Estimate of the Number of Persons Living with HIV in Massachusetts

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Disclosures

Presenter(s) has no financial interest to disclose.

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Learning Objectives

At the conclusion of this activity, the participant will be able to:

1. Describe different methods of estimating a jurisdiction’s undiagnosed HIV positive population.
2. Outline the variations of prevalence estimates using different methods.
3. Communicate the value of applying more than one estimation method.
Agenda

• Surveillance background
• State of the HIV epidemic in MA
• Methods of HIV prevalence estimation
• Methods used by MA
• Results
• Conclusion
Key Massachusetts Dates

• 1983: AIDS reportable by name
• 1994: First state-funded NEX program
• 1999: HIV reportable by code
• 2001: Medicaid expansion for PLWH
• 2006: State Health Care Reform
• 2006: Syringe deregulation
• 2007: HIV and AIDS reportable by name
• 2012: All viral loads and CD4 results reportable
• 2013: Electronic Laboratory Reporting
Massachusetts HIV/AIDS Epidemic at a Glance

• As of February 23, 2016 a cumulative total of 34,023 individuals have been diagnosed and reported with HIV/AIDS in MA.
  • 20,293 are living with HIV/AIDS
  • 13,730 have died
  • An additional 3,815 MA residents living with HIV/AIDS were first diagnosed in another state
• 629 new diagnoses reported in 2014 (9.3/100,000)
• Median viral load (most recent) is <20 copies
• Median CD4 count (most recent) is 547 cells/mm³

Data Source: MDPH HIV/AIDS Surveillance Program, Data as of 3/01/16

People Living with HIV/AIDS

Number of Prevalent Cases

Year

Data Source: MDPH HIV/AIDS Surveillance Program, Data as of 3/01/16
Trends in HIV Infection and Death among People Reported with HIV/AIDS by Year: Massachusetts, 2004–2014

- **Diagnosis of HIV Infection**: The number of individuals diagnosed with HIV infection has been decreasing over the years from 2004 to 2014.
- **Death**: The number of deaths due to HIV/AIDS has also been decreasing over the same period.

Data Source: MDPH HIV/AIDS Surveillance Program, Data as of 3/01/16
Stages of HIV Care Among People Living with HIV/AIDS in Massachusetts

- **PLWHA**
  - N=19,071

- Engaged in Care*
  - N=14,337

- Retained in Care*
  - N=11,301

- Virally Suppressed in 2014*
  - N=12,363

Among engaged in care, 86% are virally suppressed
Among those retained in care, 89% are virally suppressed

* Lab received by MDPH

1 Includes individuals diagnosed through 2013 and living in MA as of 12/31/14, based on last known address, regardless of state of diagnosis

Data Source: MDPH HIV/AIDS Surveillance Program, cases reported through 1/1/16
Distribution of PLWHA in Massachusetts by viral load

- Virally Suppressed, 65%
- No Viral Load During 2014, 28%
- NOT Virally Suppressed, 8%

N=19,071

1 Includes individuals diagnosed through 2013 and living in MA as of 12/31/14, based on last known address, regardless of state of diagnosis
• Data Source: MDPH HIV/AIDS Surveillance Program, cases reported through 1/1/16
Why estimate undiagnosed HIV infection?

• More than 1.2 million people in the United States are living with HIV infection (CDC).
  • It is estimated that almost 1 in 8 (12.8 percent) don’t know they are infected (CDC).
  • People unaware of HIV status contribute to 1/3 of ongoing HIV transmissions (CDC)

• First bar of HIV Care Continuum
  • Include undiagnosed when measuring disease burden

• Critical blind spot in HIV care and prevention
Comprehensive Health Care Reform (2006)

Uninsurance at the Time of the Survey for all Massachusetts Respondents and the Nation as a Whole, 2008-2011, 2014 and 2015

Source: www.chiamass.gov
Share experience from your jurisdiction

• Has your jurisdiction calculated undiagnosed HIV?

• What estimation methods do you employ?

• In what ways do you use this estimate?
Why look at different methods?

• The Massachusetts setting includes:
  
  • Health care reform

  • Incidence decline

  • Reduced mortality

  • Low seroprevalence in counseling and testing data
Methods of Estimating PLWHA

DOI:10.1097/QAD.0b013e3283467087
Multiple Methods of Estimating PLWHA

• Based on prevalence surveys
  • UNAIDS/WHO (EPP)
  • Multi-parameter Evidence Synthesis

• Based on diagnoses and incidence data
  • Cambridge
  • CDC back-calculation
  • Ottawa/Sydney
  • Paris
  • Bordeaux

• Based on CD4 counts and concurrent diagnosis
  • London 1
  • London 2

• Based on transmission models
Methods Adapted for Use in MA

- Multi-parameter Evidence Synthesis
- Seattle-King County Method
- CDC Back-Calculation
- Modified London-1
Multi-Parameter Evidence Synthesis

• Seroprevalence by risk population (MSM, IDU, etc)
  • Surveillance and CTR data
• Estimated number of persons in each of the high risk populations
  • Capture-recapture method
• Prevalence surveys and estimation of transmission risk populations
  • Allows for multiple sources of data

DOI:10.1097/QAD.0b013e3283467087
Multi-Parameter Evidence Synthesis Adapted for Massachusetts

• MA adapted method to use race and ethnicity data by age
• Data sources
  • State Counseling, Testing, and Referral (CTR) data
  • HIV Surveillance

DOI:10.1097/QAD.0b013e3283467087
Multi-parameter Evidence Synthesis

Results

• Estimates overall prevalence
• Uses seroprevalence by risk
• We used by race from counseling and testing

