

HIV Infection among our youngest: knowledge, survival, resiliency, and opportunity

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Disclosures

- Gilead scientific advisory board
- Merck HIV Global Therapeutic Expert Forum

DISCLAIMER

Global summary of the AIDS epidemic □ 2016

Number of people living with HIV

Total	36.7 million [30.8 million–42.9 million]
Adults	34.5 million [28.8 million–40.2 million]
Women	17.8 million [15.4 million–20.3 million]
Children (<15 years)	2.1 million [1.7 million–2.6 million]

People newly infected with HIV in 2016

Total	1.8 million [1.6 million–2.1 million]
Adults	1.7 million [1.4 million–1.9 million]
Children (<15 years)	160 000 [100 000–220 000]

AIDS deaths in 2016

Total	1.0 million [830 000–1.2 million]
Adults	890 000 [740 000–1.1 million]
Children (<15 years)	120 000 [79 000–160 000]

The Beginning: New York Times (July 1981)

“Doctors in New York and California have diagnosed among homosexual men 41 cases of a rare and often **rapidly fatal form of cancer**.

The cause of the outbreak is unknown, and there is as yet no evidence of contagion..

.....no apparent danger to nonhomosexuals from contagion..... no cases reported to date outside the homosexual community or in women.

Nine of the victims tested had **severe defects in their immunological systems.....”**

THE NEW YORK TIMES,

FRIDAY, JULY 3, 1981

A20

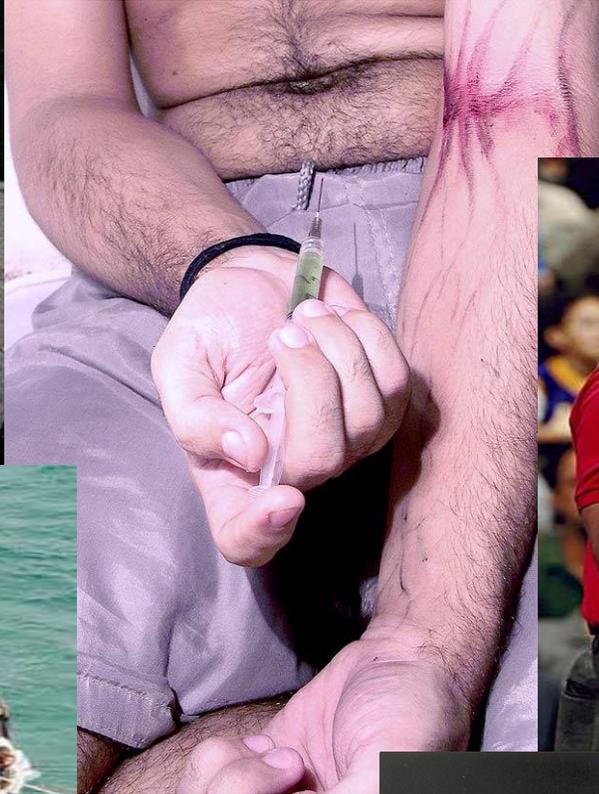
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RARE CANCER SEEN IN 41 HOMOSEXUALS

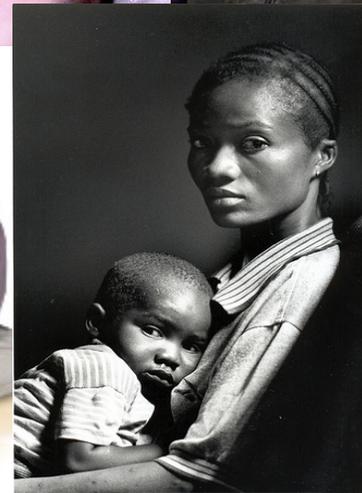
Outbreak Occurs Among Men
in New York and California
—8 Died Inside 2 Years

By LAWRENCE K. ALTMAN

Doctors in New York and California have diagnosed among homosexual men 41 cases of a rare and often rapidly fatal form of cancer. Eight of the victims died less than 24 months after the diagnosis was made.



(November 1982)



The First Pediatric Cases

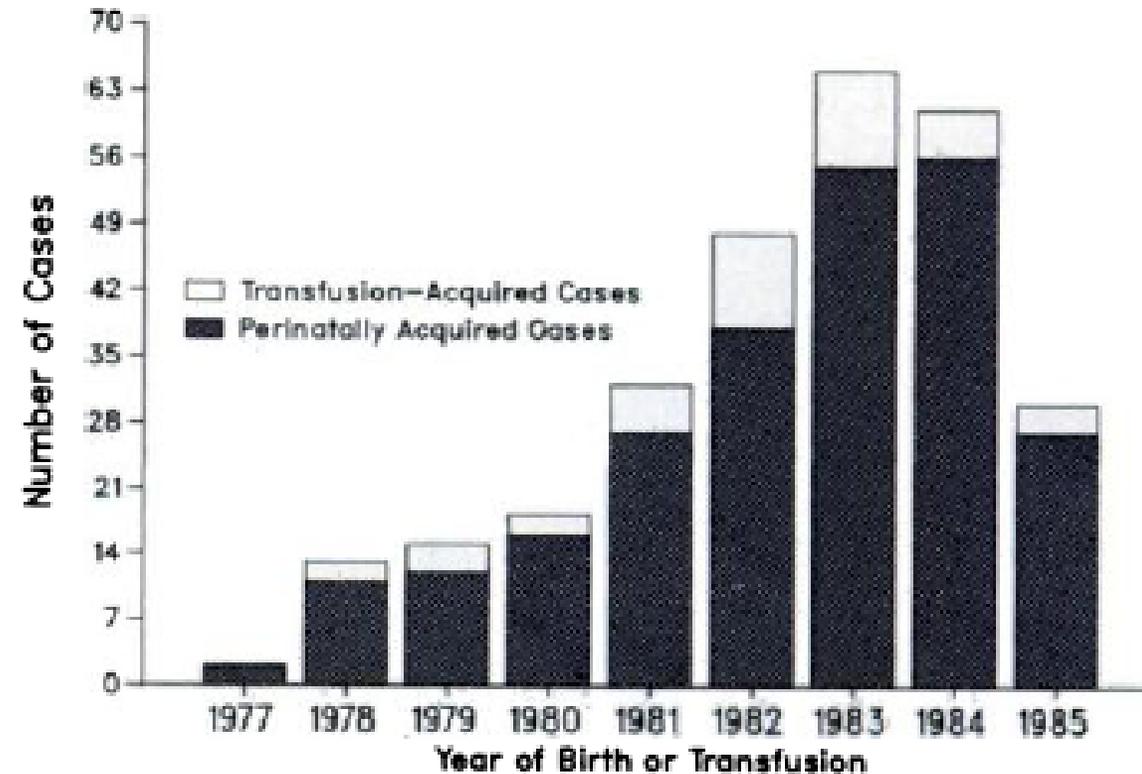
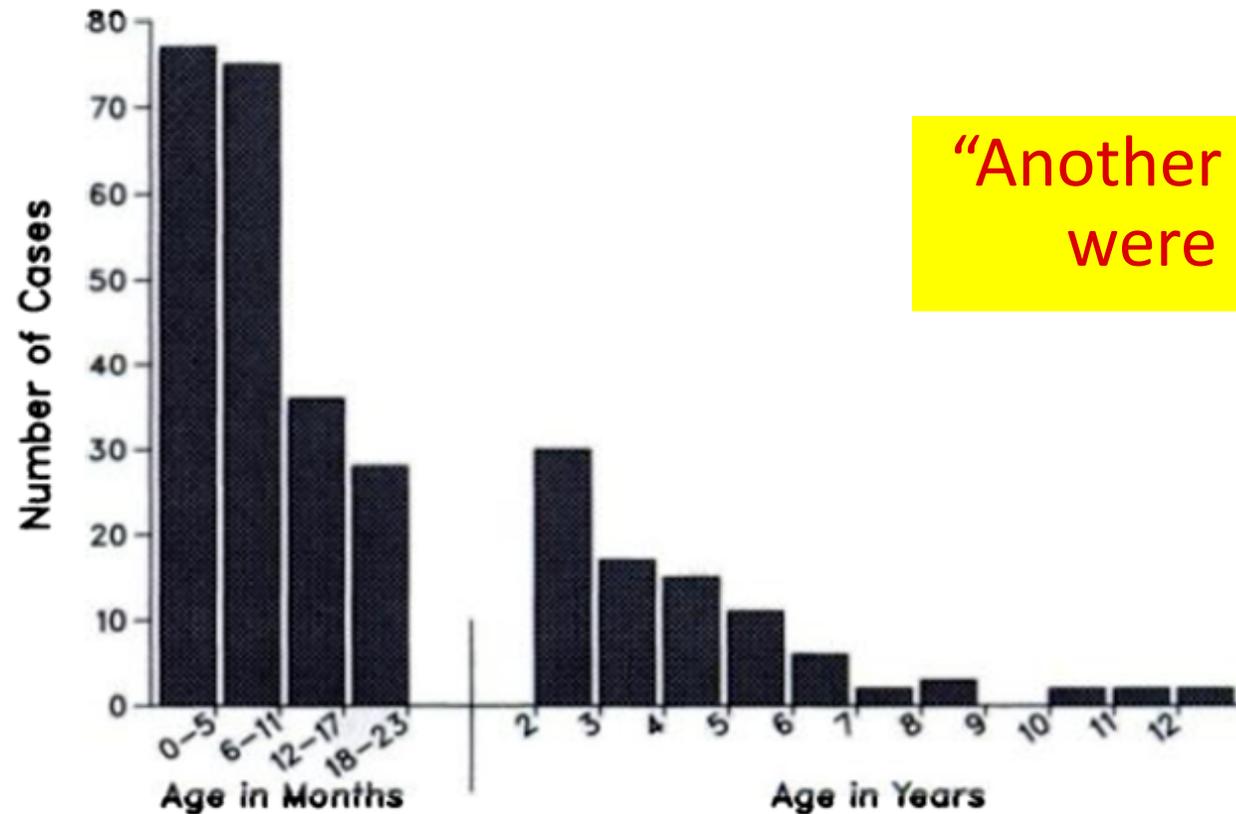


Fig 3. Pediatrics AIDS cases by year of transmission of human immunodeficiency virus. Includes children younger than 13 years of age in whom AIDS was diagnosed as of Dec 31, 1985. Year of transmission was considered year of birth for perinatally acquired cases and year of transfusion for transfusion-acquired cases.

The First Pediatric Cases



“Another 85 cases (not reviewed here) were reported in adolescents.”

Fig 5. Pediatric AIDS cases by child’s age at diagnosis. Includes children younger than 13 years of age in whom AIDS was diagnosed as of Dec 31, 1985.

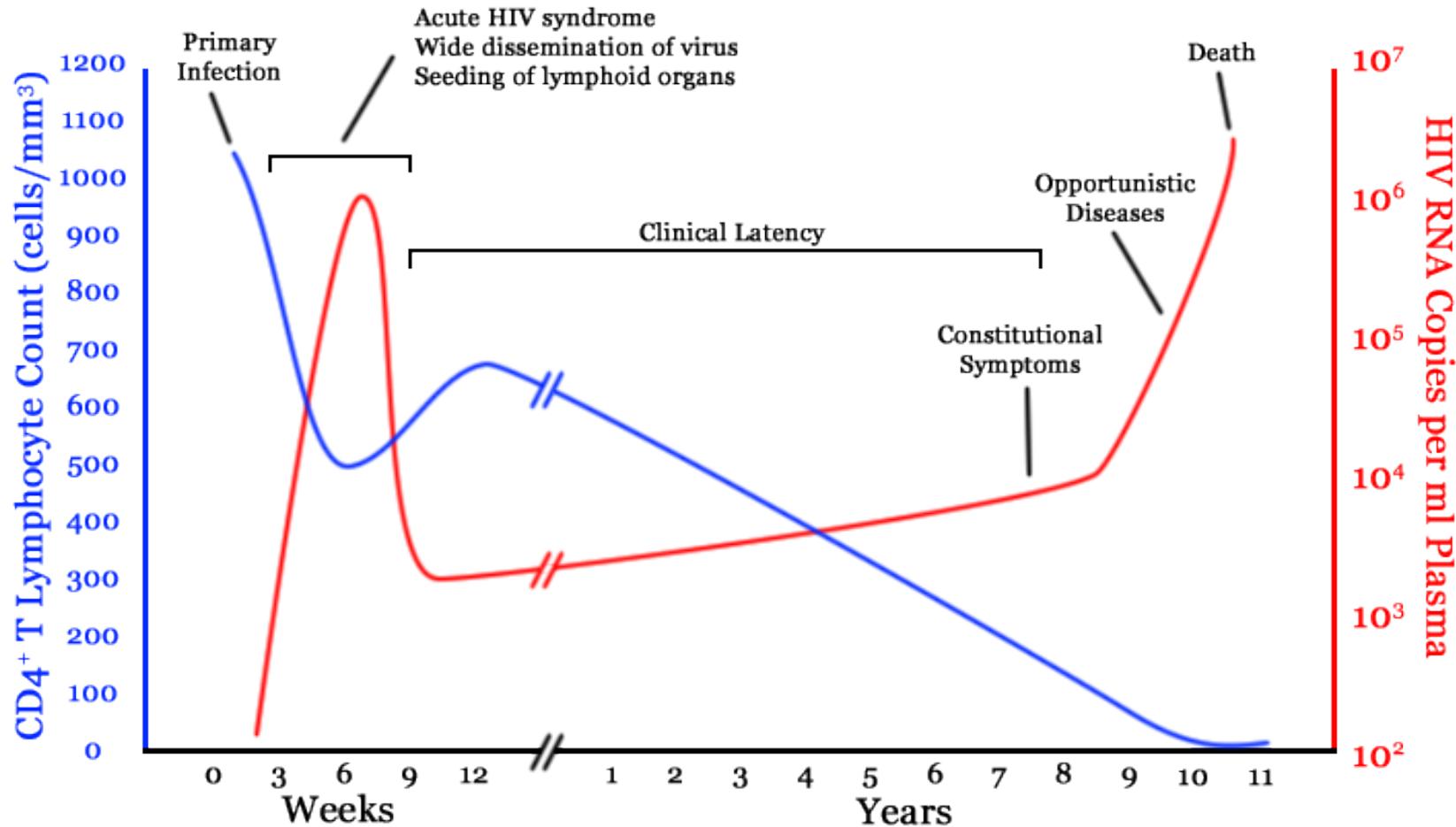
Prognosis of perinatal HIV infection

- Symptoms develop over months to years
- 25% rapidly progress to AIDS (<1 year = highest risk)
- 75% experience slow progression
- 25% mortality by age five
- Annual rate of disease progression (6-8%)

