# A 21st Century Public Health Model of HIV Prevention:

# Integrating Traditional and Molecular Methods for Case-finding and Monitoring Access to Care San Francisco


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# Disclosure

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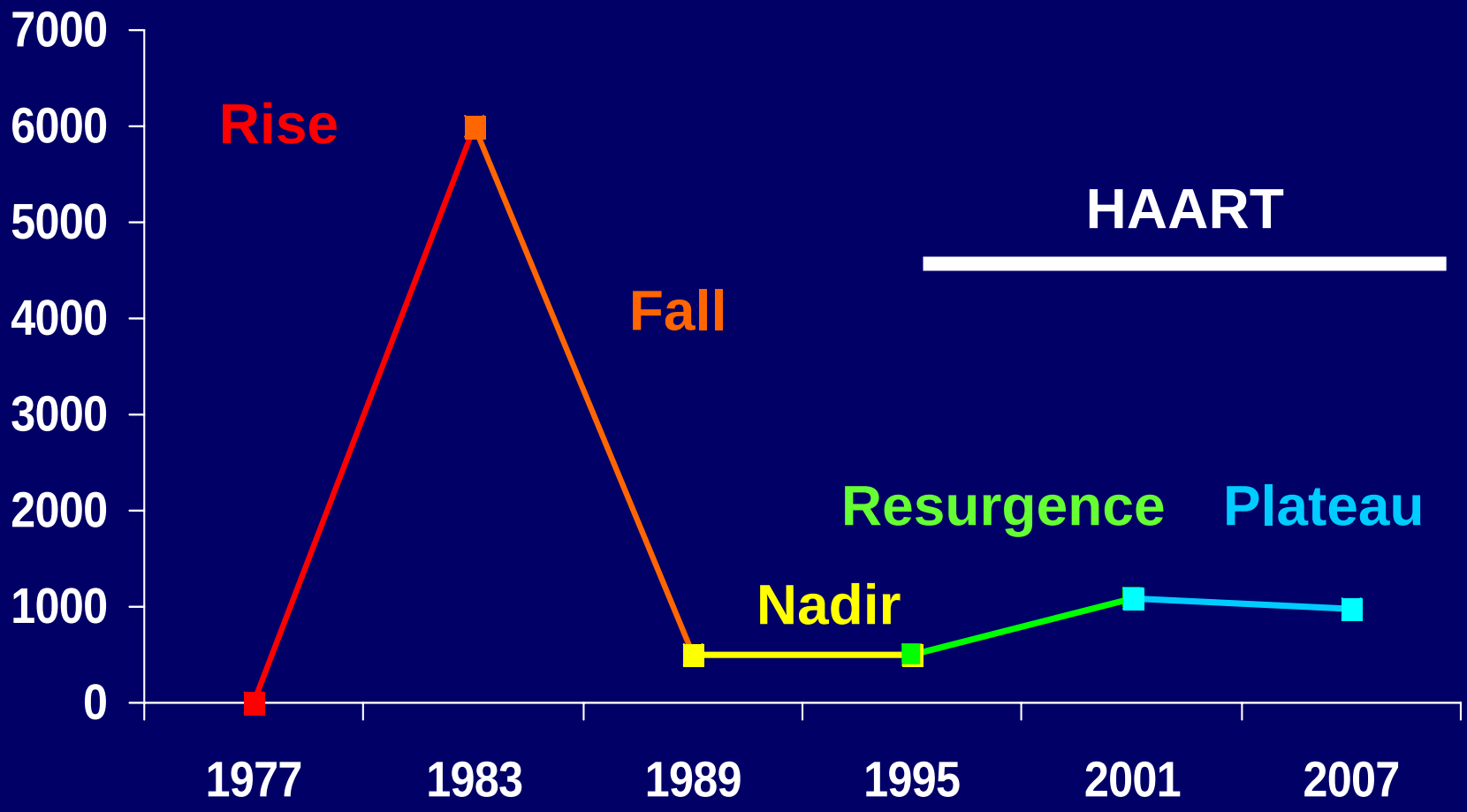
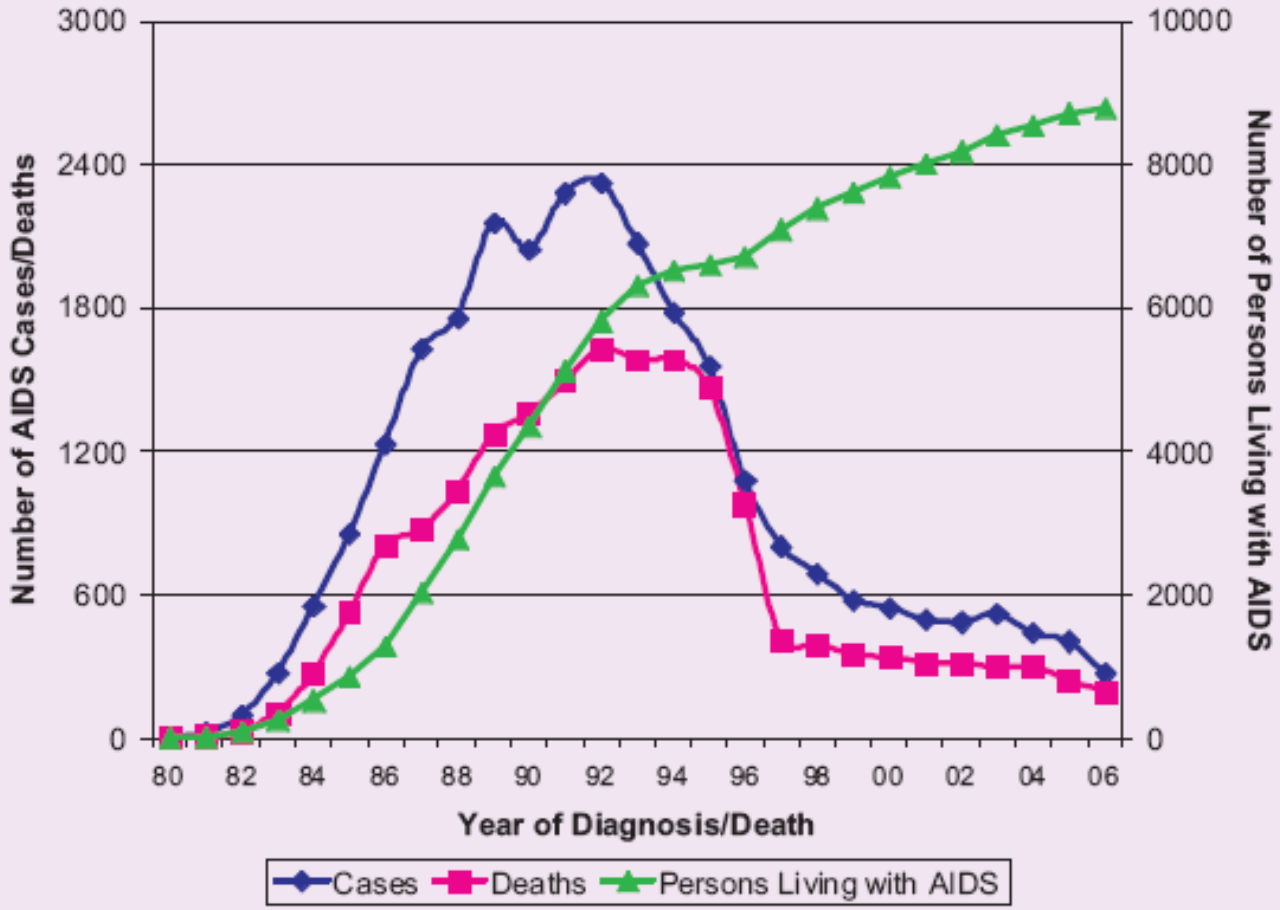
# New HIV infections
# San Francisco 1977-Present



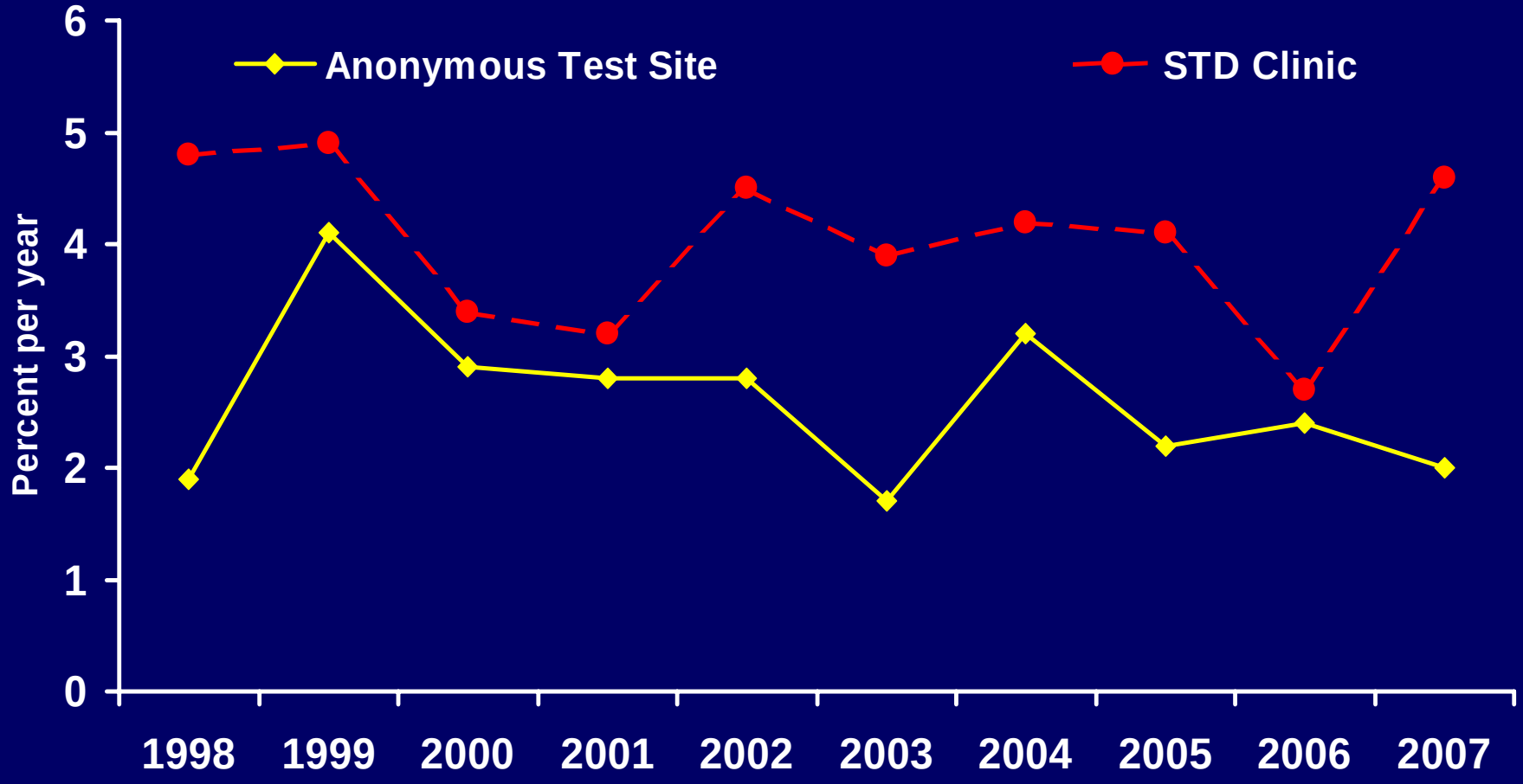

Willi McFarland, SFDPH Seroepidemiology Section

# AIDS cases, deaths, and prevalence San Francisco 1980-2006

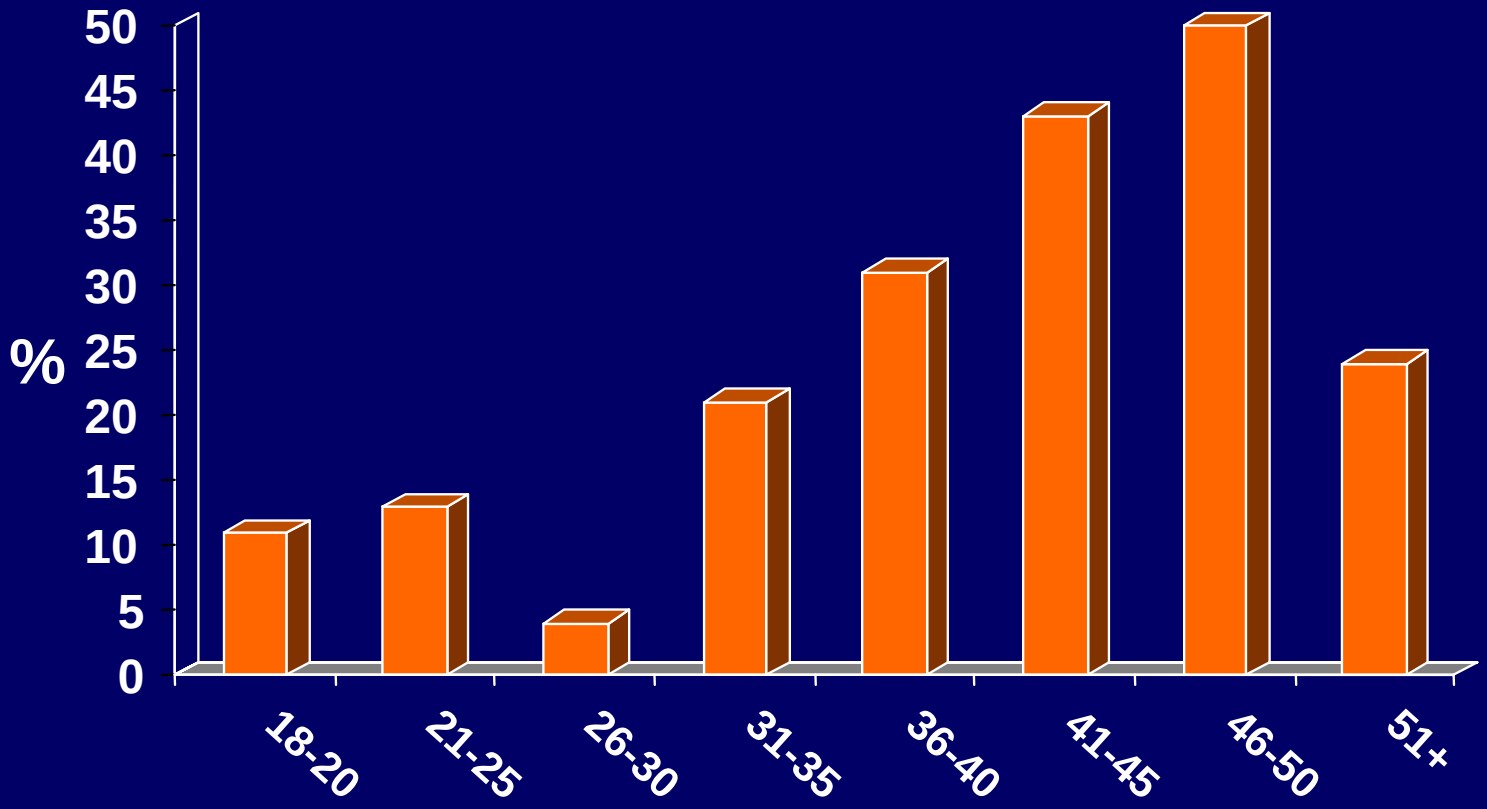
Figure 1.1 AIDS cases, deaths, and prevalence, San Francisco, 1980-2006



