The Role of Bathhouses and Sex Clubs in HIV and STD Transmission: Findings from a Mathematical Model

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Background

- HIV and STD rates in MSM
  - HIV incidence in MSM increasing
  - Syphilis and gonorrhea in MSM up, as well
  - Studies show lower condom usage rates now vs. 1980s/1990s

- Bathhouses and sex clubs
  - Implicated in original HIV epidemic
  - May be facilitating HIV/STD transmission now
  - Some have called for them to be closed
  - Others suggest closure would have no effect
Research Question

- How would closing bathhouses affect HIV transmission in urban areas?

Methodology

- Bernoulli Process Model developed by Pinkerton and Abramson, 1998
- Each sex act is treated as an independent Bernoulli trial
- Probability calculations depend on number of acts, HIV prevalence, condom usage, etc.
Data

- Survey Data from the 1997 **Urban Men’s Health Study**
- Conducted by the Center for AIDS Prevention Studies (CAPS) at the University of California at San Francisco
- MSM in New York, San Francisco, Los Angeles, and Chicago
- 2881 male responses
- 855 variables

Sample and Subpopulations

- Entire sample
Sample and Subpopulations

- Entire sample
- Those who go to bathhouses & those who do not
- Those who have main partners & those who do not

Bathhouse patrons

Non-Bathhouse

29.6%  70.4%

Main
No Main
Main
No Main

45%  55%  53%  47%
Sample and Subpopulations

- Entire sample
- Those who go to bathhouses & those who do not
- Those who have main partners & those who do not
- Those who are HIV-infected & those who are not

<table>
<thead>
<tr>
<th>Bathhouse patrons</th>
<th>Non-Bathhouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>No Main</td>
</tr>
<tr>
<td>HIV+</td>
<td>HIV-</td>
</tr>
<tr>
<td>22.2%</td>
<td>77.8%</td>
</tr>
<tr>
<td>72.1%</td>
<td>83.0%</td>
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</tbody>
</table>

Sample and Subpopulations

- Entire sample
- Those who go to bathhouses & those who do not
- Those who have main partners & those who do not
- Number of non-main sex acts last year*†

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<thead>
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<tr>
<td>Main</td>
<td>No Main</td>
</tr>
<tr>
<td>64.1</td>
<td>94.7</td>
</tr>
</tbody>
</table>

* sig. diff. between bathhouse and non-bathhouse at p < 0.05
† sig. diff. between main and no main (within each type) at p < 0.05
^ sig. diff. between HIV+ and HIV- (within each type) at p < 0.05
Sample and Subpopulations

- Entire sample
- Those who go to bathhouses & those who don’t
- Those who have main partners & those who don’t
  - Number of non-main sex acts last year*†^
  - % condom use with non-main partners*

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<th>Non-Bathhouse</th>
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</thead>
<tbody>
<tr>
<td>Main</td>
<td>64.1</td>
<td>8.8</td>
</tr>
<tr>
<td>No Main</td>
<td>94.7</td>
<td>34.0</td>
</tr>
<tr>
<td>% condom use</td>
<td>76%</td>
<td>83%</td>
</tr>
</tbody>
</table>

* sig. diff. between bathhouse and non-bathhouse at p < 0.05
† sig. diff. between main and no main (within each type) at p < 0.05
^ sig. diff. between HIV+ and HIV- (within each type) at p < 0.05

Additional Statistics

- Number of contacts with main partner:
  - 34.65
- % Condom usage with main partners:
  - 58%
- Approx. 22% of bathhouse patrons’ non-main sex acts are in the bathhouse.
  - Estimate 65% non-main sex acts are with BH patrons when BH open
Model

• Individual’s probability of acquiring HIV is:

$$P_{xm,ynz} = 1 - \left[1 - \pi \left[1 - (1 - \beta \alpha)^{xm(1 - \alpha)^{(1-x)m}}\right] \right]$$

- \( m \) acts with main partner,
- \( x\% \) condom usage

$$\times \left[1 - \pi_{BH} \beta \alpha)^{y^{zn}(1 - \pi_{BH} \alpha)^{(1-y)^{zn}}\right]$$

- \( x\% \) condom usage, \( BH \) partners only

$$\times \left[1 - \pi_{NB} \beta \alpha)^{y^{(1-z)n}(1 - \pi_{NB} \alpha)^{(1-y)(1-z)^{n}}}\right]$$

- \( x\% \) condom usage, \( Non-BH \) partners only

\( \alpha \) = per act probability of transmission, unprotected

\( \beta \alpha \) = per act probability of transmission, protected

\( \pi \) = HIV prevalence

Model cont’d

• Different parameters for each subpopulation

• Average number of total HIV infections

$$\sum (P_{x|m_{i},y_{i}|n_{i}|z_{i}} \times size \ of \ subpopulation \ i)$$

• Extended similarly to include syphilis
Assumptions

- Unprotected per act infection probability
  - $\alpha = 0.01$
- Condom effectiveness: 90%
  - $(\beta = 0.1)$
- Syphilis prevalence = .5%, uniformly distributed.
  - Sensitivity range: .5%-5%
- Impact of Syphilis on HIV transmission is to multiply infectivity by 3.
  - Sensitivity range: 3-15
HIV Attack Rate

20 40 60 80 100
% BH with BH

BH Condom 0.75
BH Condom 0.8
BH Condom 0.85
Bathhouse Closed
Bathhouse Open

HIV Attack Rate

20 40 60 80 100
% BH with BH

BH Condom 0.75
BH acts lost 25%
BH acts lost 50%
BH acts lost 75%
BH acts lost 100%
Bathhouse Closed
Bathhouse Open
Limitations

• # of acts and condom usage based only on last four partners
• Single-stage model is short term prediction
• Does not capture secondary infection effects
• Does not differentiate between acute and chronic HIV infection
• Survey data only includes city residents

Conclusions and Implications

• Suggests if BH patrons have same # of sex acts, then HIV attack rate may go up with BH closure
  – Difference of open vs closed BH is relatively small compared to effect from changes in condom usage and number of acts
• If # sex acts decrease because of closure, attack rate may go down
• Leaving BH open facilitates intervention programs, such as increasing condom usage
Acknowledgements

• Brian Kolodziejski, CDC
• Lance Pollack and Joseph Catania, University of California, San Francisco
  – UMHS 1997 primarily supported by National Institute of Mental Health grant MH54320