Connecting the Dots

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

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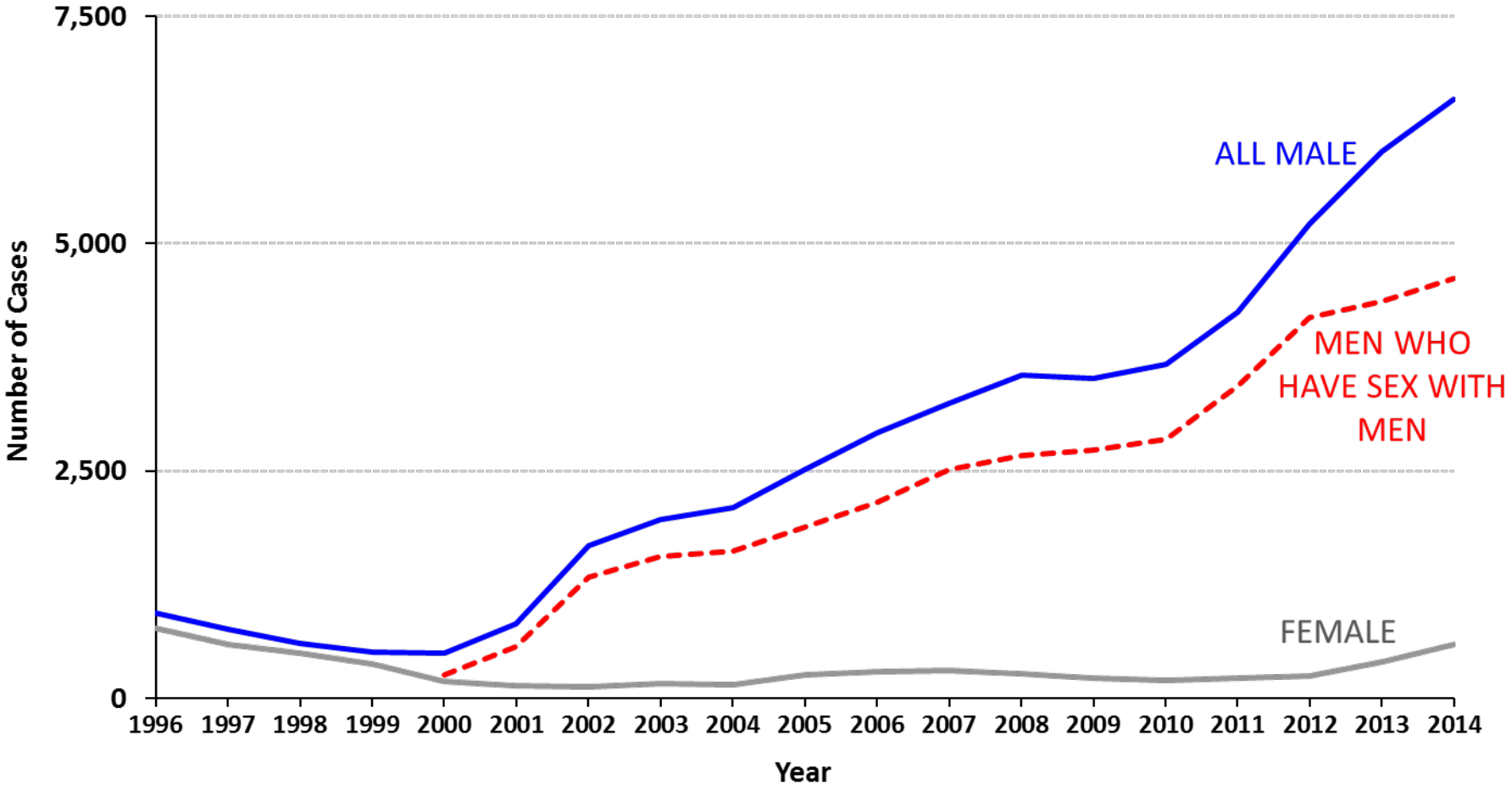
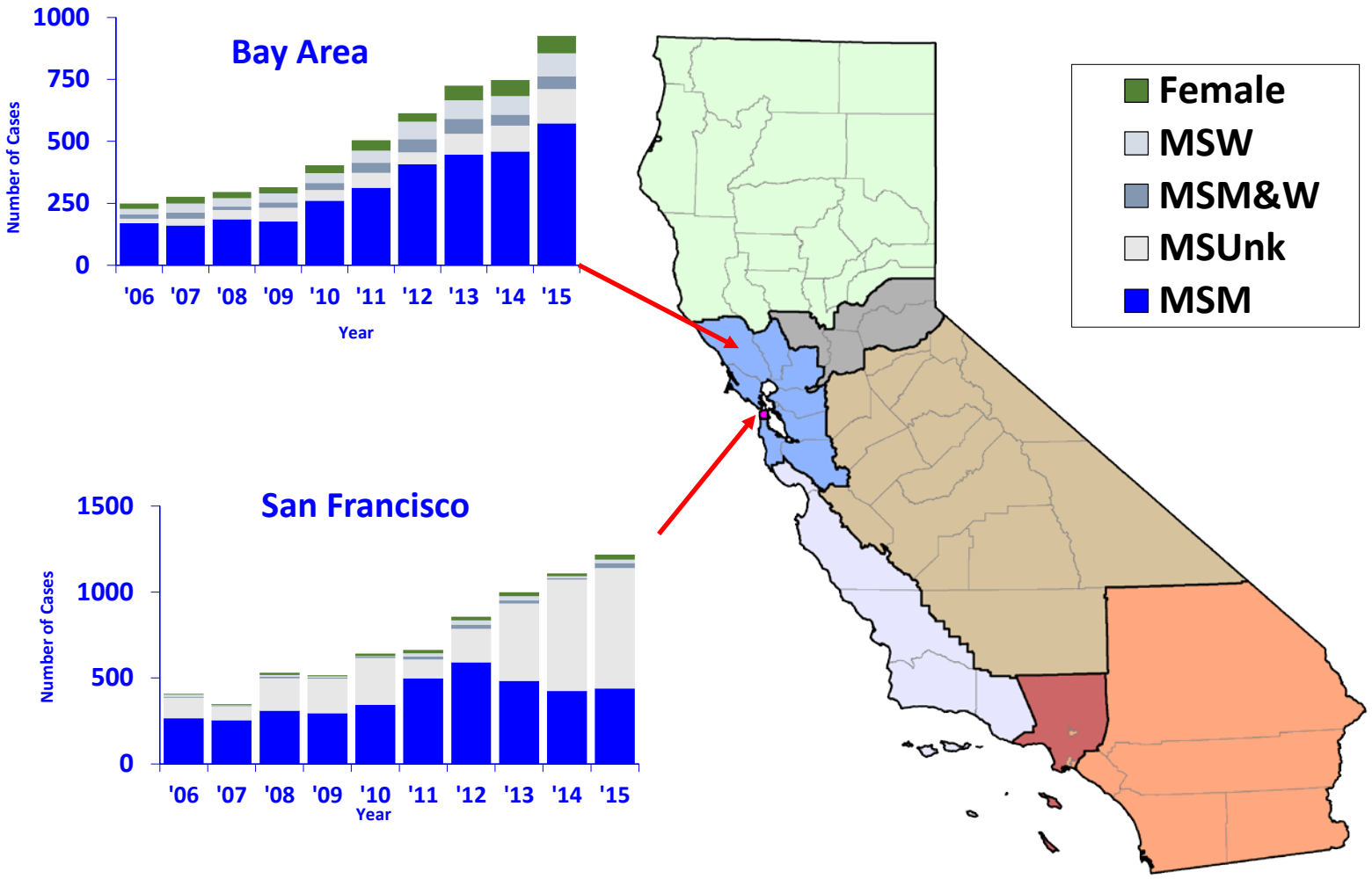
California Syphilis Prevention Summit 2017
Session: Six Degrees of Separation or Less Across the SF Bay Area-What We Know or Don't Know about Syphilis Networks
January 9, 2017

Early syphilis cases by gender, California 1996-2014



Source: CA STD Control Branch 2014 Annual Report

Early syphilis cases by sexual orientation, Bay Area and San Francisco Regions, 2006-2015



2014 STD PREVENTION CONFERENCE

San Francisco's Mega-Network

Kohn R., Fann C., Bernstein K.T., Philip S., 2014

Discovery of a Large Sexual Network Using Routine Partner Services Data, San Francisco, 2013

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**.

