DEVELOPING A MODEL TO PREDICT COUNTIES’ VULNERABILITY TO HCV, HIV, AND OPIOID OVERDOSE

Vanessa McMahan, PhD & Sarah Deutsch, MPH
BACKGROUND
Opioid Overdose, HCV, and HIV Among PWID

- Opioid use and injection drug use are increasing in the United States and in Washington State
  - Risk of opioid overdose elevated when injecting
  - ~80% of hepatitis C (HCV) cases are among people who inject drugs (PWID)
  - HIV outbreaks among PWID in recent years indicate need for improved predictive tools
    - 2015 in Scott County, Indiana
    - 2018 in Seattle, Washington

US Centers for Disease Control and Prevention (CDC)
Jones, MMWR
Zibbell, AMJPH

Washington State Department of Health (WA DOH)
Peters PJ, NEJM
Golden MR, MMWR

Mathers BM, WHO Bulletin

Washington State Department of Health | 3
CDC and Tennessee Vulnerability Assessments

- In 2015 CDC conducted an HCV and HIV vulnerability assessment among PWID in all US counties
  - 2,970 counties, 15 predictors
  - Acute HCV outcome
  - Identified 220 vulnerable counties in 26 states, none in WA

- In 2017 the Tennessee DOH conducted a state-specific assessment
  - 95 counties, 78 predictors
  - Acute HCV outcome
  - Overlap with CDC results, additional vulnerabilities identified
CDC granted Washington “Determination of Need for Syringe Services Programs” in 2016, in the first year jurisdictions were eligible to use federal funds to support syringe service programs.

Significant gaps persist in resource availability for programs that support the health of people who inject drugs in WA.

September 1, 2018 CDC provided one year of emergency response funding to address the impacts of the opioid crisis by scaling up capacity for a variety of activities.
METHODS
Outcome Measurements

- Opioid overdose
  - The sum of opioid-related hospitalizations and deaths
    
    *Data source: Prevention and Community Health, WA DOH*

- HCV
  - The sum of chronic HCV cases in people born after 1965 and acute cases
    
    *Data source: Office of Infectious Disease, WA DOH*

- HIV
  - The number of virally unsuppressed HIV cases
    
    *Data source: Office of Infectious Disease, WA DOH*
We collected 75 county-level indicators from 2015 and 2016 based on the CDC and Tennessee vulnerability assessments and Washington context.

- 6 were dropped due to WA data availability/context:
  - drug coalition
  - certified pain management clinics
  - morphine milligram equivalent (MME) rate for analgesics and MAT *
  - count and rate of substance use treatment beds
Indicators were reviewed by group of WA DOH personnel and project analyst

- 19 were dropped (e.g., highway access)

- 10 were added for WA context or to stand in for omitted indicators
  - Number and rate of opioid prescriptions
  - Rate of MME dispensed *
  - HIV cases with IDU and MSM/IDU as transmission category
  - Total and point-in-time count of homeless
  - Syringe Services Program presence
  - Counts and rates of deaths related to synthetic opioids
Depending on outcome, some predictors were omitted/modified
- Opioid overdose: 57 indicators
- HCV: 58 indicators
- HIV: 59 indicators

Lasso regression was used to identify significant predictors
- Consulted with UW biostatisticians re: approach
- Lasso decided for clearer indicator selection and interpretability
- Run 100x for each model
- Predictors in majority of runs selected for logistic regression
Prediction Models

Binary outcomes (high/low) with median as cut-off

Fit logistic regression models with 2015 data, then made 2016 predictions using the 2015 model with 2016 data

Divide predicted outcome values by median and compare the actual and predicted values
RESULTS
# Opioid Overdose Outcome Significant Indicators

<table>
<thead>
<tr>
<th>Significant Indicators</th>
<th>Data Source</th>
<th>Data Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage with vehicle access</td>
<td>American Community Survey</td>
<td>5-year estimates of percent of households with at least one vehicle</td>
</tr>
<tr>
<td>Rate of specialty care providers</td>
<td>Washington Medical Commission</td>
<td>Rate of specialist providers (infectious disease, gastroenterology, hepatology, and addiction medicine) per 100,000 population based on census data from 1/1/2015 - 12/31/2016</td>
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<td>Drug trafficking zone</td>
<td>Drug Enforcement Agency</td>
<td>Map of high intensity drug trafficking areas</td>
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<td>WA DOH Prescription Monitoring Program</td>
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## HCV Outcome Significant Indicators

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<td>Log of population per square mile</td>
<td>Washington State Office of Financial Management</td>
<td>Log of the current population divided by the 2010 land area in square miles</td>
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<tr>
<td>Unemployment rate</td>
<td>American Community Survey</td>
<td>5-year estimates of unemployment rate among population 16 years old and over</td>
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<td>Age-adjusted opioid hospitalizations</td>
<td>WA DOH Prevention and Community Health</td>
<td>Age-adjusted rate of any opioid hospitalization per 100,000 residents</td>
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## HIV Outcome Significant Indicators

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Maps of 2016 Opioid Overdose Predictions

* inaccurate predictions:
  
  Franklin predicted to be higher than median
  
  Grant predicted to be lower than median

> median
Maps of 2016 HCV Predictions

*inaccurate predictions:

Stevens and Jefferson predicted to be higher than the median

Grant and Skagit predicted to be lower than the median
Maps of 2016 HIV Predictions

* Inaccurate predictions:

Chelan & Lewis predicted to be higher than the median

> median
## Predictive Performance

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<th>Opioid Overdose</th>
<th>HCV</th>
<th>HIV</th>
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<tr>
<td>2015</td>
<td>92%</td>
<td>97%</td>
<td>95%</td>
</tr>
<tr>
<td>2016</td>
<td>95%</td>
<td>89%</td>
<td>95%</td>
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Similarities Across Models

- Population density matters
  - Population density indicator in HCV and HIV models
  - Moderate to high correlation with all outcomes
  - Strongly correlated with drug trafficking zones, which was in the HCV and overdose final models

- Indicators related to providers were in all three final models
  - Rate of specialty care providers in HIV and overdose model
  - Rate of patients with 5+ prescribers and 5+ dispensers
Limitations

- Lack of American Indian and Native American representation

- Outcome measures
  - Detection bias (e.g., diagnosing HCV or HIV)
  - Incomplete data (e.g., overdose reversal)

- Limited years of data

- Changing trends in drug use

- Changes in data collection and definitions
Next Steps

- Scale up screening and nonfatal overdose reversal reporting
- Develop plan to run the model annually
- Ensure key stakeholders are informed (Opioid Response Workgroup, SSPs, health officers, Hep C Free WA, HIV Planning & Steering Group)
- County-level “profile” one-pagers to show some of the indicators that went into the model
- Overdose Data 2 Action
- Address social determinants of health!
Questions?
Thank you!

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