Vulnerability Index Assessment
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1. Scott County, IN HIV Outbreak
Scott County, IN

- Rural county in SE Indiana
- Population: ~24,000
  - Compares in size to Otsego, Manistee, Roscommon, and Antrim Counties
  - Ranked 92 of 92 in health indicators
    - Austin, IN: ~4,200
- Less than 5 HIV cases/yr
- 95% Caucasian
- 9% without health insurance
- 33% with public health insurance
- 15% did not graduate HS
- 5.6% unemployed
- Median earnings: ~$35,000
Scott County HIV Outbreak

Late 2014: 3 new HIV cases identified

Identified two that had shared needles, which initiated contact tracing

8 more new infections were found and traced them to Austin, IN (which saw only 5 infections from 2009-2013)

By April 21, 2015: 135 HIV cases

Discovered multigenerational sharing of injection works, with 4-15 injections per day and 1-6 partners per event

Discovered that all cases reported injection of analgesic oxymorphone (Opana ER)

In total: 237 HIV cases

Rural injection of oral opioid = largest HIV outbreak of its kind in the US
<table>
<thead>
<tr>
<th>Date</th>
<th>Jan 15</th>
<th>Feb 15</th>
<th>Mar 15</th>
<th>Apr 15</th>
<th>May 15</th>
<th>Jun 15</th>
<th>Jul 15</th>
<th>Aug 15</th>
<th>Sep 15</th>
<th>Oct 15</th>
<th>Nov 15</th>
<th>Dec 15</th>
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<td>0</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
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</table>

**HIV Epidemic Curve Nov 16, 2014-Dec 27, 2015**

- **January 2015**: 3 cases
- **February 2015**: 5 cases
- **March 2015**: 5 cases
- **April 2015**: 5 cases
- **May 2015**: 5 cases
- **June 2015**: 5 cases
- **July 2015**: 3 cases

(Note: The chart shows a peak in cases during April 2015 with 22 cases.)
Outbreak demographics

- Median age: 34 yrs (18-60)
- 59% male
- 99% white non-Hispanic
- 93% admitted injecting drugs (oxymorphone, meth, heroin)
- 11% admitted exchanging sex for drugs or money
- 19% living in poverty
- 8.9% unemployed
- 21.3% did not complete HS
- High proportion without health insurance and medical care access

Poor public health infrastructure  
Increased IVDU  
Large needle sharing network  
Multiple injections per day  
Introduction of highly infectious individual
Outbreak Info

- 94% of HIV cases were co-infected with Hepatitis C (HCV)
  - 96% of HIV specimens map to one cluster, acquired within 6 months prior to sample
  - HCV specimens included multiple strains and clusters (it had been repeatedly introduced for years)
  - Seems to indicate presence IVDU network for years with recent introduction of person with infectious HIV
Expanding epidemic of injection drug use heralded by dramatic increase in acute HCV infections
Acute and Chronic Hepatitis C Rates
Scott County and Indiana, 2013-2017

Rate (per 100,000 population)

2013 2014 2015 2016 2017
Scott County Indiana
What did we learn?

- **Key term: Rapid dissemination**
- Rural settings can pose unique challenges
- Familiarity with localized data is key to timely recognition of outbreak circumstances
- Encourage providers to test for HCV and HIV, especially in high risk communities
- **Preparation**
  - Public health intervention was essential
Interventions

- Reconstructed model illustrates continuous infection until interventions were implemented
- Dramatic decrease in undiagnosed HIV immediately after SSP opens
SSP’s by the [hypothetical] numbers

- Gonsalves & Crawford (2018)
  - “an earlier public health response could have substantially reduced the total number of HIV infections”
  - Response on Jan 1, 2013: reduce outbreak by 127 cases
  - Response on Apr 1, 2011: reduce “outbreak” by 173 cases

- Goedel et al. (2019) – 1,000 mathematical simulations
  - Over a 5 year period…
  - Without SSP: 133 cases
  - SSP introduced after 10 cases: 57 cases
  - SSP introduced proactively: 27 cases

- How do we identify jurisdictions at highest risk?