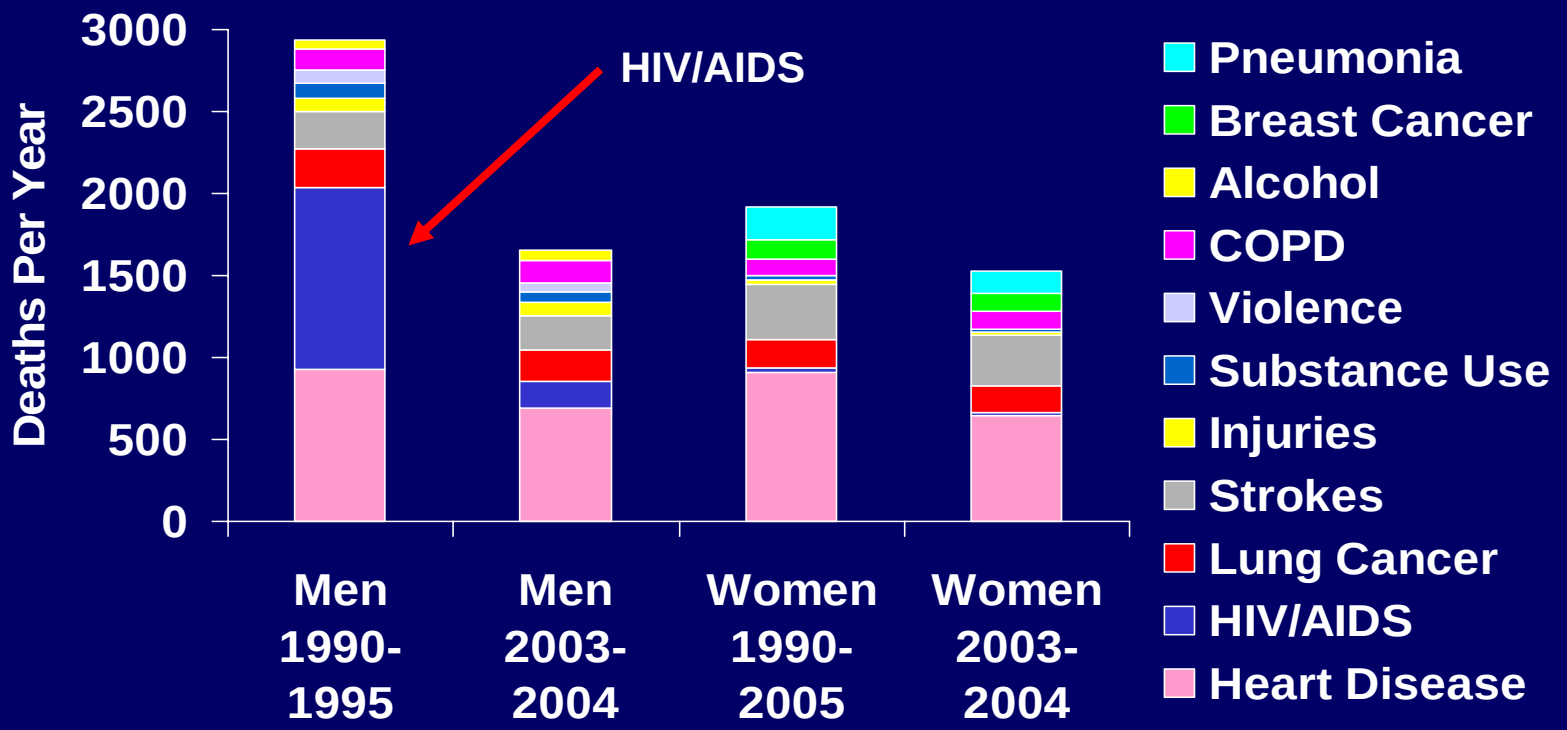
# HIV incidence among MSM seeking HIV testing using STARHS, San Francisco,1998-2007



# HIV Prevalence by Age, MSM, SF, 2004 NHBS

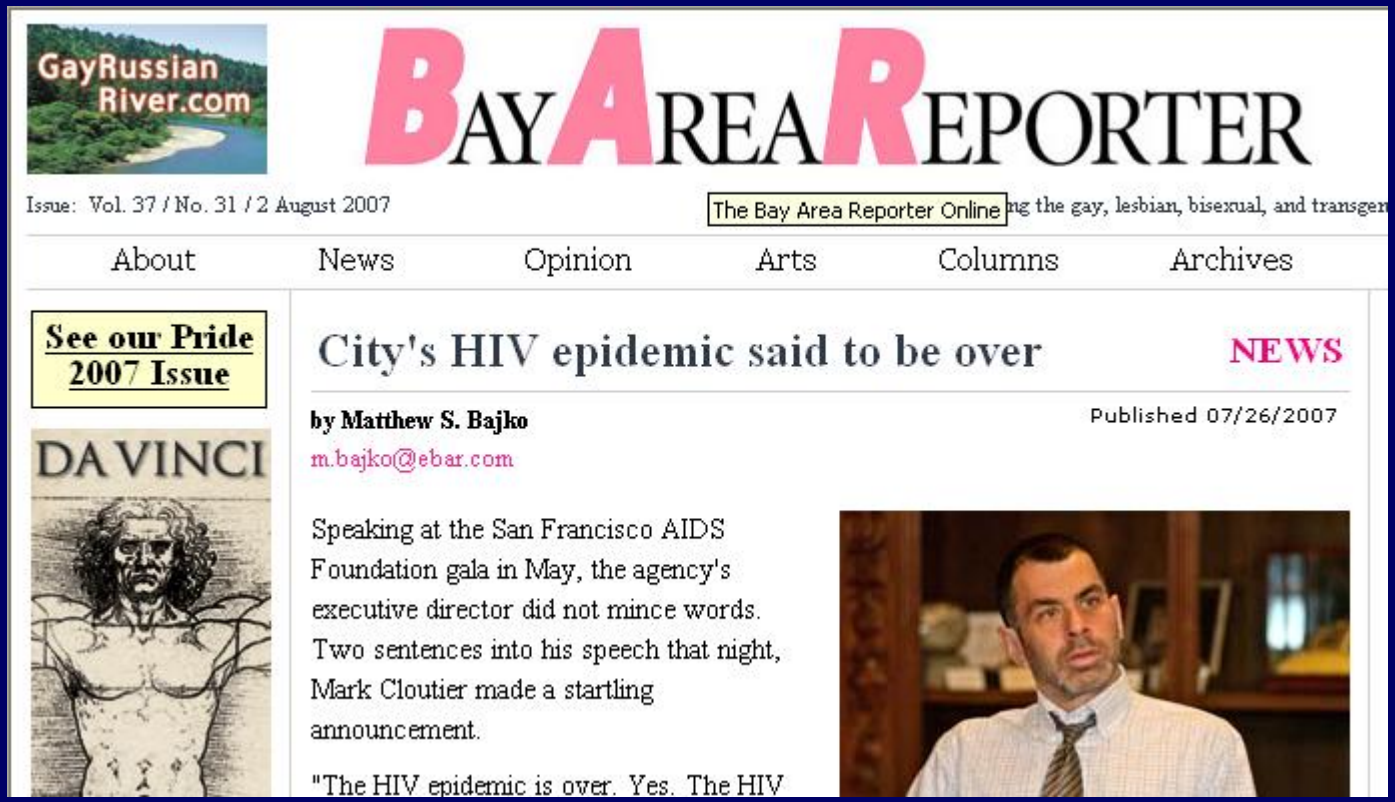


# Annualized Number of Deaths By 10 Leading Causes 1990-1995 vs. 2003-2004, San Francisco



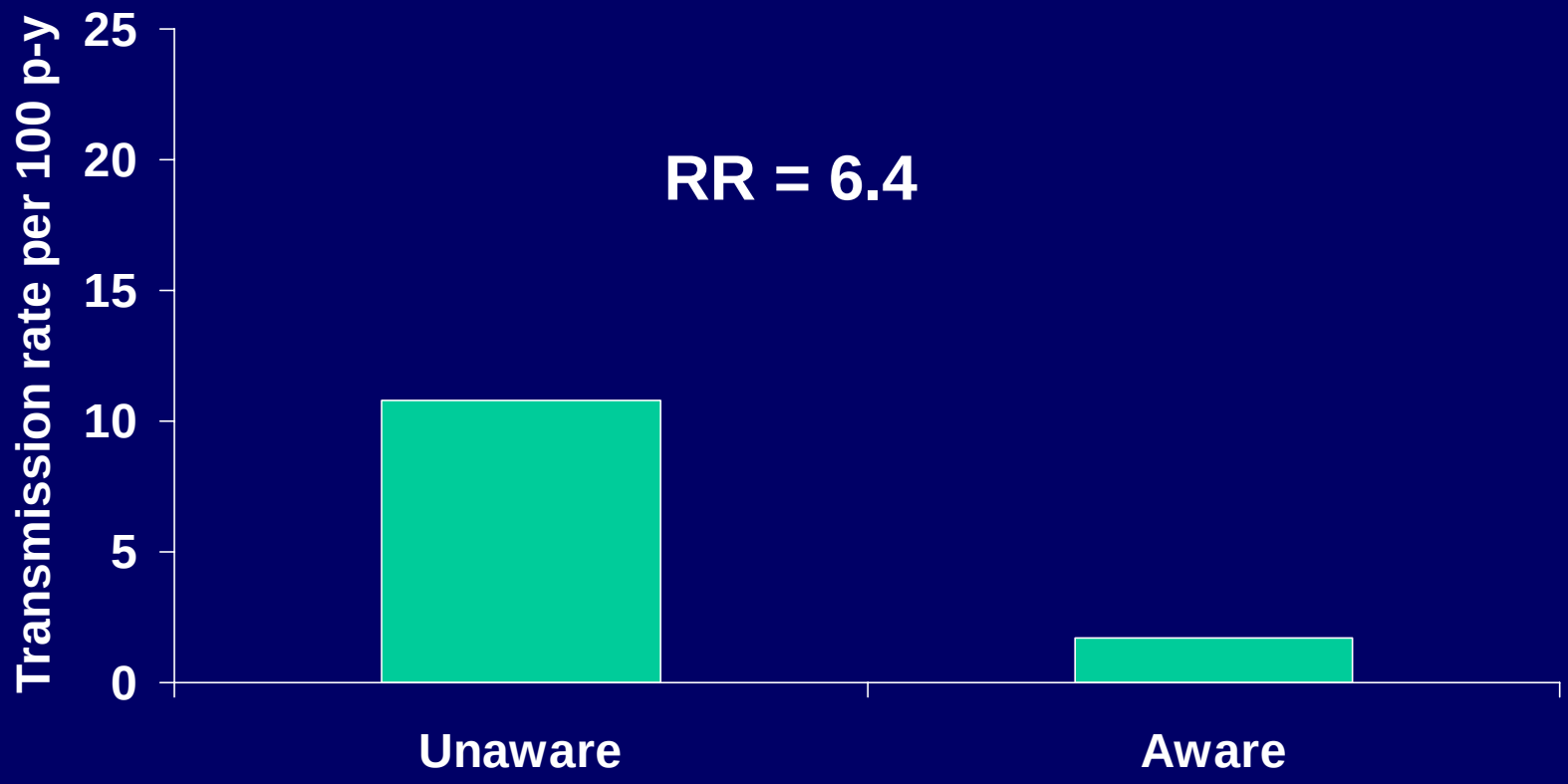

Aragon TJ et al, SFDPH, 2007

# City's HIV epidemic over?




**BAR July 26, 2007**

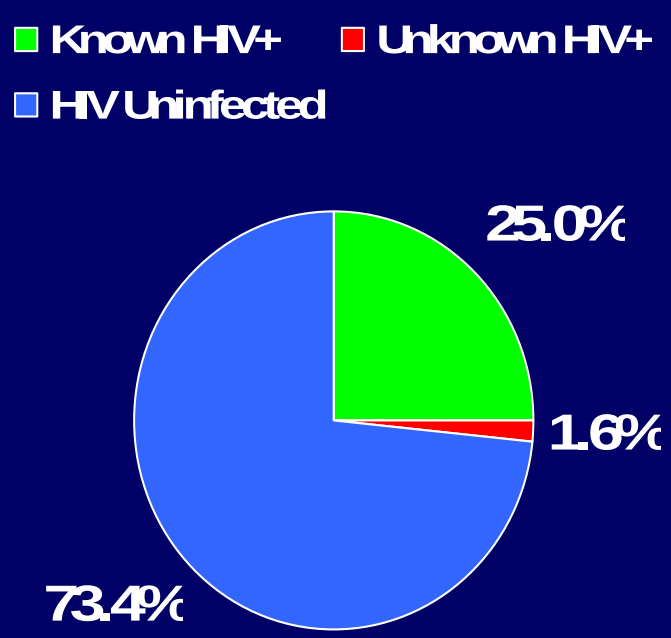
# Transmission rate by awareness of HIV status




Holtgrave et al., Int J STD AIDS 2004;15:789; Marks G et al., JAIDS 2005; 39:446. In: Bartlett JG. Routine Opt-Out Testing for HIV: Rationale and Obstacles, MedScape Today, 2007.

# Prevalence of HIV infection Gay Men, 2002-3, San Francisco

- 1976 gay men surveyed by telephone
  - 492 (24.9%) reported HIV infection
  - 8 (0.8%) HIV+ of 1049 “HIV-” tested
- 1.6% unknown




Schwarcz et a., Am J Public Health. 2007 Jun;97(6):1067-75.

**TABLE 1. HIV prevalence and proportion of unrecognized HIV infection among men who have sex with men, by city, age group, and race/ethnicity — five NHBS* cities, June 2004–April 2005**

| Characteristic | Total tested | HIV prevalence No. | HIV prevalence (%) | Unrecognized HIV infection No. | Unrecognized HIV infection (%) |
|---|---|---|---|---|---|
| **City** | | | | | |
| Baltimore | 462 | 186 | (40) | 115 | (62) |
| Los Angeles | 382 | 73 | (19) | 31 | (42) |
| Miami | 222 | 41 | (18) | 19 | (46) |
| New York City | 336 | 62 | (18) | 32 | (52) |
| San Francisco | 365 | 88 | (24) | 20 | (23) |
| **Age group (yrs)** | | | | | |
| 18–24 | 410 | 57 | (14) | 45 | (79) |
| 25–29 | 303 | 53 | (17) | 37 | (70) |
| 30–39 | 585 | 171 | (29) | 83 | (49) |
| 40–49 | 367 | 137 | (37) | 41 | (30) |
| ≥50 | 102 | 32 | (31) | 11 | (34) |
| **Race/Ethnicity†** | | | | | |
| White, non-Hispanic | 616 | 127 | (21) | 23 | (18) |
| Black, non-Hispanic | 444 | 206 | (46) | 139 | (67) |
| Hispanic | 466 | 80 | (17) | 38 | (48) |
| Multiracial | 86 | 16 | (19) | 8 | (50) |
| Other§ | 139 | 18 | (13) | 9 | (50) |
| **Total** | **1,767** | **450** | **(25)** | **217** | **(48)** |

* National HIV Behavioral Surveillance.
† Numbers for HIV prevalence do not add to 450 because of missing data in three records.
§ Because of small sample sizes, category includes Asian/Pacific Islander, Native American/Alaska Native, and other.

