HIV/AIDS
Epidemiology, Treatment and Prevention

Amy Nunn, ScD
Assistant Professor of Public Health
Executive Director
Rhode Island Public Health Institute
Outline

• Overview/HIV Biology
• History of HIV/AIDS in US
• Global HIV/AIDS estimates
• Countries of interest
• Transmission
• Testing, Prevention, PrEP
• Treatment
• Geography & Community Mobilization
Basic Definitions

- HIV (Human Immunodeficiency Virus)
- AIDS (Acquired Immune Deficiency Syndrome)
- HAART (Highly active antiretroviral therapy)

AIDS is a disease caused by HIV
As part of its commemoration of CDC's 50th anniversary, MMWR is reprinting selected MMWR articles of historical interest to public health, accompanied by a current editorial note.

On June 4, 1981, MMWR published a report about Pneumocystis carinii pneumonia in homosexual men in Los Angeles. This was the first published report of what, a year later, became known as acquired immunodeficiency syndrome (AIDS). This report and current editorial note appear below.
US Disease Burden

Rates of Persons Living with an HIV Diagnosis, by County, 2010

Source: AIDSVu (http://aidsvu.org/) 2013
Global Disease Burden Estimates

Adults and children estimated to be living with HIV | 2012

North America: 1.3 million [0.9 million – 1.9 million]
Caribbean: 250,000 [220,000 – 280,000]
Latin America: 1.5 million [1.2 million – 1.9 million]
Western & Central Europe: 860,000 [800,000 – 930,000]
Eastern Europe & Central Asia: 1.3 million [1.0 million – 1.7 million]
East Asia: 880,000 [650,000 – 1.2 million]
Middle East & North Africa: 260,000 [200,000 – 380,000]
South & South-East Asia: 3.9 million [2.9 million – 5.2 million]
Sub-Saharan Africa: 25.0 million [23.5 million – 26.6 million]
Oceania: 51,000 [43,000 – 59,000]

Total: 35.3 million [32.2 million – 38.8 million]
HIV Prevalence in Key populations

HIV prevalence in adults and key populations

HIV disproportionately affects sex workers, men who have sex with men and people who inject drugs across the world.

Source: UNAIDS 2012 Global Report
# Brazil

## HIV and AIDS estimates (2012)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people living with HIV</td>
<td>[530,000 - 660,000]</td>
</tr>
<tr>
<td>Adults aged 15 to 49 prevalence rate</td>
<td>[0.4% - 0.5%]</td>
</tr>
<tr>
<td>Adults aged 15 and up living with HIV</td>
<td>[520,000 - 650,000]</td>
</tr>
<tr>
<td>Women aged 15 and up living with HIV</td>
<td>[160,000 - 190,000]</td>
</tr>
<tr>
<td>Children aged 0 to 14 living with HIV</td>
<td>N/A</td>
</tr>
<tr>
<td>Deaths due to AIDS</td>
<td>[11,000 - 19,000]</td>
</tr>
<tr>
<td>Orphans due to AIDS aged 0 to 17</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Global AIDS Treatment

PLWHA Receiving HAART in Developing Countries in Late 2005

Argentina
Malawi
Nigeria
Zambia
Kenya
Botswana
Thailand
Uganda
South Africa
Brazil

PLWHA Receiving HAART

Data Sources: WHO Three by Five Progress Report, March 2006 & UNAIDS Epidemiological Update, May 2006
HIV Outcomes in Brazil

How did Brazil do it?!
Number of Patient Receiving ART in Brazil
Brazil’s HIV Care Continuum

- PVHA: 718
- Diagnosticados: 574 (80%)
- Vinculados ao serviço de saúde: 531 (74%)
- Retidos no serviço de saúde: 436 (61%)
- Em TARV: 313 (44%)
- Carga viral indetectável (<=50 cópias): 236 (33%)
India

<table>
<thead>
<tr>
<th>HIV and AIDS estimates (2012)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people living with HIV</td>
<td>2,100,000 [1,700,000 - 2,600,000]</td>
</tr>
<tr>
<td>Adults aged 15 to 49 prevalence rate</td>
<td>0.3% [0.2% - 0.3%]</td>
</tr>
<tr>
<td>Adults aged 15 and up living with HIV</td>
<td>1,900,000 [1,600,000 - 2,400,000]</td>
</tr>
<tr>
<td>Women aged 15 and up living with HIV</td>
<td>750,000 [610,000 - 940,000]</td>
</tr>
<tr>
<td>Children aged 0 to 14 living with HIV</td>
<td>N/A</td>
</tr>
<tr>
<td>Deaths due to AIDS</td>
<td>140,000 [100,000 - 170,000]</td>
</tr>
<tr>
<td>Orphans due to AIDS aged 0 to 17</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### Ghana

