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Breaking the Transmission Chain: New Approaches for Syphilis Control and the Role of Sexual and Social Networks

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Section A

Problem Definition

Syphilis: The Public Health Challenge

Good news

- Caused by the bacterium *Treponema pallidum*
 - Curable with cheap antibiotics
- Incubation period is 9 to 90 days
 - Should be able to find exposed sex contacts and treat them *before* they are infectious

Bad news

- Presents with protean manifestations and may be challenging to recognize and appropriately diagnose
- Cannot culture organism in vitro
 - Diagnosis relies on imperfect serologic tests
- Stigma attached to disease, diagnosis, and treatment

Disease Intervention Strategies

Diagnosis and treatment

Screening

Selective

Mass

Prophylaxis

Immunologic

Chemotherapeutic

Personal

Epidemiologic investigation

Contact tracing

Partner notification and referral

Outbreak investigation

Behavioral modification

Provider education

Public education (mass media)

Patient (individual) education

Targeted education (e.g., schools)

Thomas Parran's *Shadow on the Land*

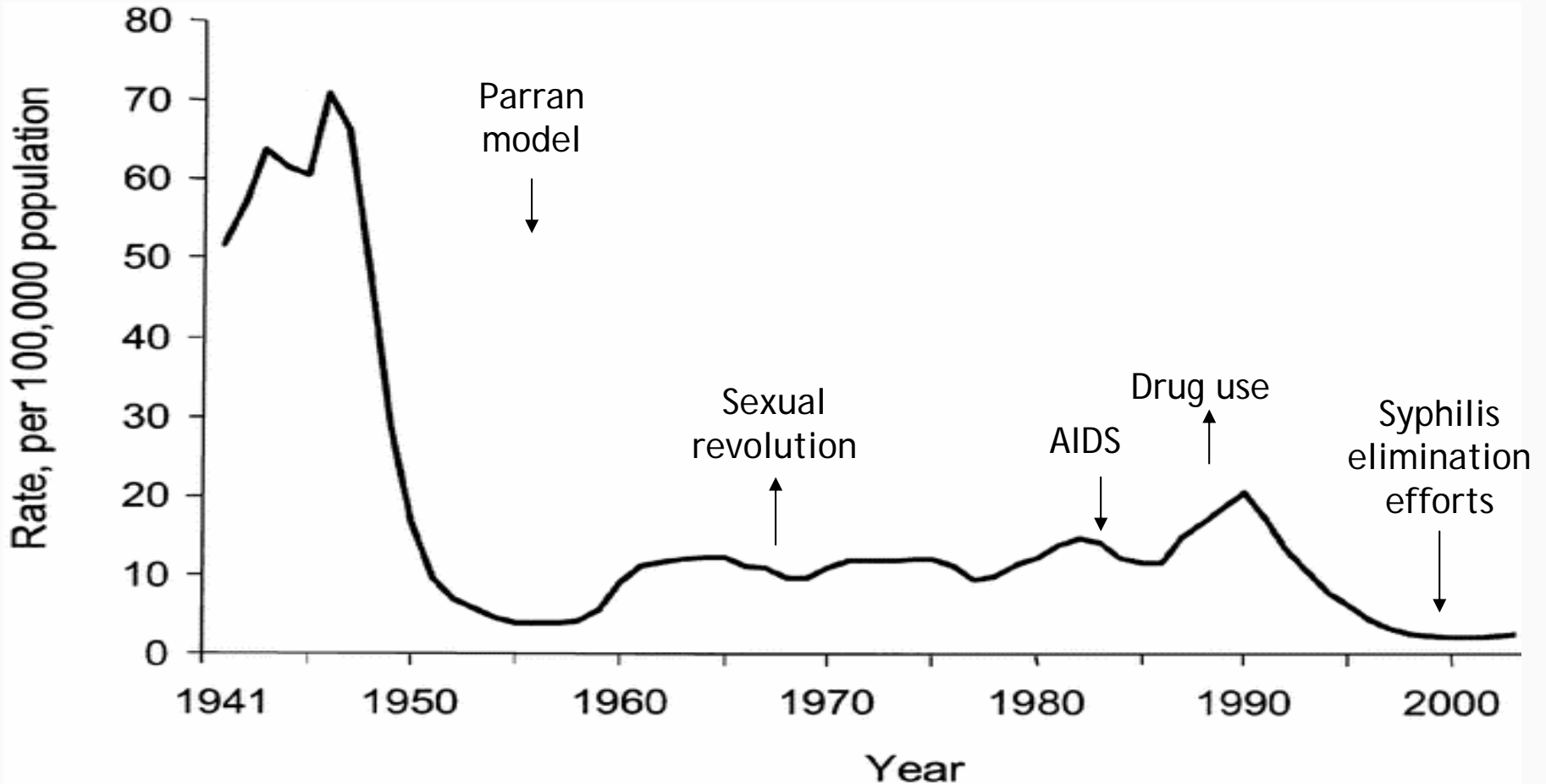
Thomas Parran, MD

Surgeon General of U.S. Public Health Service

Shadow on the Land, 1937

- Introduced contact tracing on a wide scale as a means of finding cases and interrupting patterns of infection and reinfection
- Genesis of current partner notification
- If applied rigorously, it has been effective in reducing outbreaks and containing syphilis
- Parran conceived syphilis as being spread via heterosexual contact with identifiable sex partners in identifiable venues

U.S. Primary and Secondary Syphilis Rates, 1941-2003



Current Partner Notification

- Disease intervention specialist (DIS)-assisted partner notification
 - Identify partners of a person diagnosed with syphilis (index case *or* original patient)
 - ▶ Notify partners of their exposure
 - ▶ Convince them to seek evaluation and treatment
 - Goal: treat infected persons *and* prophylactically treat those who may be incubating the infection in order to reduce the prevalence and incidence of syphilis

DIS Activities

- Interview the index case for their sex partners' identifying and locating information
- Find and notify those partners
- Try to convince partners to seek evaluation and treatment (can draw blood in the field if phlebotomy trained)
- Many also contact other persons mentioned by the index case and deemed "at risk" by the DIS
 - "Best friend" who went to a club to pick up a sex partner

How Are These Activities Evaluated for Effectiveness?