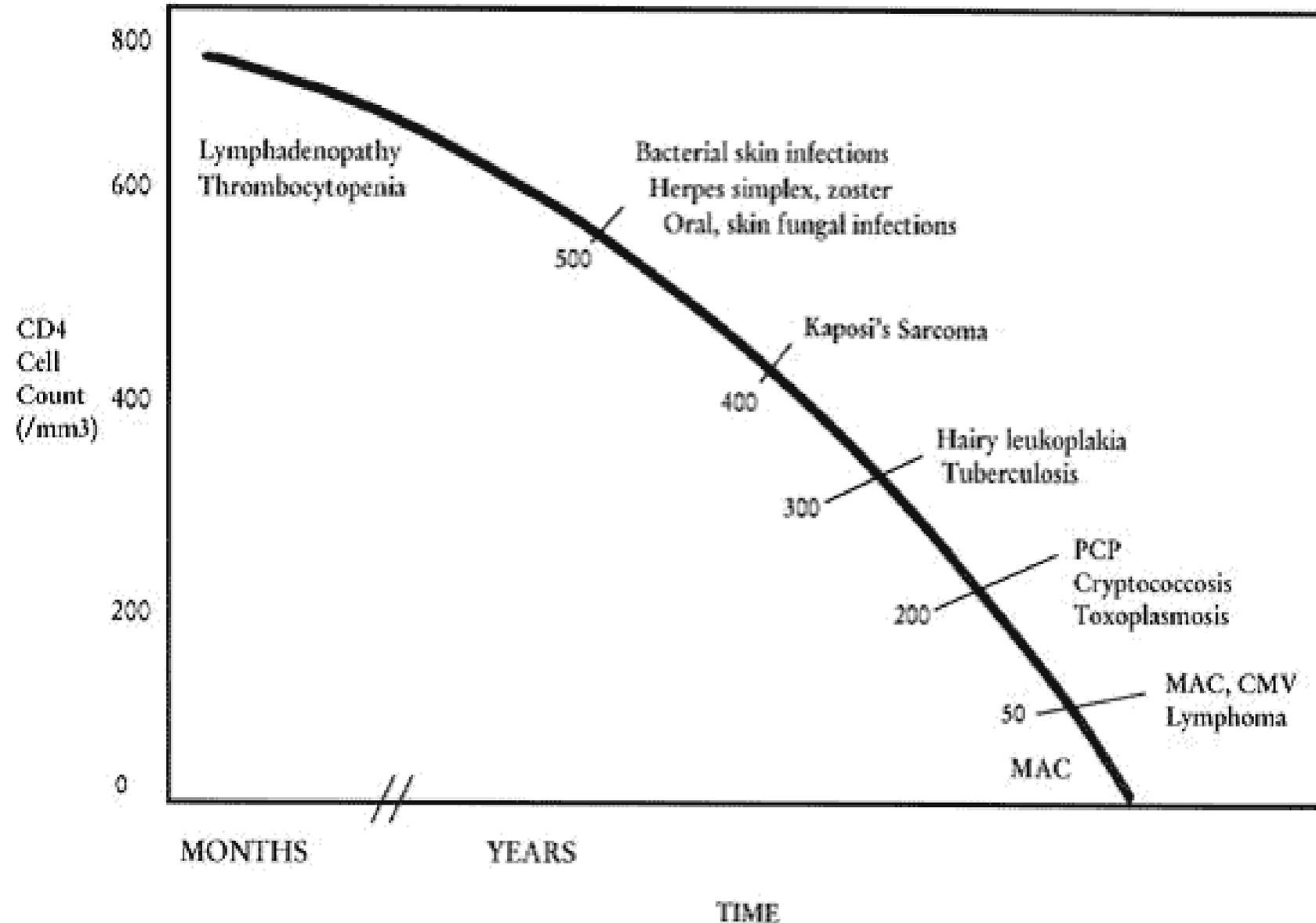


“although they make up only 1% of AIDS patients, they have unique clinical, social, and public health problems that require special attention.” Rogers

Course of Untreated HIV



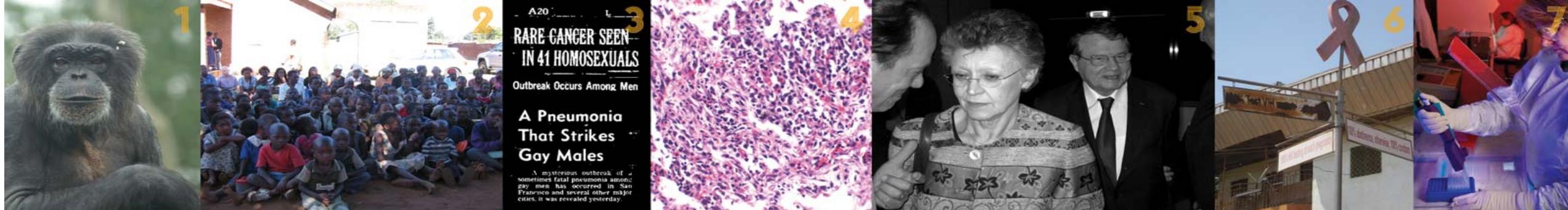
CD4 level and Risk of Opportunistic Infections (OIs)



Goals of Therapy

- 1) ↓ HIV-associated morbidity, prolong duration and quality of survival
- 2) Preserve/restore immunologic function
- 3) Maximal and durable suppression of HIV viral load
- 4) Prevent transmission
 - Treatment as prevention (TasP)
 - Undetectable= Untransmittable (U=U)





1900s-1960s

In the early 1900s, transmission of SIV to humans in west-central Africa results in virus mutation and the emergence of HIV-1.

The oldest HIV-1 genomes were sequenced in the 1990s from the preserved tissue samples of a man and woman from the Democratic Republic of Congo who died in 1959 and 1960.

In 1964, Jerome Horwitz synthesizes azidothymidine (AZT) at the Barbara Ann Karmanos Cancer Institute in Detroit. AZT would later be used for the treatment of HIV infection.

1975

Reports of severe wasting syndrome – weight loss of at least 10% of body weight – in residents of Africa, later determined to be symptoms of AIDS.

1978

A Portuguese man, "Senhor José", becomes the first confirmed case of HIV-2 infection.

1980

After presenting with Kaposi's sarcoma, Ken Horne becomes the first AIDS case to be recognized by the United States.

1981

The CDC publishes reports describing Kaposi's sarcoma and *Pneumocystis pneumonia* in gay men in California and New York.

The New York Times publishes an article – "Rare Cancer Seen in 41 Homosexuals" – describing cases of Kaposi's sarcoma affecting 41 gay men in San Francisco and New York City.

1982

The first AIDS clinic is established in San Francisco and the Gay Men's Health Crisis is founded in New York City.

Michael Marmor and his colleagues publish a report in *The Lancet* correlating risk factors for Kaposi's sarcoma with sexual activity and drug use in homosexual men.

The term AIDS is used for the first time by the CDC and is defined as "a disease at least moderately predictive of a defect in cell-mediated immunity, occurring in a person with no known case for diminished resistance to that disease."

1983

The CDC reports on immunodeficiency in female sexual partners of males with AIDS and identifies the primary routes of HIV transmission.

At the Pasteur Institute in Paris, virologists Luc Montagnier and Françoise Barré-Sinoussi isolate a retrovirus (LAV) that kills T cells from a homosexual AIDS patient.

1984

At the NCI in Maryland, Robert Gallo's group identifies the retrovirus (HTLV-III) to be the cause of AIDS.

U.S. Health and Human Services Secretary Margaret Heckler declares that a vaccine will be available for HIV within two years.

Project SIDA, the first AIDS research project in Africa is launched.

1985

The FDA approves the ELISA blood test kit used to screen for antibodies against HIV in the U.S. blood supply.

The Canadian Red Cross begins screening blood products for HIV.

The first International AIDS conference is held in Atlanta.



1986

Robert Gallo's HTLV-III and the LAV discovered by Montagnier and Barré-Sinoussi are identical and the retrovirus is named HIV.

1987

The FDA approves zidovudine (AZT) – the first antiretroviral drug – for the treatment of HIV infection.

The FDA approves the first clinical trial of an HIV vaccine candidate.

1988

The largest needle exchange program, Prevention Point, is established in San Francisco.

The first World AIDS Day is held on December 1.

UNAIDS (Joint United Nations Programme on HIV/AIDS) reports that more women are living with HIV/AIDS than men in sub-Saharan Africa.

1990s-2014...

In 1995, the FDA approves the first protease inhibitor drug, saquinavir, which makes highly active antiretroviral therapy (HAART) possible.

In 2007, Timothy Ray Brown is cured of HIV following a bone marrow transplant to treat his leukemia.

In 2012, approximately 35.3 million people are living with HIV/AIDS worldwide. In Sub-Saharan Africa, 1 in 20 adults are living with HIV.

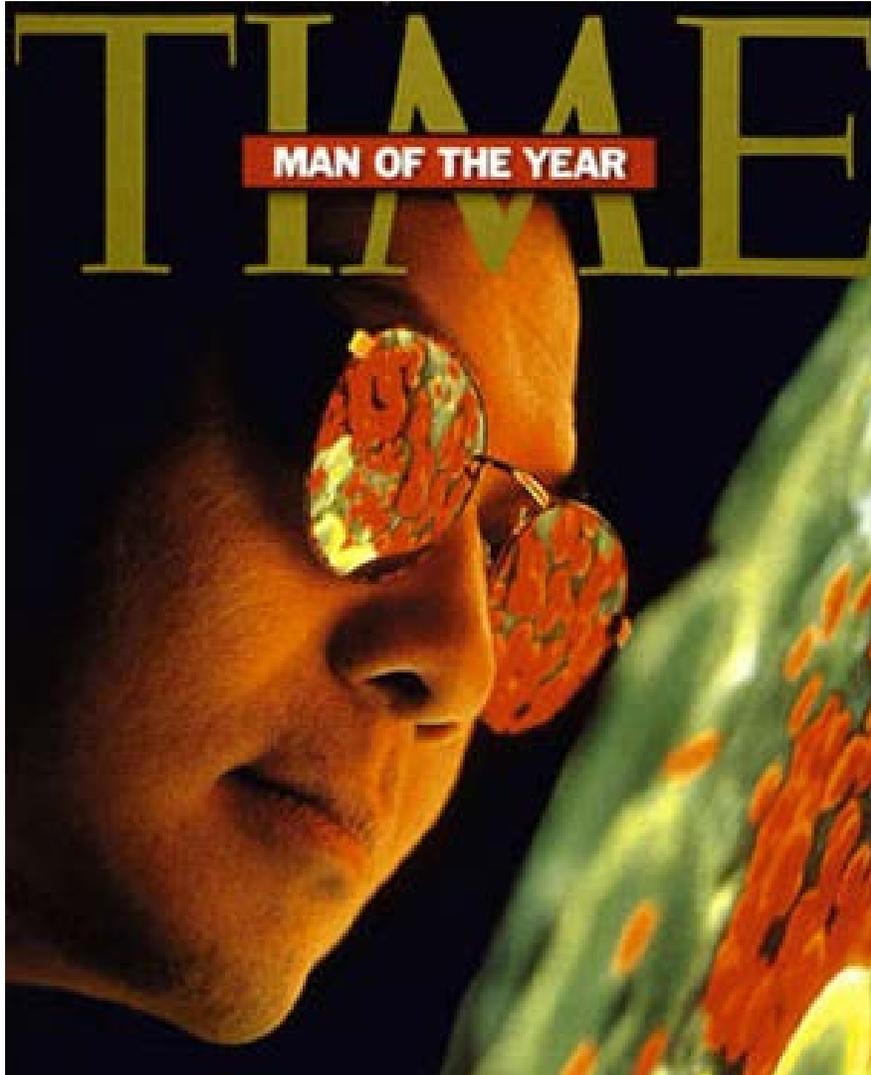
In 2014, the U.S. federal funding for HIV/AIDS research is USD \$29.7 billion.