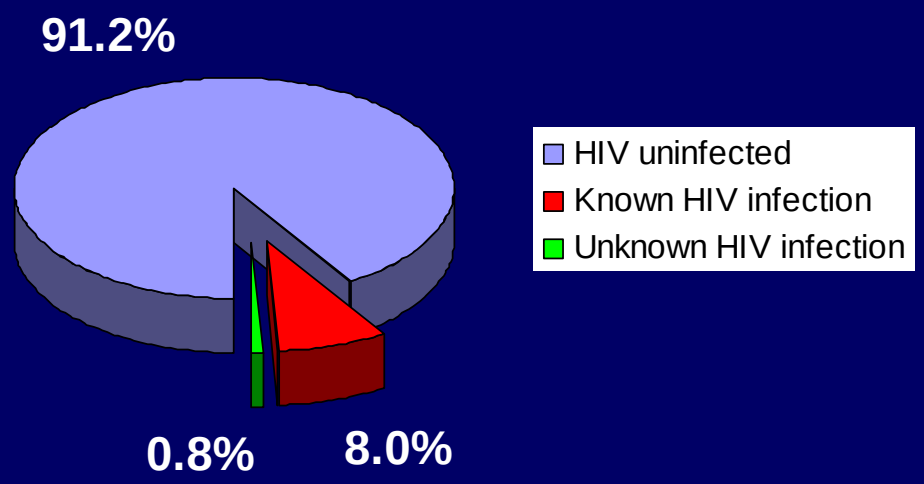
**HIV prevalence**
**24% positive**
**23% unknown**



CDC MMWR June 24, 2005 / 54(24);597-601

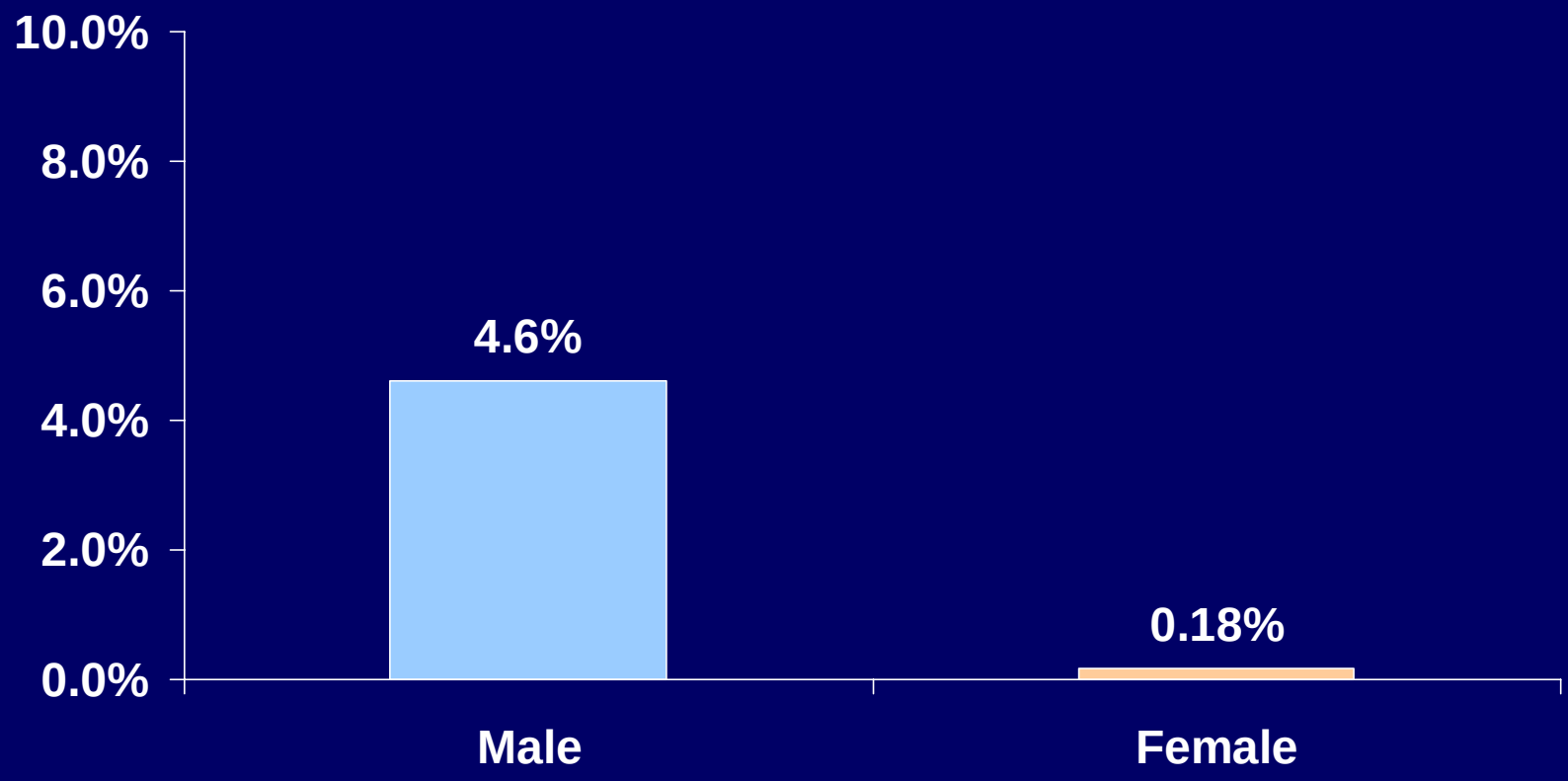
# Prevalence of HIV infection County Hospital ED, March 2007

- 1820 consecutive patients with blood collected for clinical care
- 146 (8.0%) known HIV infection
- 14 (0.8%) of 1674 HIV-infected
  - 1 acute HIV infection
- 10% unknown




**Zetola et al, Public Health Reports, in press, 2008**

# Adult HIV Prevalence by Sex San Francisco, 2006




SF Population 2000 Census: 394828 male, 381905 female; 58,000 MSM (25% HIV+)

2005 Annual Report HIV/AIDS Epidemiology, SFDPH, www.SFDPH.org

# Disease Control

- Case-detection
- Treatment
- Follow-up
- Partner management

**Thomas Parran, MD**

# HIV Case Finding

- Screening
  - Sensitivity of current tests
  - RNA pooled screening
  - Routine HIV testing
- Partner Services

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# Current HIV EIA Tests

| Generation | Antigen | Sensitivity |
|---|---|---|
| First | Viral lysate | + |
| Second* | Synthetic proteins | + + |
| Third | Synthetic proteins + anti-IgM | + + + |
| Fourth | Synthetic proteins + anti-IgM + anti-p24 | + + + + |

*Includes currently available rapid tests

# Rapid HIV Testing

- City Clinic:  Rapid tests offered to select patients at very high risk of HIV infection
  - Gay men and other men who have sex with men
  - Patients who report injection drug use
  - Patients with known HIV-infected partners

San Francisco Chronicle

# S.F. clinics getting high false-positive rate on oral HIV test

**Sabin Russell, Chronicle Medical Writer, December 9th, 2005**

OPEN ACCESS Freely available online

PLoS one

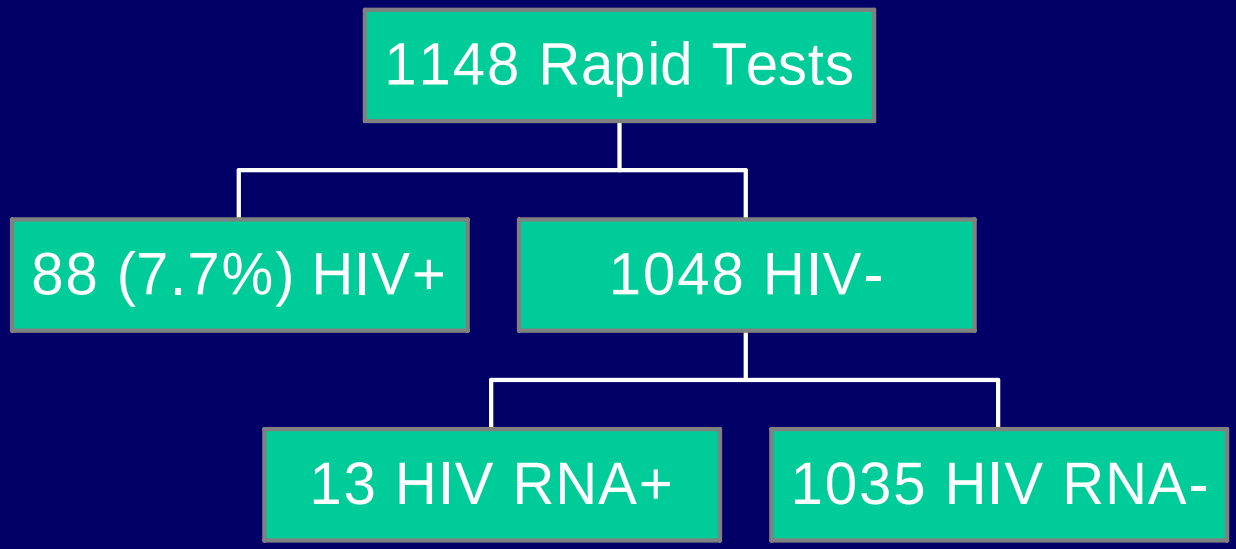
## Investigation of False Positive Results with an Oral Fluid Rapid HIV-1/2 Antibody Test

Krishna Jafa[1,4]*, Pragna Patel[1], Duncan A. MacKellar[1], Patrick S. Sullivan[1], Kevin P. Delaney[1], Tracy L. Sides[2¤], Alexandra P. Newman[3,4], Sindy M. Paul[5], Evan M. Cadoff[6], Eugene G. Martin[6], Patrick A. Keenan[7], Bernard M. Branson[1], for the OraQuick Study Group

## Performance of an oral fluid rapid HIV-1/2 test experience from four CDC studies

Kevin P. Delaney[a], Bernard M. Branson[a], Apurva Uniyal[b], Peter R. Kerndt[c], Patrick A. Keenan[d], Krishna Jafa[a,e], Ann D. Gardner[f], Denise J. Jamieson[g] and Marc Bulterys[h]

# Oraquick Advance Test Performance City Clinic 2007




**Rapid testing missed 13 of 101 HIV+ cases**
**Sensitivity for HIV infection = 87%**

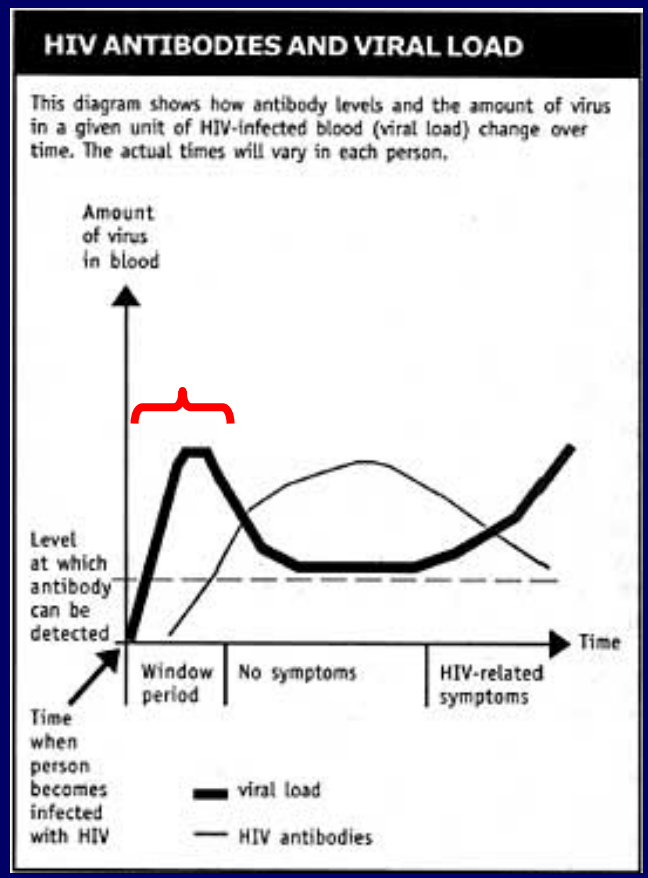
**Philip et al, CROI 2007**

# HIV Case Finding

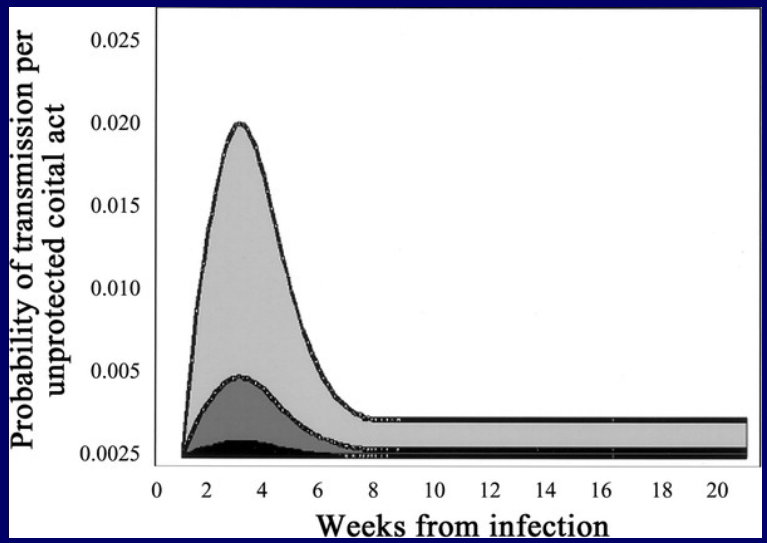
- Screening
  - Sensitivity of current tests
  - RNA pooled screening
  - Routine HIV testing
- Partner notification and contact tracing
- Social network interventions

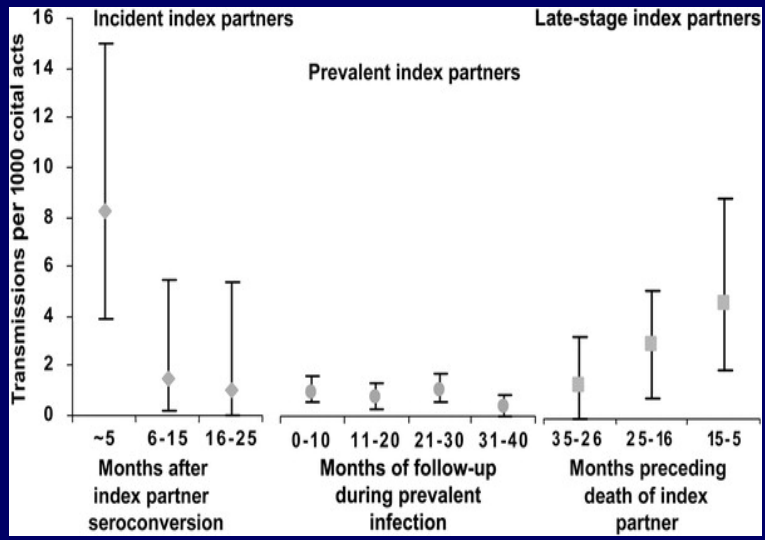
# HIV RNA Screening

- HIV RNA detected 7-12 days after exposure
- HIV RNA+/HIV Ab- specimens identify those with acute infection
  - Staging of HIV infection allows for targeted medical care and priortization of public health response



