nd} leading cause of mortality among postpartum women in CA
  - Drug-related deaths + suicide accounted for 1 in 5 postpartum deaths
- At elevated risk: Women of non-Hispanic White race, and those with Medicaid insurance
- 74\% of women dying from drugs or suicide made at least one hospital or ED visit between delivery and death
- 2 out of 3 drug/suicide deaths occurred between 6-12 months postpartum

Goldman-Mellor & Margerison. AJOG 2019;221(5).
Overall implications

- Emergency departments may be a useful setting for identifying & providing follow-up care for people at high risk of suicide and drug overdose.

- Need to conduct ongoing public health surveillance of patterns and correlates of suicide mortality, overdose mortality, and other outcomes.
Public health implications

• To address suicide and drug overdose risk, findings show need for:
  • Expanding provision of ED-based suicide & overdose prevention measures
  • Universal, routine screening all ED patients for suicidality
  • Developing new interventions to address suicidal patients’ and opioid-/sedative-dependent patients’ broad-spectrum mortality risks
    • Integrated (medical/mental/behavioral) care models may be key to improving their outcomes
• For postpartum mothers, findings show need for:
  • Increased attention to mortality from drugs, suicide & homicide
  • Increased screening & treatment while reducing stigma and punitive consequences for mothers who disclose drug use
Policy implications

1. **Support OSHPD/Vital Statistics efforts to conduct “big data” linkage**
   - HHS Record Reconciliation Project
   - California Policy Lab (CPL)

2. **Support inclusion of suicide & overdose deaths as health care quality benchmarks**
   - E.g., Healthcare Effectiveness Data and Information Set (HEDIS®) performance measures

3. **Support legislation to increase healthcare access:**
   - Extend Medicaid coverage for women to 1 year postpartum
   - Ensure access to affordable mental & behavioral health care for all
   - Address issues of parity between mental & physical health care
If physical diseases were treated like mental illness...

I get that you have food poisoning and all, but you have to at least make an effort.

You just need to change your frame of mind. Then you’ll feel better.

#MentalHealthisHealth
Thank you! Questions?

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Collaborators:

- **UC Merced**
  - Kevin Kwan, Ph.D. (now at CDPH)
  - Cristian Lidon-Moyano, Ph.D.

- **NIMH**
  - Michael Schoenbaum, Ph.D.

- **Columbia University**
  - Mark Olfson, M.D., M.P.H.

- **Prevention Research Institute**
  - Paul Gruenewald, Ph.D.

- **New York University**
  - Magdalena Cerda, Dr.P.H.

[sgoldman-mellor@ucmerced.edu]
Extra slides
Promising ED-based prevention measures

Suicide prevention:
• Safety Planning Intervention, within the index visit for anyone identified with suicide risk
• Proactive written and/or telephone follow-up contacts, over the 6-12 months after the index visit for anyone identified with suicide risk

Overdose prevention:
• ED-initiated buprenorphine treatment
• Addiction counseling
• Referral to outpatient care
HEDIS

- HEDIS is a set of 90+ performance measures widely used in the healthcare industry
  - HEDIS reflects the clinical quality performance of healthcare plans by:
    - determining which healthcare services are performed
    - showing if those services are improving health conditions
  - Rewards preventive care
  - Over 90% of health plans in the U.S. utilize HEDIS®
  - Performance measures are added, deleted, and revised annually