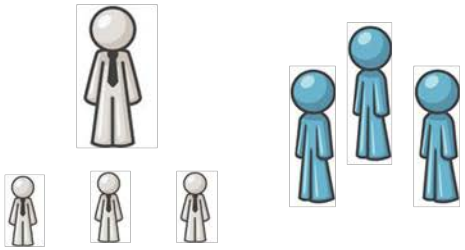
“What would happen if we put it all together?”

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



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

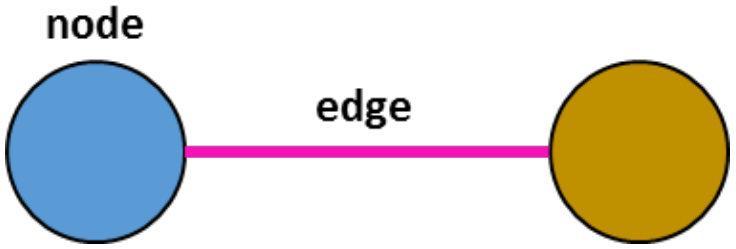
ISCHTR (SF)
person-based

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

person-based

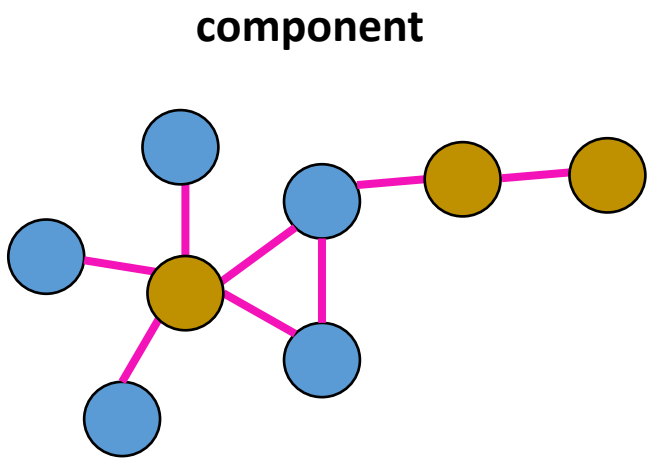
Connecting the Dots: Terminology

Nodes – unique persons (cases, partners)
color: LHJ

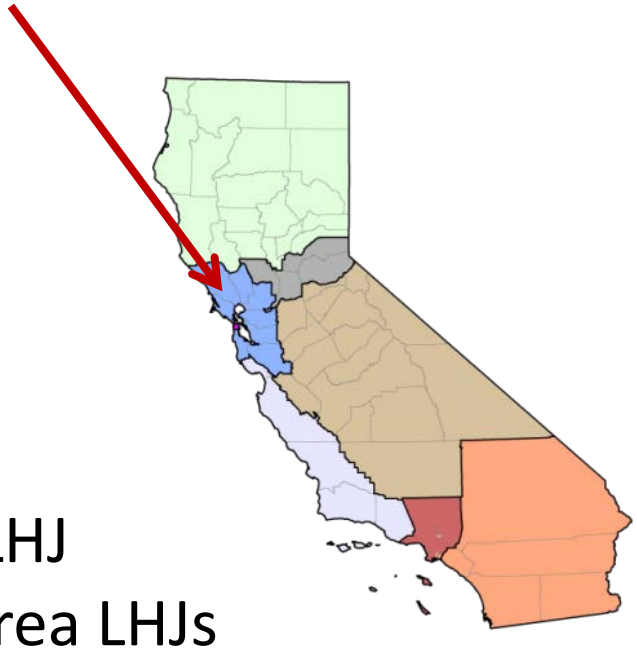


Edges – relationship between nodes

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

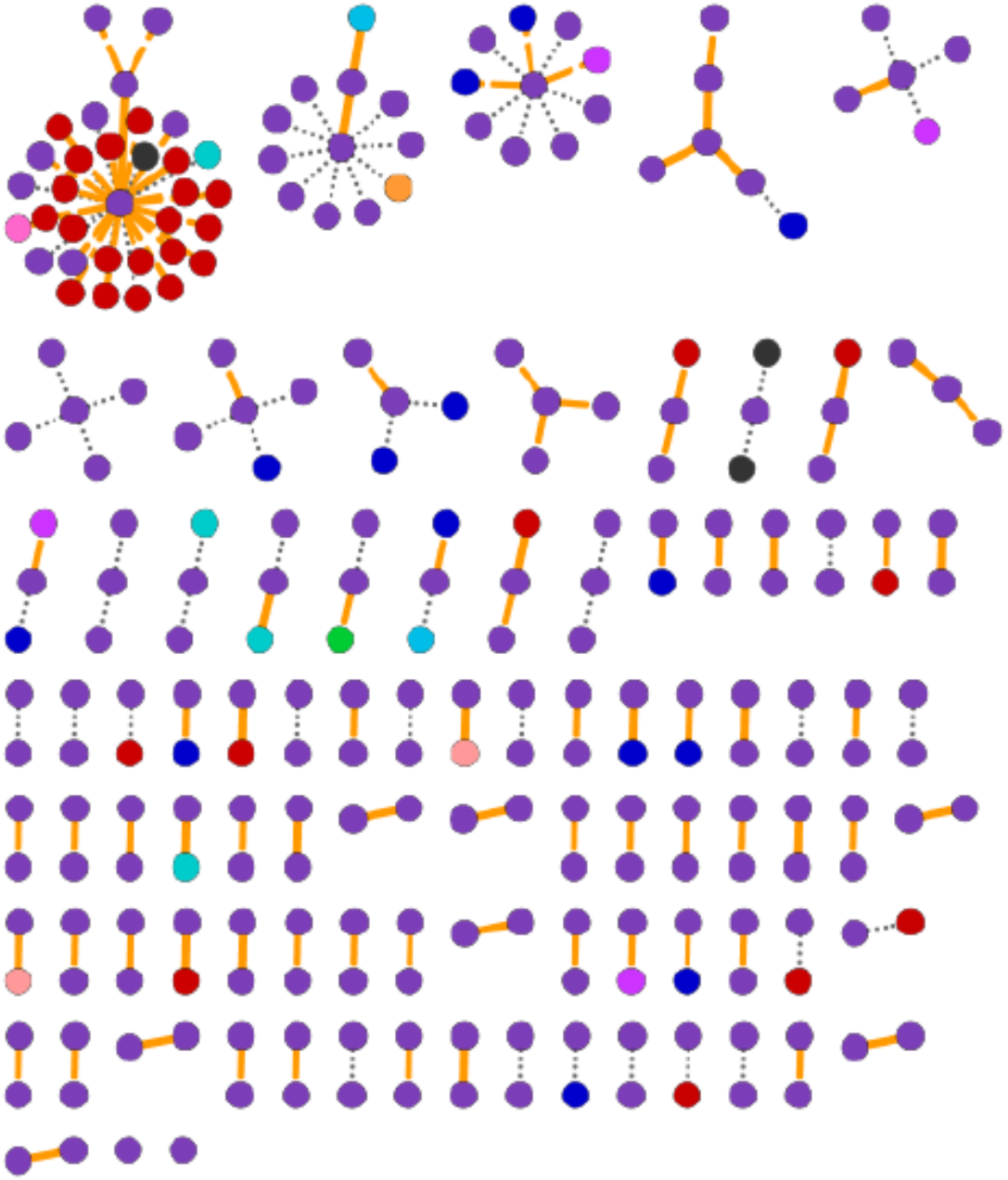
SF Bay Area Region: Alameda, Berkeley, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, Sonoma, and San Francisco

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?