- Each stage in this process can be measured relative to the index case or to the number of partners claimed by the index case
 - E.g., in Louisiana between 1993 and 1996, 78% of named partners and other contacts were located (1.8 per index case), 0.76 per index case was prophylactically treated, and 0.31 per index case was a previously undiagnosed case of syphilis
 - A recent review of 18 U.S. estimates found median of 0.22 newly diagnosed case per index patient and 0.08 newly diagnosed case per named partner

The Current Syphilis Epidemic

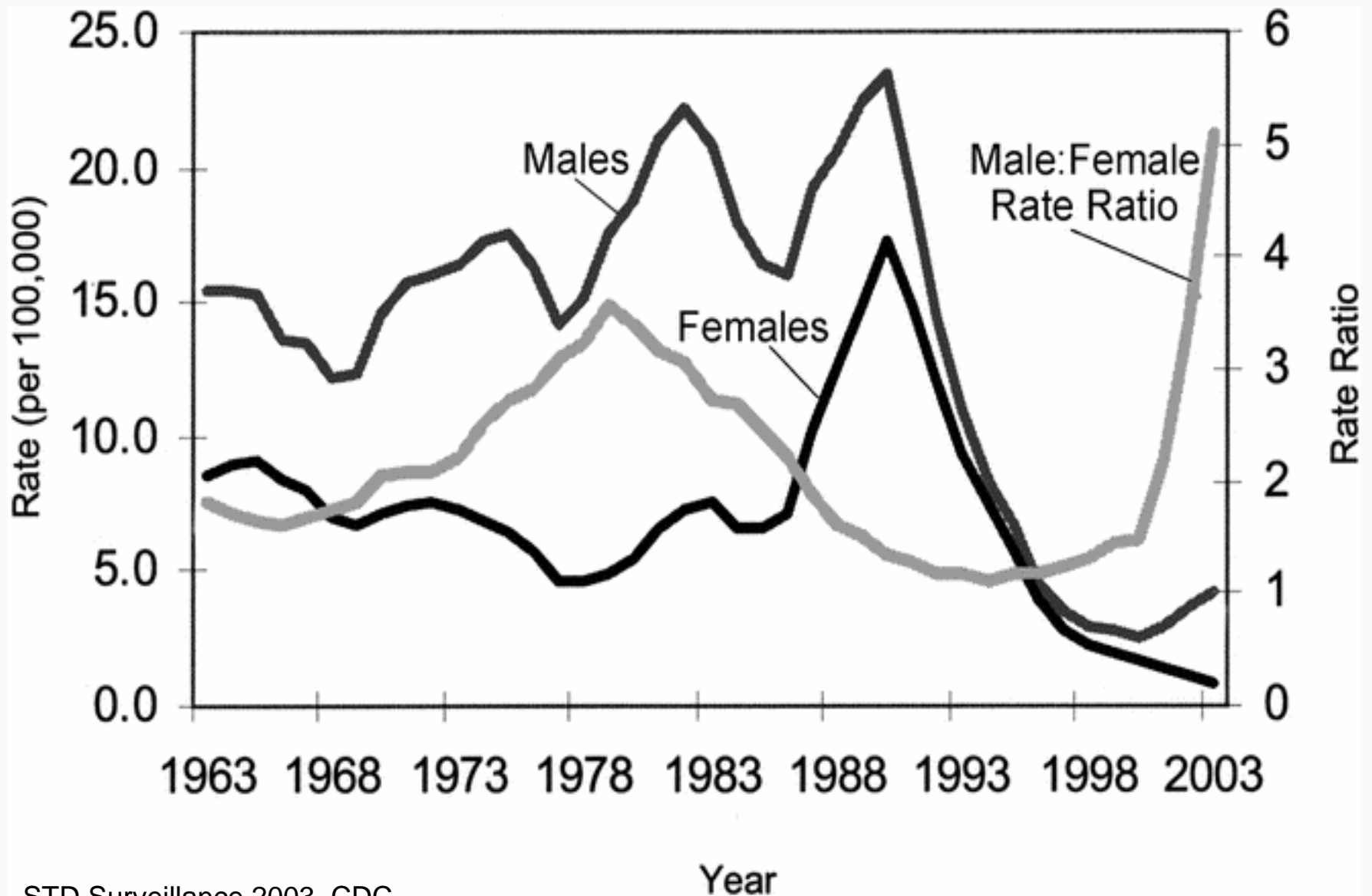
2003 Provisional Summary Partner Management Data for MSM With Primary & Secondary Syphilis

	Atlanta	Chicago	Fort Lauderdale	Houston	LA	Miami	New York	San Francisco
DIAGNOSIS STATISTICS								
Total known MSM diagnosed	254	170	141	132	283	113	105	319
MSM as proportion of all cases diagnosed	36	63.6	78.8	65.7	72.6	58.2	86.1	95.5
Proportion of MSM diagnosed outside HD settings	64.2	64.1	75.2	87.1	84.8	50.4	63.8	61.1
INTERVIEW STATISTICS								
Sex partners claimed	771	1022	1086	825	2585	432	317	3216
% Reporting anonymous partners	44.9	63	n/a	65	68	n/a	n/a	89
% Reporting no contacts of insufficient locating info	46.5	42.6	43.1	38.9	12	40.6	61	9.1
NOTIFICATION STATISTICS								
Partners contacted	371	249	88	129	254	64	41	383
Partners tested	n/a	115	80	99	254	59	30	272
Partners treated	121	96	35	67	n/a	36	29	237
Partners previously treated	34	46	31	11	n/a	19	9	47
Infected partners	24	14	10	12	n/a	14	5	37
NOTIFICATION EFFECTIVENESS STATISTICS								
Partners per index case	3.04	6.01	7.7	6.25	9.13	3.82	3.02	10.08
Contacts made per index case	1.46	1.46	0.62	0.98	0.9	0.57	0.39	1.2
Contacts as a proportion of all partners claimed	0.48	0.24	0.08	0.16	0.1	0.15	0.13	0.12
Cases found per index case (including Disposition E)	0.23	0.35	0.29	0.17	n/a	0.31	0.13	0.26
Cases found per index case (excluding Disposition E)	0.09	0.08	0.07	0.09	n/a	0.12	0.05	0.12

So What's Happening?

