HIV/HCV Outbreak Vulnerability for the Appalachia Region

John T. Brooks, MD
Division of HIV/AIDS Prevention
Centers for Disease Control and Prevention
Atlanta GA

July 26, 2016
Hepatitis: Breaking the Silence - Lexington, KY

Dr. Brooks has no relevant financial affiliations to disclose.

Number of HIV Infections Diagnosed among Adults and Adolescents, by Transmission Category, 2005–2014 - United States and 6 Dependent Areas

- Male-to-male sexual contact
- Heterosexual contact
- Injection drug use

63% decline over 10 years
6% of all HIV infections in 2014
Rural southeastern region of state
Scott County ranked 92nd in many health and social indicators among Indiana’s 92 counties
- Lowest life expectancy
- 9% unemployment
- 19% poverty
- 21% no high school
- Many uninsured

Indiana HIV Outbreak: Geography
Scott County pop. 24,000; Austin city pop. 4,200

Indiana HIV Outbreak Summary
• In early 2015, 11 new HIV infections diagnosed Scott County, IN
  • Over past decade, <1 HIV new infection in Scott County per year
  • As of June 1, 2016 → 191 new HIV diagnosis
  • >90% coinfected with hepatitis C virus
• Transmissions occurred in a dense network of persons who inject drugs
  • Opioid analgesic oxymorphone

Indiana HIV Outbreak: Geography
Scott County pop. 24,000; Austin city pop. 4,200
Drug Use among HIV-infected Cases (N=108)

- Multigenerational users
- Daily injections: 4-15
- Number of needle-sharing partners per injection event: 1-6
- Sharing of injection equipment common

Demographics of HIV-infected Cases (N=181)

- Median age 34 years, range 28 - 42
- 58% male
- 99% non-Hispanic white

Laboratory Investigation, 2015 Indiana HIV Outbreak
Phylogenetic Analysis of pol Sequences and Recency Testing*

- Single strain of HIV-1
- Mean nucleotide identity 99.7% (1302 base pairs)
- No antiretroviral drug resistance detected
- All infections epidemiologically linked to Scott County
- Availability of near real-time pol sequencing confirmed limited geographic spread of outbreak
- 85% of infections recent* (limited in time)

* Recency testing was performed using a Modified Biolog 1/2 Plus O Assay with avidity index cutoff set at 30%, corresponding to approximately 221 days.
<table>
<thead>
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<th>Major Logistical Challenges Responding to Outbreak</th>
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* Birth certificate, driver’s license, Social Security card
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Opioid Substitution Therapy Reduces HIV Transmission

64% reduction in risk of HIV infection

<table>
<thead>
<tr>
<th>Study</th>
<th>Effect estimate (95% CI)</th>
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<tr>
<td>All pooled studies</td>
<td>0.16 (0.08 to 0.24)</td>
</tr>
<tr>
<td>Williams 1992</td>
<td>0.13 (0.05 to 0.30)</td>
</tr>
<tr>
<td>Mcleod 1993</td>
<td>0.08 (0.01 to 0.48)</td>
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<tr>
<td>Chisholm 1999</td>
<td>0.28 (0.08 to 0.90)</td>
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<tr>
<td>Kielton 2004</td>
<td>0.39 (0.14 to 0.99)</td>
</tr>
<tr>
<td>Ven den Berg 2006</td>
<td>0.63 (0.44 to 0.90)</td>
</tr>
<tr>
<td>Streeckhuis 2009</td>
<td>0.35 (0.21 to 0.55)</td>
</tr>
<tr>
<td>Suchters 2012</td>
<td>0.79 (0.39 to 1.61)</td>
</tr>
<tr>
<td>Ricci 2012</td>
<td>0.17 (0.09 to 0.34)</td>
</tr>
<tr>
<td>Overall</td>
<td>0.46 (0.34 to 0.64)</td>
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Major Logistical Challenges Responding to Outbreak

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Needle and Syringe Programs Reduce HIV Incidence