# HIV infectivity by stage of infection




**Pilcher et al, JID, 2004**

**Wawer et al, JID, 2005**

# HIV Testing Protocol
# SF City Clinic

- All persons informed HIV RNA testing part of HIV test
  - Pooled testing at SFDPH (Bayer VERSANT bDNA 3.0) or from Sept—Feb 2007 (NGI/LabCorp (PCR)) followed by Abbott RT PCR
- Semi-quantitative RNA results:
  - No RNA detected
  - ≤ 10,000 RNA copies detected
  - > 10,000 RNA copies detected
- RNA positives assigned to investigator for immediate disclosure, confirmatory testing and case management

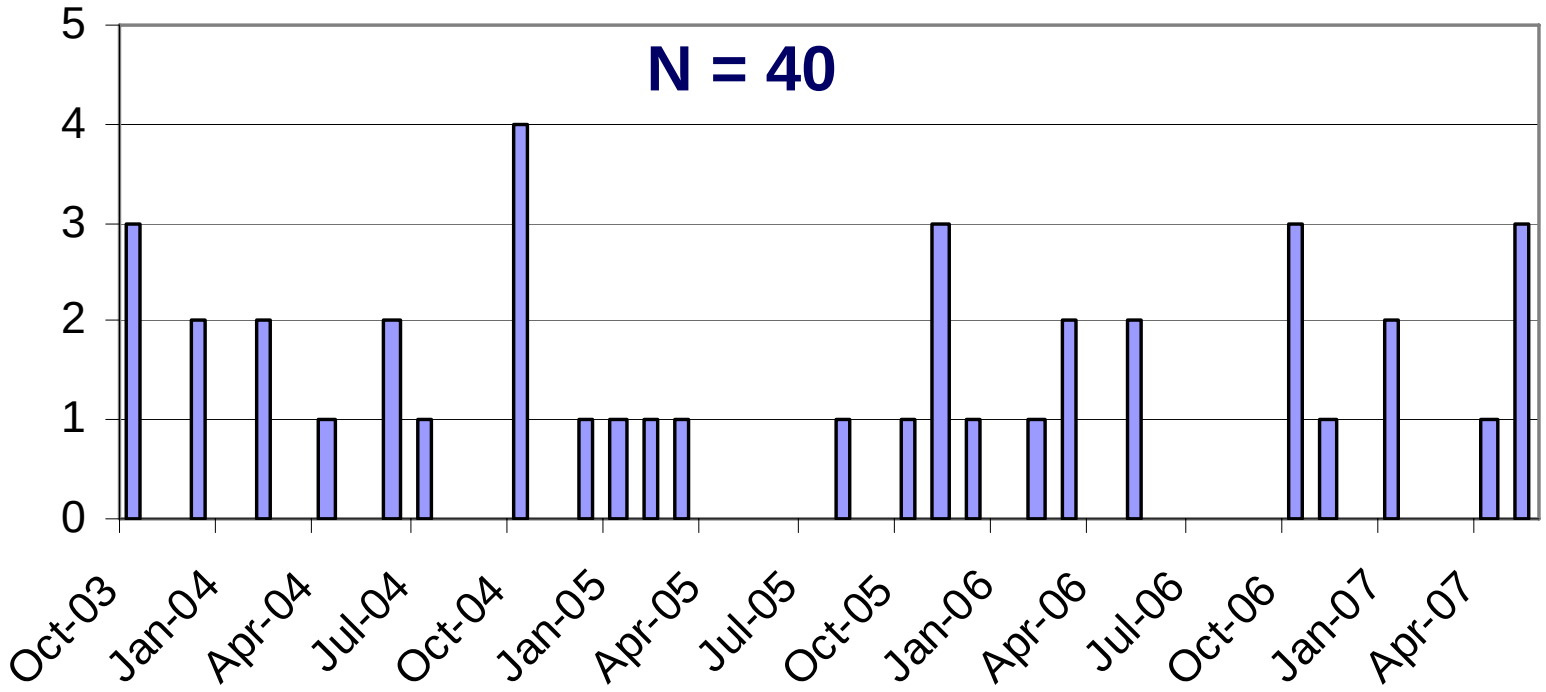
# RNA Screening
# SF City Clinic, 2003-2007

- 15,483 persons tested
  - 432 (2.8%) HIV Ab positive
  - 15,051 HIV Ab negative
    - 49 (0.33%) RNA positive
    - 11% increase in HIV case detection
    - All (48) with repeat testing confirmed

# Crude Cost Analysis
# RNA Screening, SF City Clinic

- @ $10 additional cost per RNA test, $3072 per new case identified
- @ $30 per additional costs per RNA test, $9215 per new case identified

## Acute HIV cases by month, 2003-2007



# HIV RNA Screening Demographics/Sexual Networks

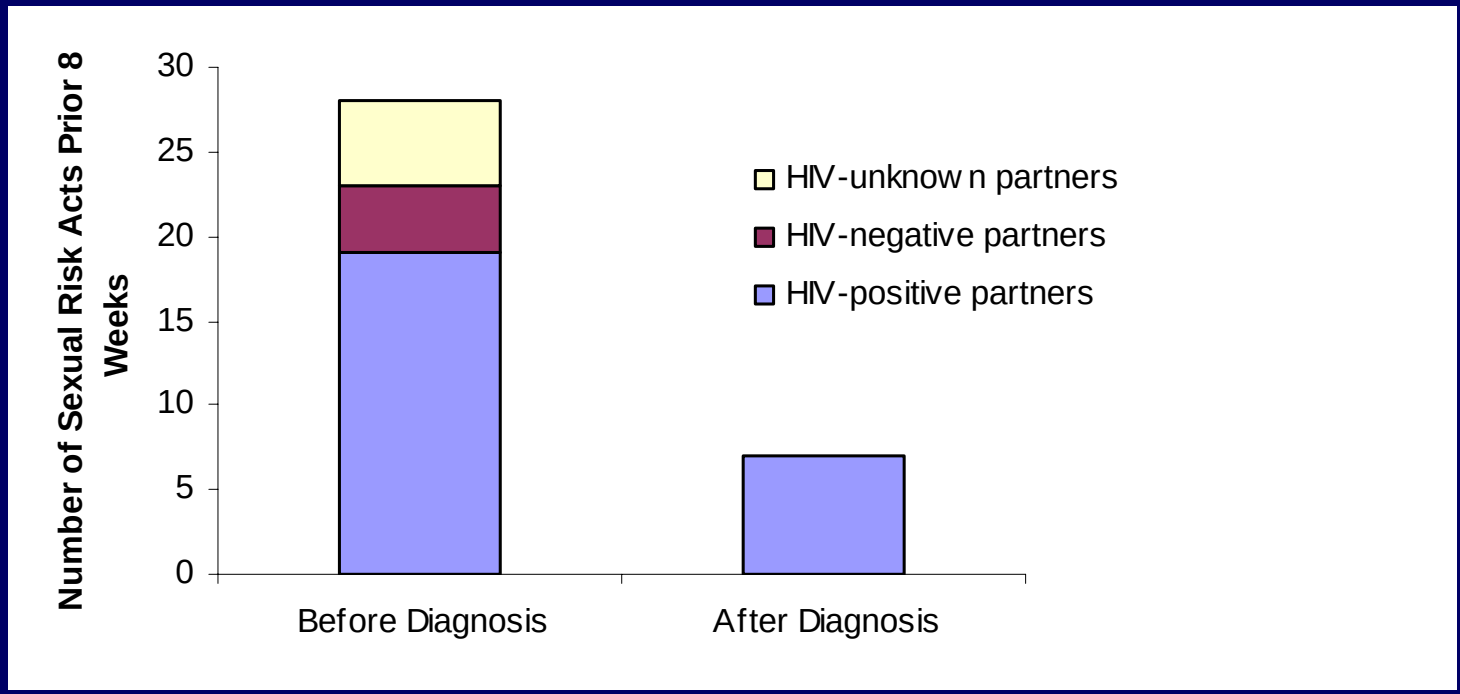
- All gay men/ men who have sex with men
  - 47% white, 30% Hispanic, 17% black
  - 54% age ≥ 30 years
  - 23% had an STD
  - 39% methamphetamine use
  - 40% Internet sex partners
    - 1 new sex venue
  - 27% HIV test in past 6 months; 73% past yr

# Expanded HIV RNA screening

- Fall 2006 extended HIV RNA screening to MAGNET and AIDS Health Project
- Client/counselor determine need for test
  - 4 cases out of 245 “clients” who were offered/accepted RNA screening

# NIMH Acute HIV Infection Study

Substantial behavior change among San Francisco participants in the 8 weeks following diagnosis with acute HIV




**Courtesy of Wayne Steward, UCSF CAPS**

# RNA testing

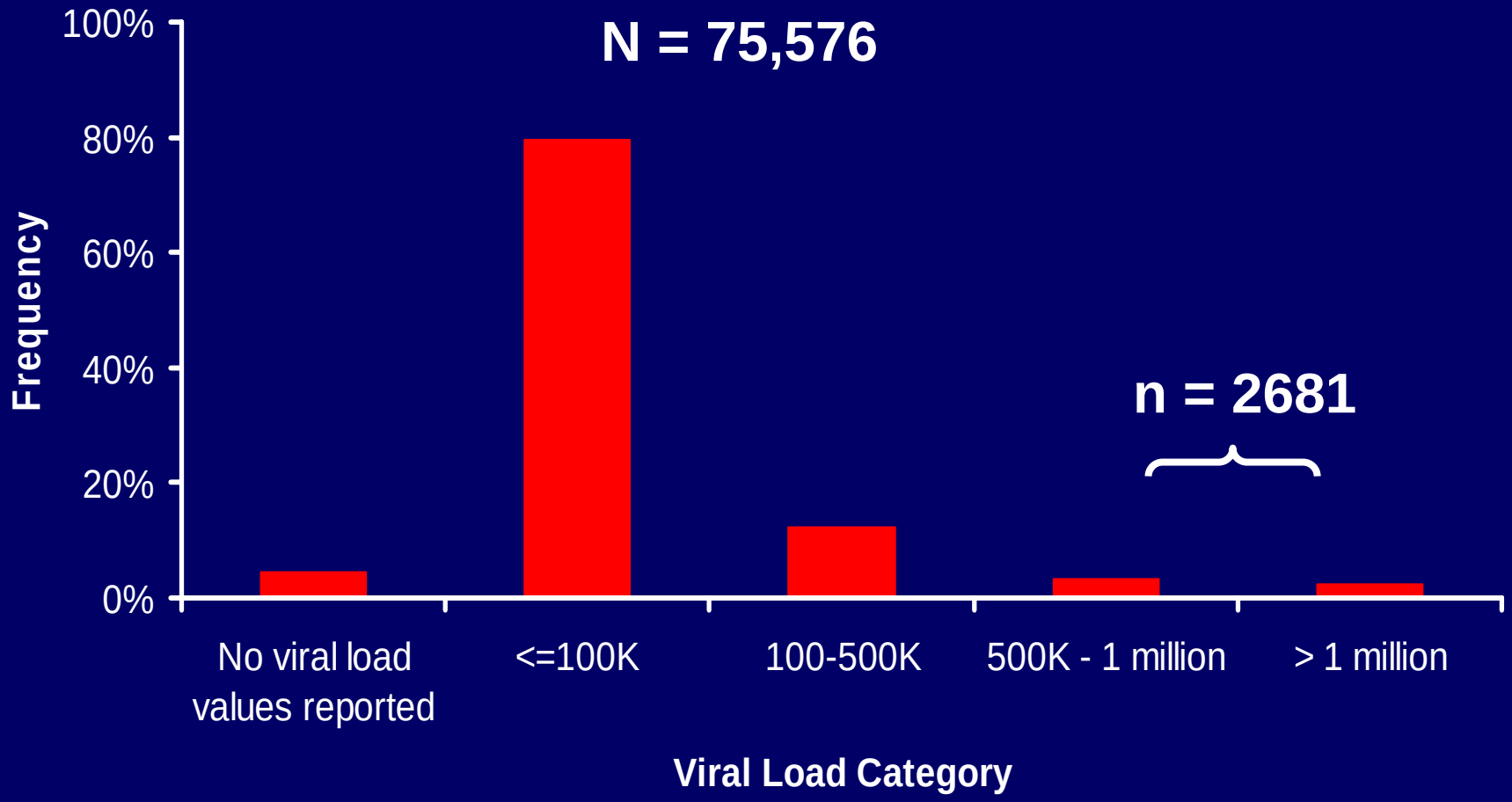
- Benefits
  - Identifies those that standard HIV Ab testing misses
  - Finds highly infectious cases
  - Enables tracking and interventions at the leading edge of epidemic
- Costs/risks
  - Added expense
  - Complicated
  - Delays “definitive” test result

# RNA screening

- Every HIV test should include HIV RNA testing in those HIV Ab negative
  - Reflex testing
  - Routine
  - Pooled, more cost-effective
- Combined Ab/Ag will detect cases earlier but may not allow staging

**Smith et al., HIV Testing Beyond Exceptionalism, *Expert Rev. Anti Infect. Ther.*, 2007**

# Distribution of reported patient viral loads, NYC, 2005-2007






**Courtesy of Colin Shepard, NYC DOH**

# HIV Case Finding

- Screening
  - Sensitivity of current tests
  - RNA pooled screening
  - Routine HIV testing
- Partner notification and contact tracing
- Social network interventions

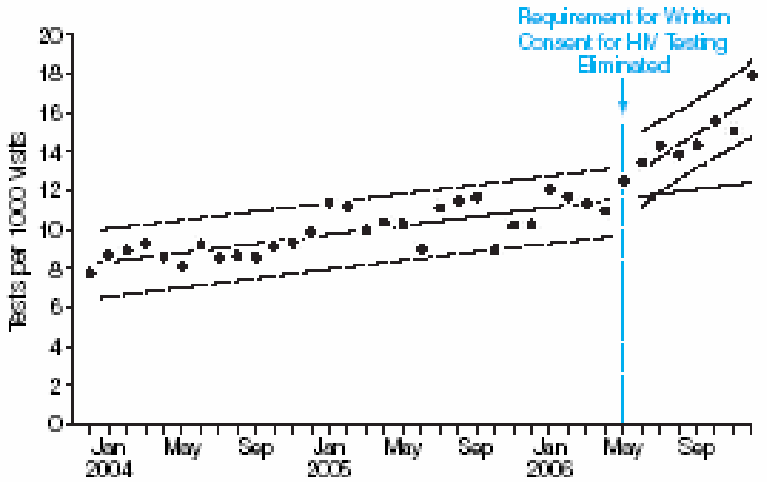
# Routine HIV testing at County Medical Center

- May 2006 county medical center updated policy to allow for non-written patient consent for HIV testing
  - Opt-in testing, informational counseling, and disclosure standard medical practice
- Physician documentation of consent in chart
- Evaluated impact of that administrative change on HIV testing and HIV case identification with time-series analysis