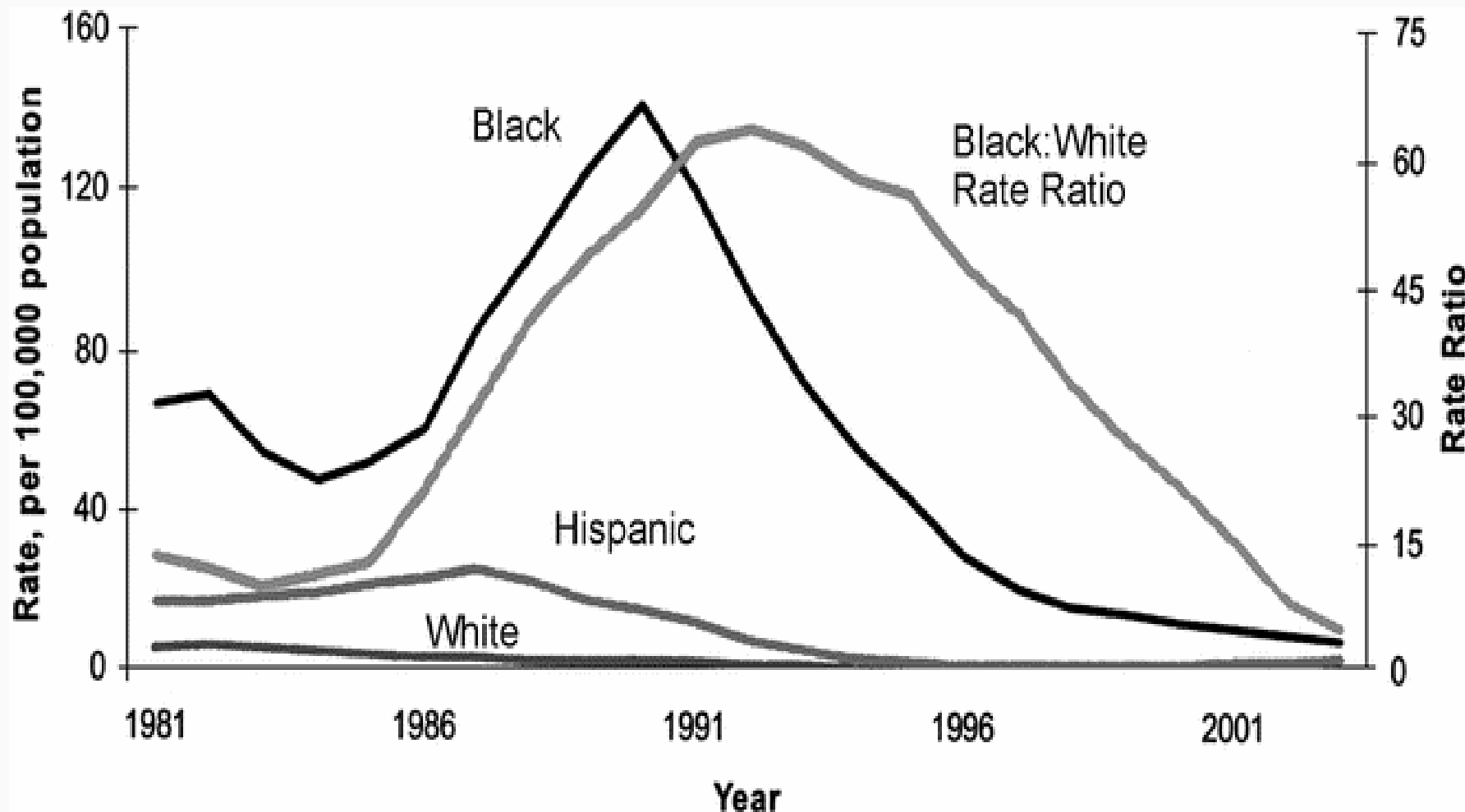
- Current epidemic involves MSM
- Over half are HIV co-infected
- Many anonymous sexual contacts met through
 - Chat rooms
 - Web sites
 - Bath houses
 - Bars
 - Parks
- Use of party drugs (methamphetamines and Viagra)
- Oral sex believed to be safe
 - Chicago outbreak: oral sex was only sex exposure for 23% of primary syphilis and 20% of secondary syphilis cases
 - (2004). *MMWR*, 53, 966-968.
- “Barebacking” (anal intercourse without condoms)

