STD Epidemiology

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- For the CDC he conceived, developed, and implemented the National Gonococcal Isolates Surveillance Program and wrote the 1989 STD Treatment Guidelines
- At Hopkins sine 1989, where he has developed an active clinical and translational research program focusing on STD epidemiology
- Chief of clinical services at the Baltimore City Health Department between 1992 and 1995 and senior medical advisor at the U.S. Department of Health and Human Services from 1995 to 1997
Section A

Background
Importance of Preventing and Controlling STDs

- International health objective
- High rates of complications and adverse health outcomes
- High human and economic costs
- STDs facilitate the transmission of HIV (Wasserheit, 1992)
- Relationship to other co-morbidities such as substance use and mental illness
Events/Outcomes: Costs and Morbidity of Sexual Behavior

- Unintended pregnancy
- LBW infants
- Terminations
- STD direct costs-medical (PID)
- Long-term STD costs (ectopics, infertility)
- Emotional and economic costs
- Potentiated HIV Risk (3–6X)
Long After Kinsey, Only the Brave Study Sex

By BENEDICT CAREY (NYT) 2517 words
Late Edition - Final , Section F , Page 1 , Column 1

DISPLAYING FIRST 50 OF 2517 WORDS - In a scene from the movie "Kinsey," opening in theaters on Friday, government agents seize a box of study materials being shipped by Dr. Alfred C. Kinsey, the pioneering sex researcher, and impound the contents as obscene. ... The scene portrays a time in American history, the 1940's and 1950's,...
Condom Use at Last Sex (YRBS*) 1991–2001

*Youth Risk Behavior Surveillance System
Condom Use at Last Sex (GSS *)


*General Social Survey
**Disease Rates**

**Total Population Based Rate**

\[
\text{Total Population Based Rate} = \frac{\text{Total cases of disease}}{\text{Total population}} - \text{Sexually active adults at risk for GC}
\]
Total Population Based Rate = \frac{\text{Total cases of disease}}{\text{Total population}}
STI Incidence Factors

INDIVIDUAL BEHAVIOR

STI INCIDENCE

BIOLOGY OF ORGANISM

Inspired by Anne Johnson. (2005)
STI Incidence Factors

BEHAVIOR OF POPULATIONS

SES and Demographics

CONTROL PROGRAMS

ECOLOGY ORGANISM

TIME

Inspired by Anne Johnson. (2005)
Structural Difference between Two Social Networks
Fig. 1. Sexual contacts among homosexual men with AIDS. Data from Centers for Disease Control Study [31].
Section B

Bacterial STDs and the Epidemiological Applications
Gonorrhea Rates


Note: The Healthy People 2010 target for gonorrhea is 19.0 cases per 100,000 population.

Source: CDC Division of STD Prevention
Gonorrhea Rates by Race and Ethnicity


Source: CDC Division of STD Prevention
Note: The Healthy People 2010 objective for gonorrhea is 19.0 cases per 100,000 population

Source: CDC Division of STD Prevention
Reported Gonorrhea Rates by Year: 1995–2004

Reported Gonorrhea Rates by Year: 1995-2004 (Projection)
Health Promotion and Disease Prevention
Baltimore City Health Department

Source: Baltimore City Health Department, STD Surveillance Unit
July 2004

* Projected 2004 Rate
2003 and 2004 US Rates
Gonorrhea in Baltimore, 2003, by Gender and Location

Baltimore City Health Dept. STD Surveillance Unit
Gonorrhea rate per 100,000 per census block group, 1994–1999, Baltimore City

Source: CDC Division of STD Prevention
Section C

Prevalent Chronic Viral Infections: Herpes Simplex
Prevalent Infections: The Control Challenge

- Strategy based on prevalent data
- Time trajectory often not known
- Evaluation of interventions is methodologically difficult
- Use of surrogate (e.g., behavioral) markers for evaluation
Figure 2. HSV-2 Seroprevalence According to Age in NHANES II (1976 to 1980) and NHANES III (1988 to 1994).
HSV-2 Seroprevalence

By age, race/ethnicity—NHANES III (1991)
HSV-2 Seroprevalence in the United States

Subclinical Viral Shedding

- More than 90% of persons with genital HSV-2 shed virus asymptotically
- Present 1–10% of asymptomatic days in persons who have recurrent herpes due to HSV-2
- Uncommon in HSV-1 genital infection
- Frequency highest in first year after acquisition
- Responsible for most transmission
Section D

Epidemiology of Syphilis
Reported Primary and Secondary Syphilis rates by Year: 1995-2004 (Projection)
Health Promotion and Disease Prevention
Baltimore City Health Department

Source: Baltimore City Health Department, STD Surveillance Unit
July 2004

* Projected 2004 Rate
2003 and 2004 US Rates

Note: The Healthy People 2010 target for P&S Syphilis is 0.2 case per 100,000 population.

Source: CDC Division of STD Prevention
Syphilis Epidemiology Reflects Social Trends

- **1940s–1970s**
  - Poverty in the South and minority communities; CSWs
- **1975–1981**
  - Gay liberation movement
- **1981–1989**
  - AIDS epidemic
- **1988–1995**
  - Crack cocaine epidemic
- **1997–2005**
  - Syphilis elimination campaign
  - Resurgence in homosexual men
Baltimore City Reported Early Syphilis, 2003

Stage
- Primary
- Secondary
- Early Latent

152 Early Syphilis Cases with Valid Baltimore City Address (2003)
7 Early Syphilis Cases with Ungeocodable Address (2003)
1 Early Syphilis Case Homeless
6 Early Syphilis Cases with Valid Address OUTSIDE Baltimore City (2003)
Male-to-Female Ratio, 2004

Source: CDC Division of STD Prevention
Section E

Reproductive Rate Equation
Simple but Useful Equation

\[ R_o = \beta \cdot c \cdot D \]

- Reproductive rate
- Probability of transmission
- Number of sexual contacts
- Duration of infectiousness

Duration of Infection—Interventions

- $R_0 = \beta c D$
- Duration of infection—interventions
  - Reduction of $d = \text{reduction of asymptomatic pool}$
  - Disease screening programs
  - Partner notification and presumptive treatment
  - Increased health care access
  - Treatment guidelines
Transmission Efficiency—Interventions

- $R = \beta cd$ Transmission efficiency—interventions
  - Condom use and barrier methods
  - Microbicides
  - Hormonal contraceptives(?)
  - Circumcision(?)
  - Antiviral therapy(?)

  "Doc, now that my viral load is zero, do I still have to use a condom?…Can I get a prescription for Viagra?…"
Section F

HIV-STD Interactions
STDs As Cofactors in HIV Transmission

- STDs increase HIV transmission
  - ↑ may influence HIV replication
  - ↑ viral load in genital secretions (ex: HSV-2 associated with higher HIV levels in plasma and in genital secretions)

- STDs increase susceptibility to HIV
  - Disrupt mucosal barrier
  - ↑ number of receptor cells in genital tract
  - ↑ receptors expressed per cell
Importance of Acute HIV Infection in Transmissibility

Probability of Infection by Week

Probability of Transmission/Unprotected Coital Act

Weeks from Infection

Increased STDs in Gay Men

- Trend observed since 1999
- Behavioral relapse and increased disease rates
- High proportion HIV-positive in syphilis epidemics
- Trend observed in U.S. and Western Europe