PHOTO CAPTIONS

1. ORIGINS - Chimpanzee (flickr: Tim Ellis)
2. EFFECTS - Children orphaned by HIV/AIDS, Malawi (flickr: khyrne54)
3. HEADLINES - New York Times (Top), San Francisco Chronicle (Bottom) 1981
4. INFECTION - Kaposi's Sarcoma, H&E stain (flickr: Yale Rosen)
5. DISCOVERY - Françoise Barré-Sinoussi, Luc Montagnier (flickr: PhOtOnQuAnTiQue)
6. AWARENESS - HIV signpost, Cameroon (flickr: Joel Abroad)
7. DIAGNOSIS - ELISA blood test for HIV antibodies (flickr: LSC)
8. BIOLOGY - HIV infected T cell (flickr: NIAID)
9. TREATMENT - AZT photomicrographs (flickr: Kat Masback)
10. SUPPORT - AIDS Walk 1988, Los Angeles (flickr: Mr Flicker)
11. PROTEST - ACT UP protest 1988, White House headquarters (flickr: The U.S. FDA)
12. SOLIDARITY - World AIDS Day 2013, White House North Portico (flickr: Ted Eytan)
13. EDUCATION - Teaching children, Central African Republic (Pierre Holtz, UNICEF)
14. STATUS - HIV blood tests for children of HIV+ mothers, Tanzania (flickr: Kim)

HIV TIMELINE

Advances in management of HIV



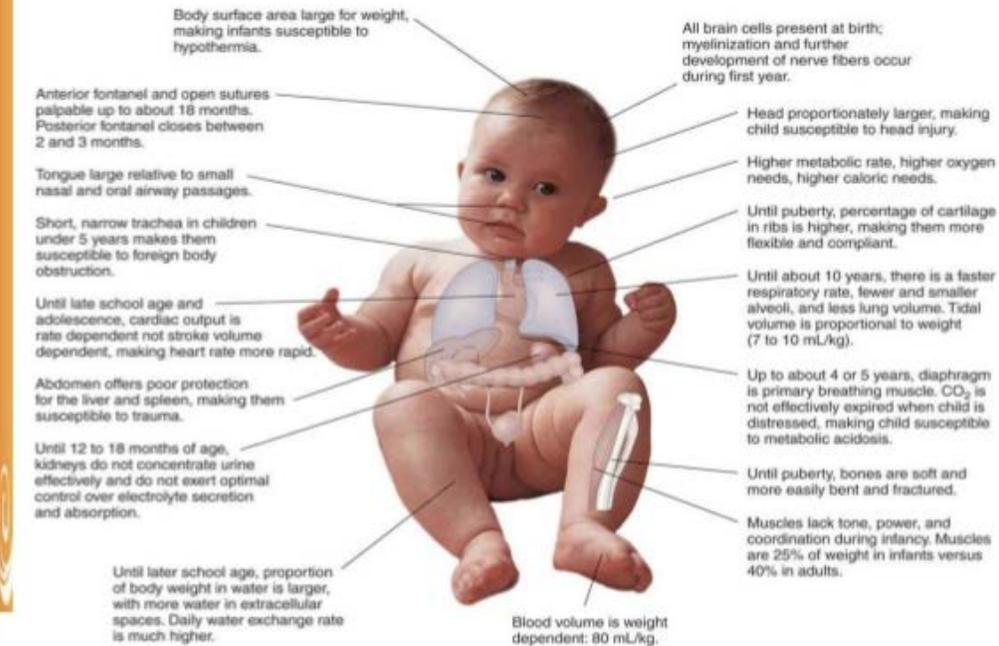
- Diagnostic tools
- Opportunistic infection prophylaxis and treatment
 - immunizations
- Antiretroviral treatment
- Identification, management, and prevention of co-morbidities

Unique clinical issues for children

- Prevention of mother to child acquisition
- Antiretroviral treatment for children
 - dosing, formulation, palatability, toxicity
- Prophylaxis of opportunistic infections
- Identification of co-morbidities
- Treatment of co-morbidities
- Immunizations



Children are not just small adults....



5



The New England Journal of Medicine

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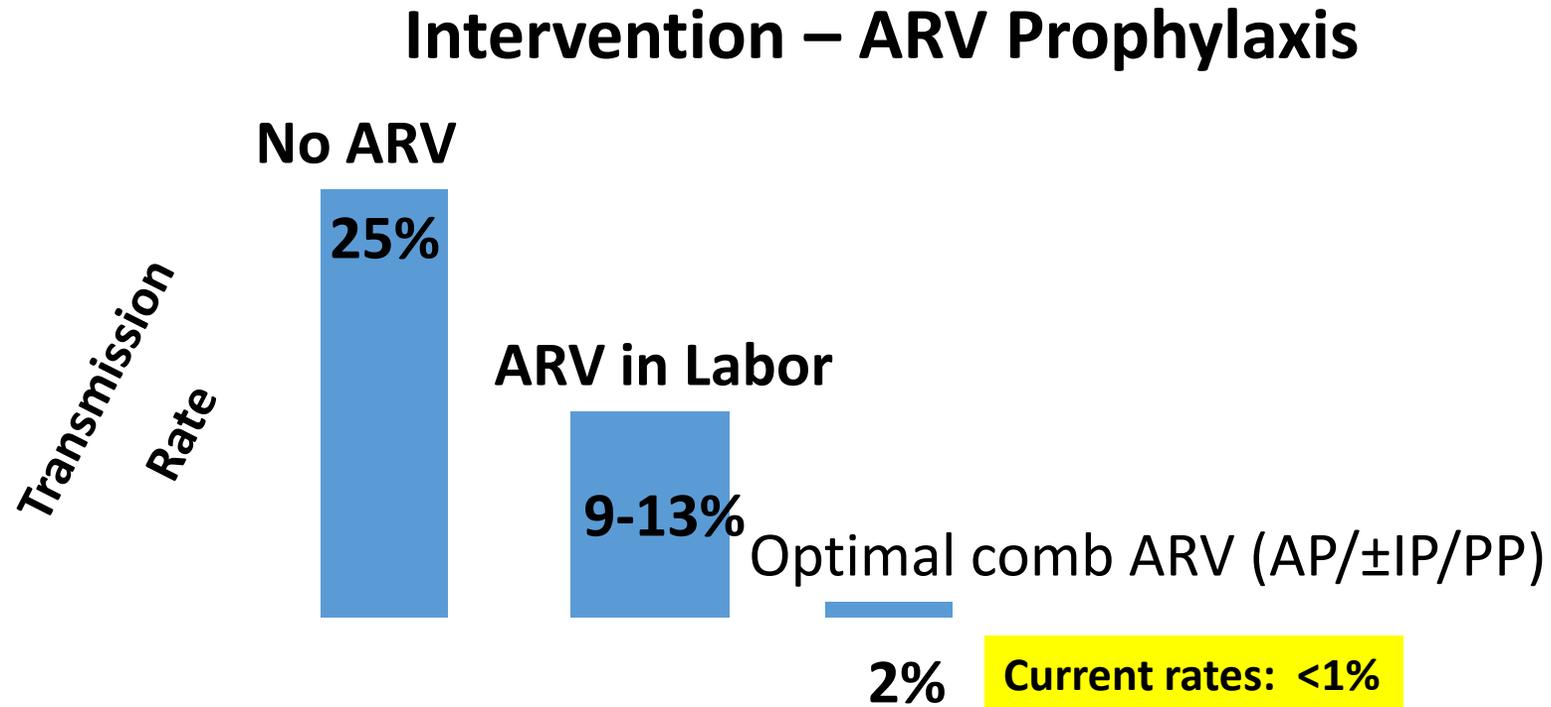
NOVEMBER 3, 1994

Number 18

REDUCTION OF MATERNAL–INFANT TRANSMISSION OF HUMAN IMMUNODEFICIENCY VIRUS TYPE 1 WITH ZIDOVUDINE TREATMENT

EDWARD M. CONNOR, M.D., RHODA S. SPERLING, M.D., RICHARD GELBER, PH.D., PAVEL KISELEV, PH.D.,
GWENDOLYN SCOTT, M.D., MARY JO O’SULLIVAN, M.D., RUSSELL VANDYKE, M.D., MOHAMMED BEY, M.D.,
WILLIAM SHEARER, M.D., PH.D., ROBERT L. JACOBSON, M.D., ELEANOR JIMENEZ, M.D.,
EDWARD O’NEILL, M.D., BRIGITTE BAZIN, M.D., JEAN-FRANÇOIS DELFRAISSY, M.D., MARY CULNANE, M.S.,
ROBERT COOMBS, M.D., PH.D., MARY ELKINS, M.S., JACK MOYE, M.D., PAMELA STRATTON, M.D.,
AND JAMES BALSLEY, M.D., PH.D.,
FOR THE PEDIATRIC AIDS CLINICAL TRIALS GROUP PROTOCOL 076 STUDY GROUP*

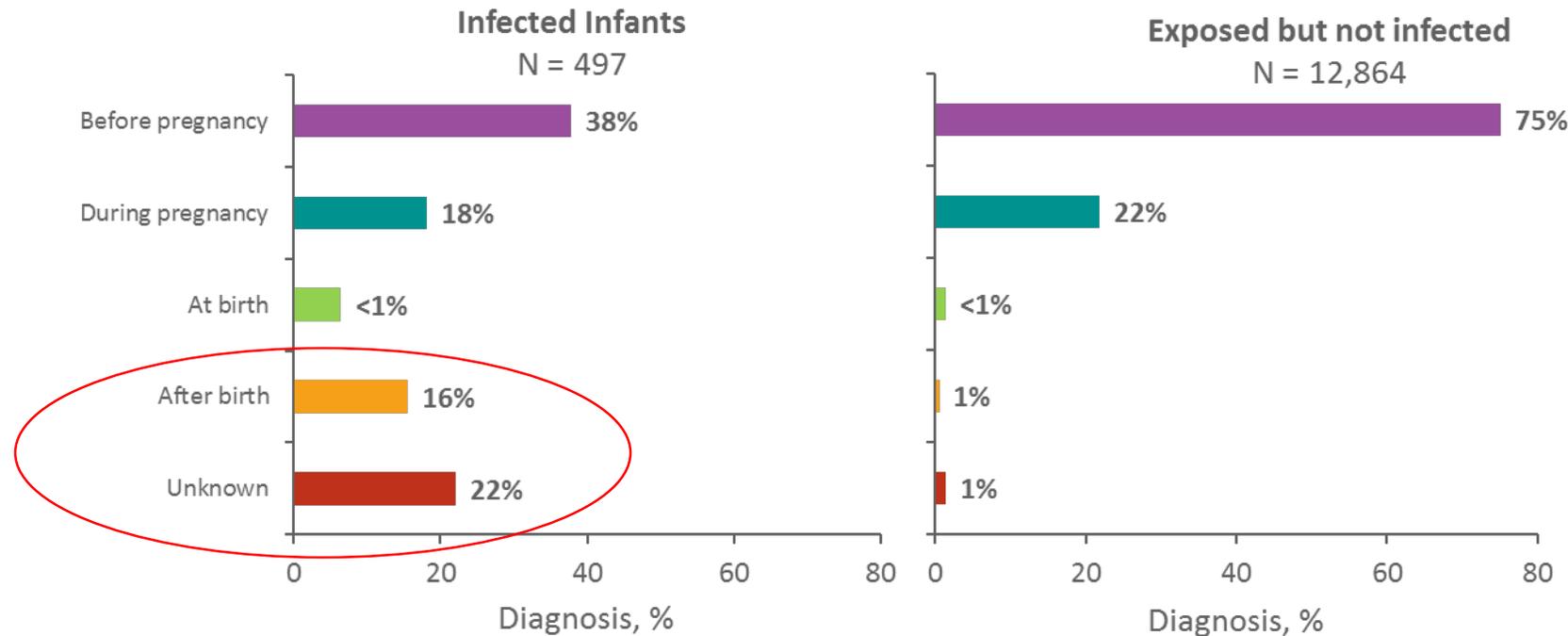
Risk of Perinatal Transmission Decreased



Wade, et al. 1998 NEJM 339;1409-14
 Guay, et al. 1999 Lancet 354;795-802
 Fiscus, et al. 2002 Ped Inf Dis J 21;664-668
 Moodley, et al. 2003 JID 167;725-735
 Nielsen-Saines, et al NEJM 21;366(25):2368-79
 Fowler, Mofenson, Taha. N Engl J Med. 2017



Time of Maternal HIV Testing among Children with Diagnosed Perinatally Acquired HIV Infection and Children Exposed to HIV, Birth Years 2009–2013—United States and Puerto Rico



Note. Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis.

FDA Approval of HIV Medicines

Fixed Dose Combinations (FDC)

Partial regimen

Complete regimen

'80-'84	1981 First AIDS cases reported in United States			
'85-'89	1987 * Zidovudine (NRTI)			
'90-'94	1991 Didanosine (NRTI)	1992 Zalcitabine (NRTI)	1994 * Stavudine (NRTI)	
'95-'99	1995 * Lamivudine (NRTI) Saquinavir (PI)	1996 * Indinavir (PI) Nevirapine (NNRTI) Ritonavir (PI)	1997 Combivir (FDC) Delavirdine (NNRTI) Nelfinavir (PI)	1998 * Abacavir (NRTI) Efavirenz (NNRTI)
'00-'04	2000 Didanosine EC (NRTI) Kaletra (FDC) Trizivir (FDC)	2001 * Tenofovir DF (NRTI)	2003 Atazanavir (PI)* Emtricitabine (NRTI) Enfuvirtide (FI) Fosamprenavir (PI)	2004 Epzicom (FDC) Truvada (FDC)
'05-'09	2005 Tipranavir (PI)	2006 Atripla (FDC) Darunavir (PI)*	2007 Maraviroc (EI) Raltegravir (INSTI)*	2008 Etravirine (NNRTI)*
'10-'14	2011 Complera (FDC) Nevirapine XR (NNRTI)* Rilpivirine (NNRTI)	2012 Stribild (FDC)*	2013 Dolutegravir (INSTI)*	2014 Cobicistat (PE) Elvitegravir (INSTI) Triumeq (FDC)
'15-'16	2015 Evotaz (FDC) Genvoya (FDC)* Prezcobix (FDC)	2016 Descovy (FDC) Odefsey (FDC)	2017	2018 Raltegravir (Isentress HD)

Needs:

- Pediatric PK studies
- Access to FDA-approved agents
- Combination pills
- Suitable formulations
- Agents for highly treatment experienced children



*pediatric studies

Drug Class Abbreviations:

EI: Entry Inhibitor; **FDC:** Fixed-Dose Combination; **FI:** Fusion Inhibitor; **INSTI:** Integrase Inhibitor; **NNRTI:** Non-Nucleoside Reverse Transcriptase Inhibitor; **NRTI:** Nucleoside Reverse Transcriptase Inhibitor; **PE:** Pharmacokinetic Enhancer; **PI:** Protease Inhibitor

Note: Drugs in gray are no longer recommended for use in the United States by the HHS HIV/AIDS medical practice guidelines.