RESEARCH LETTER

# Association Between Rates of HIV Testing and Elimination of Written Consents in San Francisco

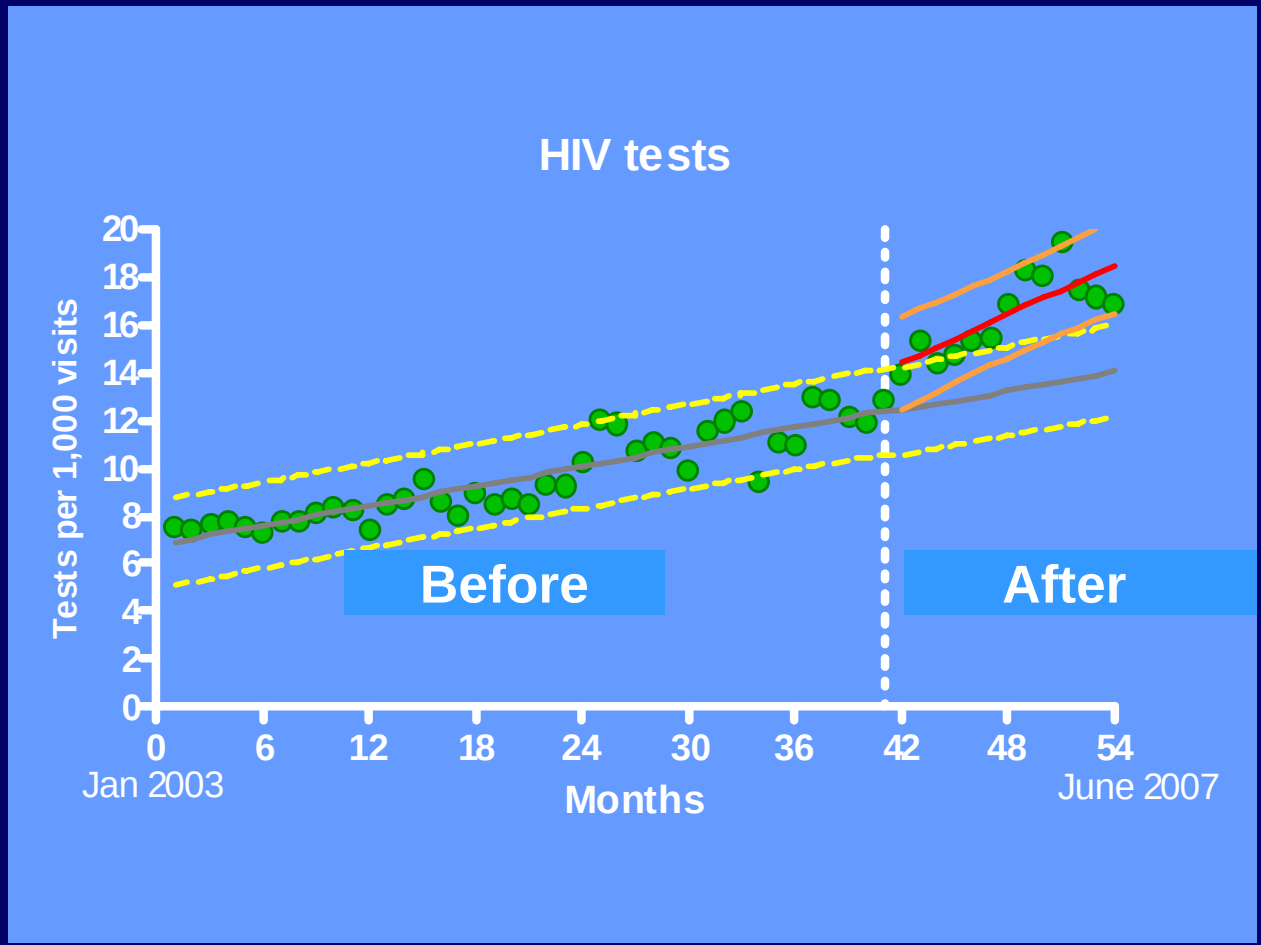
**Figure.** Mean Rate of HIV Tests per 1000 Patient-Visits in Persons Aged 18 Years or Older (December 2003-December 2006), San Francisco Department of Public Health Medical Care System




Requirement for written consent for human immunodeficiency virus (HIV) testing was eliminated in May 2006. The data points represent the number of HIV tests per 1000 patient-visits per month, solid lines represent the testing trend before and after the change in policy, and the dotted line represents the expected trend in HIV testing if the policy had not changed. Dashed lines indicate 95% confidence intervals for the HIV testing trend before and after the policy change. $P<.001$ for observed vs expected trend.

**Zetola et al, *Jama*, March 2007**

# Follow-up thru June 2007
# County Hospital Medical Center

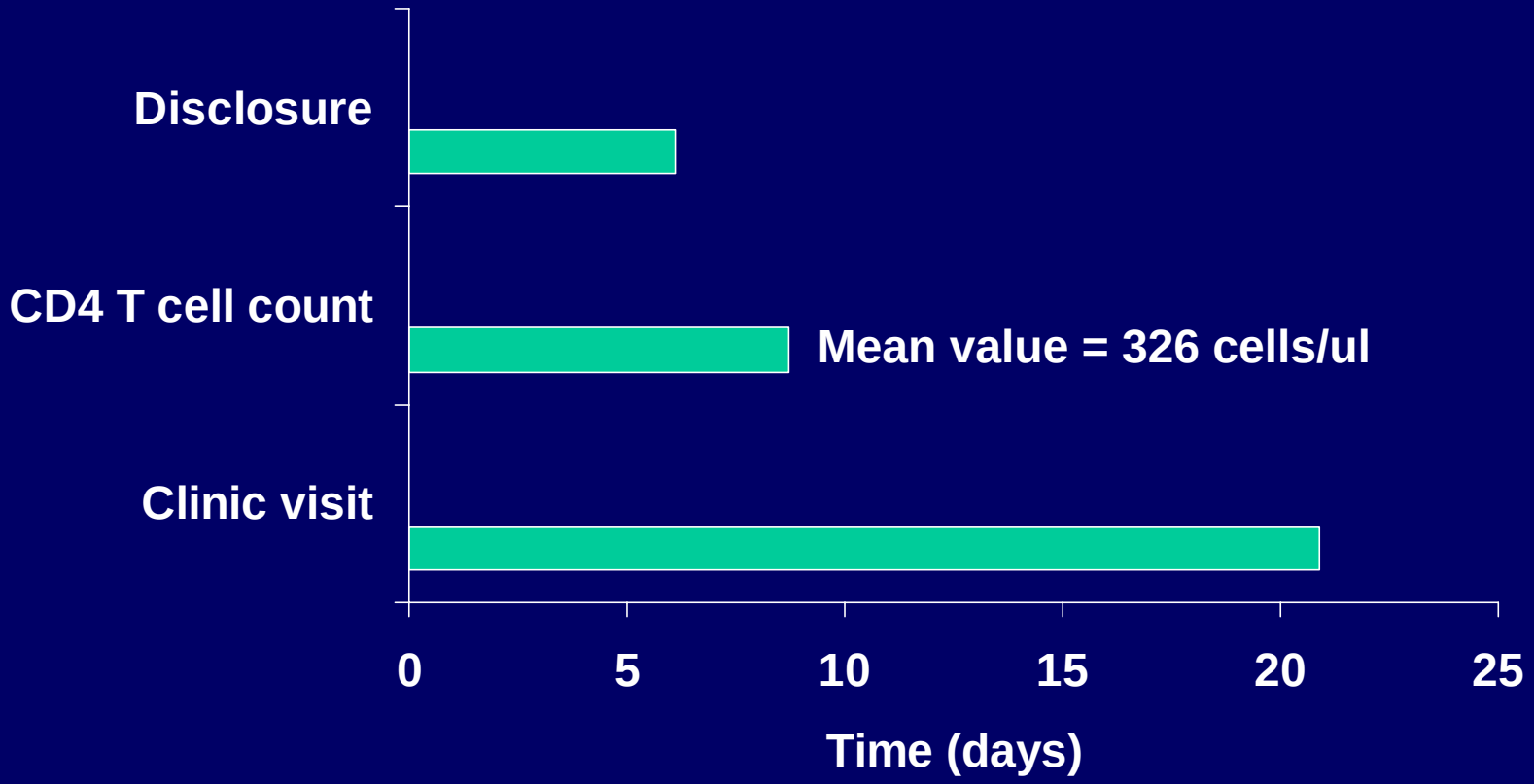





**Zetola et al, PloS One, in press, 2008**

# Mean time to disclosure, CD4 T cell count and clinic visit, county medical center, 2007-2008

**N = 55 cases**



# Routine testing

- Benefits
  - Identifies more persons with HIV infection
  - Streamlines and may ‘normalize’ HIV testing process
  - Medical settings offer streamlined access to care
- Costs/ risks
  - Requires more provider time, $$, laboratory resources
  - Increased burden of care
  - May result in discrimination, psychological stress, false positive results

# New California HIV Testing Law
# October 12, 2007

120990. (a) Prior to ordering a test that identifies infection with HIV, a medical care provider *shall*:

- inform the patient that the test is planned,
- provide information about the test, treatment options and need for future tests, if negative, and;
- advise the patient of his/her right to decline the test and document that refusal.

# New California HIV Testing Law
# October 12, 2007

120990. (b) Subdivision (a) shall not apply when a person independently requests an HIV test from the provider.

# Routine HIV testing implementation

- Private providers not routinely offering
- Medical centers and hospitals requiring written consent
- Confusion about counseling requirements
- Hospital administrators and associations are risk averse

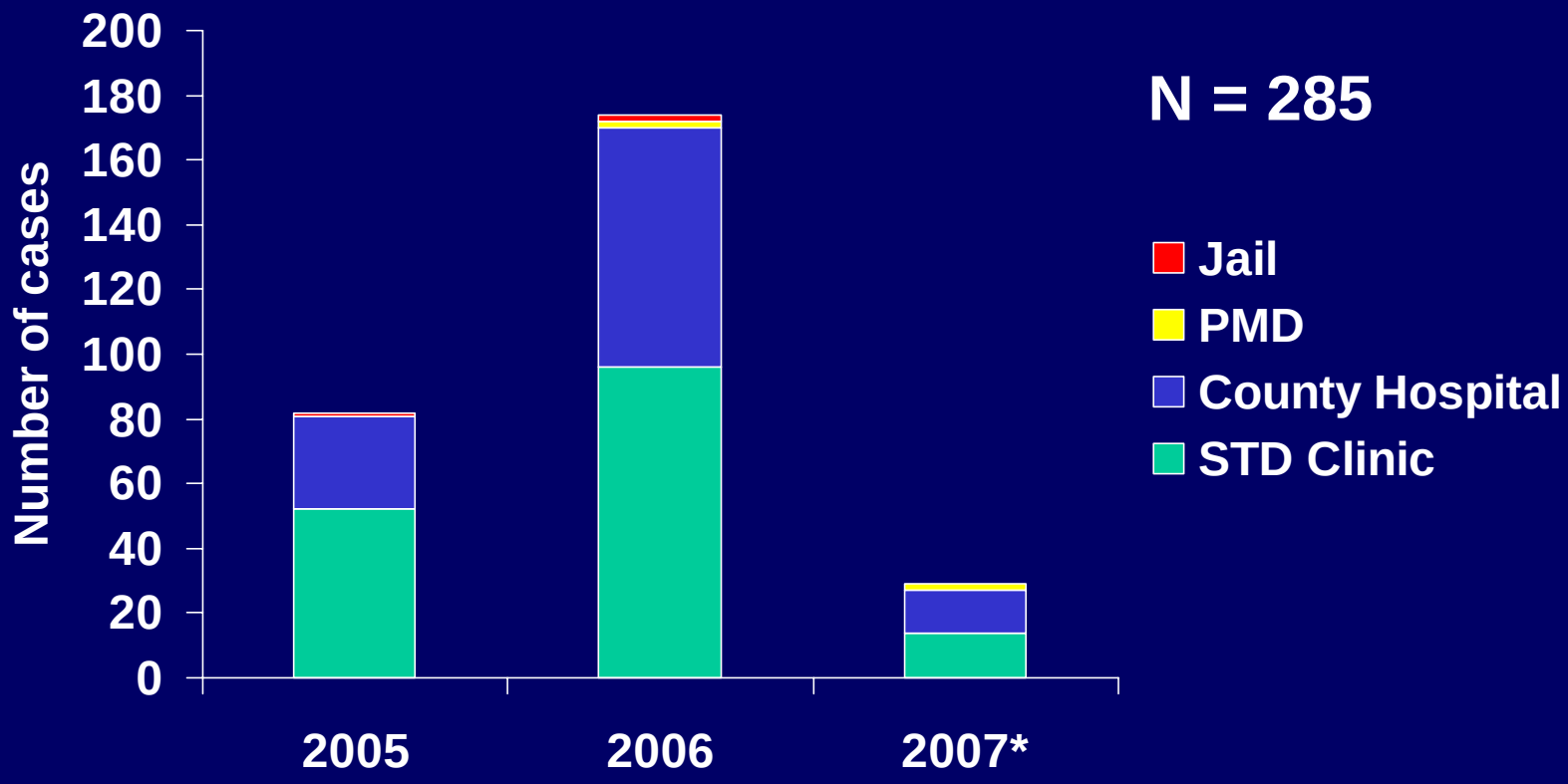
# HIV Case Finding

- Screening
  - Sensitivity of current tests
  - RNA pooled screening
  - Routine HIV testing
- Partner notification and contact tracing

# Implementation of HIV Safety Net and Partner Services

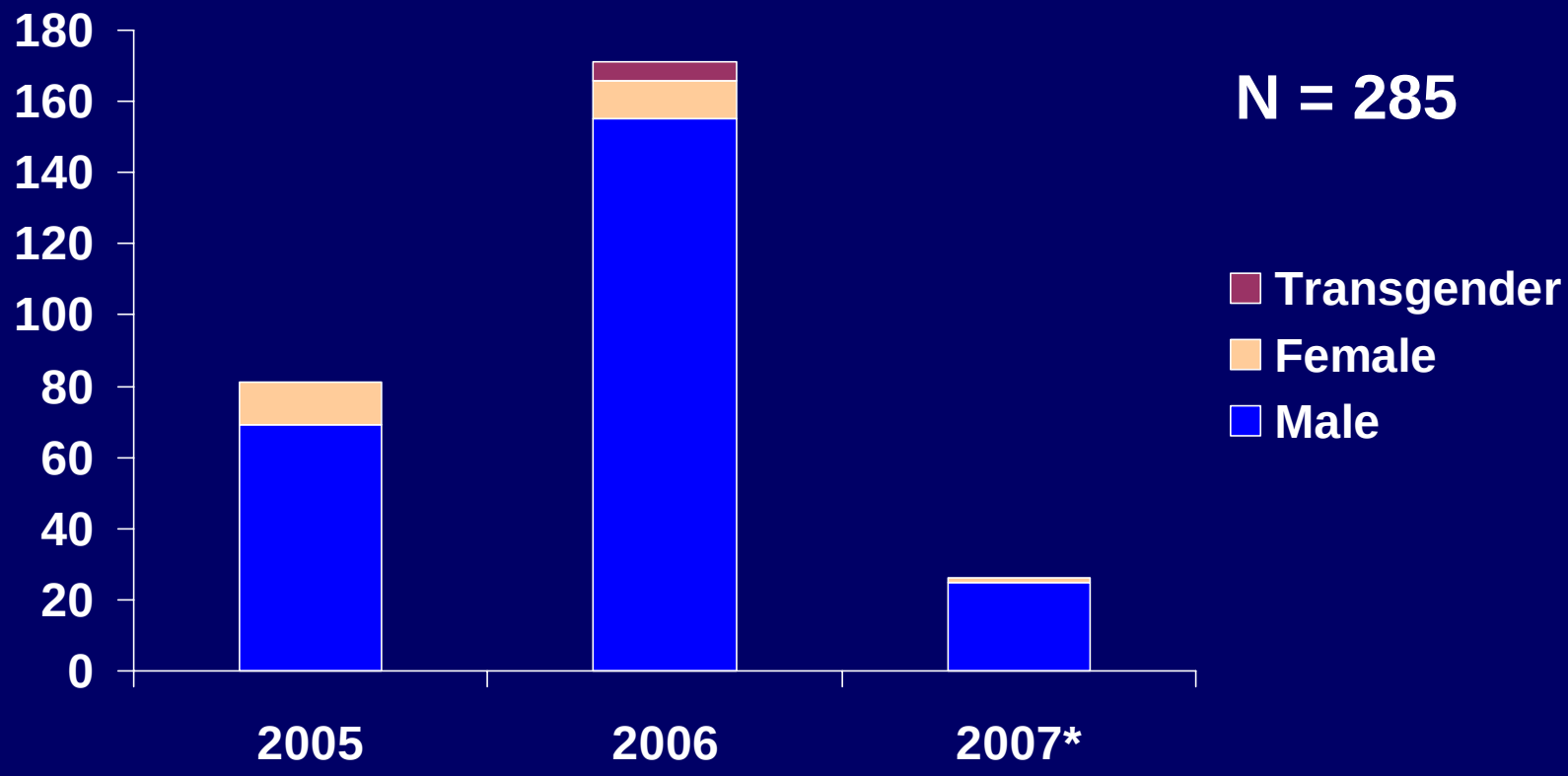
- **January 2005**
  - **Assured STD clinic cases learned test results**
  - **Interviewed HIV cases (acute, new, syphilis/HIV) to identify risk behaviors, venues and elicit contacts for partner notification**
- **July 2006**
  - **Hospital laboratory reported cases to STD program**
  - **Expanded safety net and partner notification services throughout county medical center**
  - **County hospital HIV clinic nurse team**