Primary and Secondary Syphilis Rates by Gender



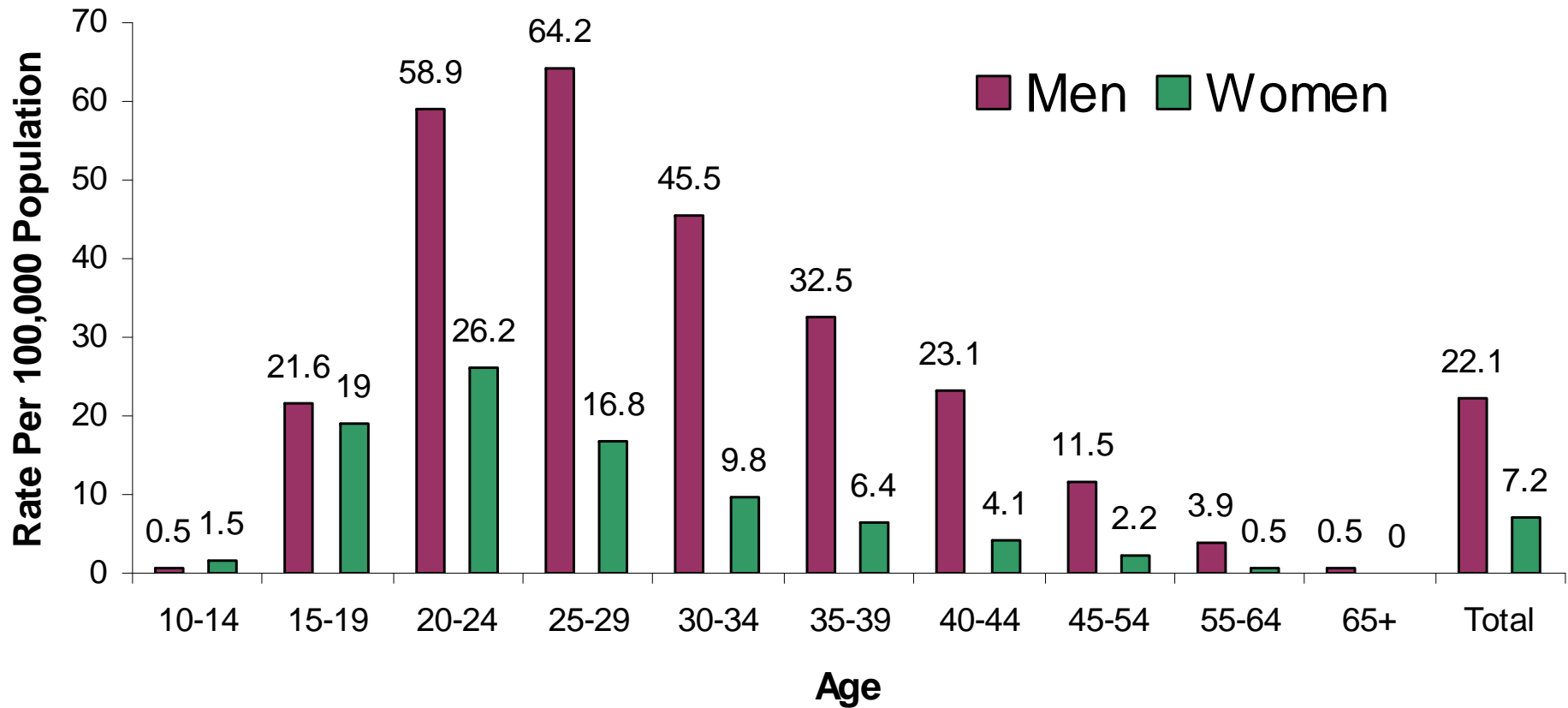
Syphilis Rates by Race and Ethnicity

- Primary and secondary syphilis rates by race and ethnicity



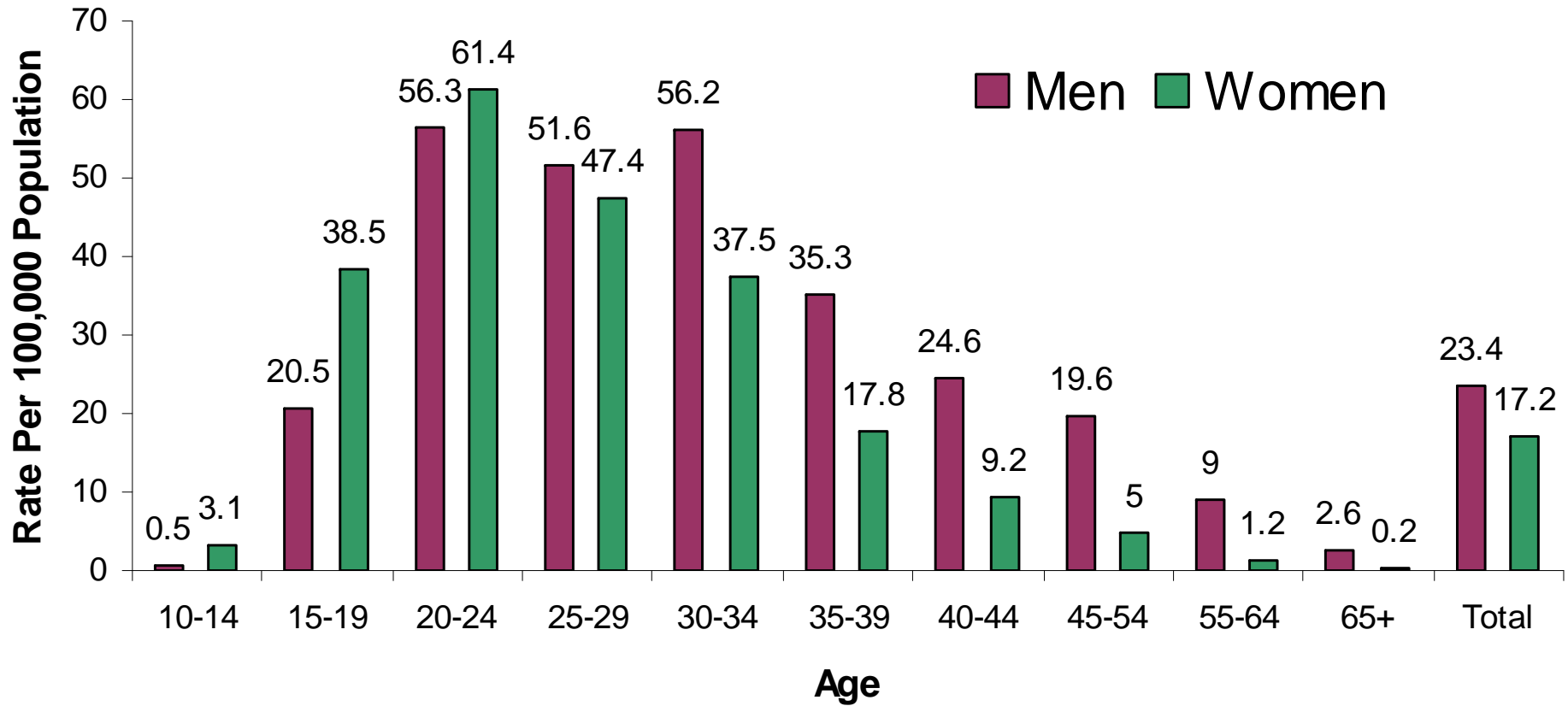
Syphilis Rates by Age and Sex for 1982

1982



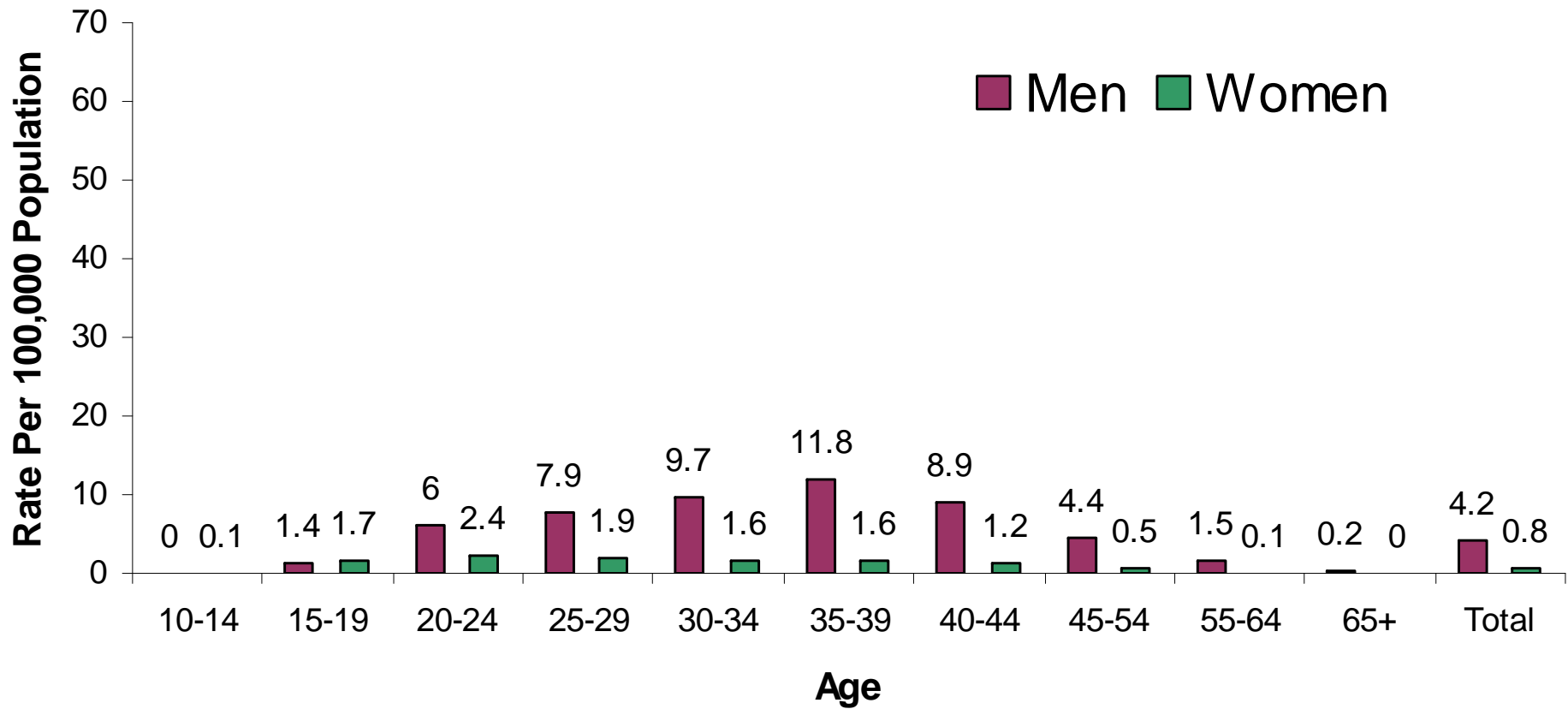
Syphilis Rates by Age and Sex for 1993

1993

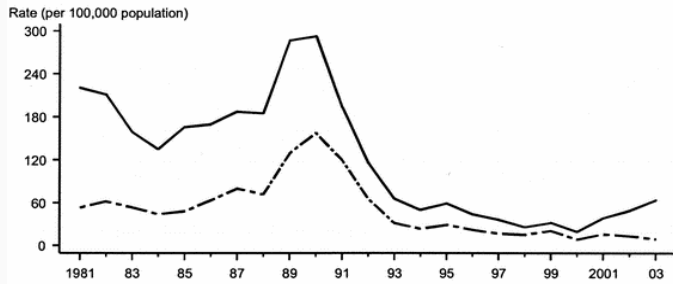


Syphilis Rates by Age and Sex for 2003

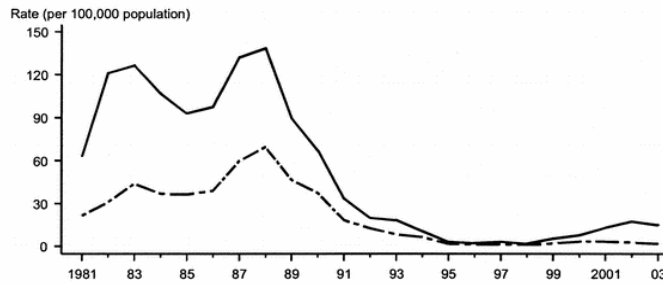
2003



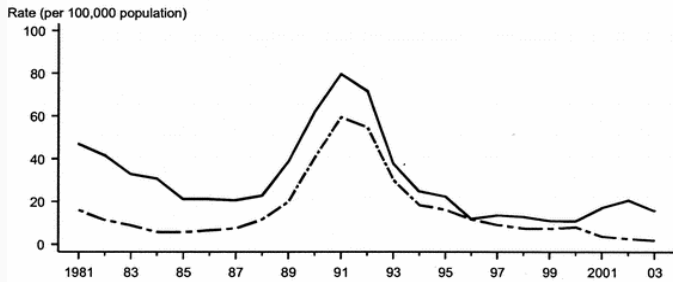
Atlanta



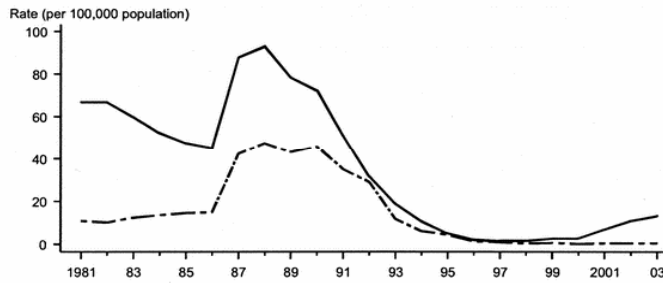
Miami



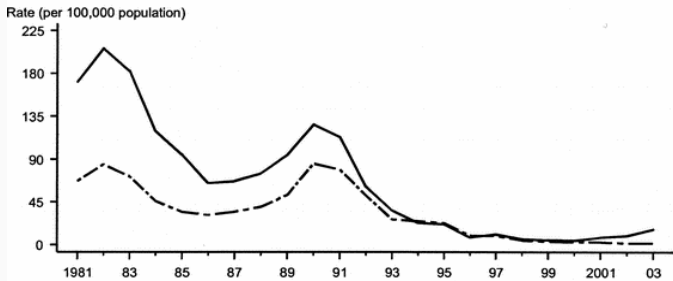
Chicago



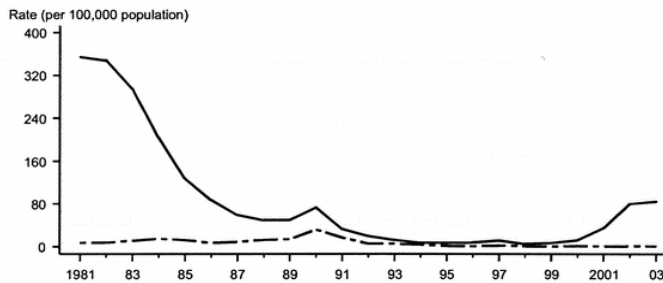
New York City



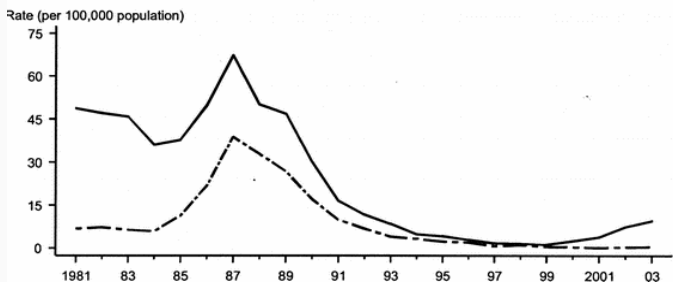
Houston



San Francisco



Los Angeles

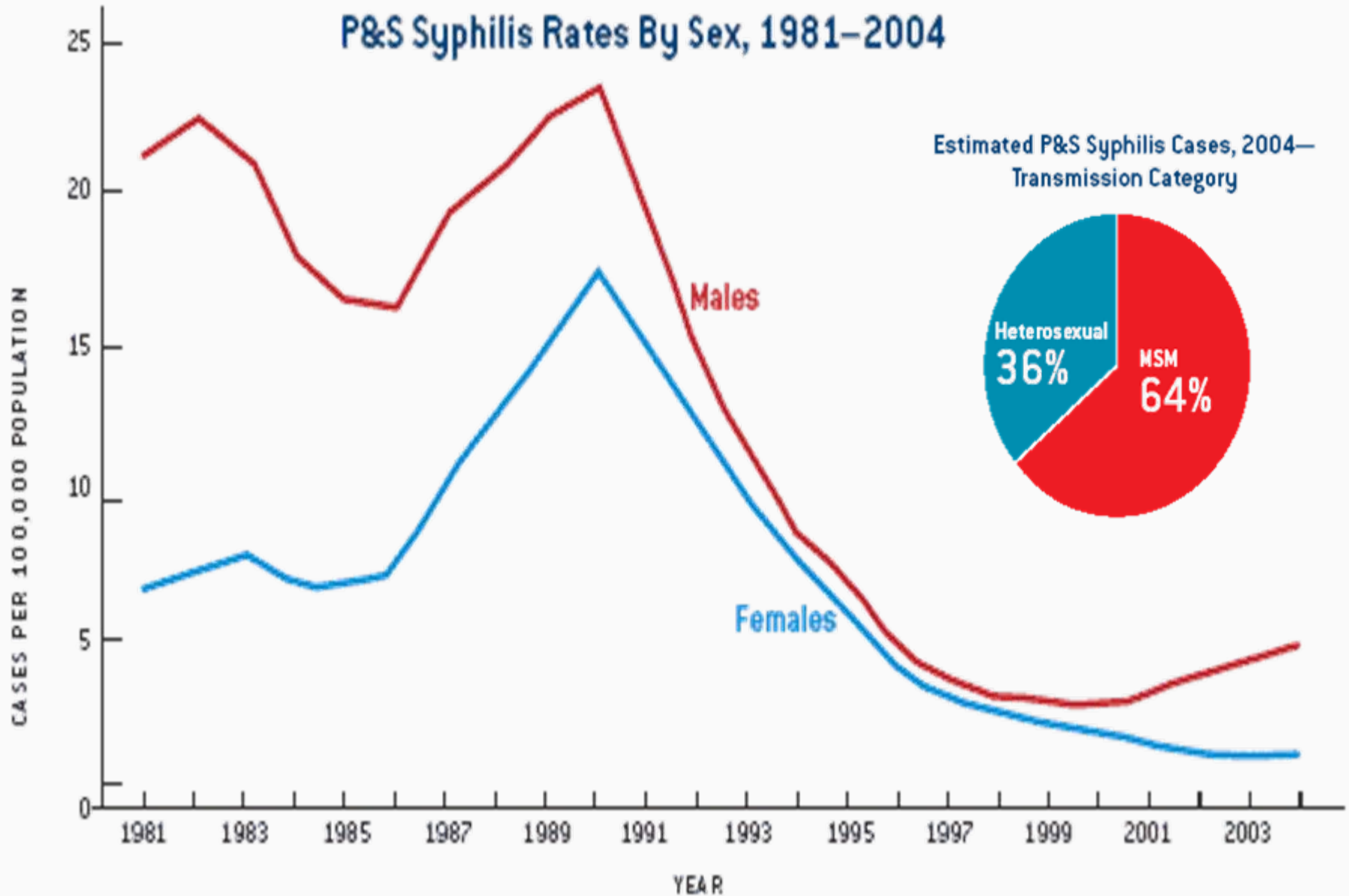


Syphilis rates in seven U.S. cities, 1981-2003

Solid line = men

Dashed line = women

Primary, Secondary Syphilis Rates by Sex, 1981-2004



Current Problems with the Parran Model

