The Geography of Infectious Diseases Related to the Opioid Epidemic

Patrick Sullivan, DVM, PhD
Emory University
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Presentation Outline

• The importance of infectious diseases in the opioid epidemic
• An epi perspective on infectious diseases as a sentinel system for opioid epidemics
• Geography of HIV, HCV relative to opioid indicators
• Lessons learned from mapping of HIV and HCV can inform opioid use monitoring and prevention
• Other infectious diseases and impact on women
Why are infectious diseases important in the opioid epidemic?

- Infectious diseases are a sentinel for opioid use
- Infectious diseases are an outcome of opioid use
- People reached for treatment of opioid abuse need screening for related infectious diseases
- Effective programs to reduce opioid use have secondary benefits of reducing related infectious diseases
- Successful uses of data to inform programmatic responses to other infectious diseases can serve as models for new opioid-focused programs
- Social determinants of health may be jointly associated with infectious diseases and opioid use epidemics
Infectious diseases as sentinels -- considerations

• Are there surveillance systems in place?
• Are there competing causes/routes of infection (specificity)
• How likely is a single episode of needle sharing to result in the infection? (sensitivity)
• How long does it take from exposure to detection through a surveillance system? (Latency)
• Is the infectious state persistent? (Durability)
Per Act Risk of HIV and HCV Transmission, per 10,000 Acts

### Infectious Diseases as Sentinels -- examples

<table>
<thead>
<tr>
<th>Infection</th>
<th>Surveillance</th>
<th>Specificity</th>
<th>Sensitivity</th>
<th>Latency</th>
<th>Durability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>Green</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Red</td>
<td>Green</td>
</tr>
<tr>
<td>HCV</td>
<td>Yellow</td>
<td>Green</td>
<td>Green</td>
<td>Red</td>
<td>Green</td>
</tr>
<tr>
<td>Skin infections</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>Infectious Endocarditis</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Green</td>
<td>Yellow</td>
</tr>
</tbody>
</table>
About AIDSVu

**AIDSVu** is a compilation of interactive, online maps that allows users to visually explore the HIV epidemic in the U.S. alongside critical resources such as HIV testing and treatment center locations.

**AIDSVu**’s mission is to make HIV prevalence data widely accessible and locally relevant.

**AIDSVu** provides users with an intuitive, visual way to connect with complex information about persons living with an HIV diagnosis at national, state and local levels.
Interactive Maps

National, State, and Local Maps

- Persons living with an HIV diagnosis by state, county, ZIP Code, census tract, and neighborhood
- Persons newly diagnosed with HIV by state and county, year-by-year
- Social determinants of health (e.g., poverty, insurance, education)
- HIV transmission modes

Service Locators

- HIV testing and treatment center locations and PrEP locations
- NIH-funded HIV Prevention, Vaccine & Treatment Trials Sites
- Housing Opportunities for People with AIDS
Diagnoses of HIV Infection among Adults and Adolescents, by Transmission Category, 2010–2015—United States and 6 Dependent Areas

Note. Data have been statistically adjusted to account for missing transmission category. “Other” transmission category not displayed as it comprises less than 1% of cases.

*Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.
Number of Persons Living with Diagnosed HIV Attributed to Injection Drug Use, 2014

*Data not shown to protect privacy because of a small number of cases and/or a small population.

**State health department, per its HIV data re-release agreement with CDC, requested not to release data to AIDSvu. See Data Methods for more information.

NOTE: There are no country-level maps for Alaska, District of Columbia, and Puerto Rico because there are no counties in these states.
Number of Persons Living with Diagnosed HIV Attributed to Injection Drug Use, 2014

*Data not shown to protect privacy because of a small number of cases and/or a small population.
Rates of men living with diagnosed HIV infection, 2014

Rates of women living with diagnosed HIV infection, 2014

Source: CDC; Maps: AIDSVu.org
Percent men living with diagnosed HIV infection whose Infections were attributed to IDU, 2014

Percent women living with diagnosed HIV infection whose Infections were attributed to IDU, 2014

Source: CDC; Maps: AIDSVu.org
Service data and HIV new diagnoses
Service data and HIV new diagnoses
HIV testing locations and HIV new diagnoses
PrEP providers and HIV new diagnoses
Hepatitis C
Natural history and diagnosis

• Broadly, infection has two phases
  • Acute
    • 25% have mild acute illness (nausea, joint pain, jaundice)
    • A similar proportion also spontaneously clear infection
  • Chronic
    • Lifetime infection with progressive liver damage

• Diagnostics have two keys formats
  • Antibody test: Screens for lifetime exposure to HCV
  • RNA test: Diagnoses current infection with HCV
Incidence of Reported Acute Hepatitis C, United States, 1982 - 2008

Surrogate testing of blood donors
Anti-HCV test (1st generation) licensed
Anti-HCV test (2nd generation) licensed
Decline among transfusion recipients
Decline among injection drug users

Source: Viral Hepatitis Surveillance Statistics, CDC
Two different US HCV epidemics
Problem: Without national surveillance, no way to compare HCV prevalence across the US
## Data sources