56% reduction in risk of HIV infection


40% and higher prevalence may be reached within 1-2 years

New York, USA
Edinburgh, Scotland
Bangkok, Thailand
Chiang Rai, Thailand
Ruili, China
Manipur, India
Ho Chi Minh, Vietnam
Kathmandu, Nepal
Nikolaev, Ukraine
Odessa, Ukraine

Emergency Declaration and New Law
Permitted Syringe Exchange in Response to Outbreak

After Temporary Emergency Action, Illinois Passes Law to Allow Syringe Exchange Programs

"From AIDS United"

Oklahoma Governor Mike Pence has signed a bill approved by the state legislature this week giving local officials across the state the ability to re-establish needle exchange programs. The legislation, signed by Pence on Wednesday, is part of a disaster response to the recent outbreak of HIV infections in the southeastern part of the state, which was initially caught by surprise and ill-equipped for HIV prevention and response.


One Hundred Fourteenth Congress
of the
United States of America

AT THE FIRST SESSION
Begun and held at the city of Washington on Tuesday, the fifth day of January, one thousand eight hundred and thirty-nine

In Act

Making appropriations for the several executive departments of the government of the United States, and for other purposes. The House of Representatives of the United States of America in Congress assembled,

This Act may be cited as the "Consolidated Appropriations Act, 2015."
Federal funds can be used for syringe service programs (except purchase of needles and syringes) if – in consultation with CDC – a need is demonstrated (i.e., significant increase in hepatitis infections, HIV outbreak).

2016 Consolidated Appropriations Act: Federal Funds Can Now be Used to Support SSPs
• Modifies the restriction on use of federal funds for SSPs for HHS programs
• Still prohibits use of federal funds for sterile needles or syringes
• Allows for federal funds to be used for other components of SSPs based but first health department must demonstrate need for SSPs in consultation with CDC:
  Jurisdiction is...
  • experiencing or
  • at risk for
  ...significant increase in...
  • hepatitis infections or
  • HIV outbreak
  ...due to...
  injection drug use

2016 Consolidated Appropriations Act: Federal Funds Can Now be Used to Support SSPs
• Any health department can apply
• Compiling the data required to demonstrate need creates a compelling narrative for action
Purpose

- Identify counties in the United States potentially vulnerable to rapid dissemination of HIV/HCV infection among persons who inject drugs.

Methods: Multi-step Approach

- Poisson Regression Model
- Composite Index Score – "Vulnerability Score"

Why acute HCV infection as proxy outcome?
- HCV is highly transmissible through injection drug use
- HCV and the injection event are linked closely in time and space
- Acute HCV infections are reportable to the National Notifiable Disease Surveillance System (NNDSS)
- For this analysis, we excluded acute HCV infection data from 8 states and District of Columbia due to absent or unreliable reporting
Methods: Multi-step Approach

Which variables best predict injection drug use?

- Poison Regression Model
  - used acute HCV infection as outcome, proxy for IDU
  - had to be recent, complete, and comprehensive

Criteria for independent variables

- Known or plausibly associated with injection drug use
- Available from national data sources at the county level
- Recent: 2012 or later
- Complete: >90% of U.S. counties with valid values

Results: Variables selected for analysis (n=15)

<table>
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<tr>
<th>Outcome/Variables</th>
<th>Data Source, Year(s) reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription opioid sales</td>
<td>Drug Enforcement Administration - Reports and Consolidated Orders System, 2013</td>
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<tr>
<td>Mental health services</td>
<td>Center for Medicare and Medicaid Services, National Provider Identification, 2014</td>
</tr>
<tr>
<td>Urgent care facilities</td>
<td>Homeland Security Infrastructure Program Gold Database, 2013</td>
</tr>
<tr>
<td>Access to interstate</td>
<td>ESRI maps and data, 2014</td>
</tr>
<tr>
<td>Prescription prescribing potential</td>
<td>SAMHSA DATA 2000 Program Information, 2014</td>
</tr>
<tr>
<td>Unemployment status</td>
<td>National Center for Health Statistics, 2013</td>
</tr>
<tr>
<td>Insurance coverage</td>
<td>American Community Survey, 2012-2013 5-year estimates</td>
</tr>
<tr>
<td>Vehicle access</td>
<td>American Community Survey, 2012-2013 5-year estimates</td>
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<td>Education</td>
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<tr>
<td>Income</td>
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<tr>
<td>Race/ethnicity</td>
<td>American Community Survey, 2012-2013 5-year estimates</td>
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<tr>
<td>Unemployment</td>
<td>American Community Survey, 2012-2013 5-year estimates</td>
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<tr>
<td>Population density</td>
<td>US Census, 2010</td>
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Results: Which variables best predicted acute HCV infection?