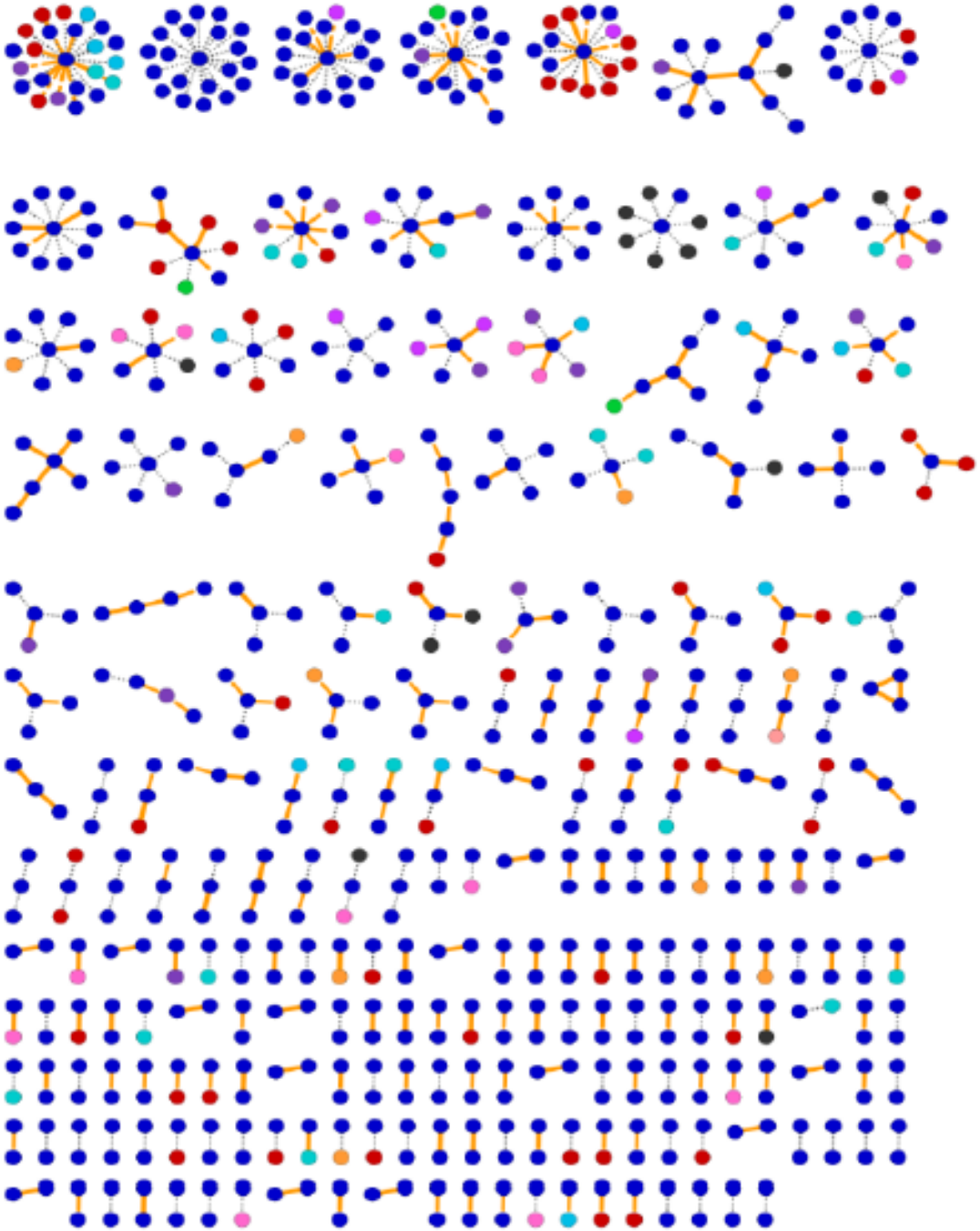


Contra Costa early syphilis case networks, 2008-14

90 components

- 96% dyads/triads
- 2-**33** nodes
- 37% had ≥1 IJ partnership

Alameda
Contra Costa
Santa Clara
San Mateo
San Francisco

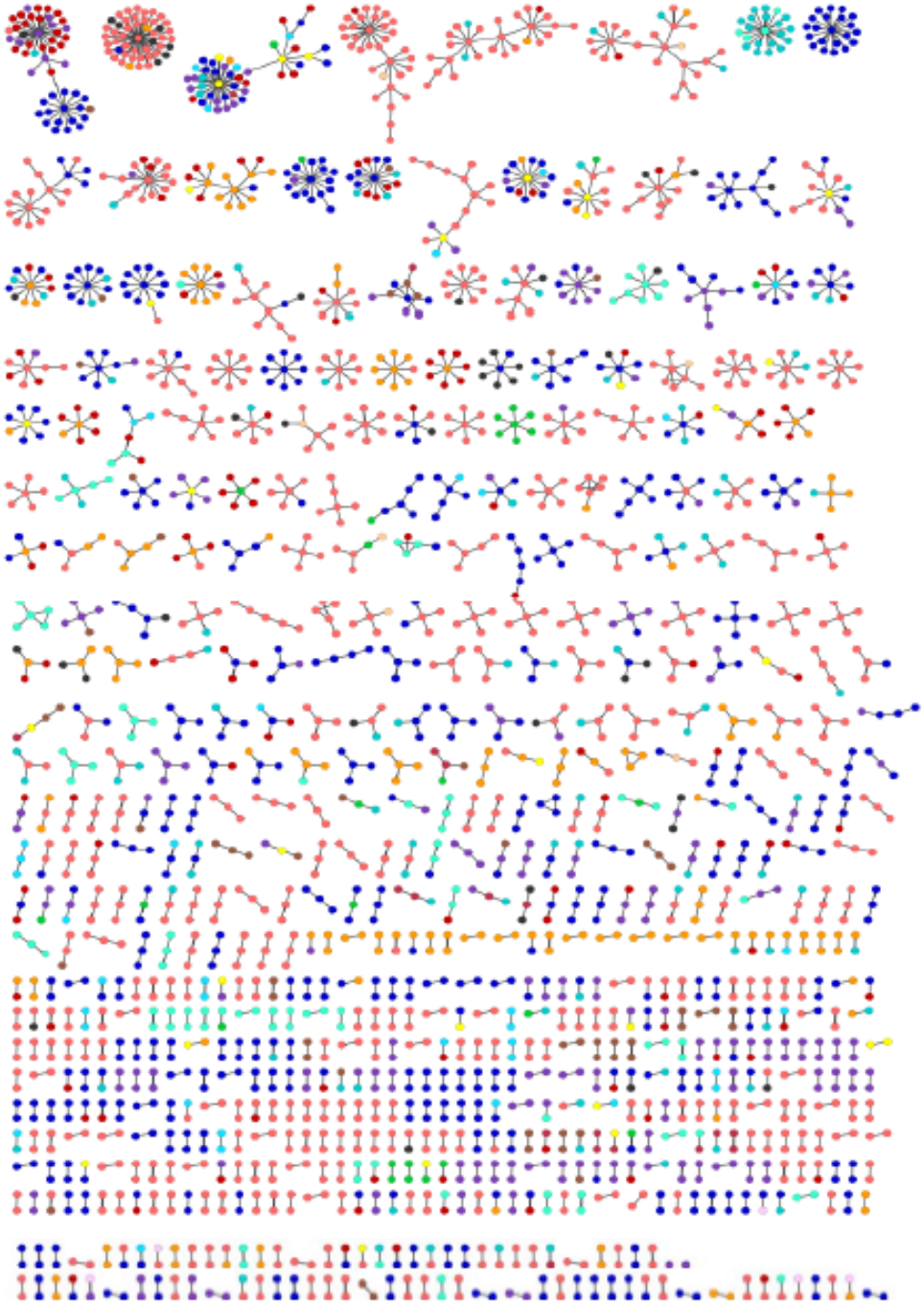


Alameda early syphilis case networks, 2008-14

213 components

- 64% dyads/triads
- 2-**23** nodes