2. CDC County-Level Vulnerability Assessment
Background

- Study conducted in response to the Scott County outbreak
- Utilized acute HCV infections as a proxy measure of IVDU
- Nationwide, county-level

Goals:
- Identify risk factors/demographic data points most related to IVDU indicator (acute HCV infections)
- Identify counties prevalent in those associated risk factors to focus prevention strategies
Data and Analysis

- County level variables known or plausibly associated with IVDU
- Identified 48 variable, 15 met inclusion criteria
  - Had to be available at county level, nationwide, reported annually, recent, and complete
- Multivariable Poisson regression model
- Used regression coefficients to generate vulnerability scores for each county
- “Vulnerable” = upper 90% CI exceeded the 95th percentile of scores
Predictor Variables

- Drug OD deaths per 100,000
- Prescription opioid sales per 10,000
- Median per capita income (-)
- Proportion of white, non-Hispanic population
- Percent unemployed (population 16+ yrs old)
- Buprenorphine prescribing potential per 10,000
220 Vulnerable Counties Identified
MI Vulnerable Counties:

- Ogemaw (3058)
- Clare (3057)
- Oscoda (3056)
- Montmorency (3053)
- Lake (3007)
- Presque Isle (2970)
- Alcona (2960)
- Roscommon (2946)
- Crawford (2936)
- Kalkaska (2916)
- Cheboygan (2866)

(CDC Rank; Higher = more vulnerable)
Limitations

- Very limited dataset due to availability of nationwide, county-level, data
- Proxy measure for IVDU only included acute HCV cases
  - Chronic HCV is not reported by all states
- Some data may have been outdated (3+ years old)
- Needs more localized data
Benefits

▸ Creates basis for this study to be emulated
▸ Replicable on a periodic basis to assess change in IVDU/HCV associated risks
▸ Rural, impoverished, predominantly Caucasian communities are most vulnerable

205 vulnerable counties have no SSP
Not a vulnerable county, has an SSP
15 vulnerable counties have SSPs

93% of vulnerable counties don’t have a SSP.
4. Michigan County-Level Vulnerability Assessment
Michigan Specific Data

- Dramatic increase in hepatitis C cases in recent years
- 8th most drug OD deaths in the nation in 2017 (2,694 deaths)
Data and Analysis

- Modeled methodology after CDC and Tennessee’s vulnerability assessments
- Use of Michigan specific data to associate with acute *and* chronic HCV cases
  - Outcome: HCV in 18-39 year olds
- Identified 93 variables for consideration
- Included 21 variables in model
- Negative binomial regression with backwards stepwise selection
### Predictor Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>Proportion without a vehicle</td>
<td>0.1419</td>
<td>0.0012</td>
</tr>
<tr>
<td>Proportion without college education</td>
<td>0.0417</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Proportion of non-family households</td>
<td>0.0351</td>
<td>0.0230</td>
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<tr>
<td>Heroin treatment admissions per 100,000</td>
<td>0.0029</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>NAS cases per 100,000 births</td>
<td>0.0003</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>STD's per 100,000</td>
<td>-0.0007</td>
<td>0.0389</td>
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</tbody>
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- Used as a multiplier to predict rates of HCV, based on county specific values of each significant variable
- Useful in highlighting jurisdictions that may be prone to increased HCV incidence in the future
Results

▸ Most “vulnerable” counties align with:
  ▶ Highest rates of HCV under 40 yrs old
  ▶ Highest rates of opioid prescription
  ▶ Predominantly Caucasian, rural counties with less healthcare access (but some urban counties, as well)
  ▶ Counties without long standing harm reduction services

▸ Provides a tool to aid in informing focus of limited resources
Expansion of SSP in Michigan

2018 Adults Under 40 yrs HCV Rate by County (Per 100,000 18-40 yr old Persons)

Jurisdictions Receiving SSP Funding from MDHHS in FY2019
Conclusion

▸ These data reflect a point-in-time estimate
  ▸ Easily duplicated and/or adjust to account for trends over time
  ▸ Will be replicated with drug poisonings as model outcome
▸ Data include community specific factors, providing a more granular, tailored model
▸ Results can be used, in part, to inform administrative decisions pertaining to SSP’s
▸ Prepares us to be proactive in efforts to avoid a major outbreak