<table>
<thead>
<tr>
<th>Variables</th>
<th>Final Model</th>
<th>Standardized Relative Risk</th>
<th>p-value</th>
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<tr>
<td>Percent White, Non-Hispanic Population</td>
<td>1.68</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Drug Overdose Deaths per 100K Persons</td>
<td>1.21</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Per Capita Income</td>
<td>0.81</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Percent Unemployed Population</td>
<td>1.14</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>Prescription Opioid Sales per 10K persons</td>
<td>1.09</td>
<td>0.013</td>
<td></td>
</tr>
<tr>
<td>Buprenorphine Prescribing Potential by Waiver per 10K Persons</td>
<td>1.08</td>
<td>0.010</td>
<td></td>
</tr>
</tbody>
</table>

1. Percent of the county population of white, non-Hispanic race/ethnicity
2. Mean income computed for every person in the county, determined by dividing the total income of all people 15 years and older by the total population, modeled as log base 10
3. Percent of civilian persons aged 16 years and older, unemployed and actively seeking work
4. Rate of opioid pain reliever prescriptions (timothy rate per 10,000 population per year)
Methods: Vulnerability Score Calculation

- Created a “scoring” dataset containing each county’s values for the six significant variables (indicators) from the parsimonious final Poisson regression model
  - Averaged data for the three indicators with two years of data
  - Imputed values for missing data (i.e., 133 counties for drug overdose deaths)
- For each county, we calculated the composite index score as:

\[
\text{Composite Index Score}_i = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6
\]

Where: \(i\) = county, \(\beta\) = regression coefficient, \(X\) = observed value for county \(i\)
- Thus, for each county, the “vulnerability score” was the sum of the regression coefficients multiplied by the observed values for each indicator

Methods: Vulnerability Score Selection – Approximate Upper 5%

Counties for Which Estimated Vulnerability Scores or their Upper 90% Confidence Interval Exceeded the 95th Percentile
Results – Vulnerability to HIV/HCV Outbreak

- 56% of counties were located in the Appalachian core region (Kentucky, Tennessee, West Virginia)
- Residing in an area identified as vulnerable does not indicate risk of infection for all residents
  - Purpose of analysis was to identify places where HIV/HCV, if introduced, might spread rapidly among PWID

Limitations

- Inclusion criteria for indicators excluded some factors that may be associated with injection drug use, such as:
  - EMS calls and ER visits for drug overdose
  - Prescription drug monitoring program (PDMP) data
- Vulnerability to rapid dissemination of HIV or HCV dependent on prevalence in the region and injection drug use behaviors
  - The number of times people inject per day may increase their risk for acquisition of HIV or HCV
  - A region with low HIV prevalence may be at lower risk for rapid dissemination than a region with high HIV prevalence

Estimated Rates of People Living with Diagnosed HIV Infection per 10,000 Population In and Around Each Vulnerable County at Year-end 2012.
Estimated Rates of People Living with Diagnosed HIV Infection per 10,000 Population In and Around Each Vulnerable County at Year-end 2012.

Recommendations — “Take-Homes”

1. Determine if unsafe injection of drugs is occurring
   - Monitor data sources that may indicate injection drug use (e.g., assess vulnerability)
   - Improve surveillance for acute HCV infection

2. Enhance testing for HIV and HCV infections
   - Providers of services for persons with substance use disorder
   - Jails and prisons
   - Emergency departments and in-patient settings

3. Prepare an action plan for a potential HIV outbreak
   - Know your HIV, HCV, HBV prevention and treatment landscapes
   - Be prepared to set-up emergency prevention services (e.g., SSP, MAT)

Thank you

For more information please contact: or John T. Brooks, MD | jbrooks@cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.