Juluca
dolutegravir 50mg/
raltegravir 25mg tablets



Raltegravir (Isentress HD)



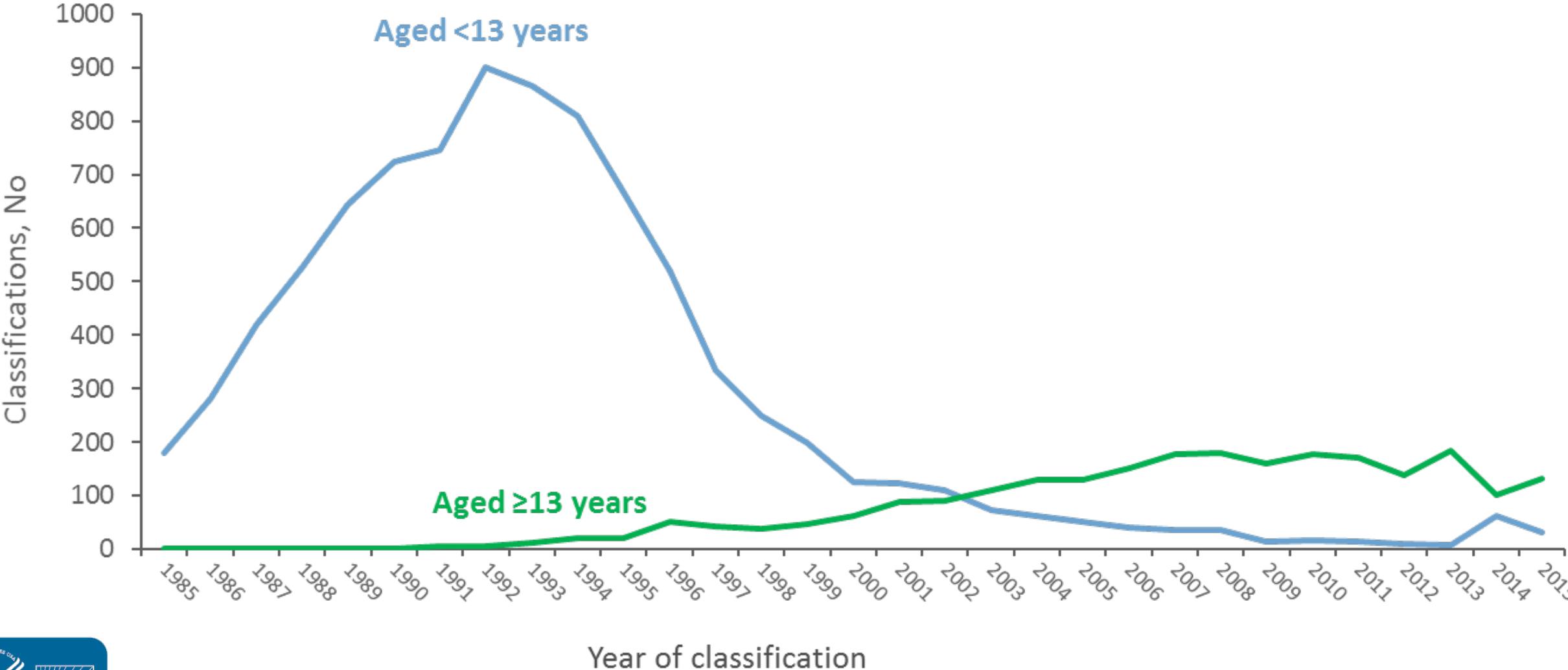
Prevention of illness

- Optimization of OI prophylaxis
- Improve ab responses to vaccination
 - HPV
 - HBV
 - Meningococcus
 - Influenza
 - Rotavirus
 - RSV

Vaccine	Age											
	Birth	1 mo	2 mos	4 mos	6 mos	12 mos	15 mos	18 mos	24 mos	4-6 yrs	11-12 yrs	14-16 yrs
Recommendations for these vaccines are the same as those for immunocompetent children												
Hepatitis B [†]	Hep B1										Hep B	
		Hep B2			Hep B3							
DTaP [§]			DTaP	DTaP	DTaP			DTaP			DTaP	Td
<i>Haemophilus influenzae</i> type b [¶]			Hib	Hib	Hib		Hib					
Inactivated polio ^{**}			IPV	IPV	IPV					IPV		
Hepatitis A ^{††}										Hep A in selected areas		
Recommendations for these vaccines differ from those for immunocompetent children												
Pneumococcus ^{§§}			PCV	PCV	PCV		PCV			PPV23	PPV23 (age 5-7 yrs)	
MMR ^{¶¶¶}							MMR			MMR	MMR	
Do not administer to severely immunosuppressed (Category 3) children												
Varicella ^{***}							Var	Var				Var
Administer only to asymptomatic nonimmunosuppressed (Category 1) children; contraindicated for all other HIV-infected children												
Influenza (inactivated) ^{†††}							A dose is recommended every year					
Live influenza vaccine should not be given to HIV-infected patients												

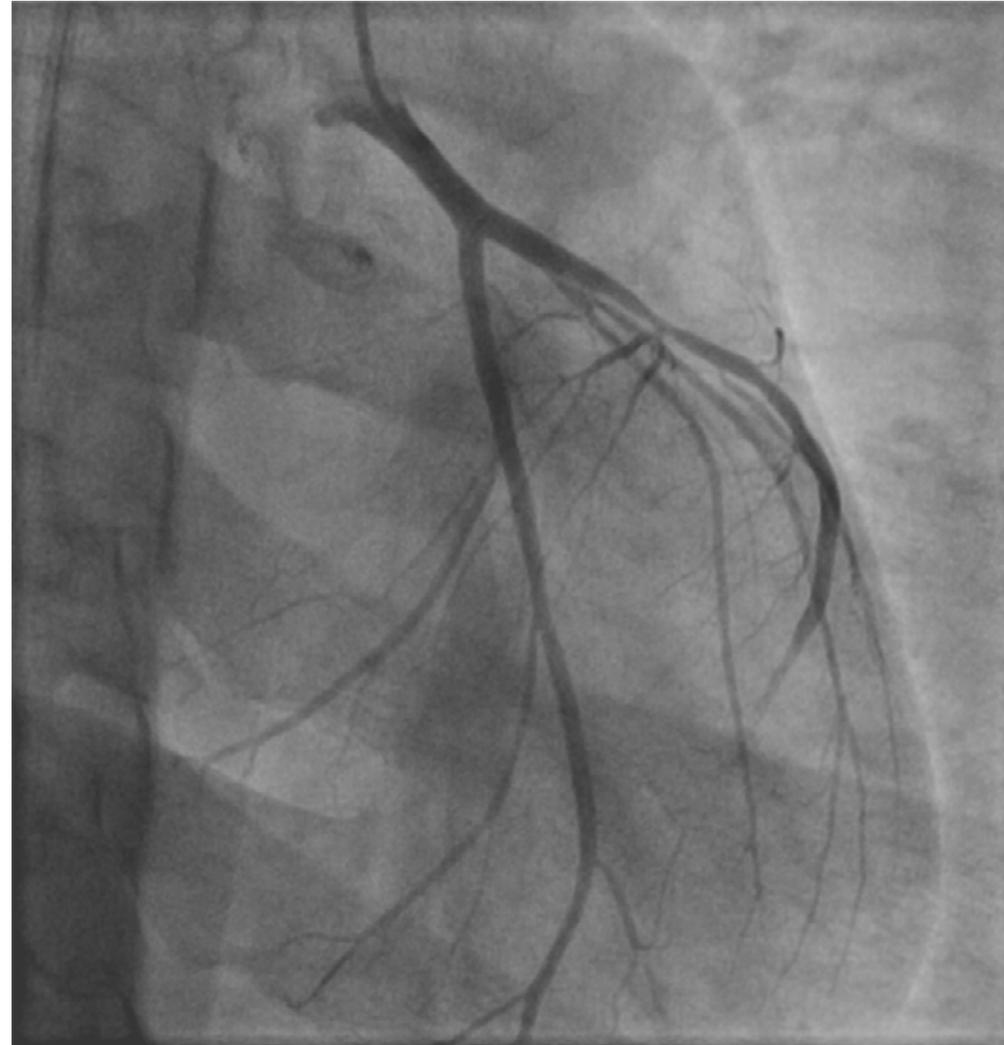
Range of recommended ages for vaccination
 Recommended in selected states or regions
 Vaccines to be administered if previously recommended doses were missed or were administered at other than the recommended minimum age

Stage 3 (AIDS) Classifications among Persons with Perinatally Acquired HIV Infection, 1985–2015—United States and 6 Dependent Areas



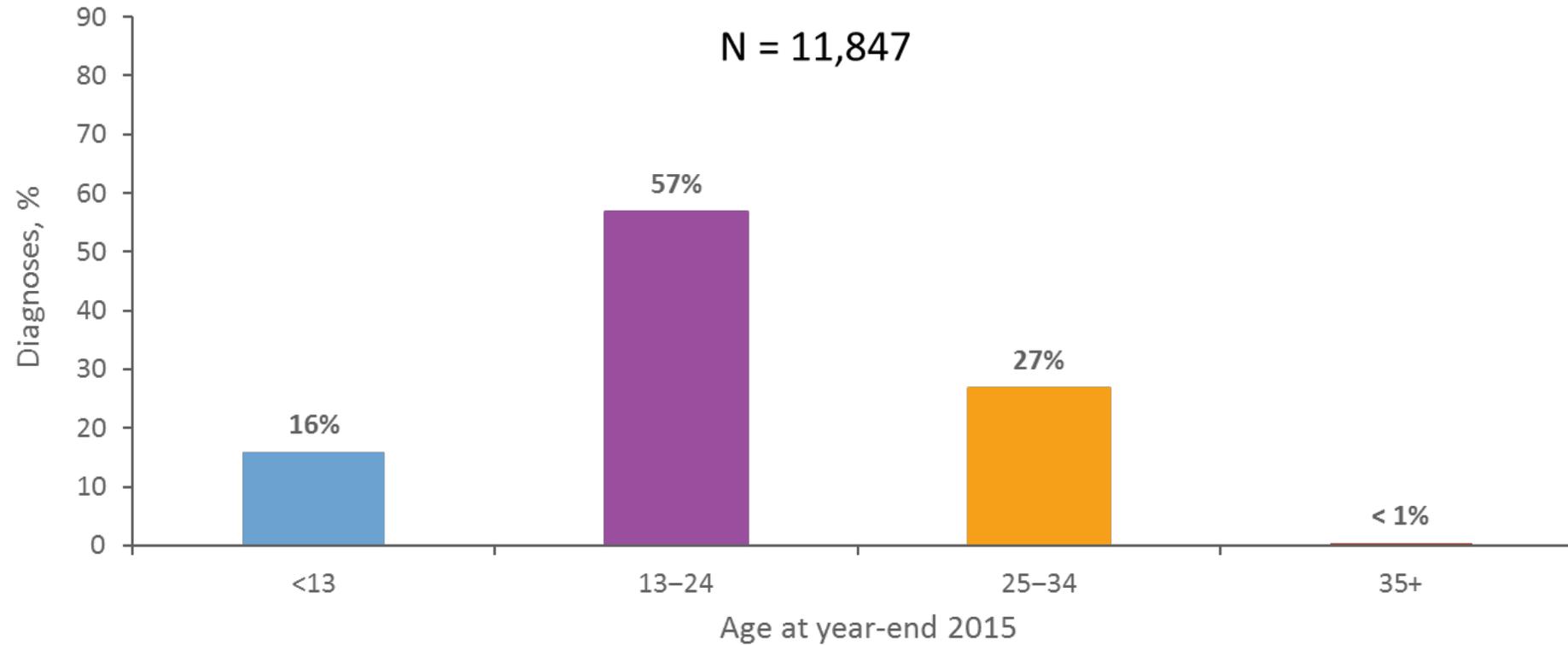
Long-term Morbidity of HIV and/or ART

- Cardiovascular disease
- Malignancy
- Medication side effects:
 - Kidney, bone, liver
- Metabolic abnormalities:
 - mitochondrial toxicity
 - lipodystrophy
 - lipoatrophy
- Longstanding inflammation
- CNS abnormalities
 - strokes, cognitive effects, mental health
- Unknown?
 - Consequences of lifelong ART?
 - Consequences of lifelong HIV?