- 40% with ≥1 IJ partnership

Alameda
Contra Costa
Santa Clara
San Mateo
San Francisco

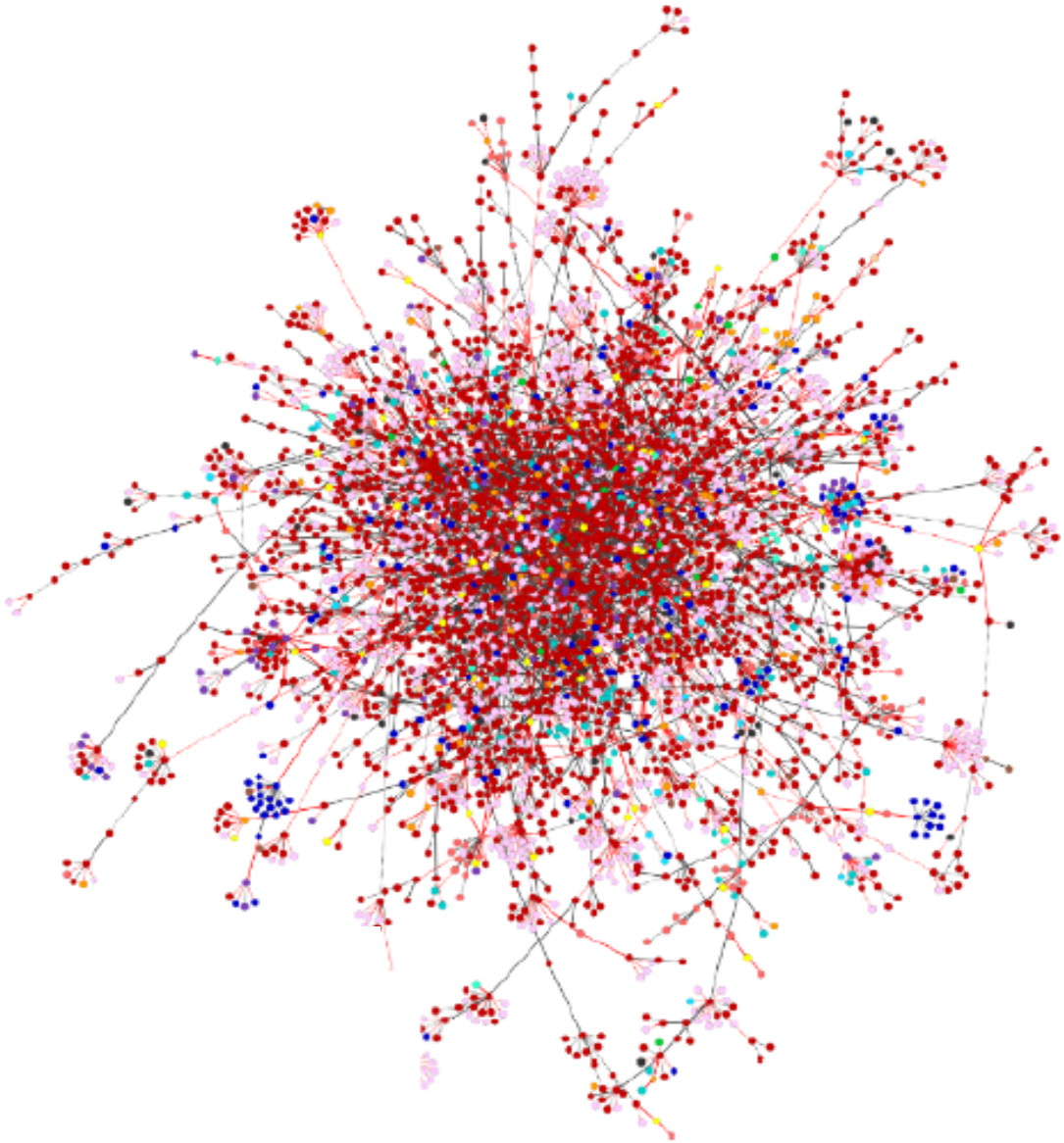


CPA Bay Area early syphilis case networks, 2008-14

729 components

- 77% dyads/triads
- 2-**50** nodes
- 37% with ≥1 IJ partnership

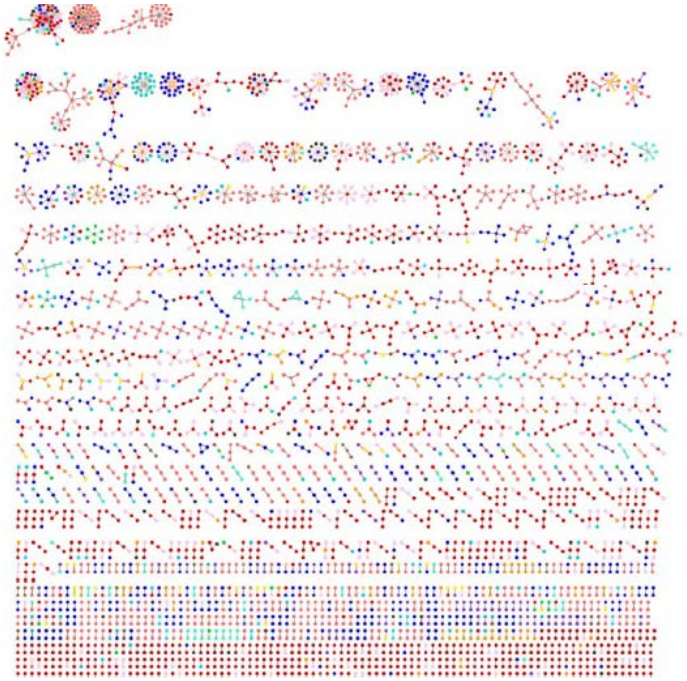
High proportion of networks in each LHJ had partnerships between persons in different LHJs