#### HIV and AIDS estimates (2012)

<table>
<thead>
<tr>
<th>Category</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people living with HIV</td>
<td>240,000 [200,000 - 270,000]</td>
</tr>
<tr>
<td>Adults aged 15 to 49 prevalence rate</td>
<td>1.4% [1.2% - 1.6%]</td>
</tr>
<tr>
<td>Adults aged 15 and up living with HIV</td>
<td>210,000 [180,000 - 240,000]</td>
</tr>
<tr>
<td>Women aged 15 and up living with HIV</td>
<td>120,000 [100,000 - 140,000]</td>
</tr>
<tr>
<td>Children aged 0 to 14 living with HIV</td>
<td>28,000 [23,000 - 33,000]</td>
</tr>
<tr>
<td>Deaths due to AIDS</td>
<td>12,000 [8,900 - 15,000]</td>
</tr>
<tr>
<td>Orphans due to AIDS aged 0 to 17</td>
<td>190,000 [160,000 - 230,000]</td>
</tr>
</tbody>
</table>
Diagnoses of HIV Infection among Adults and Adolescents, by Transmission Category, 2011—United States and 6 Dependent Areas

N = 50,007

- Male-to-male sexual contact: 62%
- Injection drug use (IDU) – Males: 10%
- Injection drug use (IDU) – Females: 5%
- Male-to-male sexual contact and IDU: 3%
- Heterosexual contact\(^a\) – Males: 3%
- Heterosexual contact\(^a\) – Females: 3%
- Other\(^b\): <1%

Note. Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis. All displayed data have been statistically adjusted to account for reporting delays and missing transmission category, but not for incomplete reporting.

\(^a\) Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

\(^b\) Includes hemophilia, blood transfusion, perinatal exposure, and risk factor not reported or not identified.
Diagnoses of HIV Infection among Adults and Adolescents, by Race/Ethnicity, 2008–2011—United States and 6 Dependent Areas

Black/African American

White

Hispanic/Latino

Native Hawaiian/other Pacific Islander

American Indian/Alaska Native

Asian

Multiple races

Year of diagnosis

2008 2009 2010 2011

Note. Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis. All displayed data have been statistically adjusted to account for reporting delays, but not for incomplete reporting.

Hispanics/Latinos can be of any race.
Transmission risk by subpopulation in the US

Source: CDC (http://www.cdc.gov/hiv/policies/hip.html) 2013
## Estimated Per-Act Probability of Acquiring HIV from an Infected Source, by Exposure Act

<table>
<thead>
<tr>
<th>Type of Exposure</th>
<th>Risk per 10,000 Exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parenteral</strong></td>
<td></td>
</tr>
<tr>
<td>Blood Transfusion</td>
<td>9,250</td>
</tr>
<tr>
<td>Needle-sharing during injection drug use</td>
<td>63</td>
</tr>
<tr>
<td>Percutaneous (needle-stick)</td>
<td>23</td>
</tr>
<tr>
<td><strong>Sexual</strong></td>
<td></td>
</tr>
<tr>
<td>Receptive anal intercourse</td>
<td>138</td>
</tr>
<tr>
<td>Insertive anal intercourse</td>
<td>11</td>
</tr>
<tr>
<td>Receptive penile-vaginal intercourse</td>
<td>8</td>
</tr>
<tr>
<td>Insertive penile-vaginal intercourse</td>
<td>4</td>
</tr>
<tr>
<td>Receptive oral intercourse</td>
<td>low</td>
</tr>
<tr>
<td>Insertive oral intercourse</td>
<td>low</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
</tr>
<tr>
<td>Biting</td>
<td>negligible⁴</td>
</tr>
<tr>
<td>Spitting</td>
<td>negligible</td>
</tr>
<tr>
<td>Throwing body fluids (including semen or saliva)</td>
<td>negligible</td>
</tr>
<tr>
<td>Sharing sex toys</td>
<td>negligible</td>
</tr>
</tbody>
</table>

*HIV transmission through these exposure routes is technically possible but unlikely and not well documented.