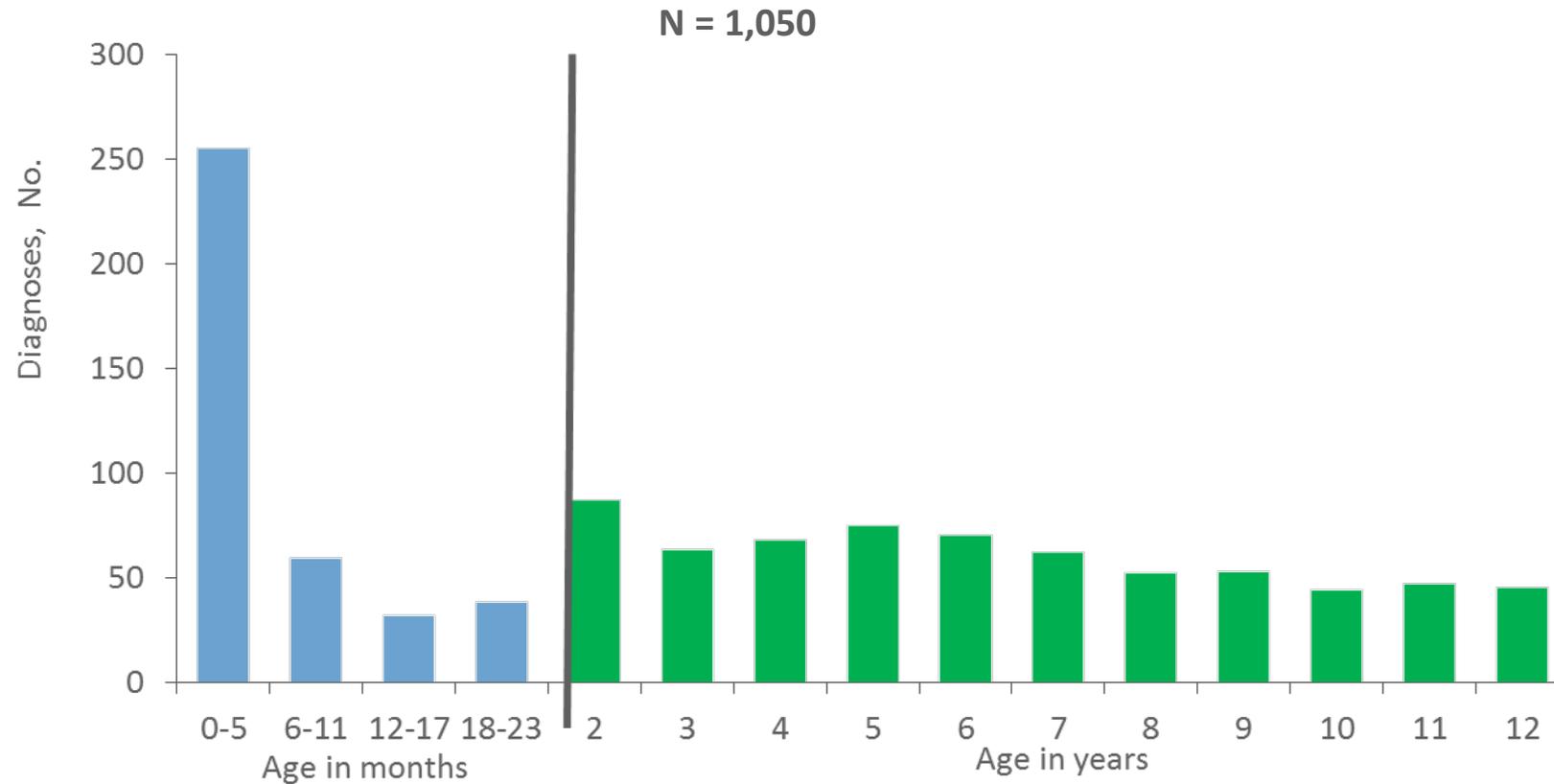


Hazra R et al.; Griffith D et al OFID 2017, Izbudak AJNR 2013, Venkataramani M AIDS Pt Care STDs 2010.

Age Distribution of Persons Living with Diagnosed Perinatally Acquired HIV Infection, Year-end 2015—United States and 6 Dependent Areas

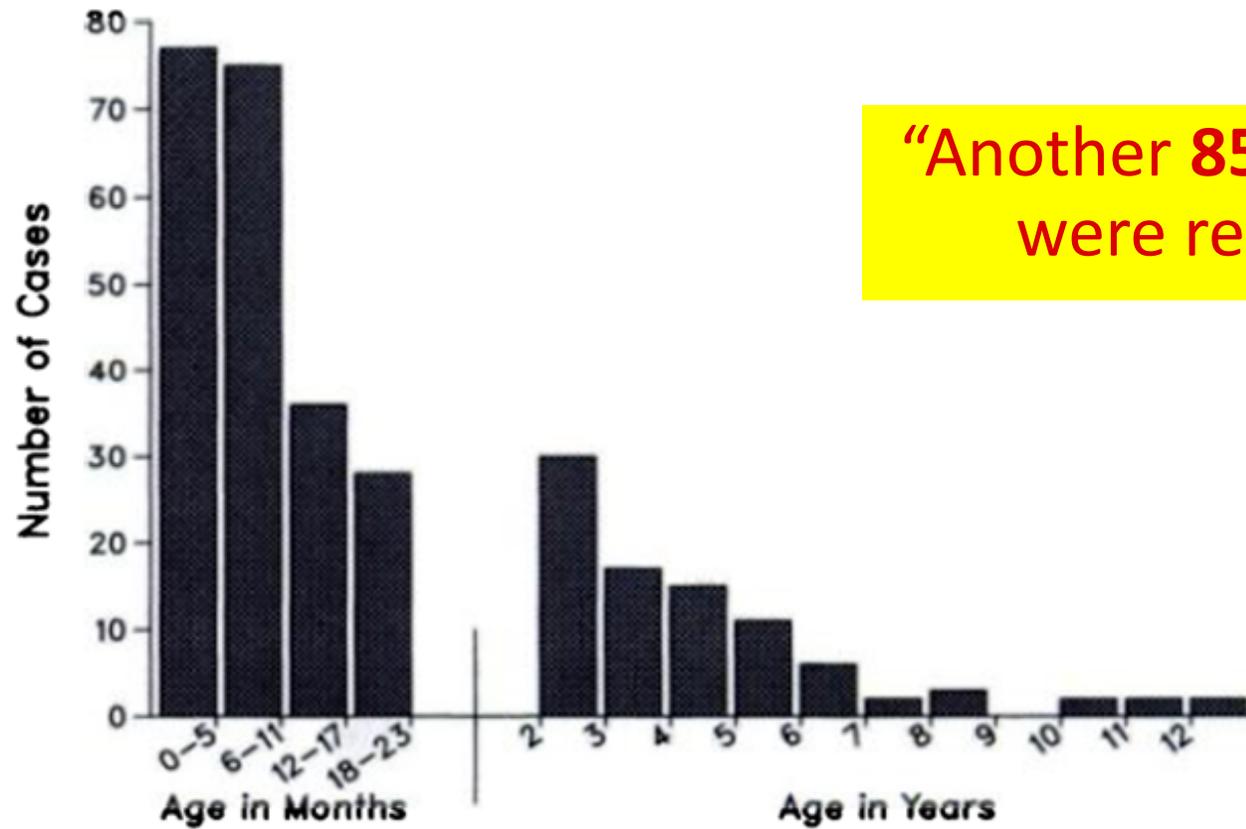


Diagnoses of HIV Infection among Children Aged <13 Years, by Age at Diagnosis, 2010–2014— United States and 6 Dependent Areas



Note. Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis.

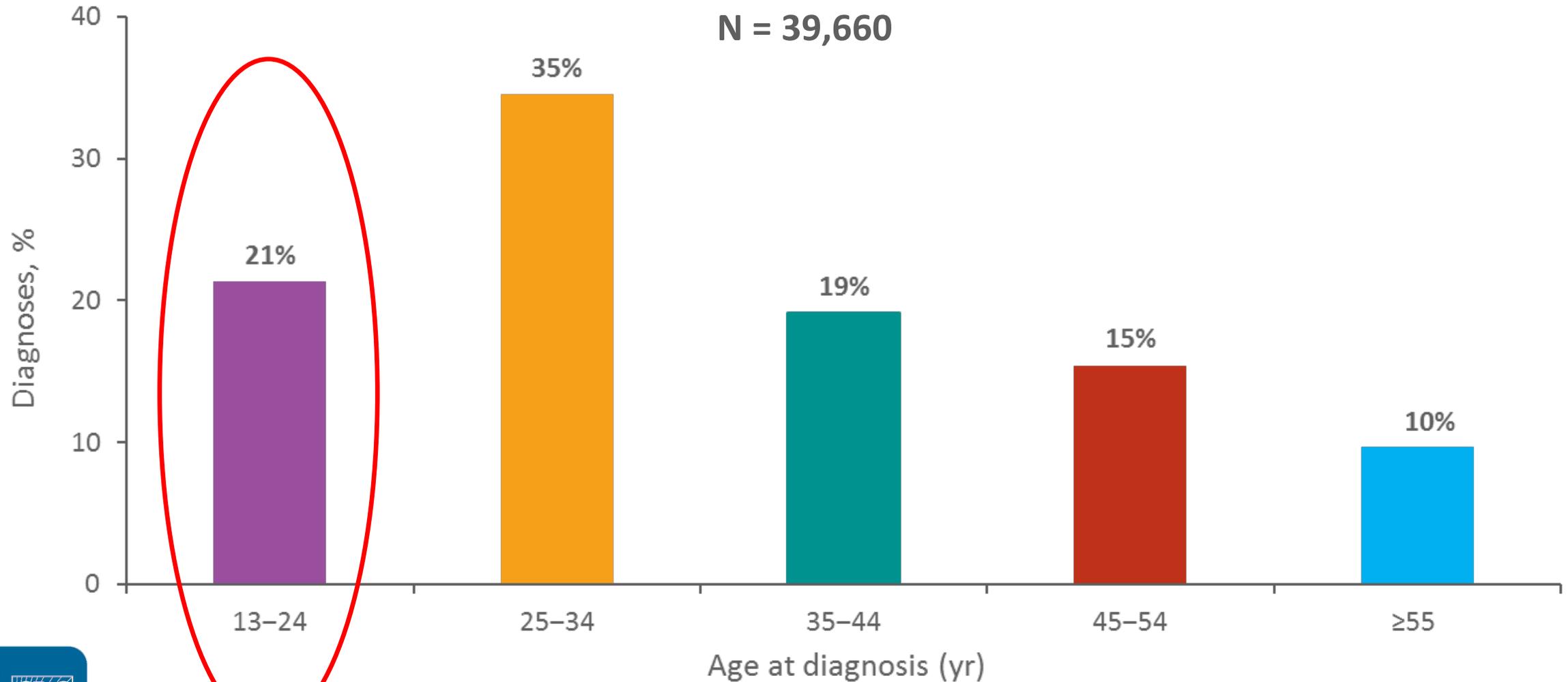
The First Pediatric Cases



“Another **85** cases (not reviewed here) were reported in adolescents.”

Fig 5. Pediatric AIDS cases by child’s age at diagnosis. Includes children younger than 13 years of age in whom AIDS was diagnosed as of Dec 31, 1985.

Diagnoses of HIV Infection among Adults and Adolescents by Age at Diagnosis, 2016—United States

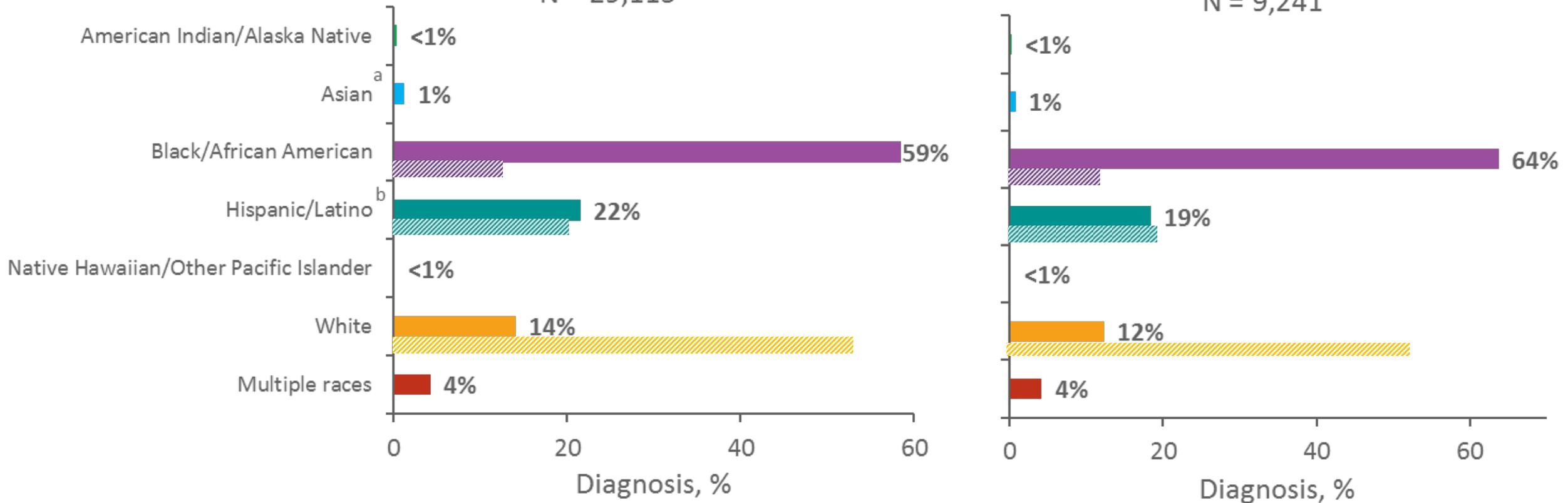


Note. Data for the year 2016 are preliminary and based on 6 months reporting delay.