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>%</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>White non-Hispanic</td>
<td>0.3%</td>
<td>15796</td>
</tr>
<tr>
<td>Black non-Hispanic</td>
<td>0.7%</td>
<td>3041</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.9%</td>
<td>5649</td>
</tr>
<tr>
<td>Total</td>
<td>~0.9%</td>
<td>~24500</td>
</tr>
</tbody>
</table>

DOI:10.1097/QAD.0b013e3283467087
Seattle-King County Method

- Using HIV testing history data
- Time between last negative HIV test and 1\textsuperscript{st} positive result
  - Date of last negative
  - Date of diagnosis
- Estimating Time from Infection to Diagnosis (TID)
- Sources of HIV testing data
  - Case Surveillance (eHARS)
  - HIV Incidence Surveillance (eHARS)
  - Partner Services data
Seattle-King County Method Adapted for Massachusetts

• Software for this methodology was available through R and was made available to the public on GitHUB.

• MA used HIV case and incidence surveillance data 2007-2014 diagnosis.

# Seattle Method Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Min.</th>
<th>1\textsuperscript{st} Qu.</th>
<th>Median</th>
<th>Mean</th>
<th>3\textsuperscript{rd} Qu.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence (Base Count)</td>
<td>286</td>
<td>321</td>
<td>345</td>
<td>339</td>
<td>363</td>
<td>377</td>
</tr>
<tr>
<td>Incidence (Upper Bound)</td>
<td>314</td>
<td>341</td>
<td>360</td>
<td>356</td>
<td>374</td>
<td>383</td>
</tr>
<tr>
<td>Undiagnosed (Base Case)</td>
<td>1338</td>
<td>1746</td>
<td>2043</td>
<td>1954</td>
<td>2187</td>
<td>2499</td>
</tr>
<tr>
<td>Undiagnosed (Upper Bound)</td>
<td>3083</td>
<td>3750</td>
<td>3928</td>
<td>3934</td>
<td>4203</td>
<td>4685</td>
</tr>
</tbody>
</table>

CDC Back Calculation

- SAS macro/programs, R programs provided by CDC
- Three step process:
  - Reporting delay weights
  - Multiple imputation
  - Back Calculation
- eHARs data (HIV Surveillance data)
- Estimate the prevalence of person $\geq 13$ with HIV infection, currently residing in MA, data up to 12/31/2013 reported as of 12/31/2015
CDC Back Calculation cont.

• Reporting Delay weights
  • Measures elapsed time before a diagnosis or death is reported to CDC
  • Estimates the distribution of delay in reporting diagnosis and death.

• Multiple Imputation
  • Imputes values for observations with missing info.

• Back Calculation
  • Data are adjusted for reporting delays, missing risk info, incorrect dx dates and under-reporting of HIV cases
## CDC Back-Calculation Results

<table>
<thead>
<tr>
<th>Year</th>
<th>Prevalence</th>
<th>Undiagnosed</th>
<th>% of diagnosed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>95% CI</td>
<td>No.</td>
<td>95% CI</td>
</tr>
<tr>
<td>2011</td>
<td>32,100</td>
<td>(31,500-32,500)</td>
<td>4,400</td>
<td>3,600-5,000</td>
</tr>
<tr>
<td>2012</td>
<td>32,600</td>
<td>(32,000-33,200)</td>
<td>4,200</td>
<td>3,200-5,000</td>
</tr>
<tr>
<td>2013</td>
<td>33,200</td>
<td>(32,300-34,100)</td>
<td>4,000</td>
<td>3,000-5,000</td>
</tr>
</tbody>
</table>
London-1 Method

• Estimate person infected with need for treatment (CD4 <200)
• Number of diagnosed persons with symptoms related to HIV infection, regardless of CD4 count
• Applies incidence rate of HIV related symptoms per person year from a seroconversion cohort

Lodwick et al. 2015 PLOS ONE DOI:10.1371/journal.pone.0121992
Modified London-1 Adapted to Massachusetts

• Data sources
  • eHARS
  • CD4 at diagnosis
  • Counseling and Testing

• # HIV diagnosed persons by Country of Birth
  • Recent 3 years
  • By CD4 count

Lodwick et al. 2015 PLOS ONE DOI:10.1371/journal.pone.0121992
## Modified London-1- Results

<table>
<thead>
<tr>
<th>Country of Birth</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>US born</td>
<td>1,339</td>
</tr>
<tr>
<td>US dependency</td>
<td>152</td>
</tr>
<tr>
<td>Other</td>
<td>969</td>
</tr>
<tr>
<td>Total Est Undiagnosed</td>
<td>2,460</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prevalence Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Est Undiagnosed</td>
<td>2,460</td>
</tr>
<tr>
<td>Prevalent</td>
<td>~20,000</td>
</tr>
<tr>
<td>Total</td>
<td>~22,500</td>
</tr>
</tbody>
</table>
Summary of Estimate by Method

- Multi
- Seattle
- CDC
- London

Estimated number of persons

- Multi: 25,000
- Seattle: 25,000
- CDC: 35,000
- London: 25,000
Conclusions

• Useful in testing multiple methods to get a better range or representation of PLWHA
• More consistent with collection of indicators (death trends, incidence trend, seroprevalence)
• Methods can be applied by any surveillance program or jurisdiction
• Each method has its strengths and weakness but using multiple methods gives you a range
  - Result is stronger than any one given method
  - Permits greater confidence when multiple methods yield consistent estimates
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