HIV TRANSMISSION RISKS

Half of transmission in first 5 months
Wawer et al, 2005

HIV Prevention Approaches

**Relative Efficacy of TasP, PrEP and Other Prevention Strategies**

<table>
<thead>
<tr>
<th>Study</th>
<th>Reduction in HIV Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPTN 052 (ARV treatment as prevention)</td>
<td>96%</td>
</tr>
<tr>
<td>iPrEx (FTC/TDF) in MSM</td>
<td>44%</td>
</tr>
<tr>
<td><strong>Subjects with detectable drug levels</strong></td>
<td>94%</td>
</tr>
<tr>
<td>Partners PrEP (FTC/TDF) in discordant couples</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Subjects with detectable drug levels</strong></td>
<td>90%</td>
</tr>
<tr>
<td>Condoms in heterosexuals</td>
<td>80%</td>
</tr>
<tr>
<td>Condoms in US MSM</td>
<td>70%</td>
</tr>
<tr>
<td>TDF2 (FTC/TDF) in men &amp; women</td>
<td>62%</td>
</tr>
<tr>
<td>Medical male circumcision</td>
<td>54%</td>
</tr>
<tr>
<td>STD treatment</td>
<td>42%</td>
</tr>
<tr>
<td>CAPRISA 004 (1% TFV vaginal gel) in women</td>
<td>39%</td>
</tr>
<tr>
<td>FEM-PrEP (FTC/TDF) in women</td>
<td>Not Significant</td>
</tr>
<tr>
<td><strong>VOICE (FTC/TDF, TDF, TFV vaginal gel) in women</strong></td>
<td></td>
</tr>
<tr>
<td>HIV vaccine (RV144)</td>
<td></td>
</tr>
</tbody>
</table>

Efficacy (%)

1. Adapted from Abdool Karim S and QA. Lancet 2011;S0140-6736:1136-7

5. Smith DK, et al. CROI 2013; Atlanta, GA. Oral #32
7. Marrazzo JM, et al. CROI 2013; Atlanta, GA. Oral #26LB
Over half of resources go towards treatment

Where does the money go?

More than half of the resources to the AIDS response are invested in treatment programmes. However, investment patterns vary from country to country. Finding the right combination of investments to fit the epidemic is key.
Resources towards prevention for key populations

FIGURE 1.8
International and domestic public spending on programmes for sex workers in low- and middle-income countries, by region, latest available data as of 2013
FIGURE 1.12
International and domestic public spending for programmes for men who have sex with men in low- and middle-income countries, by region, latest data available (2007–2012)

FIGURE 2.4
Treatment - ARV

COMPLERA™
(emtricitabine, rilpivirine, tenofovir disoproxil fumarate) Tablets
200 mg / 25 mg / 300 mg

ATRIPLA™
(efavirenz 600 mg/emtricitabine 200 mg
tenofovir disoproxil fumarate 300 mg)
Tablets
30 tablets

Stribild™
(integravir, cobicistat, emtricitabine,
tenofovir disoproxil fumarate) Tablets
150 mg / 150 mg / 200 mg / 200 mg
Early Treatment

• Survival benefit
• HIV-associated cardiovascular disease, kidney disease, liver disease, and malignancy
• Availability and tolerability of newer antiretrovirals
• Decrease HIV transmission
HPTN 052
Confirmed ‘Treatment as Prevention’
1763 Discordant couples
Early versus delayed treatment
May, 2011: DSMB found a 96% reduction in HIV transmission in HIV positive individuals who were on treatment
Rates of Persons Living with an HIV Diagnosis, by County, 2010

Source: AIDSVu (http://aidsvu.org/) 2013
HIV in America, 2010

El-Sadr, Mayer, Hodder. NEJM March 2010
Geographic Disparities

• In many urban areas, a few neighborhoods count for a large share of HIV infections
• HIV infections cluster
• Some neighborhoods have infection HIV rates similar to sub-Saharan Africa
• Maps tell us where to focus intensive prevention and treatment efforts

Source: AIDSVu
Rates of Persons Living with HIV/AIDS by Zip Code and Census Tract, 2009

ZIP Code Rates

Census Tract Rates

Data are not shown to protect privacy because of a small number of cases and/or a small population size.