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Years</th>
<th>Number of individuals represented</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Health and Nutrition Examination Survey (NHANES)</td>
<td>1999-2012</td>
<td>36,726 persons 18 or above with non-missing HCV antibody test results</td>
<td>662 with positive anti-HCV result</td>
</tr>
<tr>
<td><em>U.S. Census</em> intercensal data</td>
<td>1999-2012</td>
<td>3,125,647,447 person-years age 18 or above</td>
<td>n/a</td>
</tr>
<tr>
<td>National Vital Statistics System (NVSS)</td>
<td>1999-2012</td>
<td>33,540,118 decedents age 18 or above who resided in the 50 states or Washington D.C.</td>
<td>185,285 with HCV listed as underlying or multiple cause of death</td>
</tr>
<tr>
<td><em>U.S. Census</em> 2010</td>
<td>2010</td>
<td>234,564,071 persons age 18 or above</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Overview of Approach

1. Allocate NHANES national total of HCV to each state based on distribution of demographic variables (indirect standardization)
   • Sex x race x birth year cohort = 24 strata

2. Model predicted HCV death rate in each stratum in each state. Compare to national averages for each strata to calculate state effects.

3. Multiply NHANES case allocation by state effect in each strata. Sum to get the number of estimated HCV cases in each state.
   • Divide number of estimated cases by 2010 U.S. Census population to get estimated prevalence in each state.
Benefits of statistical approach

• **Exactly** standardizes the 2 systems to each state
  • Nearly all residual bias due to underlying data and data system considerations, rather than statistical model choice

• Method and large dataset permit detection of high-order demographic group and state interactions
Total persons with HCV Antibodies Present, 2010

National total=3,911,900
Anti-HCV prevalence rate, 2010

West
10/13 states above national average

Midwest and Northeast
1/21 states above national average (RI)

South
5/16 states and DC above national average

HepVu.org | Info@HepVu.org | @HepVu
Mortality Cases of Males Attributed to Hepatitis C, 2014

Mortality Cases of Females Attributed to Hepatitis C, 2014

* Data are not shown to protect privacy. See Data Methods.

DATA NOT RELEASED TO HepVu
DATA NOT SHOWN
Opioid Indicators and Correlation
Possible Indicators in a Comprehensive Surveillance Approach

• HIV
• HCV
• Infectious endocarditis
• Drug-related overdose deaths
• Narcan units used
• Needle sales in pharmacies
• Antecubital abscesses
• Use of drug treatment services
• Hotline calls
• Others


Figure 1. Age-adjusted drug overdose death rates: United States, 1999–2016

1 Significant increasing trend from 1999 to 2016 with different rates of change over time, p < 0.001.
2 2016 rate for males was significantly higher than for females, p < 0.001.

NOTES: Deaths are classified using the International Classification of Diseases, Tenth Revision. Drug-poisoning (overdose) deaths are identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. The number of drug overdose deaths in 2016 was 53,632. Access data table for Figure 1 at: https://www.cdc.gov/nchs/data/databriefs/254_table.pdf

Detecting recent trends in opioid overdose ED visits provides opportunities for action in this fast-moving epidemic.

PERCENT CHANGE
- Decrease
- Increase 1 to 24%
- Increase 25 to 49%
- Increase 50% or more
- Data unavailable

SOURCE: CDC’s Enhanced State Opioid Overdose Surveillance (ESOOS) Program, 16 states reporting percent changes from July 2016 through September 2017.

https://www.cdc.gov/vitalsigns/opioid-overdoses/infographic.html#graphic2
https://findtreatment.samhsa.gov/locator
Downloadable Services Data (SAMHSA)

• Substance Abuse Services, Mental Health Services, or Both
  • Types of Care (Substance abuse treatment, detoxification, accepts clients on opioid medication)
  • Service Setting (Hospital inpatient, outpatient, day treatment)
  • Payment/Insurance Accepted (Medicaid, Private, Cash)
  • Payment Assistance Available (Sliding fee scale, Payment assistance)
  • Special Programs/Groups Offered (Veterans, Seniors, Persons with HIV/AIDS, Persons who have experienced trauma)
  • Age Groups Accepted
  • Gender Accepted

• Buprenorphine Physicians
• Health Care Centers
Drug-Related Deaths Per 100,000

Substance Abuse Treatment Facilities Accepting Clients on Opioid Medications and Prescribing/Administering Buprenorphine and/or Naltrexone

Drug Deaths per 100,000
- (14.3, 17)
- (17, 20.9)
- (20.9, 46.3)

Drug Deaths: amFAR, Locations: SAMHSA
Comparisons corroborate state-level HCV prevalence rates

Estimated HCV Antibody Prevalence, 2010

National Prevalence = 1.67%

Age-adjusted Drug Overdose Deaths/100,000, 2010
Comparisons corroborate state-level HCV prevalence rates

**Estimated HCV Antibody Prevalence, 2010**

**Opioid-related deaths per 100,000**
Summary

• There are several infectious diseases that are associated with opioid epidemics
• They vary in utility as adjunct data to understand opioid epidemics because of variable surveillance infrastructure and sensitivity/specificity as sentinels of needle sharing
• In other fields, correlation of service location data with indicators of infectious diseases can guide programs
• Preliminary analyses suggest correlations between HCV data and opioid abuse indicators
• Improved surveillance systems are needed for HCV, other infectious diseases, and indicators of opioid use
• Existing indicator data for HIV, HCV and opioids suggest differences between women and men
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