SF Bay Area Region
early syphilis case networks, 2008-14

mega-network

- 4,550 partnerships
- 3,829 nodes
- 41% IJ partnerships



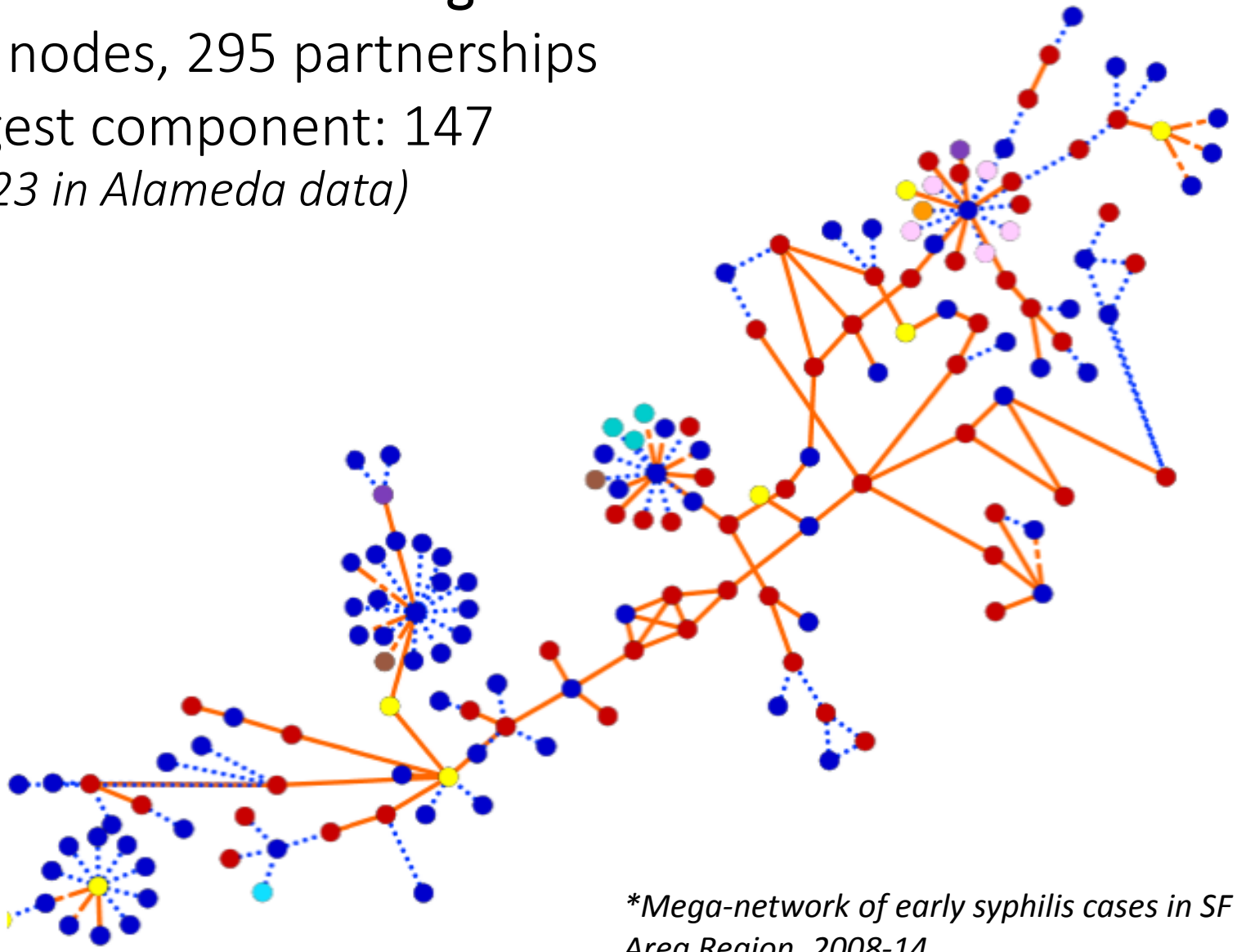
Inside the Mega-Network*, 2008-14: Alameda

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

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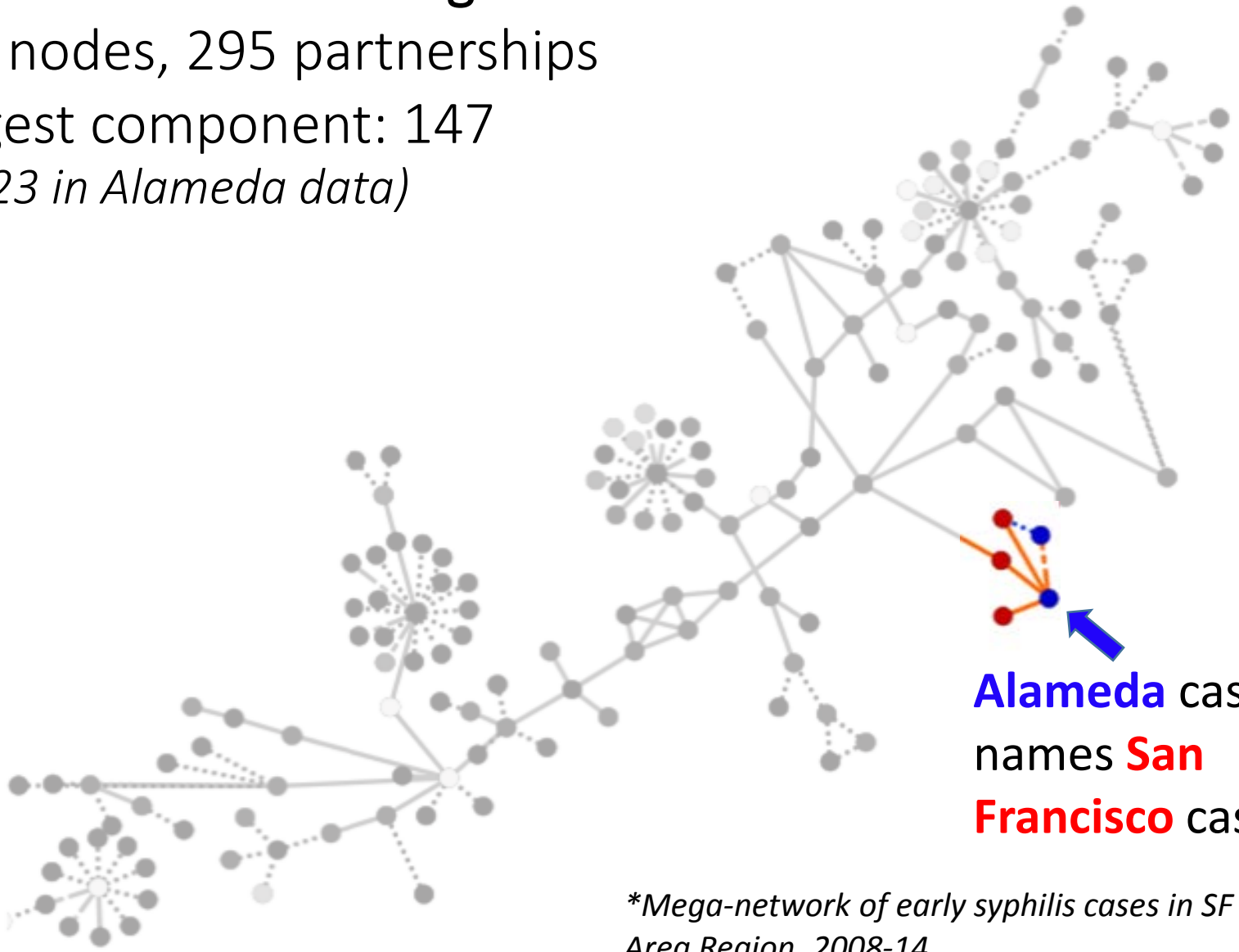