Source: AIDS Vu
Geography Should Not Be Destiny: Focusing HIV/AIDS Implementation Research and Programs on Microepidemics in US Neighborhoods

African Americans and Hispanics are disproportionately affected by the HIV/AIDS epidemic. Within the most heavily affected cities, a few neighborhoods account for a large share of new HIV infections.

Addressing racial and economic disparities in HIV infection requires an implementation program and research agenda that assess the impact of HIV prevention interventions focused on increasing HIV testing, treatment, and retention in care in the most heavily affected neighborhoods in urban areas of the United States.

Neighborhood-based implementation research should evaluate programs that focus on community mobilization, media campaigns, routine testing, linkage to and retention in care, and block-by-block outreach strategies. (Am J Public Health. 2014; 104:775–780. doi:10.2105/ AJPH.2013.301864)

ALTHOUGH HIV INCIDENCE IN the United States has remained relatively stable since the mid-1990s, rates among African Americans and Hispanics are 8 and 3 times those among Whites, respectively.1 Approximately 65% of new HIV infections in the United States occur in non-White populations. Individual behavioral risk factors, including unprotected sex and substance use, do not fully explain racial disparities in HIV infection; minority populations do not engage in higher rates of HIV risk behaviors than individuals of other races.2

GEOGRAPHIC AND RACIAL DISPARITIES IN HIV INFECTION

New research underscores the pivotal role that sexual networks, structural factors, and geography play in potentiating HIV risks; a recent study published in Mor-

Point–Mott Haven, as well as predominately White Chelsea, have rates ranging from 2.4% to 4.5% (Figure 1). However, AIDS-related mortality rates in the predominately White neighborhood of Chelsea, which has a large gay population, are far lower than those in other predominantly African American and Hispanic neighborhoods with high infection rates.

Finally, Philadelphia’s HIV infection rate of 114 per 100 000 is five times the national average. Although HIV prevalence in Philadelphia is high among residents of Center City, an affluent, predominantly White neighborhood with a large gay community, AIDS-related mortality in Center City is far lower than that in predominantly African American neighborhoods with high rates of infection (Figure 2).6 These higher rates of HIV infection and AIDS-related mortality in inner-city neighborhoods have important implications for both HIV prevention and treatment programs and for understanding the complex interplay between social determinants of health and HIV transmission.
Geography Should Not be Destiny

Note. PLWHA = people living with HIV/AIDS. Marked neighborhoods are (1) High-Bridge Morrisania, (2) Central Harlem–Morningside Heights, (3) Hunts Point–Mott Haven, (4) East Harlem, and (5) Chelsea–Clinton.

FIGURE 1—Racial and geographic disparities in HIV/AIDS outcomes in New York City neighborhoods for (a) HIV diagnoses (b) age-adjusted death rate (c) 2010 rate of adults/adolescents living with HIV/AIDS diagnosis and (d) PLWHA as percentage of population: 2012.
Geography Should Not be Destiny


FIGURE 2—Racial and socioeconomic disparities in AIDS-related mortality, by census tract and neighborhood in Philadelphia, PA, for (a) PLWHA (b) AIDS death rate (c) socioeconomic status, and (d) percentage of African American Residents: 2011.
Community Mobilization
Do One Thing Door To Door
HIV/HCV Testing Campaign
More Community Mobilization: African American Clergy

PHILLY FAITH IN ACTION

I AM BROTHER RAFIQ AND I GOT TESTED.

I AM PASTOR WALLER AND I GOT TESTED.

I AM PASTOR FORD AND I GOT TESTED.

I AM PASTOR WHITE AND I GOT TESTED.
Mississippi Faith in Action, founded in 2013, is a coalition between Brown University and dozens of faith and community leaders in Mississippi committed to eradicating the AIDS epidemic.
Frameworks for Engaging Faith Based Institutions

- Social justice
- Testing and treatment
- Human rights
- Routine health care
- NOT BEHAVIORAL INTERVENTIONS

Slide at Anderson United Methodist Church on World AIDS Day 2013 in Jackson, MS

Nunn et al, Global Public Health, Feb 2013
Acknowledgements
Acknowledgements
Contact Me

Amy_Nunn@Brown.edu 401-863-6568