Adolescents and Young Adults Aged 13–24 Years Living with Diagnosed HIV Infection, by Sex and Race/Ethnicity, Year-end 2014—United States and 6 Dependent Areas

Male
N = 29,115

Female
N = 9,241



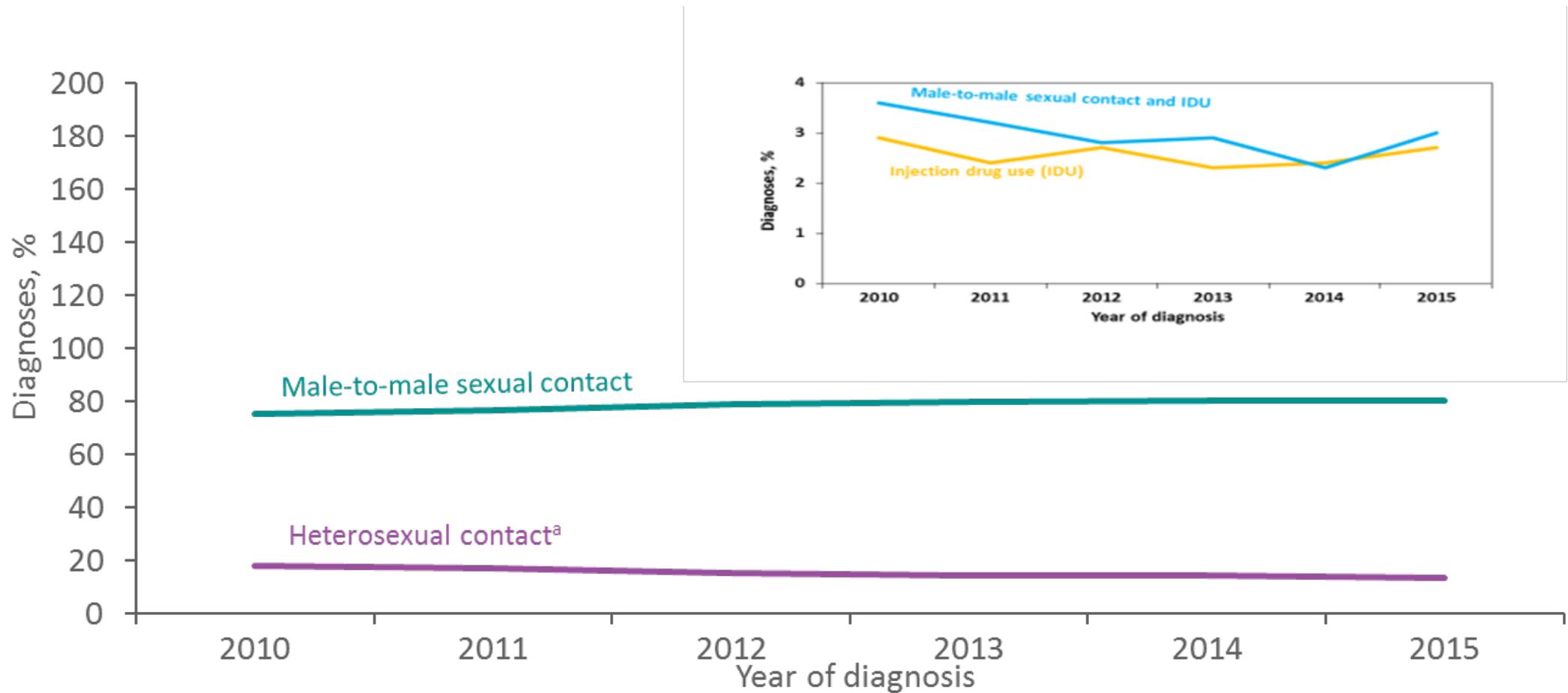
Note. Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis.

^a Includes Asian/Pacific Islander legacy cases.

^b Hispanics/Latinos can be of any race.



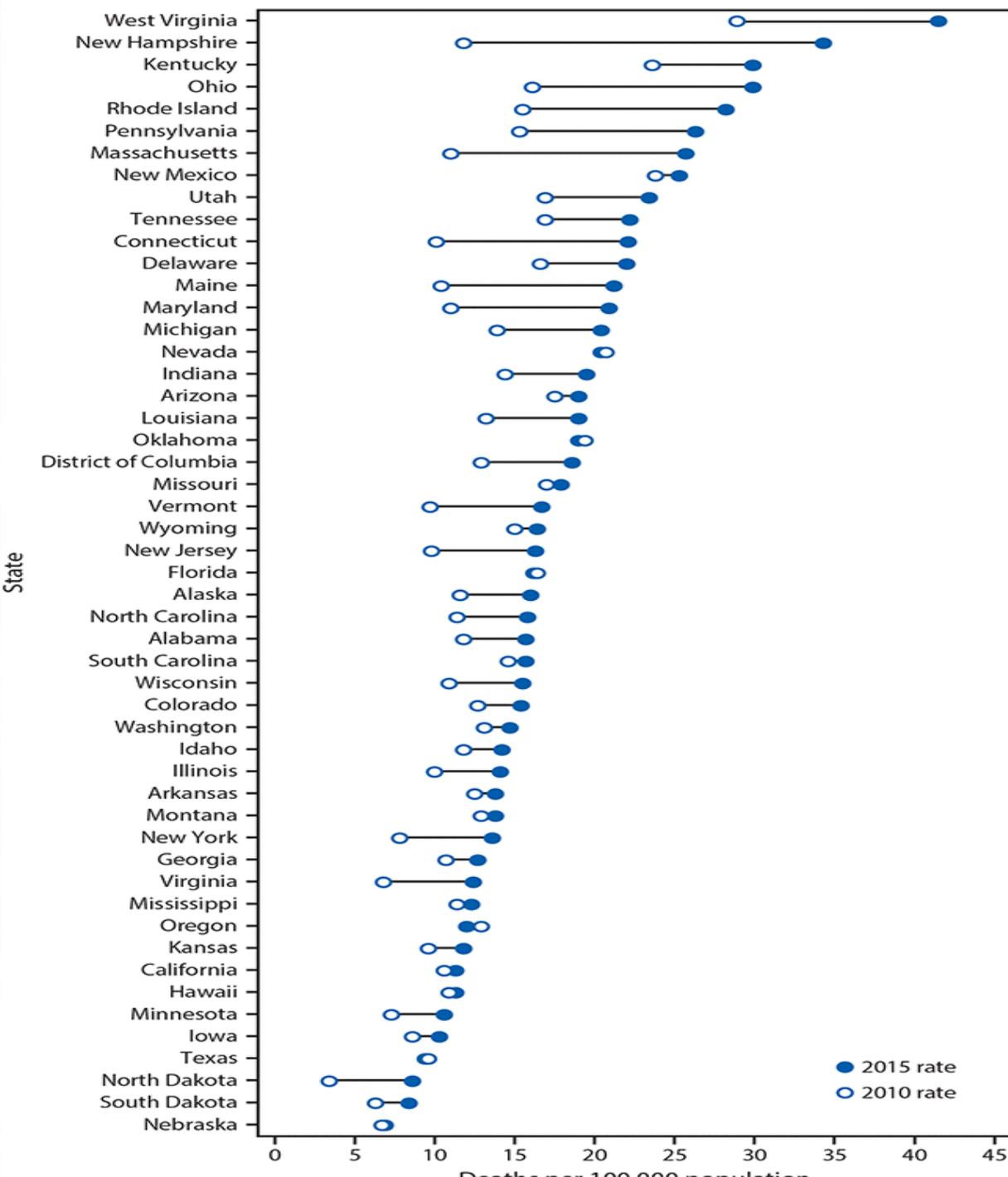
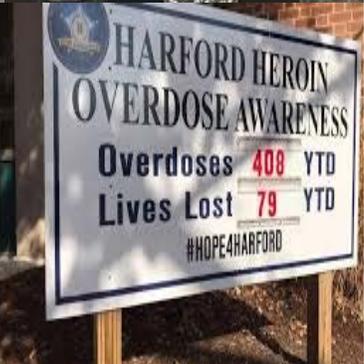
Diagnoses of HIV Infection among Adolescents and Young Adults Aged 13–24 Years, by Transmission Category, 2010–2015—United States and 6 Dependent Areas



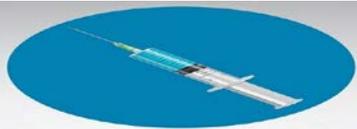
Note. Data have been statistically adjusted to account for missing transmission category. "Other" transmission category not displayed as it comprises less than 1% of cases.

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

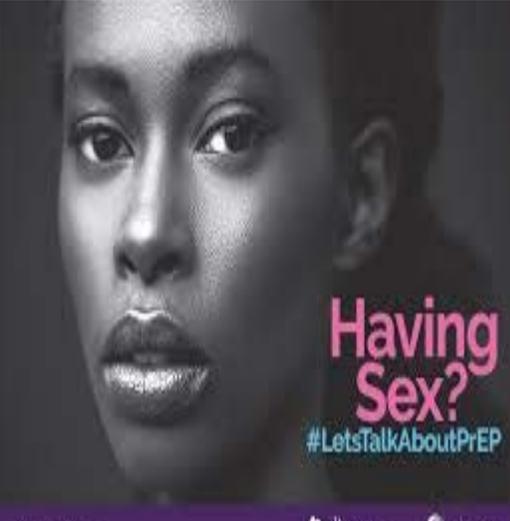




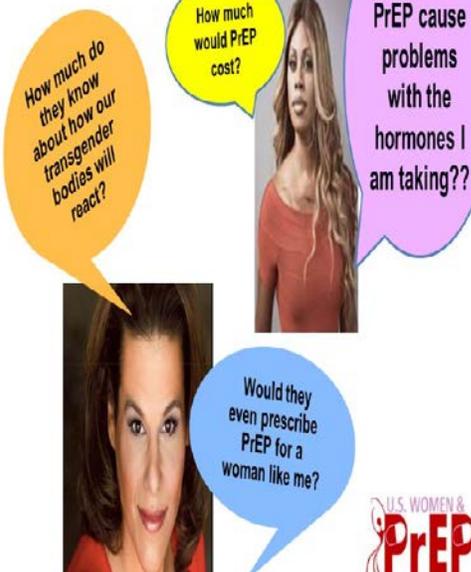
Prevention...

70%
Daily PrEP can reduce the risk of HIV infection among people who inject drugs by more than 70%.



When transgender women choose to take PrEP



How much do they know about how our transgender bodies will react?

How much would PrEP cost?

Will using PrEP cause problems with the hormones I am taking??

Would they even prescribe PrEP for a woman like me?

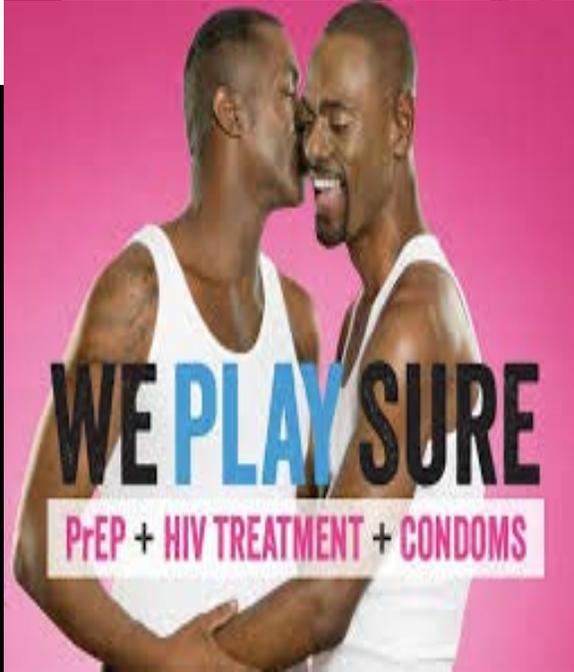
U.S. WOMEN & PrEP

HOW DO YOU DO IT?

PrEP CONDOMS UVL



GET INFORMED.
MAKE THE RIGHT CHOICE FOR YOU.

WE PLAY SURE
PrEP + HIV TREATMENT + CONDOMS

#PrEPForHer

DOMINATE *your sex life*

PrEP is a safe, daily pill that helps prevent HIV.
PrEP Find yours at PrEPForHer.com





Medical challenges

	Perinatal	Non-perinatal
<u>Disease</u>		
Advanced disease/immunosuppression	X	*
Co-morbidities [†]	X	*
Neurocognitive delay and dysfunction	X	*
Mental health (anxiety, depression, PTSD), substance use	X	X
Delayed puberty and short stature	X	
Suboptimal responses to vaccines	X	*
<u>Treatment</u>		
Treatment experienced	X	*
More complicated ART	X	*
Treatment fatigue	X	X
Drug-resistant virus	X	*



*some NPHIV youth

Psychosocial challenges

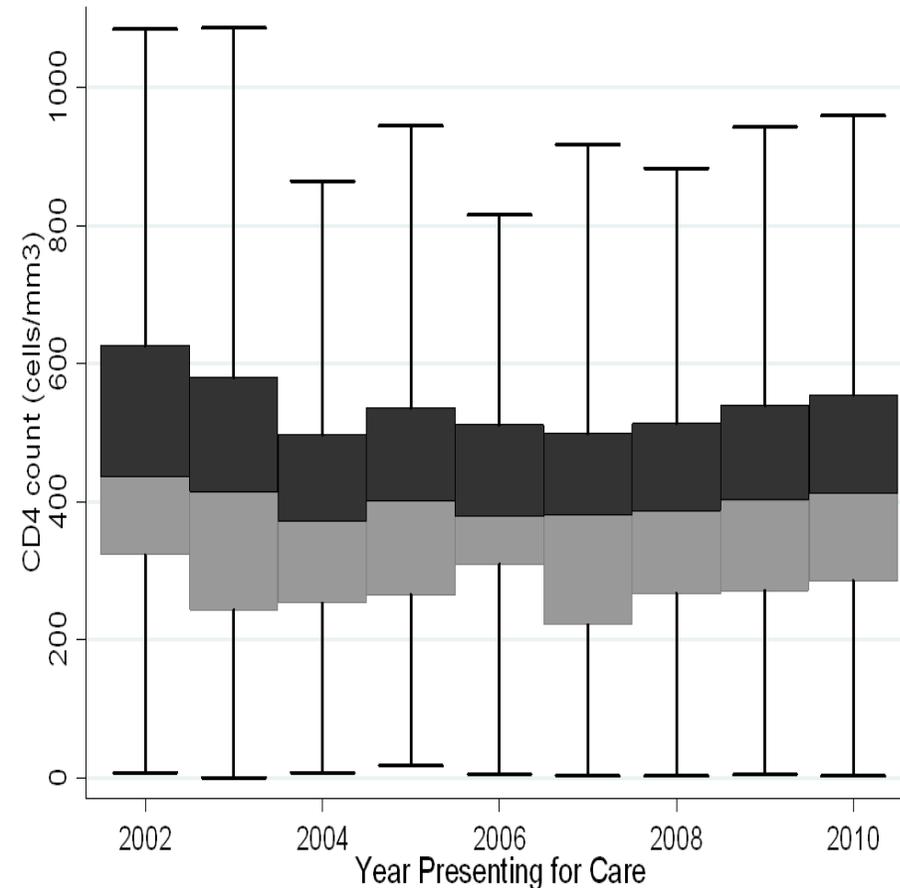
	Perinatal	Non-perinatal
Stigma (HIV, sexuality)	X	X
Disclosure (HIV, sexuality)	X	X
Limited support systems	X	X
Clinical staff may be only reliable support	X	X
Poor adjustment to illness/status, self efficacy, outcome expectancy	X	X
Denial/guilt	X	X
Limited health literacy	X	X
Logistic barriers: insurance, childcare, transportation, poverty, legal	X	X
Attempting to be “normal”	X	X