# Partner notification cases by year and site of diagnosis



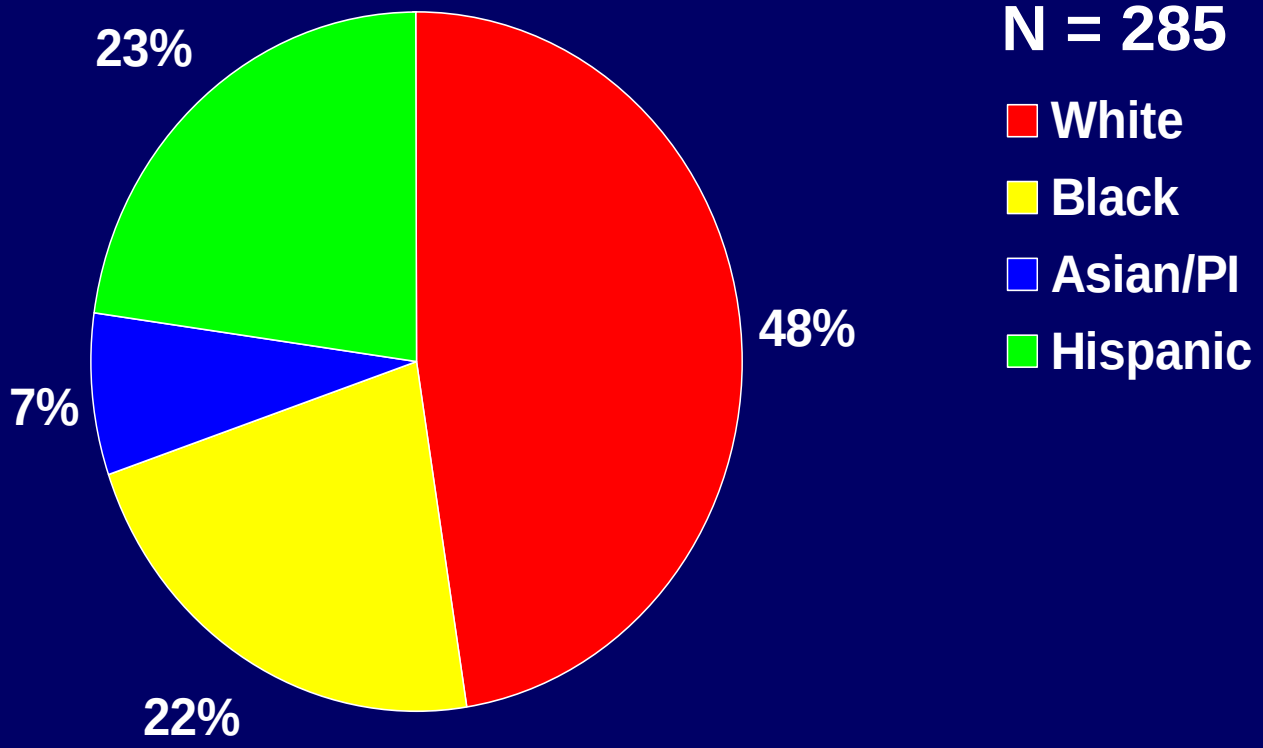

*through February 2007

# Partner notification cases by gender and year

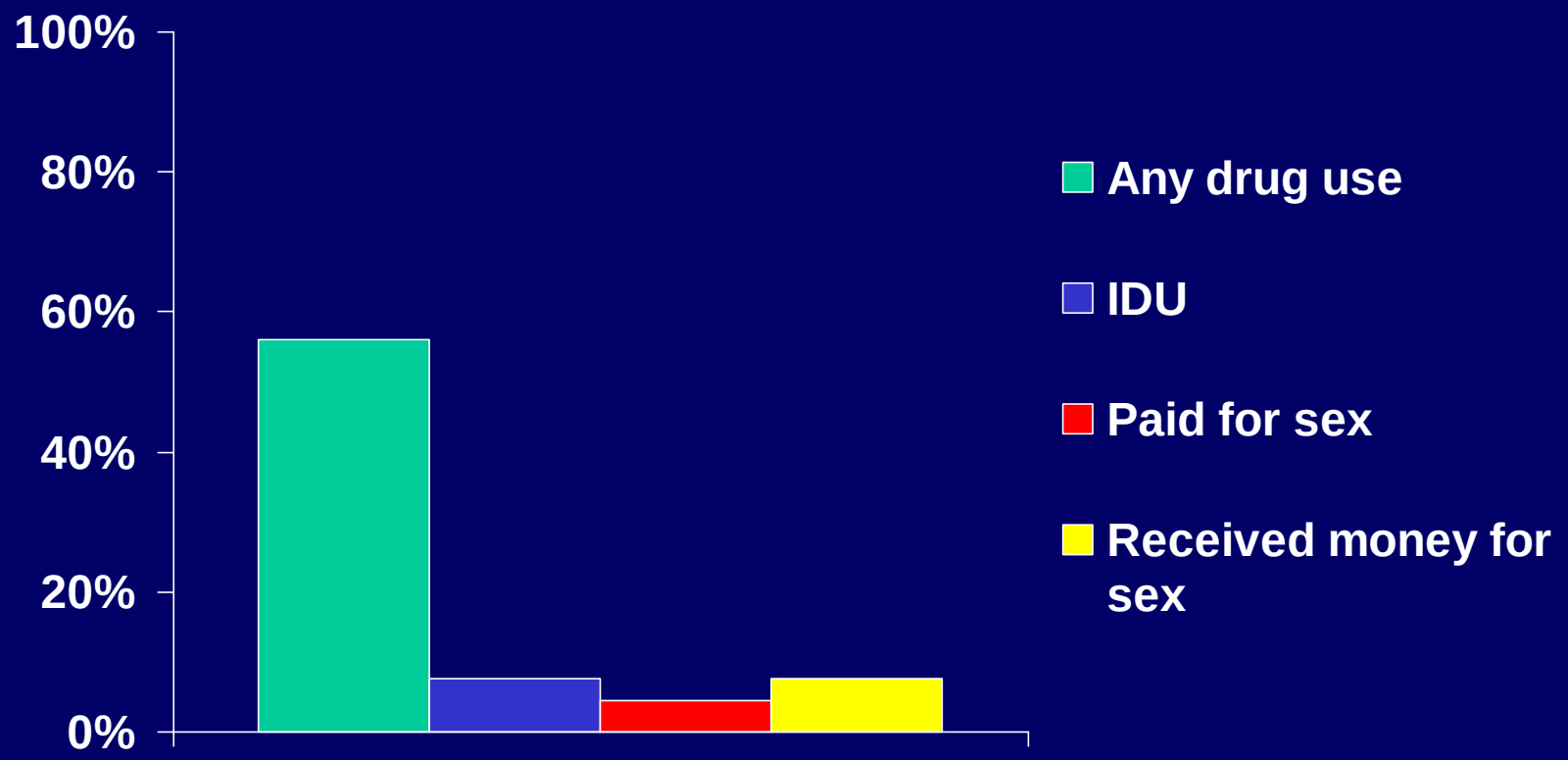



*Through February 2007

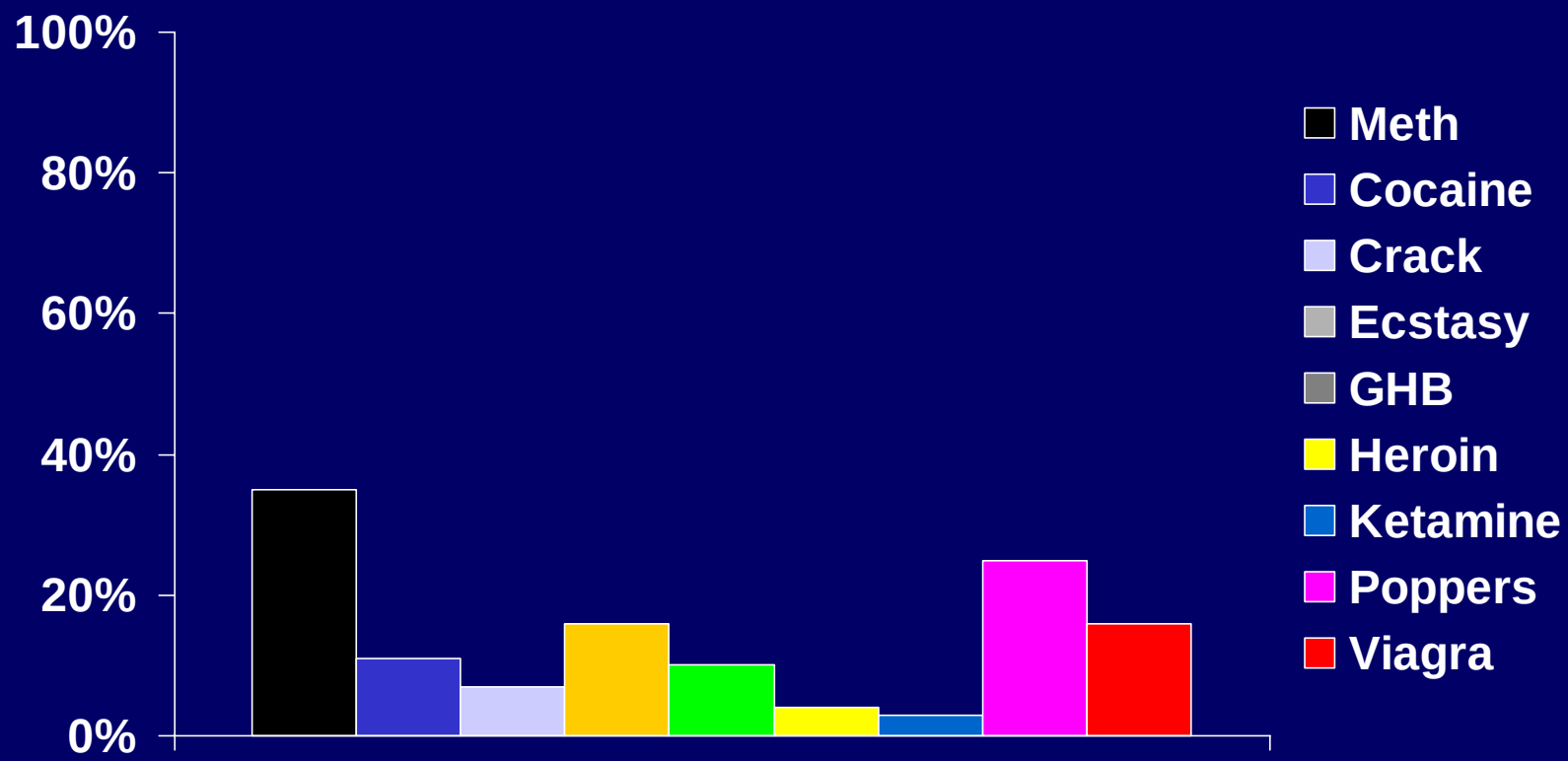
# Partner notification cases by race/ethnicity



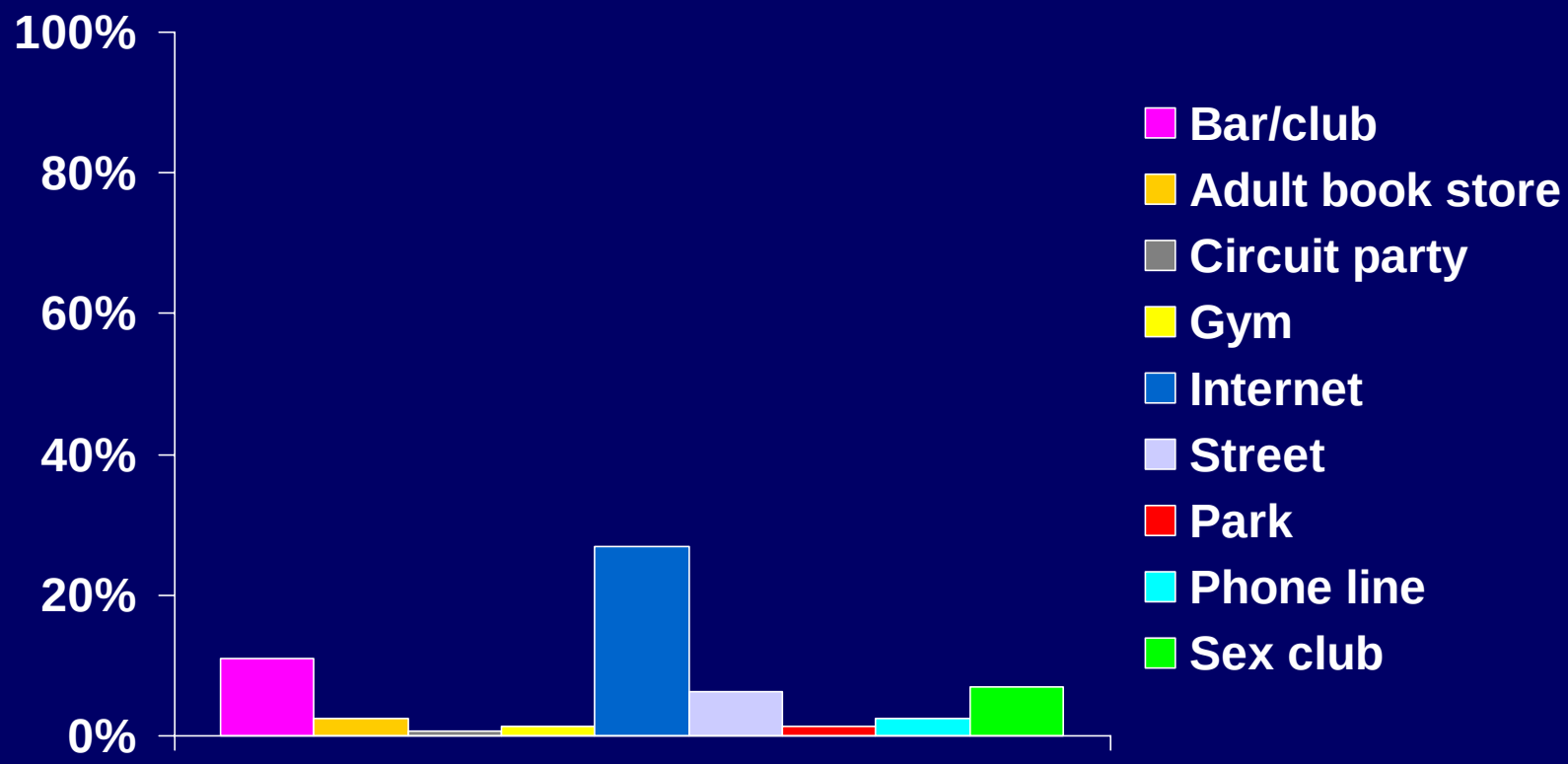
# Select risk behaviors among interviewed HIV cases, 2007 N=158



