The Current Status of HIV Testing

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Learning Objectives

Define the current state of the HIV epidemic and trends in HIV Diagnosis

Cite the CDC & Medical Organization recommendations for routine HIV testing

Understand the importance of routine HIV testing in the POL setting and clinics

Describe the strategies for HIV Testing in Clinic & POL Settings
In 2010, in the 46 states and 5 U.S. dependent areas with confidential name-based HIV infection reporting since at least January 2007, the estimated number of diagnoses of HIV infection was 48,298. The estimated number of diagnoses of HIV infection ranged from zero in American Samoa and the Northern Mariana Islands to 6,417 in California.

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

Diagnoses of HIV Infection among Adults and Adolescents, by Transmission Category, 2010—46 States and 5 U.S. Dependent Areas

N=48,079

- Male-to-male sexual contact: 61%
- Injection drug use (IDU) – Males: 18%
- Injection drug use (IDU) – Females: 10%
- Male-to-male sexual contact and IDU: 5%
- Heterosexual contact* – Males: 3%
- Heterosexual contact* – Females: 3%
- Other**: <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 risk-factor information, but not for incomplete reporting.
* Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.
** Includes hemophilia, blood transfusion, perinatal exposure, and risk factor not reported or not identified.
Diagnoses of HIV Infection among Adults and Adolescents, by Sex and Transmission Category, 2010—46 States and 5 U.S. Dependent Areas

Males
N=37,910
7% Male-to-male sexual contact
4% Heterosexual contact
<1% Injection drug use (IDU)
<1% Male-to-male sexual contact and IDU
12% Other
77%

Females
N=10,168
<1% Male-to-male sexual contact and IDU
<1% Injection drug use (IDU)
14% Male-to-male sexual contact
86%

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 risk-factor information, but not for incomplete reporting.

* Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

Other 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, 2007–2010—46 States and 5 U.S. Dependent Areas

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.
Diagnoses of HIV Infection among Adults and Adolescents, by Sex and Race/Ethnicity, 2010—46 States and 5 U.S. Dependent Areas

Males
N = 37,910

- 32% Asian
- 24% Black/African American
- 41% White
- 2% Hispanic/Latino
- 1% Native Hawaiian/other Pacific Islander
- <1% Multiple races

Females
N = 10,168

- 62% White
- 18% Black/African American
- 17% Hispanic/Latino
- 1% Asian
- <1% Native Hawaiian/other Pacific Islander
- 1% Multiple races

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.
AIDS Diagnoses and Deaths of Adults and Adolescents with AIDS, 1985–2009—United States and 6 U.S. Dependent Areas

Note. All displayed data have been statistically adjusted to account for reporting delays, but not for incomplete reporting. Deaths of persons with an AIDS diagnosis may be due to any cause.
Adults and Adolescents Living with an AIDS Diagnosis, by Sex, 1993–2009—United States and 6 U.S. Dependent Areas

Note. All displayed data have been statistically adjusted to account for reporting delays, but not for incomplete reporting.
Persons Living with an AIDS Diagnosis, by Race/Ethnicity, 1993-2009—United States and 6 U.S. Dependent Areas

Note. All displayed data have been statistically adjusted to account for reporting delays, but not for incomplete reporting.

a Hispanics/Latinos can be of any race.
b Includes Asian/Pacific Islander legacy cases.
CDC & Medical Organization recommendations for routine HIV testing
Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health-Care Settings

MMWR 2006;55 (No. RR-14):1-17

Published September 22, 2006

Revised Recommendations
Adults and Adolescents - I

Routine, voluntary HIV screening for all persons 13-64 in health care settings, not based on risk

All patients with TB, or seeking treatment for STDs, should be screened for HIV

Repeat HIV screening of persons with known risk at least annually
Revised Recommendations
Adults and Adolescents - II

When acute retroviral infection is a possibility, use an RNA test in conjunction with an HIV antibody test.

Settings with low or unknown prevalence:

- Initiate screening
- If yield from screening is less than 1 per 1000, continued screening is not warranted
Revised Recommendations
Adults and Adolescents - III

Opt-out HIV screening with the opportunity to ask questions and the option to decline testing

Separate signed informed consent should not be required

Prevention counseling in conjunction with HIV screening in health care settings should not be required
Screening is voluntary

Inform patients orally, or in writing, that HIV testing will be performed unless they decline.