- Many MSM are in regular private care
 - 50% of MSM cases are diagnosed outside the health department setting
 - This may delay reporting since clinicians do not always report cases *before* laboratories
 - ▶ Case reports are not diminished in scope, but in timing
 - Many physicians distrust the health department and dislike the interference
 - May provide greater logistical difficulties for partner elicitation interviews
 - ▶ Reduced situational normative social influence and resulting conformity
 - Many MSM are employed and difficult to reach and interview

Sex Partner Anonymity and Identifiability

- Is anonymity genuine?
- Pseudoanonymity—index gives chat room or Web site where partner was met
 - San Francisco, Houston, and L.A. have used Internet-based partner notification efforts
 - ▶ Instant messaging by index to make first contact is more effective (San Francisco data)
- MSM want to “handle this myself”
 - MSM patients are not always competent to perform the notification
 - Notification will not necessarily lead to treatment



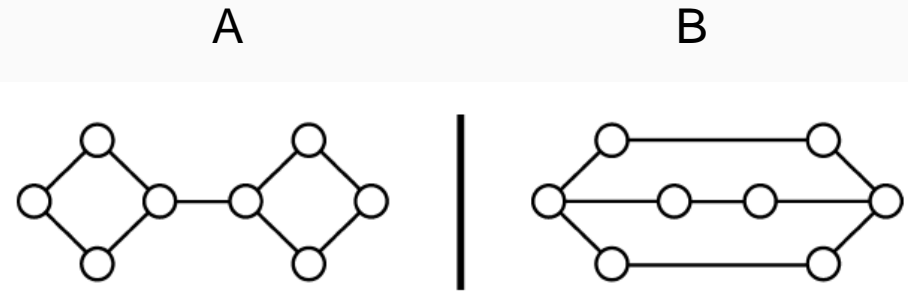
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Section B

New Models for Breaking the Transmission Chain—
Fragmenting the Network

Overview of Sexual Networks

- Networks matter because of structure
 - The architecture of the networks and how such conformation can modulate risk of STD



Klov Dahl AS. Social network research and human subjects protection: Towards more effective infectious disease control. *Social Networks*. Volume 27, Issue 2, May 2005, Pages 119-137. Copyright © 2005 Elsevier B.V. All rights reserved.

- Figure 1
 - Each network has eight persons connected by nine relationships
 - Two persons each have three partners, and the other six each have two partners
 - Transmission will be less efficient in network A, and prevention will be more difficult in network B
 - In A, in just two steps from the index person, half the network can be infected and half spared
 - In B, two steps can result in everyone being infected except for the person on the extreme right

Sexual Networks

- Consist of persons who are sexually connected directly or indirectly to one another
- Key features for sustaining STD/HIV transmission
 - Sufficient number of persons
 - Moderate to high density of connections
 - Centrality of infected persons
 - Pattern of partner selection—mixing between high- and low-risk persons

Sexual Mixing Patterns

- Mutually monogamous
 - Figure A: serial monogamy; person accumulates sexual partners one at a time
- Concurrency
 - Figure B: person moves back and forth among different partners
- WHO IS AT GREATER RISK?

Networks

- With MSM, numbers of partners are important as well as patterns of connectivity
- An appreciable minority of MSM report high numbers, and data from Great Britain indicate that these men are also those most likely to engage in unprotected sex
- These represent the “core group”
- They contribute a disproportionate share of HIV/STDs and can fuel sustained transmission even when they make up only a minority of the population