Alameda case names **San Francisco** cases

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

Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + **1-degree**

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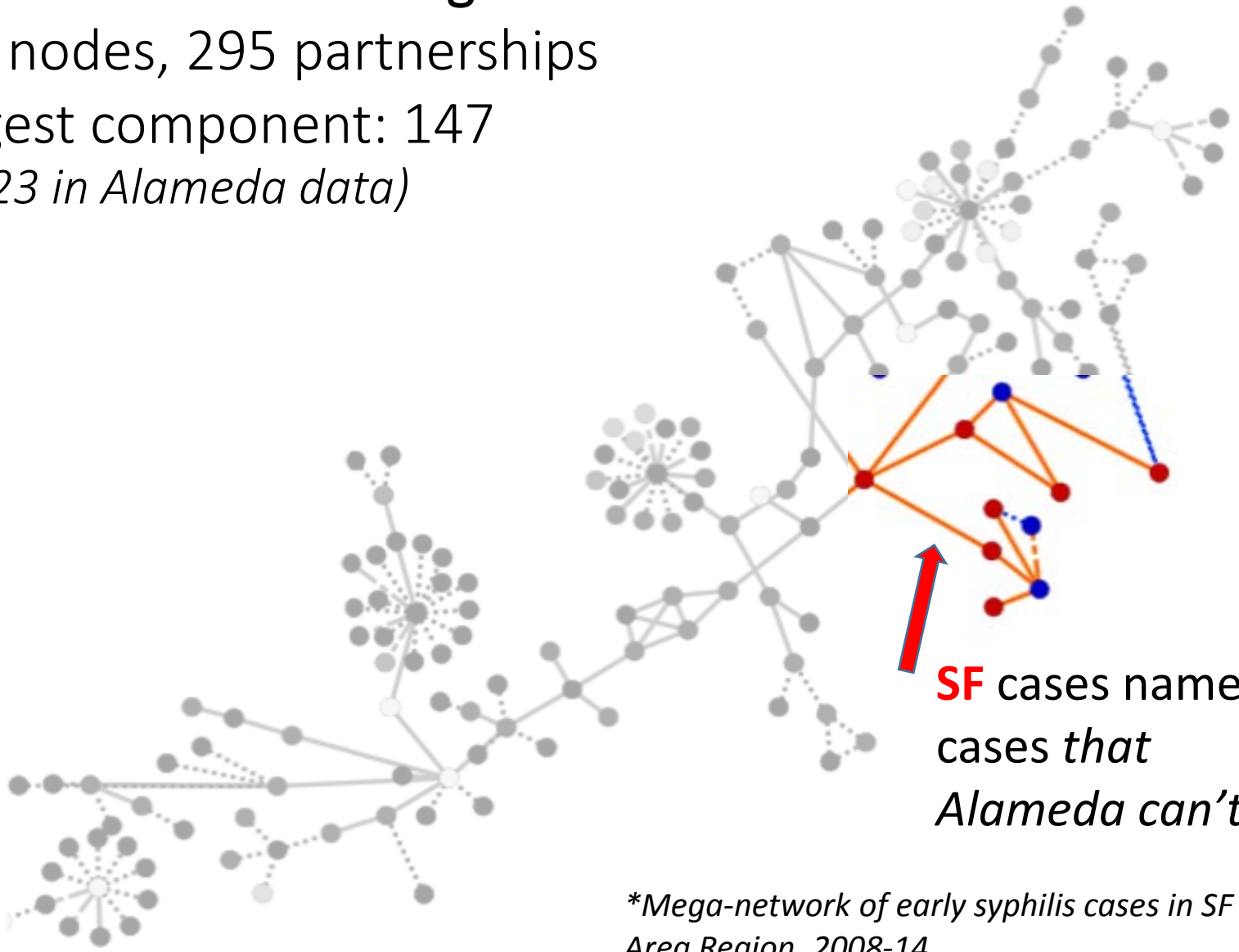


SF cases name **SF** cases *that Alameda can't see*

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

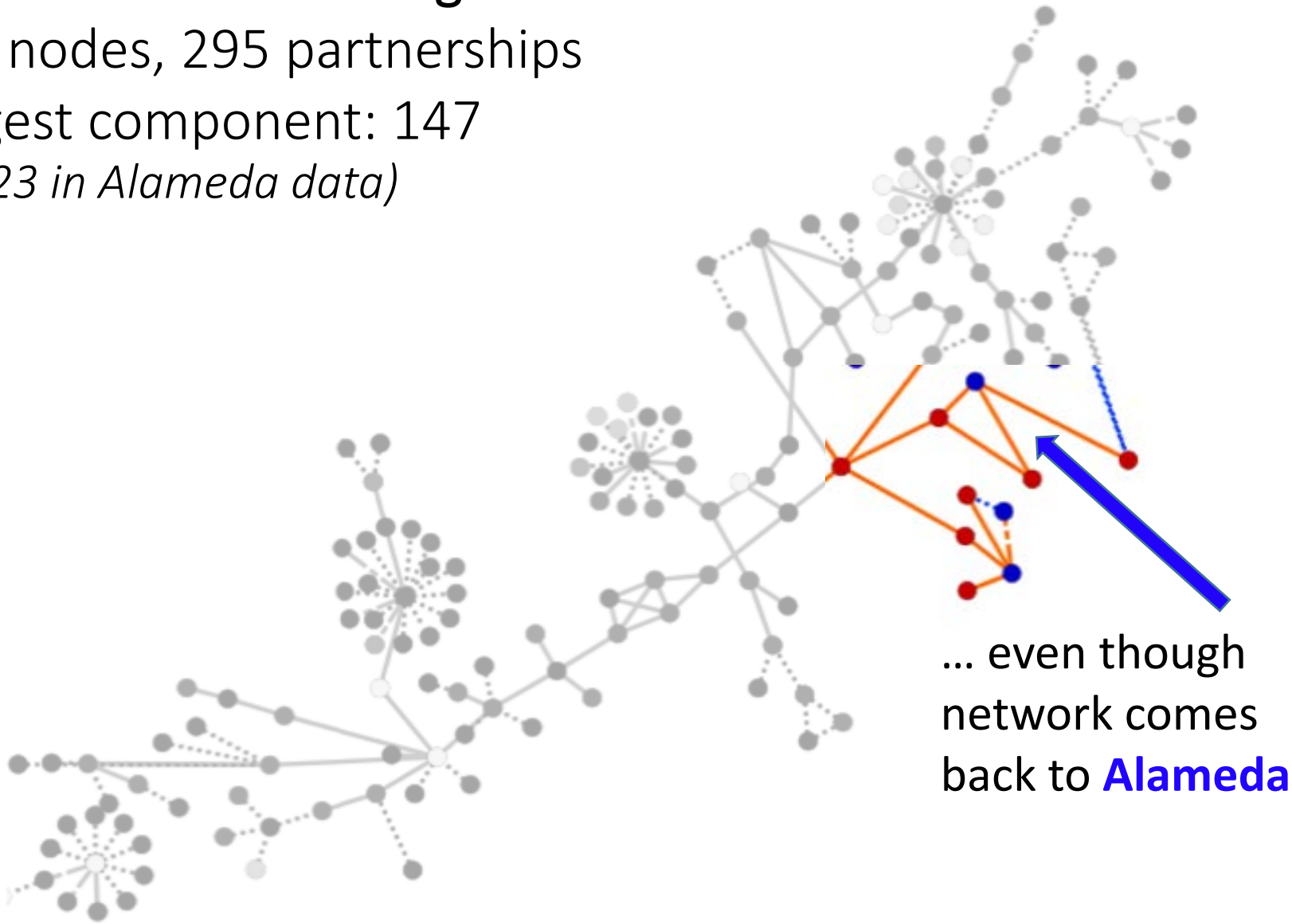
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + **1-degree**

328 nodes, 295 partnerships

Largest component: 147

(vs. 23 in Alameda data)



