Connecting the Dots
A Glimpse into the Sexual Networks of Syphilis Cases in the San Francisco Bay Area

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Early syphilis cases by sexual orientation, Bay Area and San Francisco Regions, 2006-2015
Methods: Use SF patient-based registry of STD screening and surveillance data to link unique individuals in partnerships identified through syphilis and HIV partner services activities.

Results: 286 networks identified in 2013; 80% consisted of 2-3 persons. A “mega-network” of 435 persons identified; more likely to be HIV+ (p<.0001) and repeat infections compared to isolates or persons in other networks (p<.0001).

Conclusions: More connections were identified looking at networks than were found in case-by-case review. Further analysis using network approach may help prioritize work by identifying unseen connections.
“What would happen if we put it all together?”

Collaboration between CDPH and SFDPH to look at the sexual networks of early syphilis cases diagnosed in 2008-2014 in the San Francisco Bay Area Region, using routinely collected surveillance data.

Alameda, Berkeley, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, Sonoma, San Francisco
Method: A Tale of Three Surveillance Databases

CPA Legacy (1999-2013)  
case-based

2008  2010  2012
no unique “person” ID over time

CalREDIE (2013-present)  
person-based

unique “person” ID

ISCHTR (SF)  
person-based

unique “person” ID
Method: Apply a probabilistic matching algorithm

- **Legacy (1999-2013)**: case-based
- **CalREDIE (2013-present)**: person-based
- **ISCHTR (SF)**: person-based

First Name, Last Name, DOB, Gender, Race/ethnicity + County

person-based
Connecting the Dots: Terminology

**Nodes** – unique persons (cases, partners)

*color: LHJ*

**Edges** – relationship between nodes

**Component** – a group of nodes that are all connected to each other
Connecting the Dots: Node characteristics
SF Bay Area Region 2008-2014

12,227 unique nodes

8,399 (68%) of persons with ≥ 1 partnership

- 47% resided in SF
- 31% resided in a CPA Bay Area LHJ
- 2% resided in multiple SF Bay Area LHJs
- 3% resided in other CA regions
- 2% resided out-of-state
- 15% named by SF cases, but residency unknown

SF Bay Area Region: Alameda, Berkeley, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, Sonoma, and San Francisco
Connecting the Dots: Interjurisdictional (IJ) Partnerships of Early Syphilis Cases, SF Bay Area Region 2008-2014

1) What type of sexual networks can an individual LHJ see?

2) What type of sexual networks emerge when you look at the CPA Bay Area LHJs together?

3) What type of sexual networks emerge when you look at the entire SF Bay Area Region?
Contra Costa early syphilis case networks, 2008-14
90 components
• 96% dyads/triads
• 2-33 nodes
• 37% had ≥1 IJ partnership
Alameda early syphilis case networks, 2008-14
213 components
- 64% dyads/triads
- 2-23 nodes
- 40% with ≥1 IJ partnership
CPA Bay Area early syphilis case networks, 2008-14
729 components
• 77% dyads/triads
• 2-50 nodes
• 37% with ≥1 IJ partnership

High proportion of networks in each LHJ had partnerships between persons in different LHJs
SF Bay Area Region
early syphilis case networks, 2008-14
mega-network
• 4,550 partnerships
• 3,829 nodes
• 41% IJ partnerships
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + 1-degree

328 nodes, 295 partnerships

Largest component: 147

(vs. 23 in Alameda data)

*Mega-network of early syphilis cases in SF Bay Area Region, 2008-14*
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + 1-degree
328 nodes, 295 partnerships
Largest component: 147
(vs. 23 in Alameda data)

*Mega-network of early syphilis cases in SF Bay Area Region, 2008-14
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + 1-degree
328 nodes, 295 partnerships
Largest component: 147
(vs. 23 in Alameda data)

*Mega-network of early syphilis cases in SF Bay Area Region, 2008-14
Inside the Mega-Network*, 2008-14: **Alameda**

**Alameda nodes + 1-degree**

328 nodes, 295 partnerships

Largest component: 147

*(vs. 23 in Alameda data)*

... even though network comes back to **Alameda**
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + 1-degree
328 nodes, 295 partnerships
Largest component: 147
(vs. 23 in Alameda data)

*Mega-network of early syphilis cases in SF Bay Area Region, 2008-14
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + 2-degrees

328 1,300 nodes – 295 1,533 partnerships

*Mega-network of early syphilis cases in SF Bay Area Region, 2008-14
Key Findings

Low connectivity in CPA Bay Area data alone
- largest component: 50 nodes
- 33% of partnerships were interjurisdictional
- 37% of components with $\geq 1$ interjurisdictional partnership

Inclusion of SF data revealed regional connections not observed otherwise
- majority dyads/triads join to form large network
- 41% of mega-network partnerships were interjurisdictional
Limitations

• Incomplete network ascertainment results in lack of generalizability to larger at-risk population
  • cases not interviewed or naming partners
  • under/overmatching
  • challenges using CalREDIE to initiate/link cases and partners

• Aggregate data results in overestimation of connectivity and difficulty analyzing node attributes that can change over time
Conclusions

• Visualizing networks across counties reveals otherwise unseen regional connections

• High proportion of interjurisdictional partnerships warrants more regional syphilis control efforts
  • enable data sharing between counties
  • begin dialogue between counties to shift perception of disease control from local to collective responsibility
Conclusions

- Understanding position/profile of nodes may help DIS target follow-up for cases most likely to be involved in ongoing transmission
  - bridges between networks
  - position of repeat infections
  - position of HIV+/- may highlight impact of PrEP

- Consider leveraging new technology to create real-time networks that help DIS prioritize follow-up of high-risk persons
Conclusions

If syphilis is increasing in your county or project area, what might networks reveal about your connection to surrounding areas? Is there opportunity to partner together and leverage knowledge and resources to interrupt transmission?
Acknowledging my network

STATE AND LOCAL DIS COLLEAGUES

CA STD Control Branch
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Denise Gilson
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Jodi Halpern
Eileen Gambrill
Art Reingold
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Centers for Disease Control and Prevention
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Romni Neiman

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Robert Kohn
Basics of syphilis surveillance and partner services

All syphilis cases reported to health department

DIS interview early syphilis cases *(partner elicitation)*

DIS locate partners, notify of exposure, and link to testing/care *(partner notification)*

Partner outcome *(e.g. – infected, treated; previously treated)*

(if partner is a *newly identified infection*, process repeats)
SANTA CLARA

763 partnerships
288 components
- 94% dyads and triads
- 2-48 nodes
- 28% with ≥1 IJ partnership

Alameda
Contra Costa
Santa Clara
San Mateo
San Francisco
SAN MATEO

163 partnerships
68 components

- 94% dyads and triads
- 2-17 nodes
- 47% with ≥1 IJ partnership

Alameda
Contra Costa
Santa Clara
San Mateo
San Francisco