# Substance use
# N=158



# Meeting places
# N=158

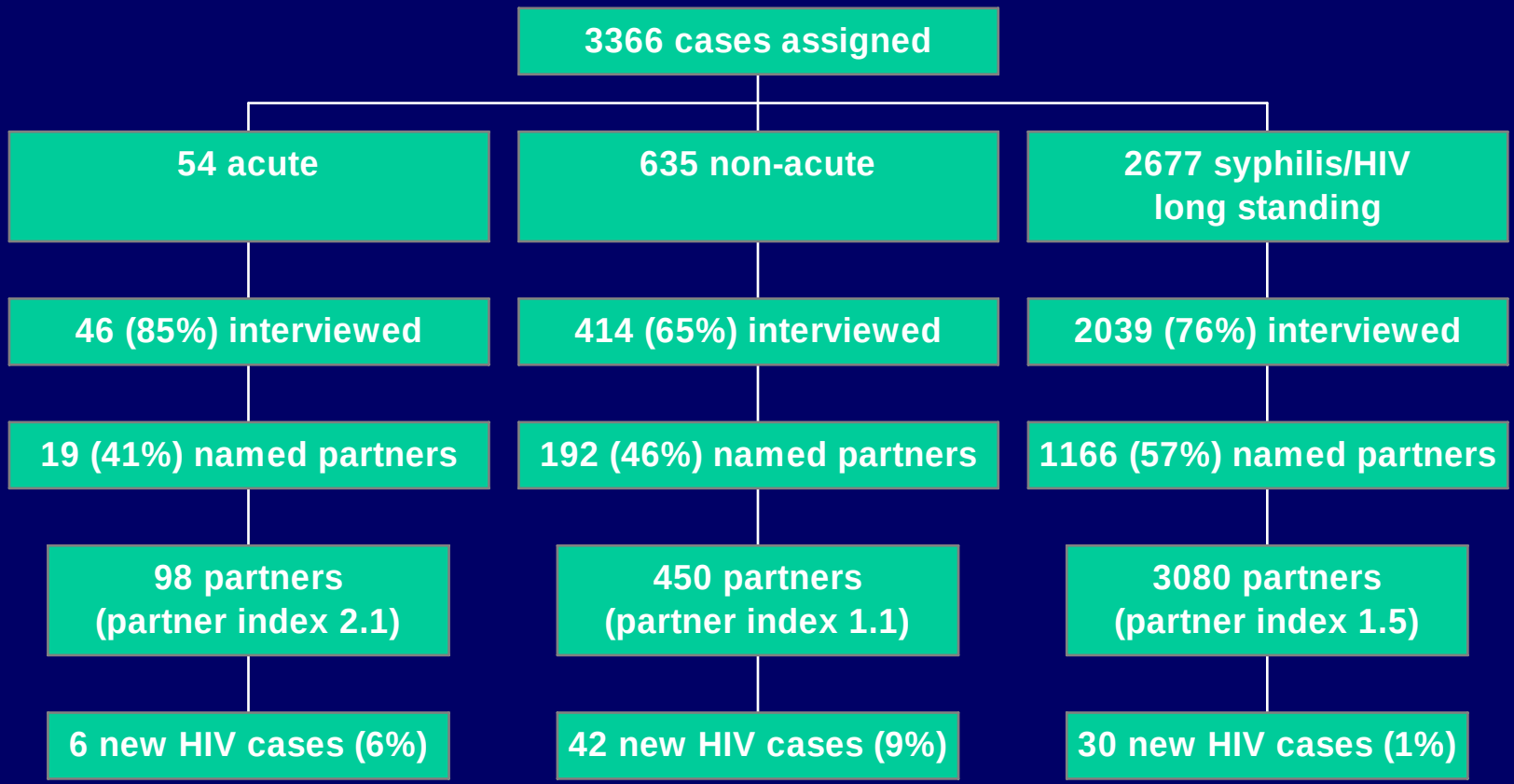


# Partner notification interview outcomes by duration of infection, 2004-2006

| | Acute HIV | | Nonacute HIV | | Long-Standing HIV | | All | |
|---|---|---|---|---|---|---|---|---|
| | N | (%) | N | (%) | N | (%) | N | (%) |
| Total | 30 | (100.0) | 398 | (100.0) | 335 | (100.0) | 763 | (100.0) |
| Offered Partner Services | | | | | | | | |
| Interviewed | 25 | (83.3) | 308 | (77.4) | 274 | (81.8) | 607 | (79.6) |
| Refused | 3 | (10.0) | 37 | (9.3) | 23 | (6.9) | 63 | (8.3) |
| Unable to locate | 2 | (6.7) | 53 | (13.3) | 38 | (11.3) | 93 | (12.2) |

**Ahrens K et al, *JAIDS*, 2007**

# Contact elicitation and partner notification outcomes 2003-2008



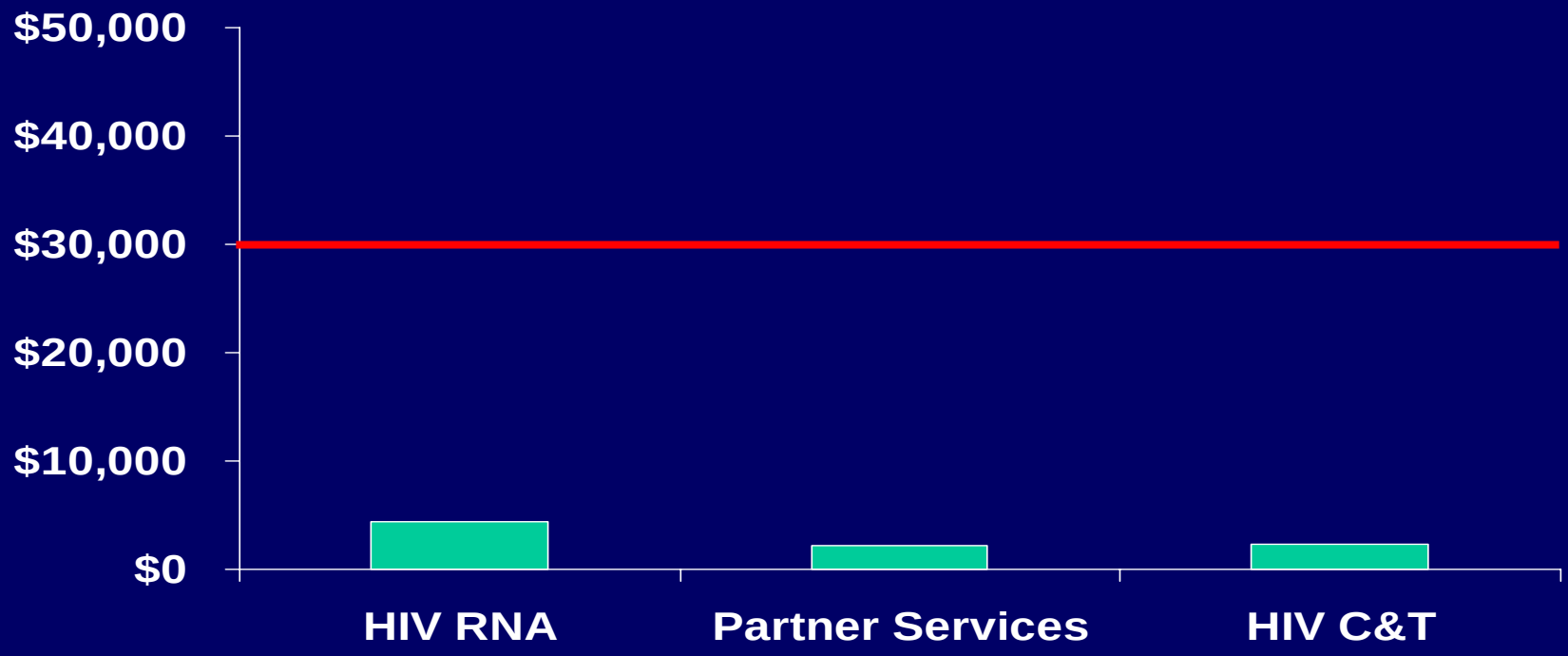

**NNTI = 16.3** **NNTI = 9.9** **NNTI = 68**

# Cost analysis of contact elicitation and partner notification

- **Number Needed to Interview (NNTI) = Interviews/ new cases**
  - **~ 8-10 interviews to find 1 new case of HIV infection among newly detected HIV cases**
- **Cost**
  - **Time per interview with average partner follow-up ~ 8 hours of staff time**
  - **$2240 / new case of HIV infection detected**
  - **If NNTI = 20, cost = $4480**

***At $28/ hour of staff time**

# Cost per new HIV case identified by case-finding method




**$30,000 estimated "cost-effective" amount to identify new HIV case, Coco *Am Fam* Med 2005**

# Summary

- RNA screening combined with rapid testing offers optimized testing protocol
- HIV control—screening, disclosure, partner services— is feasible and identifies high prevalence population
- Costs comparable to traditional counseling & testing and “cost-effective”

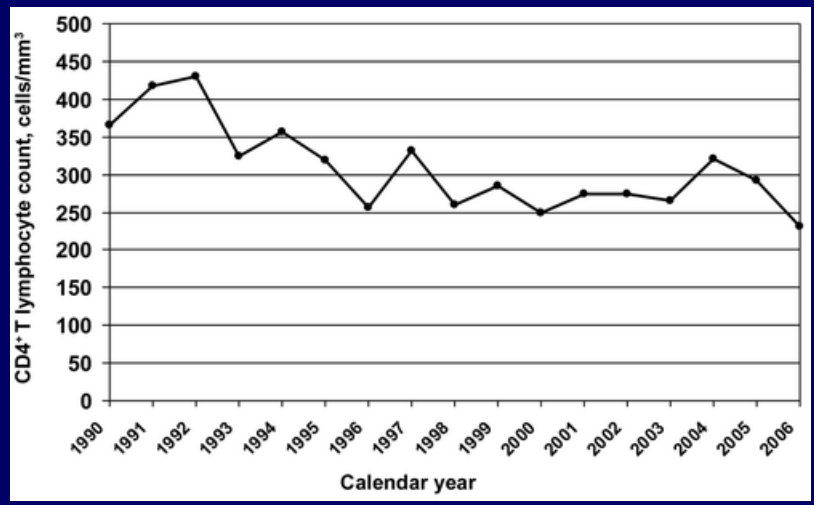
# CD4 T cell count as impact measure

- Monitoring the impact of HIV testing is critical to evaluate public health activities
- Linkage to care is key component of CDC Advancing HIV Prevention
  - Assures timely medical care and risk reduction counseling

Klausner et al, CDC HIV Prevention 2007

# Johns Hopkins Clinic Study Baltimore 1990-2006

- **In 1990-1994, average CD4 T cell count upon clinic entry was 371 cells/ mm$^3$**
- **In 2003-2006, average CD4 T cell count upon clinic entry declined to 276 cells/ mm$^3$**




Plot of CD4+ cell count in antiretroviral-naive persons at presentation for HIV care, by calendar year.

Keruly J and Moore R. Clinical Infectious Diseases, Nov 15 2007

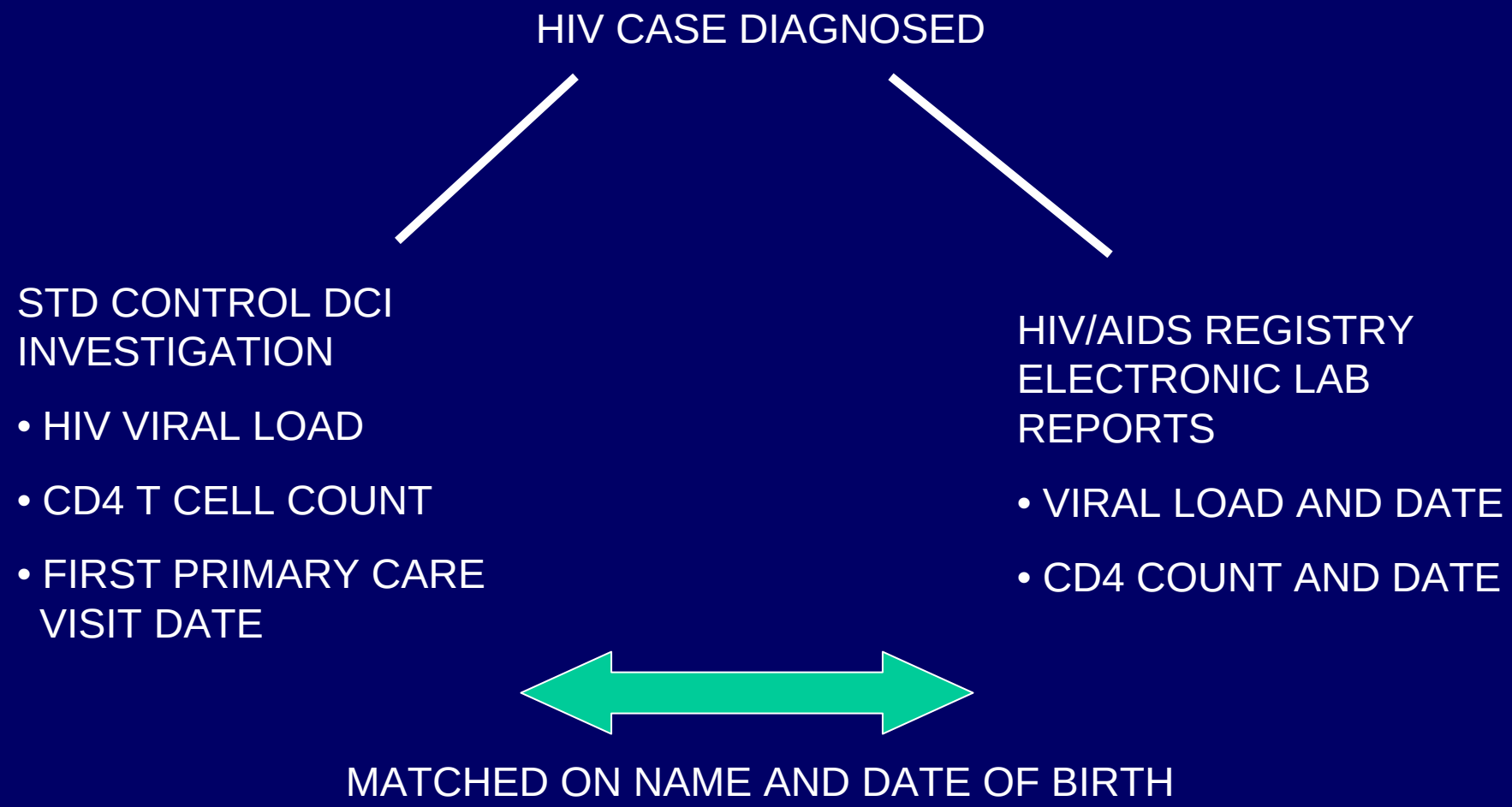
# Data collection

- In July 2006, standard HIV case management updated to include monitoring access to care
- Disease control investigators (DCI) collected date of first HIV primary care visit, value/date of initial viral load and value/date of initial CD4 T cell count:
  - Patient interview
  - Used confidential electronic medical records
  - Requested information from HIV care providers via telephone or FAX
  - Closed case after 90 days