… even though network comes back to **Alameda**

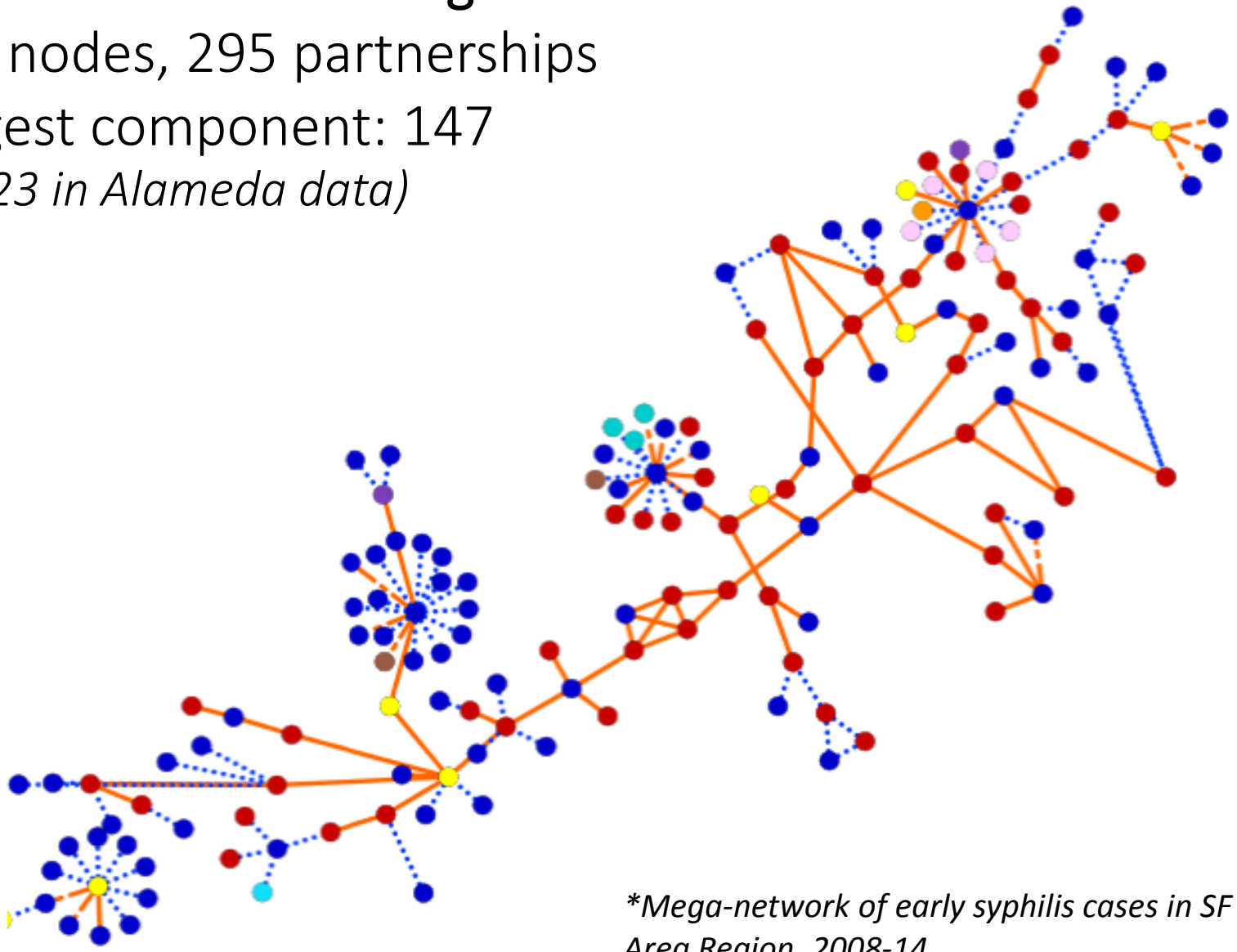
Inside the Mega-Network*, 2008-14: Alameda

Alameda nodes + **1-degree**

328 nodes, 295 partnerships

Largest component: 147

(vs. 23 in Alameda data)

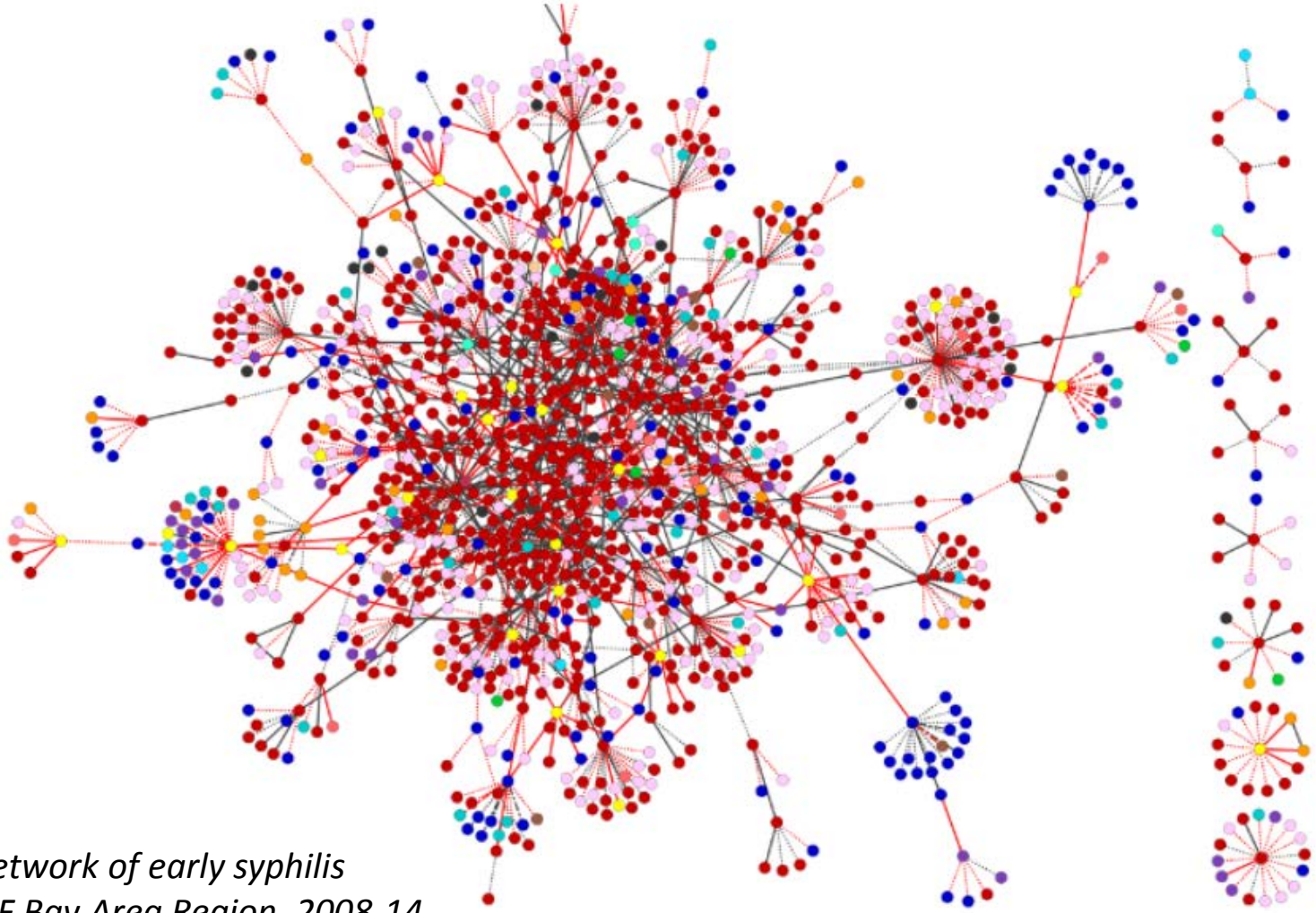


**Mega-network of early syphilis cases in SF Bay Area Region, 2008-14*

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

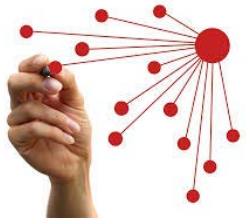
Low connectivity in CPA Bay Area data alone

- largest component: 50 nodes
- 33% of partnerships were interjurisdictional
- 37% of components with ≥ 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

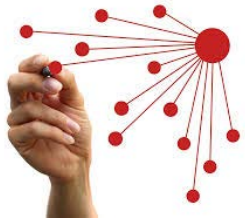
- Aggregate data results in overestimation of connectivity and difficulty analyzing node attributes that can change over time

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
Heidi Bauer
Nicole Burghardt
Joan Chow
Denise Gilson
Michael Samuel

Centers for Disease Control and Prevention
Kyle Bernstein
Romni Neiman

University of California, Berkeley
Jodi Halpern
Eileen Gambrill
Art Reingold
George Rutherford

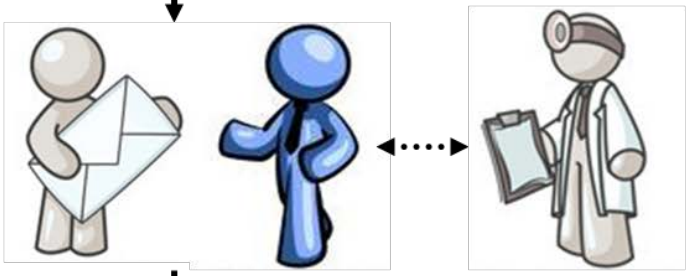
San Francisco Dept. of Public Health
Robert Kohn