Arrange access to care, prevention, and support services for patients with positive HIV test results.
Many HIV-infected persons access health care but are not tested for HIV until symptomatic

Effective treatment available

Awareness of HIV infection leads to substantial reductions in high-risk sexual behavior

Inconclusive evidence about prevention benefits from typical counseling for persons who test negative

Great deal of experience with HIV testing, including rapid tests
Progression to Routine Testing

2006
• CDC

2007 - 2008
• American Academy of FPs
• ACOG
• American College of Physicians

2009
• Medicare Coverage Decision

2010
• National HIV/AIDS Strategy

2012
• USPTF Review of Routine HIV Screening
Importance of Routine HIV Testing in POLs and clinics
Awareness of Serostatus Among People with HIV and Estimates of Transmission

- ~25% Unaware of Infection
  - Account for: ~54 - 70% of New Infections

- ~75% Aware of Infection
  - Account for: ~30 - 46% of New Infections

People Living with HIV/AIDS: 1,039,000-1,185,000
New Sexual Infections Each Year: ~32,000

Marks, et al AIDS 2006
## HIV Prevalence in the United States

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total persons living with HIV infection</th>
<th>Persons whose HIV infection was undiagnosed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (95% CI)</td>
<td>No. (95% CI)</td>
</tr>
<tr>
<td>Total</td>
<td>1,178,350 (1,128,350 – 1,228,500)</td>
<td>236,400 (224,900 – 247,900)</td>
</tr>
</tbody>
</table>

Objective HIV-13: Proportion of Persons Living with HIV Who Know Their Serostatus

Target: 90.0%

Baseline: 79.0% of persons aged 13 years and older living with HIV were aware of their HIV infection in 2006.

Target setting method: Consistent with the National HIV/AIDS Strategy.

Data source: HIV Surveillance System, CDC, NCHHSTP.

Reasons for Testing: Late versus Early Testers

Supplement to HIV/AIDS Surveillance, 2000-2003
Late HIV Testing, 1996--2005

CDC. Late HIV testing—34 states, 1996–2005. MMWR. 2009;58:661-665
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5824a2.htm#tab
Late Diagnosis of HIV Infection - 2009

Among persons initially diagnosed with HIV infection during 2009, 32% received an AIDS diagnosis within 12 months.
Missed Opportunities for Earlier Diagnosis of HIV Infection

KEY POINTS

- Data collected from:
  - 60 Emergency Departments
  - 62 Inpatient Facilities
  - 63 Ambulatory-Care facilities
  - 19 Free medical clinics
- 2001 – ‘05: 4,315 reported cases of HIV infection in SC
Missed Opportunities for Earlier Diagnosis of HIV Infection

4,315 Reported Infections

41% - Late Testers (n=1,769)

73% of Late Testers (n=1,291) made 7,988 visits to a SC Healthcare Facility

79% of visits were not likely to get to prompt HIV testing under a risk-based testing strategy

Author’s Findings suggest the need for routine HIV screening

Criteria that Justify Routine Screening

- Serious health disorder that can be detected before symptoms develop
- Treatment is more beneficial when begun before symptoms develop
- Reliable, inexpensive, acceptable screening test
- Costs of screening are reasonable in relation to anticipated benefits
- Treatment must be accessible

Principles and Practice of Screening for Disease
- WHO Public Health Paper, 1968
Opt-Out Screening

Prenatal HIV testing for pregnant women:

RCT of 4 counseling models with opt-in consent:

- 35% accepted testing
- Some women felt accepting an HIV test indicated high risk behavior

Testing offered as routine, opportunity to decline

- 88% accepted testing
- Significantly less anxious about testing

Cost Effectiveness

Expanded screening for HIV in the U.S. – an analysis of cost effectiveness.

“In all but the lowest-risk populations, routine, voluntary screening for HIV once every 3 to 5 years is justified on both clinical and cost-effectiveness grounds. One-time screening in the general population may also be cost-effective.”

## Cost Effectiveness

<table>
<thead>
<tr>
<th>Screening Method</th>
<th>Outcomes</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal HIV screening</td>
<td>Averts ~1500 cases of neonatal HIV per year</td>
<td>Cost saving</td>
</tr>
<tr>
<td>HIV antibody testing of 15 million blood donations</td>
<td>Averts ~1500 HIV infections per year</td>
<td>$3,600 per QALY</td>
</tr>
<tr>
<td>Pooled RNA screening for HIV and HCV</td>
<td>Averts 4 HIV and 56 HCV infections per year</td>
<td>$4.3 million per QALY</td>
</tr>
</tbody>
</table>
Cost-Effectiveness of Expanded HIV Screening in the US

One-time HIV screening of low-risk persons coupled with annual screening of high-risk persons could prevent 6.7% of a projected 1.23 million new infections

- Cost $22,382 per QALY gained


http://annals.org/article.aspx?articleid=746571
Strategies for HIV Testing in Clinic & POL Settings
Role for Rapid HIV Tests

- Increase receipt of test results
- Increase identification of HIV-infected pregnant women so they can receive effective prophylaxis
- Increase feasibility of testing in acute-care settings with same-day results
- Increase number of venues where testing can be offered to high-risk persons
Rapid Lateral Flow Tests

Capture antibody or antigen immobilized as a line on nitrocellulose

Detector antibody or antigen is a gold particle or latex particle
Generations of HIV Tests

1\textsuperscript{st} Generation – Detect antibody to HIV with viral lysate

2\textsuperscript{nd} Generation – Detect antibody to HIV with recombinant proteins or synthetic peptides

3\textsuperscript{rd} Generation – Detect both IgG and IgM antibody to HIV

4\textsuperscript{th} Generation – Detect antibody and viral protein
HIV Infection & Laboratory Markers

p24 antigen

• p24 antigen is a viral protein that makes up most of the viral core.
P24 antigen