Core Groups

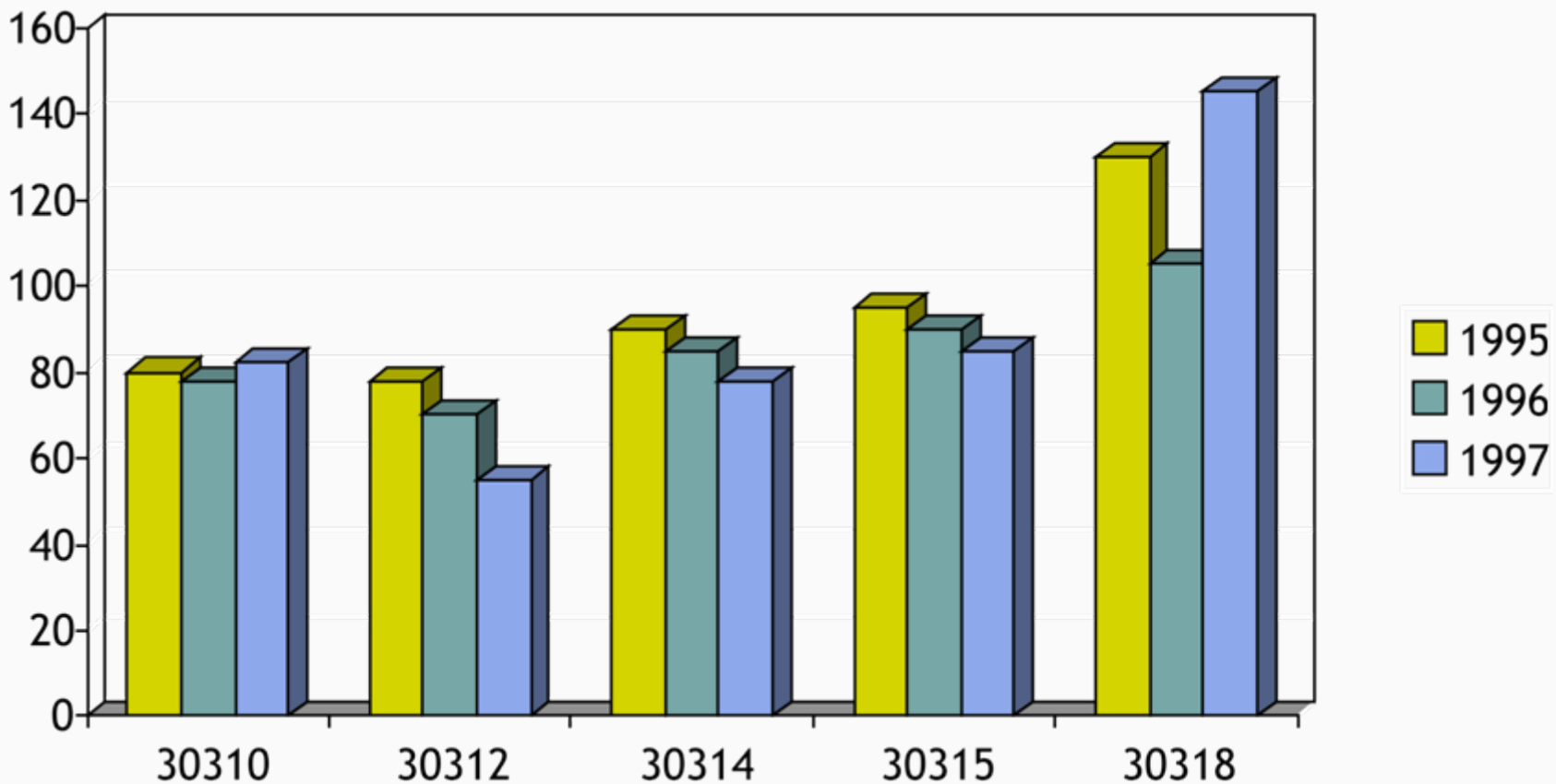
- Men can enter and exit the core group at different times of their lives
- High-risk behavior appears to be correlated with synchronous epidemics (syndemics)
 - Substance abuse
 - Histories of childhood sexual abuse
 - Clinical depression
 - Partner violence
- The more complex the mix, the higher the level of sexual risk

Using Network Tools—The Endemic Setting

- Comparative syphilis rates, 1997

	Rate per 100,000
Healthy 2000 objective	4
State of Georgia	34
Fulton County	109
Zip codes 30310, 30312, 30314, 30315, 30318	251
Zip code 30318	260

Syphilis: High-Morbidity Zip Codes in Fulton County



Target Population

- Men and women who live in zip code 30318 who are related to a case of syphilis by sex, drugs, or socially
- Behaviors that put this population at risk are inconsistent use of barrier methods, multiple sex partners, sex for drugs or money, drug use and abuse

Intervention Strategies

- Create a street team of two project assistants
- Plan for 80% of time in the field
- Develop an ethnographic base: be known in the community
- Interview persons with syphilis
- Interview selected non-infected partners (more at first)
- Elicit all contacts (sex partners, drug partners, friends)

Intervention Strategies

- Base field decisions on known network connections and ethnographic observations
- Field blood testing
- Maintain data base of all contacts, suspects, associates, and encounters
- Use of pagers and cellular phones
- Use very long interview periods for everyone
- Do not close a case

Data Sources

- Standard CDC interview form (73.54)
- Standard CDC field record (29.36)
- Standard cluster interview form
- Case management form
- Weekly, monthly, and quarterly reports
- Fulton County surveillance reports
- Information from clinic staff

Data Tools

- Epi Info (Mini-STD/MIS)
- UCINET KRACKPLOT
- Pajek

Changing Pattern of Case-Finding Effectiveness

- March-October 1998

Group size	Syphilis cases	Network contribution (%)
43	4	25
96	10	30
194	17	24
262	25	24
386	48	13

Observations

- Drug relationships parallel disease transmission
- Non-infected people and gatekeepers are just as valuable to the intervention process as the infected people
- Marginal contacts can be found when workers are known in the community
- Develop a relationship with the community, fostering a non-threatening presence
- Team interaction/communication is enhanced
- Workers become a community resource
- Knowledge of the community is enhanced
- Contact index may not be an adequate measure of productivity

Tools for Evaluation

- Observation of field activities
- Analysis of data collection methods
- Analysis of network diagrams
- Analysis of quantitative data
- Analysis of qualitative data

Back to Reality and the Current Epidemic

- How do we fragment the network?

Intervene in Gay Male Venues

- Bathhouses and sex clubs
 - Tie together geographically isolated networks
 - Public health workers have episodically used these venues to educate and test persons at risk
 - ▶ However, the number of blood tests collected are remarkably low
 - ▶ Persons likeliest to harbor the infection may be the least likely to seek testing

The Internet

- Two fragmentation strategies
 - Help men make informed choices about their partners and thus become better “shoppers”
 - ▶ Like “e-harmony”—get more information about sexual history, risk-taking preferences, and HIV/STD status
 - Discouragement of contact between core-group, high-risk members (both infected and uninfected) and low-risk men

The Internet

- Use online advertising: outreach; partner notification; and interactive, targeted interventions
- Give information to become “better shoppers” to fragment sexual networks by pulling low-risk men away from high-risk men and to facilitate partner notification services
- Dutch site has created a computerized algorithm that allowed patrons to enter information describing themselves and their preferences and provided them with tailored feedback
 - Offered advice to an “out” gay man seeking sex with a new partner regarding condom use
- San Francisco created a Web site designed to attract men who only seek safe sex
- Another new Web site also serves to promote seroconcordant relationships