Distribution of HIV Transmission by Network and Clinical Factors Among US MSM
Chapin-Bardales J1, Jenness SM1, Rosenberg ES1, Sullivan PS1, Goodreau SM2
1Emory University Rollins School of Public Health, Atlanta, GA
2University of Washington, Department of Anthropology, Seattle, WA

BACKGROUND

- Sexual role, partnership types, infection stage, and care engagement strongly determine HIV transmission rates within serodiscordant MSM partnerships.
- Previous studies to estimate the distribution of transmissions by these factors have yielded conflicting results.
  - **Partnership Type:** 35% to 68% of transmissions have been estimated to occur in main MSM partnerships.1,2
  - **HIV Stage of Infection:** 11% to 49% of transmissions have been estimated to occur while the infected partner was in acute-stage infection.3,4
- Conflicting results are likely due to heterogeneous populations and methods.
  - Parameters estimated from different data sources of MSM, different geographical regions.
  - Use of static deterministic models, dynamic network models, phylogenetic analyses.

METHODS

- **Data Sources:**
  - Men’s Atlanta Networks (MAN) Project, a cross-sectional network study of MSM in Atlanta from 2011-2013.
- **Analysis:**
  - Network-based mathematical modeling
  - Network model for the formation and dissolution of main, casual, and one-time MSM sexual partnerships over time using the statistical framework of separable, temporal exponential random graph models (STERGMs).
  - Characteristics of sexual acts, HIV transmission, and HIV disease progression were simulated on top of dynamic sexual networks using EpiModel (www.epimodel.org).

OBJECTIVE

To assess the distribution of HIV transmissions by behavioral and clinical factors in one comprehensive US-based model for MSM in order to provide internally-consistent and actionable estimates.

RESULTS

- **Table 1:** Estimated Population Attributable Fraction (PAF) of Behavioral and Clinical Factors for Incident HIV Infections among US Men Who Have Sex With Men

<table>
<thead>
<tr>
<th>Partnership Type</th>
<th>PAF</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>Main</td>
<td>41.7</td>
<td>37.3–46.0</td>
</tr>
<tr>
<td>Casual</td>
<td>47.9</td>
<td>43.7–51.7</td>
</tr>
<tr>
<td>One-time</td>
<td>9.8</td>
<td>6.8–12.8</td>
</tr>
<tr>
<td>Sexual Position during Anal Intercourse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive</td>
<td>74.9</td>
<td>71.6–78.2</td>
</tr>
<tr>
<td>Insertive</td>
<td>24.6</td>
<td>20.6–28.2</td>
</tr>
</tbody>
</table>

DISCUSSION

- Our model suggests two high-value targets for prevention:
  - MSM in non-main partnerships
  - MSM in partnerships in which the infected partner has fallen out of HIV care
- Assessing risk behavior specific to partnership type remains necessary to tailor the delivery of HIV prevention tools.
- For HIV-negative MSM in non-main partnerships, targeting strategies may emphasize PrEP as partners’ HIV status or care engagement may be unknown.
- Within main serodiscordant partnerships, strategies may include PrEP for the HIV-negative partner and support for the HIV-positive partner to remain effectively engaged in care.
- HIV-positive men not retained in care contribute the majority of ongoing HIV transmissions.

- These results are consistent with other modeling methods5 and demonstrate importance of prevention through clinical interventions and retention programs with positive MSM.
- Efforts to engage these men individually and through their partnerships will be challenging but essential.