# Matching records with HIV/AIDS Registry

- After DCI investigation, we matched our data to the plasma viral loads and CD4 T cell counts reported to the county's HIV/AIDS Surveillance Section
  - San Francisco has had names-based HIV-reporting since April 2006
  - Longstanding AIDS Registry

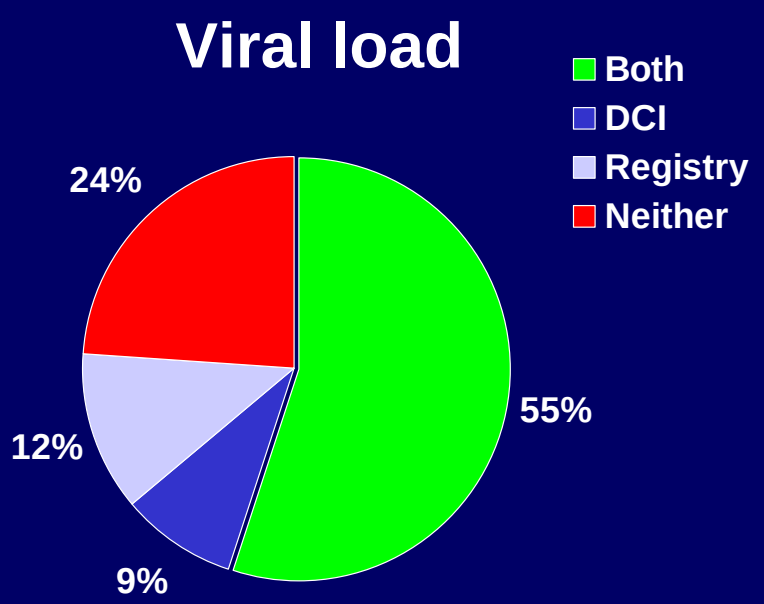
# Data Collection Schema

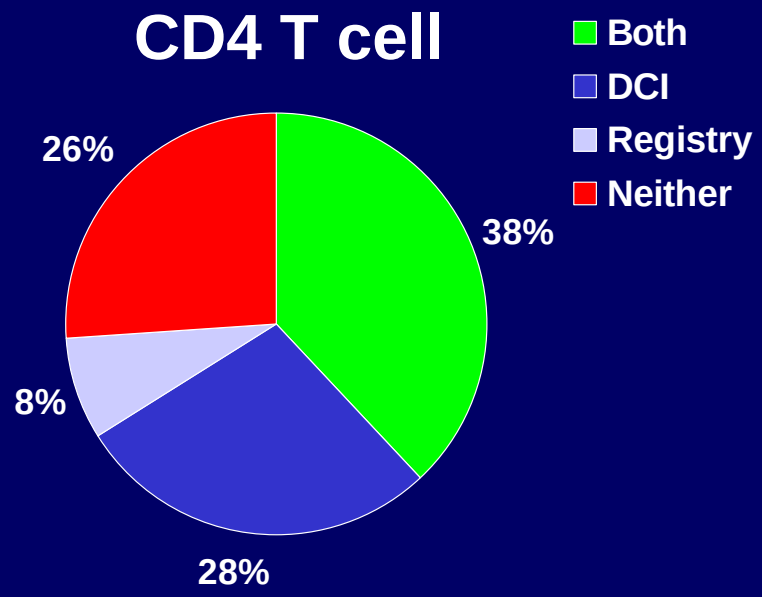


# Analysis

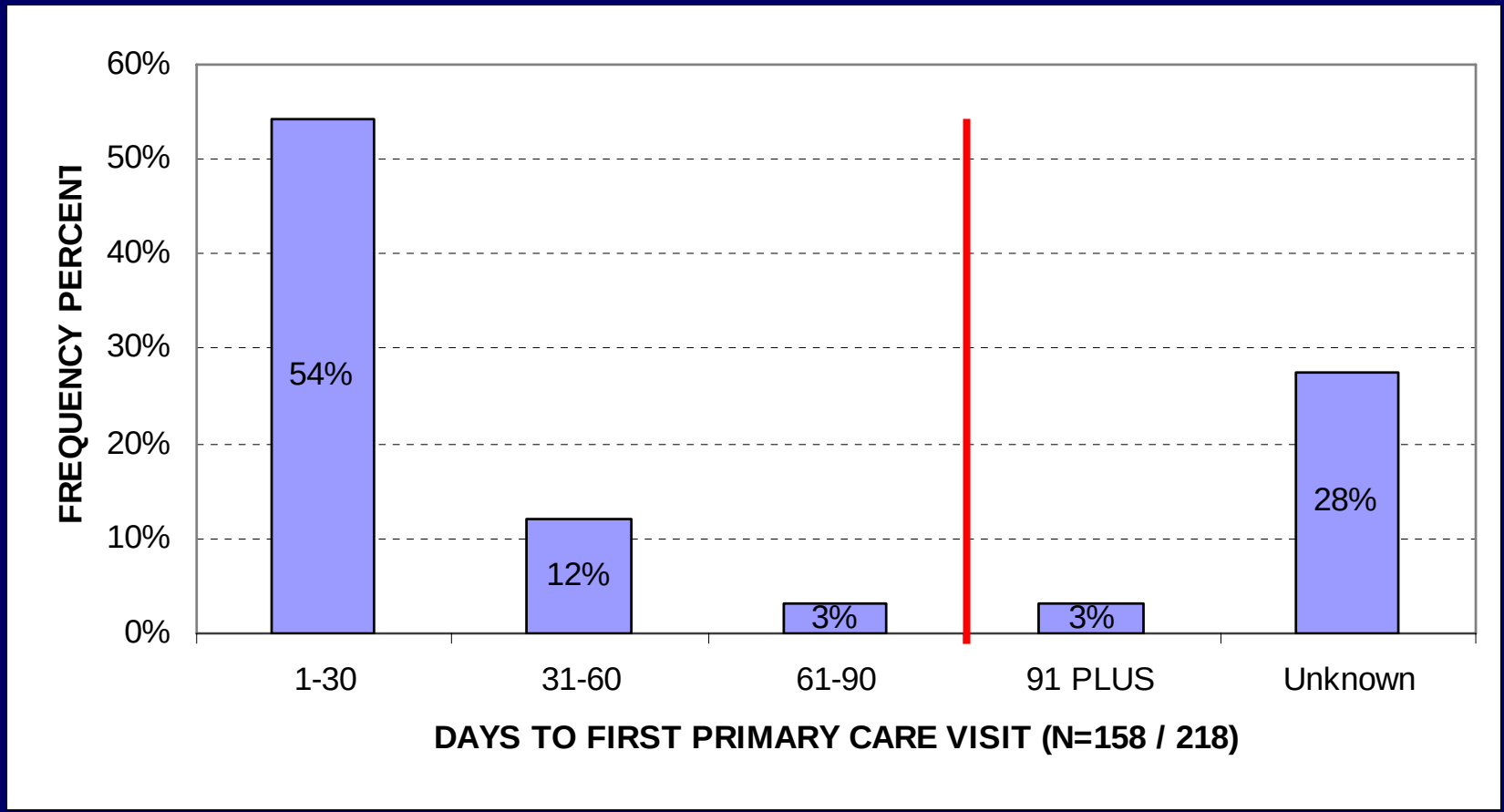
- Used first dates of primary care visit and laboratory tests after HIV diagnosis
- With discrepant laboratory results but same dates, used HIV/AIDS Registry data
- Excluded persons with HIV laboratory tests ordered on same day of diagnosis (n=26)

# Data source of viral load and CD4 T cell count (N=160)



# Distribution of time to first care visit
# N = 218*




**72% had a documented or reported primary care visit**



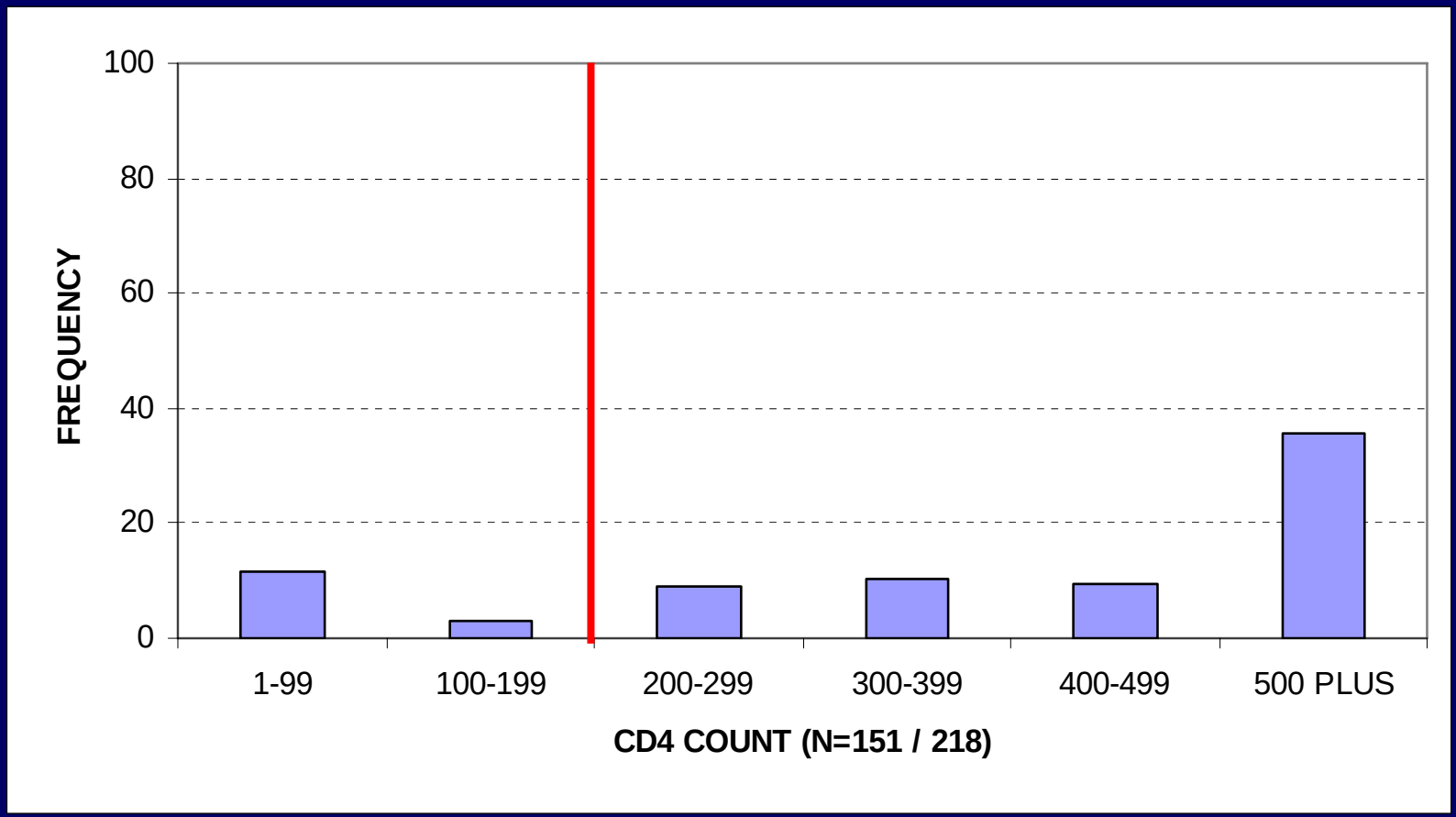
***Complete 2007 and updated 2008 data**

# Entry into primary care by interview status

| | Case Interviewed? | | | |
|---|---|---|---|---|
| | **No (n=39)** | **Yes (n=121)** | **PR** | **P-value** |
| First visit within 3 months of diagnosis | 21 (54%) | 89 (74%) | 1.4 | 0.02 |
| Initial CD4 <200 | 8 (8%) | 18 (17%) | | |
| Initial CD4 200-500 | 7 (7%) | 33 (32%) | | |
| Initial CD4 500 + | 5 (5%) | 32 (31%) | | 0.09 |

**Interviewed cases associated with first primary care visit < 90 days**

# Distribution of initial CD4 T cell count




**15% with CD4 T cell count ≤ 200 cells/ $mm^3$; 25% ≤ 350 cells/ $mm^3$**

# Summary

- Clinical measures can be collected by public health staff and used to monitor outcomes of case-finding and HIV testing programs
- In first 90 days, DCI collected CD4 T cell count data more often than were available in the HIV/AIDS Surveillance Registry
- Interviewed HIV-cases were more likely to be in primary care than non-interviewed cases
- 15% of HIV-cases were diagnosed with AIDS at first CD4 T cell count
  - 25% met current criteria for HIV therapy (CD4 $\leq$ 350 cells/ $mm^3$)

# Policy Implications

- Public health model:
  - Routine HIV testing
  - Disclosure, linkage and documentation of care
  - Partner services

*Should be prioritized within existing health departments and emphasized over other less proven prevention strategies*

# Policy Implications

- Routine HIV testing requires national coalition:  medical and hospital associations, insurers, businesses, thought leaders
  - Operational research
- Integrated CDC Guidelines for Partner Services offers timely opportunity to expand effective programs

# Policy Implications

- CDC should require jurisdictions to use reported HIV case information for case management—disclosure, linkage to care, partner services
- CDC should directly fund local STD control programs to perform HIV case-finding and control activities
  - Evaluate, monitor, disseminate best practices

# Policy Implications

- Testing programs should routinely monitor CD4 T cell counts
  - Evaluate impact of testing promotion
  - Documentation of linkage to care
  - Promote testing in groups with lower values
  - Clear goals should be set for what % of newly diagnosed patients have CD4 T cells $\leq$ 350 $mm^3$
    - For example, < 10% of newly diagnosed patients should have CD4 $\leq$ 350 cells/ $mm^3$

# Future Considerations

- Demonstrate how HIV genotyping data (pol) can identify networks for targeted intervention in recent transmission clusters
- Recommend that sequence data be locally reportable and monitored
  - Routinely measured with resistance assays
  - Support appropriate informatics

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