- Serum concentrations of p24 antigen are high in the first few weeks after infection; tests sensitive to p24 antigen are therefore useful for diagnosing very early infection when antibody levels are not present or are still low.
Rapid HIV Tests (Waived)

Clearview® HIV 1/2 STAT-PAK®

Determine Combo HIV/AG

Clearview® COMPLETE HIV 1/2

OraQuick Advance®

Uni-Gold Recombigen™

INSTI™ HIV-1 Antibody Test
Rapid HIV Tests (Moderate)

Reveal® G3

Multispot HIV-1/HIV-2
# FDA-approved Rapid HIV Tests

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Sensitivity (95% C.I.)</th>
<th>Specificity (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whole blood (F.S.)</strong></td>
<td></td>
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</tr>
<tr>
<td>OraQuick Advance®</td>
<td>99.6 (98.5 – 99.9)</td>
<td>100 (99.7 – 100)</td>
</tr>
<tr>
<td>Uni-Gold Recombigen™</td>
<td>100 (99.5 – 100)</td>
<td>99.7 (99.0 – 100)</td>
</tr>
<tr>
<td>Clearview® HIV 1/2 STAT-PAK®</td>
<td>99.7 (98.9 – 100)</td>
<td>99.9 (98.6 – 100)</td>
</tr>
<tr>
<td>Clearview® COMPLETE HIV 1/2</td>
<td>99.7 (98.9 – 100)</td>
<td>99.9 (98.6 – 100)</td>
</tr>
<tr>
<td>INSTI® HIV-1 Antibody Test</td>
<td>99.8 (99.3 – 99.9)</td>
<td>99.5 (99.0 – 99.8)</td>
</tr>
<tr>
<td>Determine HIV Combo</td>
<td>99.9 (99.4-100)</td>
<td>99.6 (99.2 – 99.8)</td>
</tr>
<tr>
<td><strong>Serum/plasma</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reveal® G3</td>
<td>99.8 (99.2 – 100)</td>
<td>99.9 (98.6 – 100)</td>
</tr>
<tr>
<td>Multispot</td>
<td>100 (99.9 – 100)</td>
<td>99.9 (99.8 – 100)</td>
</tr>
</tbody>
</table>
CDC Study: Early HIV screening

Number of identified cases (out of 33)

- Architect Combo: 29
- Determine Combo: 25
- Genetic Systems: 19
- Multispot: 11
- Clearview Complete: 8
- Unigold Rec: 8
- Clearview Stat-Pak: 7
- Oraquick Advance: 7
Performance of Alere Determine™ HIV-1/2 Ag/Ab Combo

Sensitivity of assay reactivity during early HIV-1 infections relative to number of days before first positive Western Blot

Alere Determine™ HIV-1/2 Ag/Ab Combo
15.5 days before Western Blot positive

-25  -20  -15  -10  -5   0

Average days before positive Western Blot:
- NAT
- 4th gen IA
- 3rd gen IA
- Conventional antibody only rapid tests

**Objective:** Direct comparison of 6 FDA approved rapid HIV Tests (STAT-PAK, COMPLETE, OraQuick, Uni-Gold, Multispot, and Reveal)

**Design:**
- Conducted at LA Gay & Lesbian Center, & Altamed Clinic
- 6282 participants that were at high risk for HIV infection

**Summary:**
All 6 rapid HIV tests demonstrated high sensitivity and specificity compared with conventional EIAs. Other characteristics such as convenience, cost, time to results, shelf life – determining factors for a specific application.
Objectives:

1. Compare diagnostic accuracy of oral fluid vs. whole blood samples
2. Compute Positive Predictive Values in high- and low-prevalence settings

Study Design

- Systematic review & meta-analysis
- Five databases of published work & five key HIV Conferences
- Bayesian Statistical Model
Pooled sensitivity of oral fluid was ~2% lower than FS whole blood
RECOMMENDED CDC GUIDELINES

4th generation HIV-1/2 immunoassay

(+)  

HIV-1/HIV-2 antibody differentiation immunoassay

HIV-1 (+)  
HIV-2 (-)  
HIV-1 antibodies detected

HIV-1 (-)  
HIV-2 (+)  
HIV-2 antibodies detected

HIV-1 (+)  
HIV-2 (+)  
HIV antibodies detected*

HIV-1 (-) or indeterminate

HIV-2 (-)

RNA

RNA (+)  
Acute HIV-1 infection

RNA (-)  
Negative for HIV-1

*Additional testing required to rule out dual infection
How do rapid tests fit into HIV algorithm?

The CDC prefers using the algorithm, but understands that it is not practical in many settings.

Rapid tests,

- if negative, no further testing
- If positive, start at beginning of algorithm
Summary

There is an urgent need to increase the proportion of persons who are aware of their HIV-infection status

Expanded, routine, voluntary, opt-out screening in health care settings is needed

Such screening is cost-effective

New CDC guidelines focuses on early infections