Basics of syphilis surveillance and partner services

All syphilis cases reported to health department

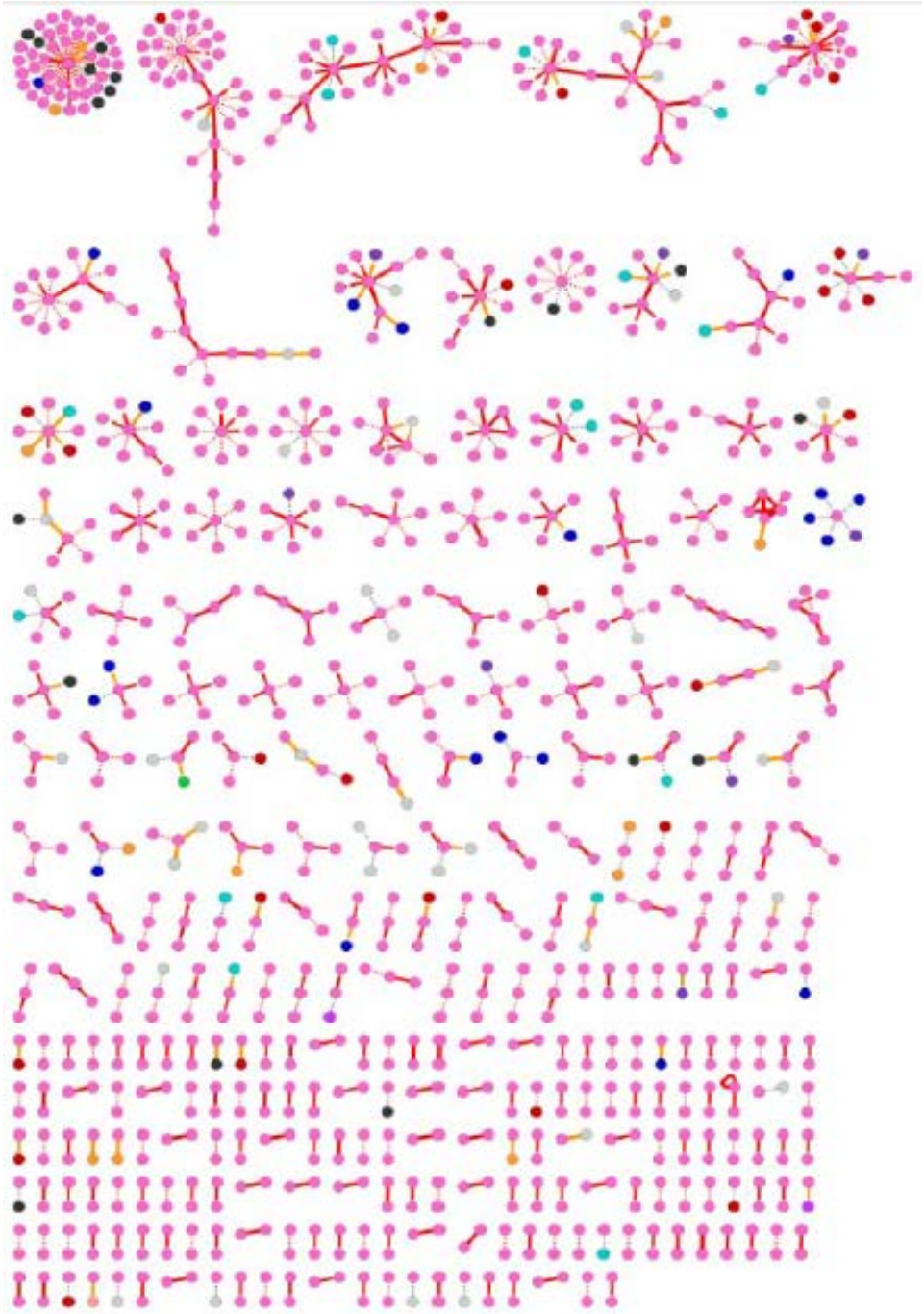
DIS interview early syphilis cases
(partner elicitation)

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 identfied infection, process repeats)



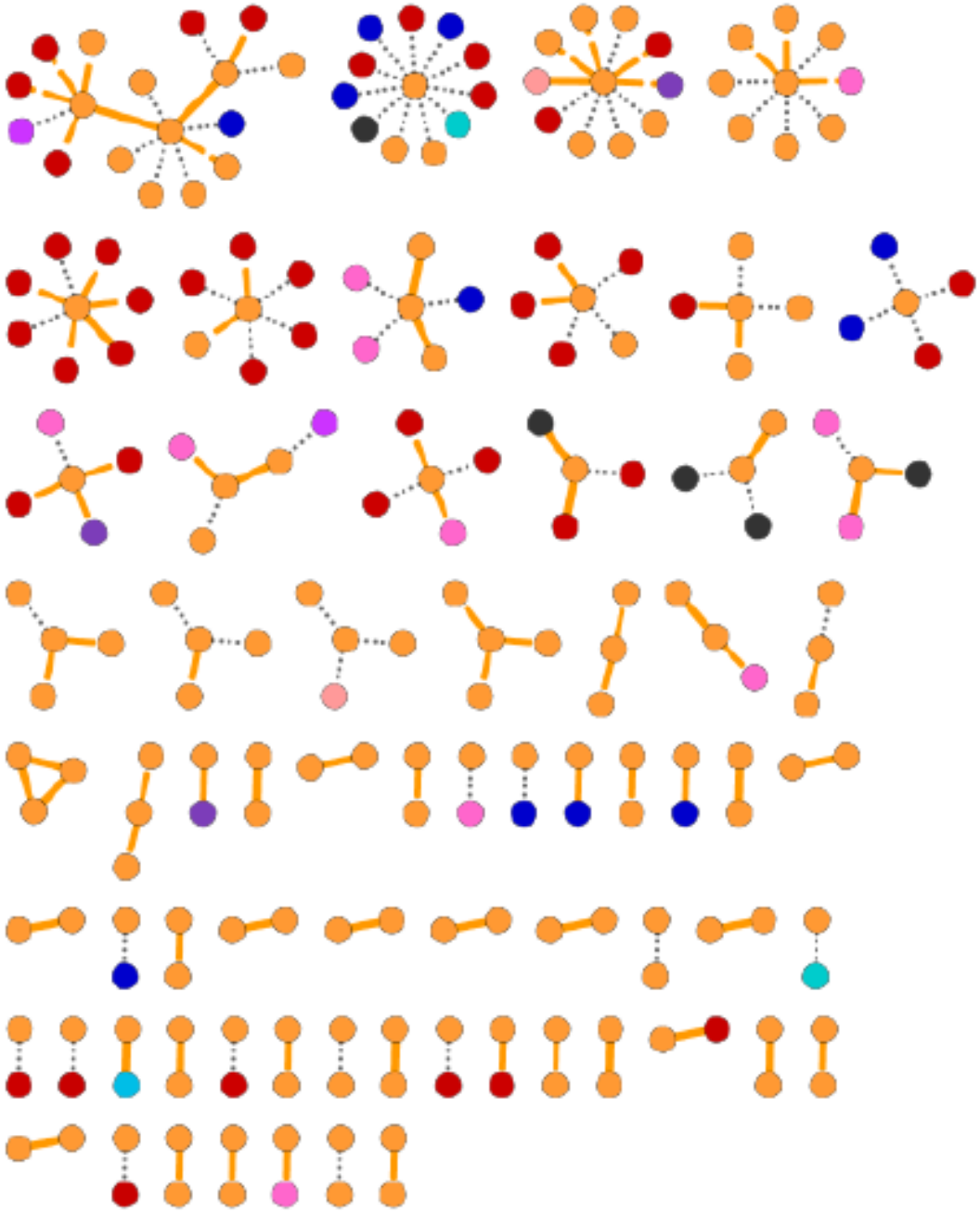
SANTA CLARA

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