Clinical Observations → Research Questions

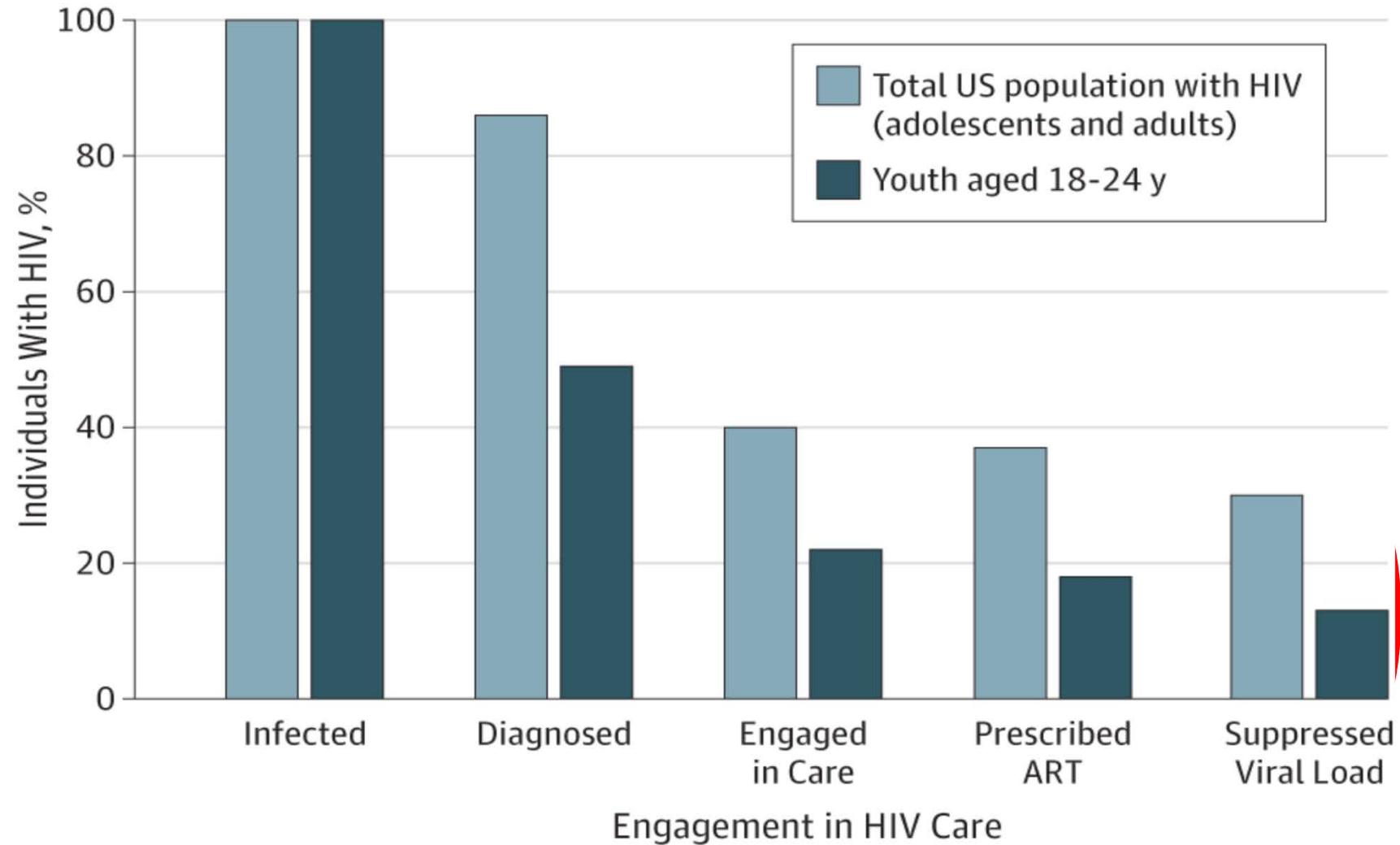
- Youth presenting with advanced HIV
- Youth less likely to initiate ART
 - CD4 recovery not better
- Providers reluctant to start ART
- Youth have worse outcomes
 - poor virologic suppression
 - continuing failing ART
 - ART discontinuation
 - high hospitalizations
 - Poor retention in care
- Youth do better in pediatric & adolescent vs. adult settings
 - Differences in how providers of varied training interact with youth

Median CD4 Counts of nPHIV-infected Youth



40% CD4 < 350; 20% CD4 < 200

Continuum of care for YHIV



“What are we missing?”



- Life is dynamic
- Adherence is hard & multifactorial
- Side effects
- Long term toxicity
- One size does not fit all
- Forever is a long time
- Fatigue
- Disclosure
- Stigma
- Mental health
- “I don’t want to be here?”

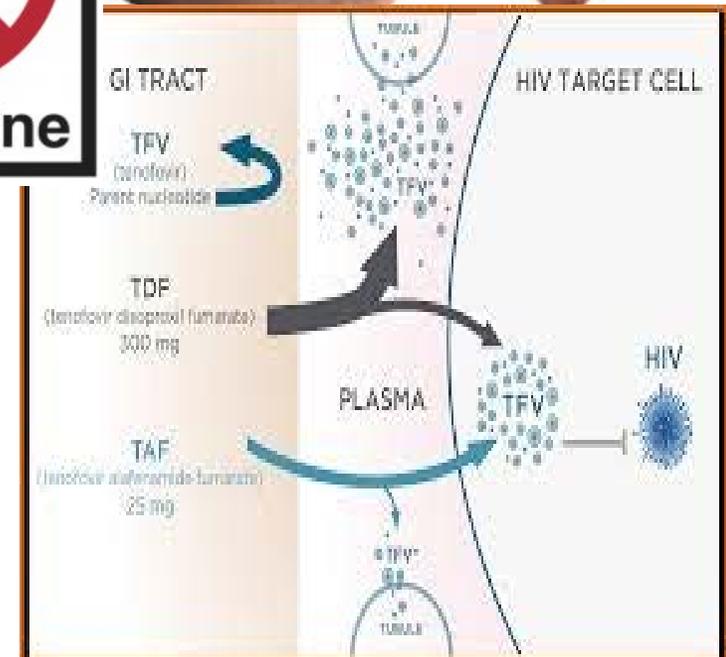


Choice
=
Power



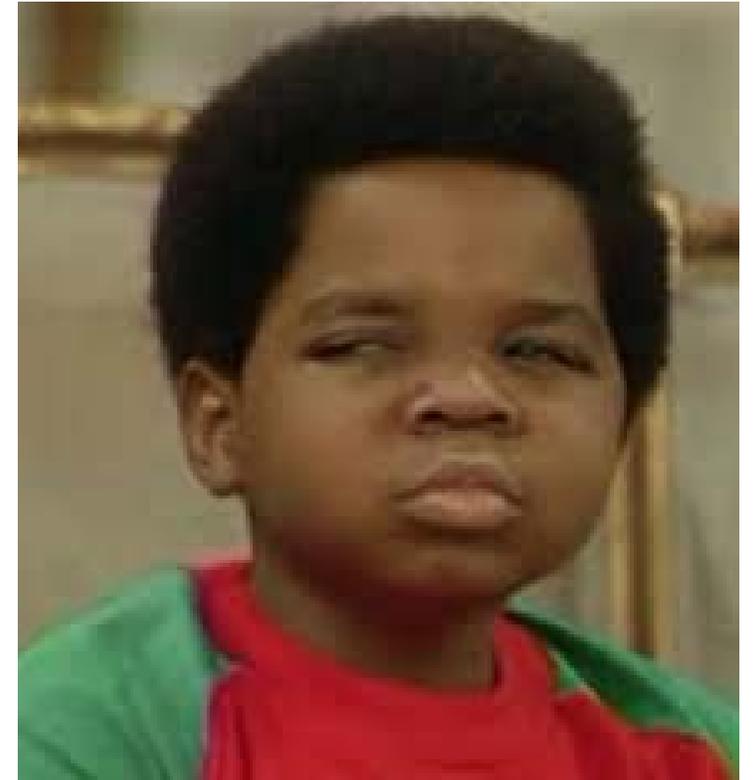
Simplifying treatment: better drugs

- Fewer pills
 - Combination pills
 - One-pill regimen options
 - Once daily options
- Smaller pill size
- More formulations
- More delivery options
- Better taste
- Higher barrier to resistance
- Fewer drug-drug interactions
- Fewer side effects
- Fewer dietary requirements
- More options for treatment-experienced individuals



Simplifying treatment: fewer agents?

- 2 drug regimens
- NRTI-sparing regimens
- Decreased drug interactions
 - Dolutegravir/rilpivirine (Juluca)
 - Non-inferior to 3-drug regimen
 - Dolutegravir/lamivudine
 - Adults: switch to 3TC/DTG → **no VF**, improved CD4, reduced cost
 - Pediatrics??



Simplifying treatment: are pills even needed?



Population: 309 treatment-naïve, HIV+

92% male; 15% AA, 79% White, median age 35, baseline CD4 489

Location: USA, Canada, Spain, France, and Germany

Meds: oral cabotegravir , rilpivirine, and abacavir

Intramuscular cabotegravir and rilpivirine (two 2 mL injections)- buttocks

Method:

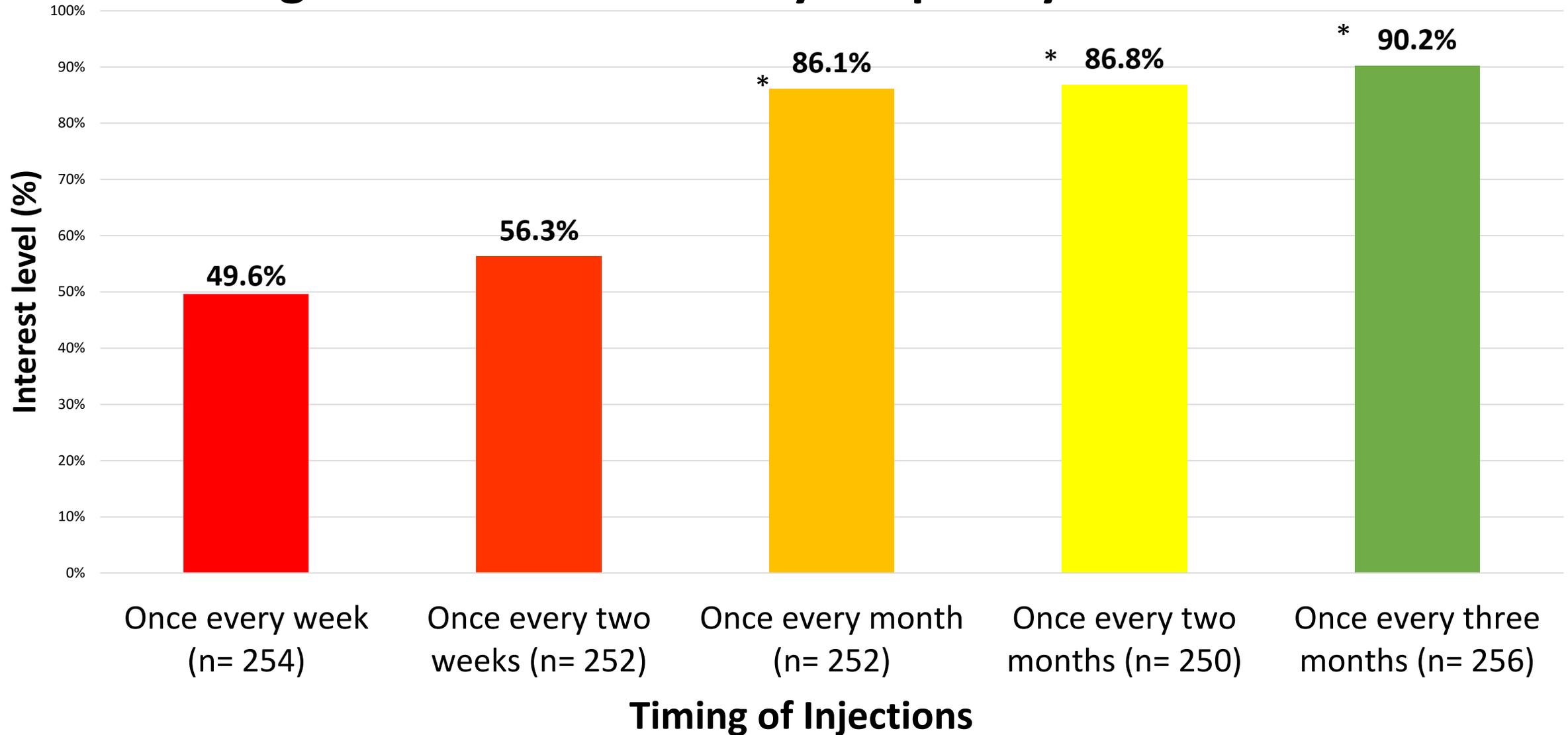
All start oral → suppress

→ continue oral cabotegravir/rilpivirine/abacavir

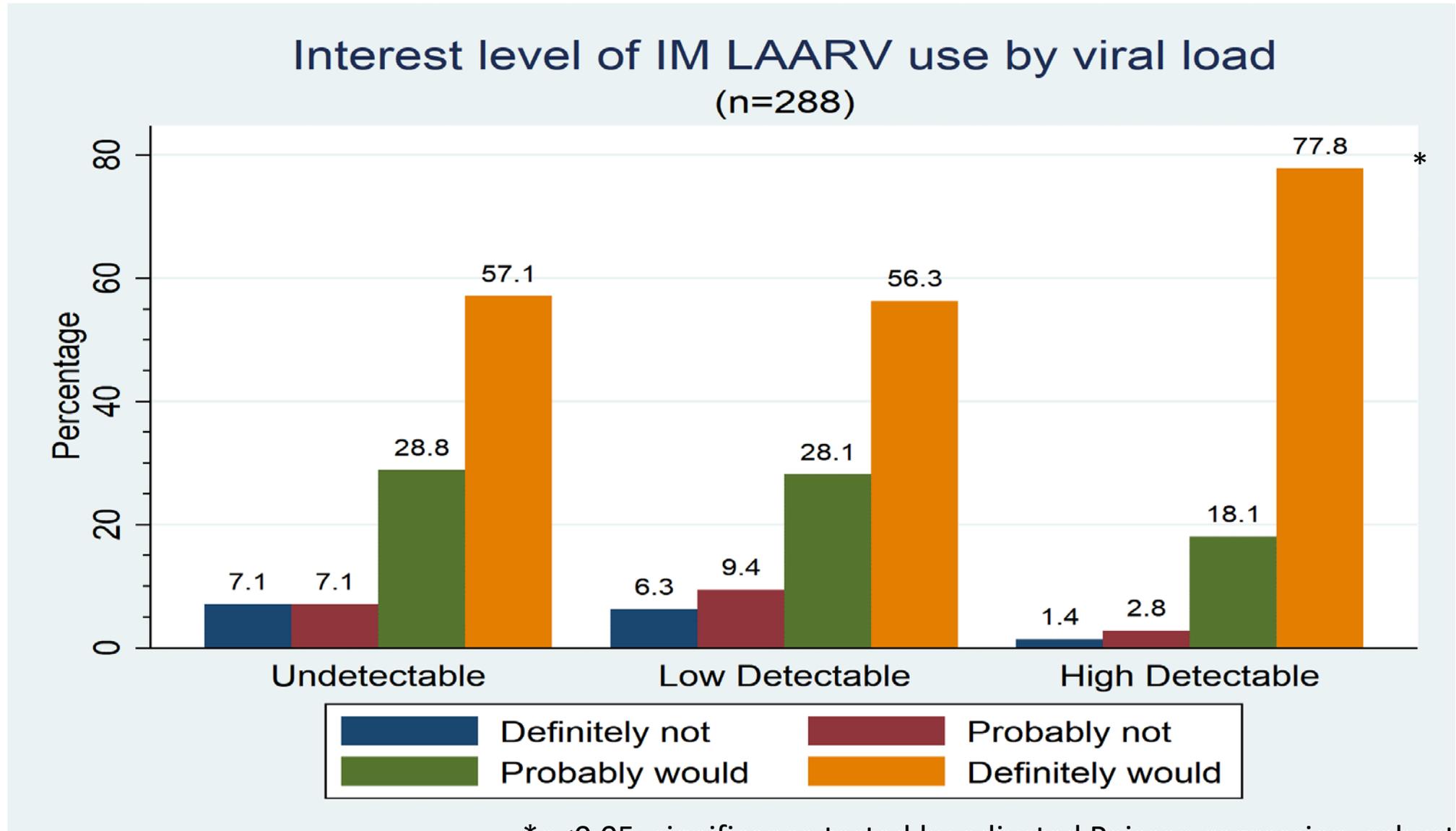
→ IM cabotegravir/rilpivirine every 4 weeks

→ IM cabotegravir/rilpivirine every 8 weeks

Youth willingness to use LA-ART by frequency of administration



Impact of non-adherence on interest among youth



* $p < 0.05$; significance tested by adjusted Poisson regression, robust variance

Development Pipeline for Long-Acting ART

➤ Cabotegravir & rilpivirine LA --Phase IIb

➤ FLAIR

➤ ATLAS

➤ HPTN 083

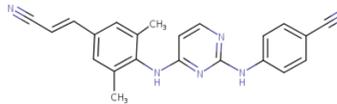
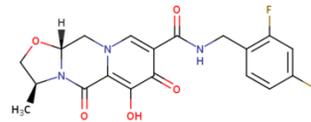
➤ HPTN 084

➤ ACTG 5359

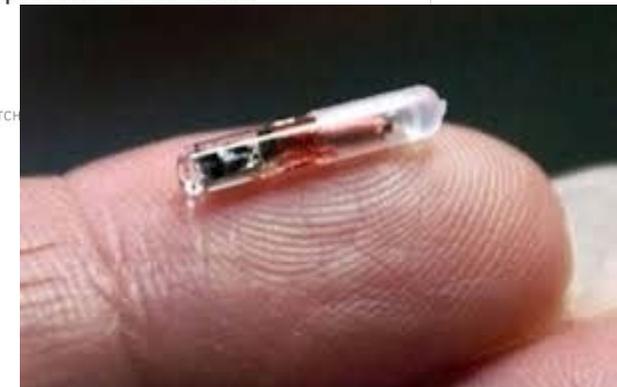
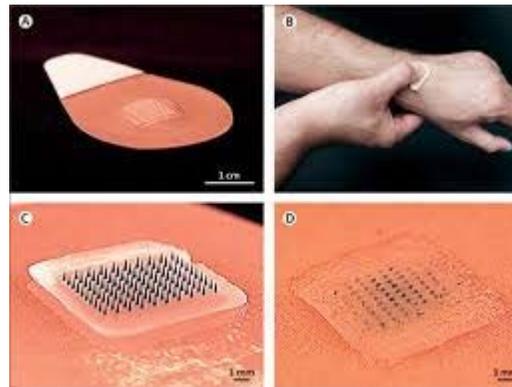
➤ IMPAACT 2017

➤ IMPAACT 2022*

➤ MK-8591 (EFdA)



An injectable combination therapy could replace oral medications and experts think it may improve adherence rates.



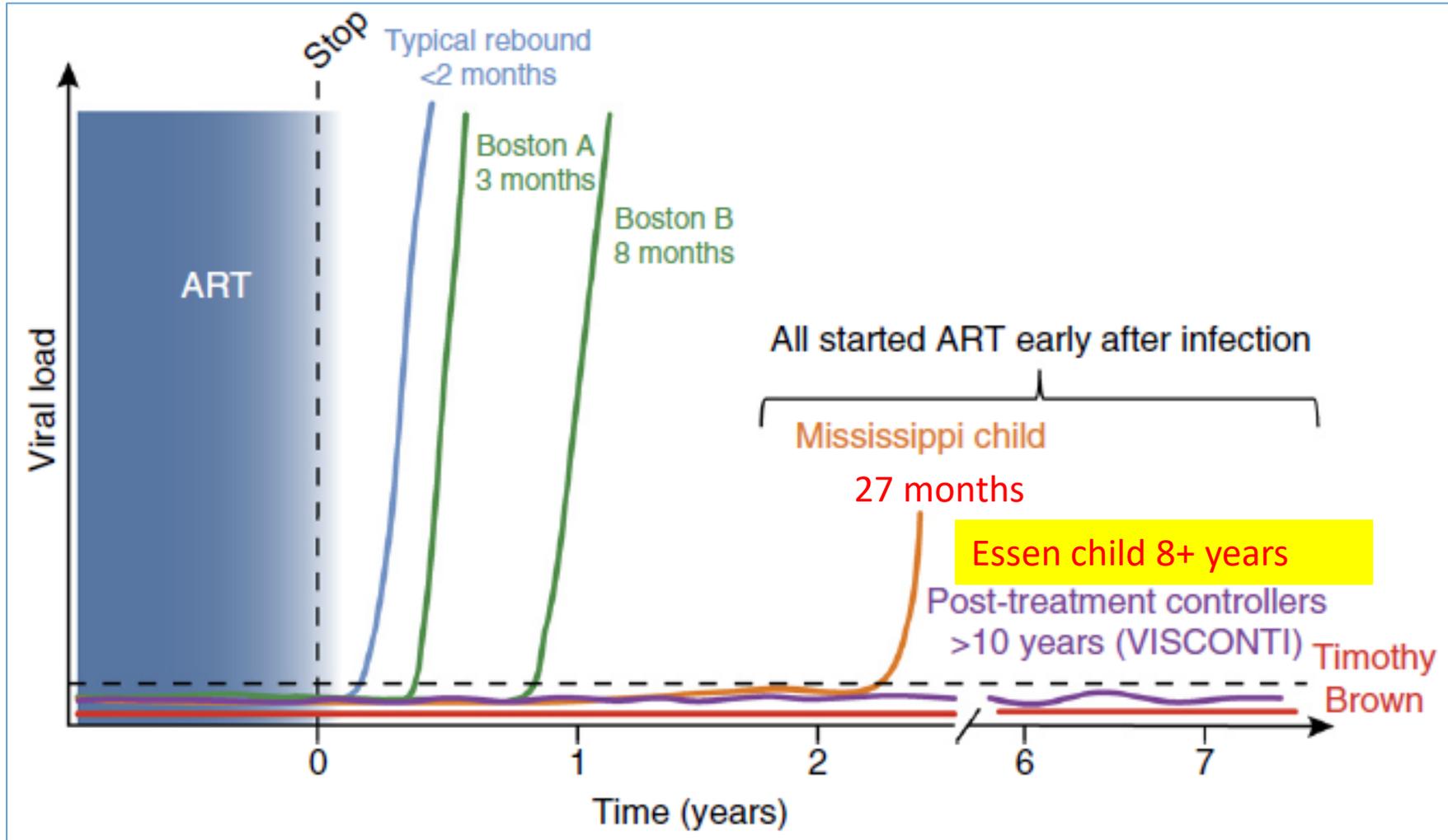
Beyond ART



“Forever is a long time”
Beyond viral suppression as a destination....



Outcome Measure to Detect HIV-1 Remission: Time to Viral Rebound



**VERY EARLY INTENSIVE TREATMENT OF HIV-INFECTED
INFANTS TO ACHIEVE HIV REMISSION: A PHASE I/II PROOF OF
CONCEPT STUDY**

A Multi-Center Trial of the
International Maternal Pediatric Adolescent AIDS
Clinical Trials Group (IMPAACT)

Sponsored by:

The National Institute of Allergy and Infectious Diseases (NIAID)
and
Eunice Kennedy Shriver
National Institute of Child Health and Human Development (NICHD)

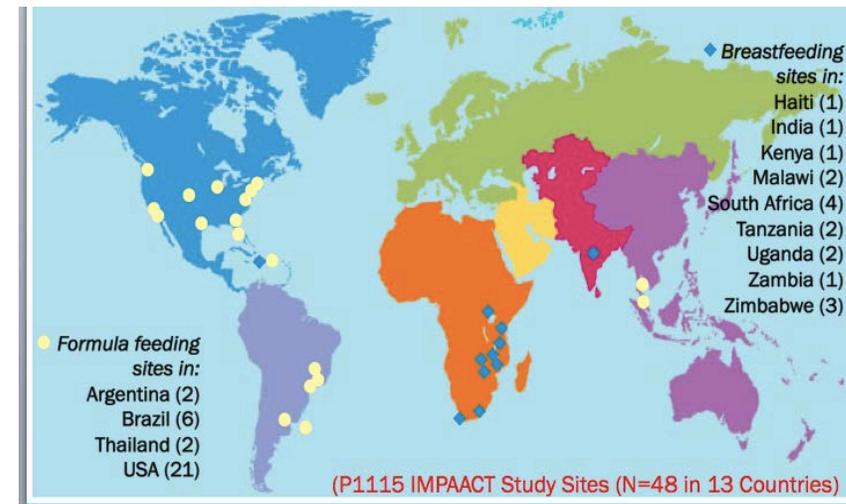
Pharmaceutical Support Provided by:

Merck Research Laboratories
National Institute of Allergy and Infectious Diseases Vaccine Research Center

DAIDS ES #11954
IND # TBA

IMPAACT CURE

Scientific Committee Chair:	Deborah Persaud, M.D.
Protocol Co-Chairs:	Yvonne Bryson, M.D. Ellen Chadwick, M.D.
Protocol Vice Chair:	Mark Cotton, <u>M.Med. FCPaed</u>
NIAID Medical Officer:	Patrick Jean-Philippe, M.D.
NICHD Medical Officer:	<u>Rohan Hazra, M.D.</u>
Clinical Trials Specialists:	Anne Coletti, M.S. Charlotte Perlowski, M.S.P.H.



48 clinical trial sites in 13 countries

October 2017:

Version 1:

- Step 1: Enrolled **440** mother-infant pairs
- Step 2: 34 infected infants (Cohort 1)
- Step 2: 18 infected infants (Cohort 1)
- Step 3: ART cessation to detect remission
- Step 4: Restart ART for viremic rebound

December 2017: Version 2

additional 445 mother-infant pairs
(ARVs +/- bNAbs)

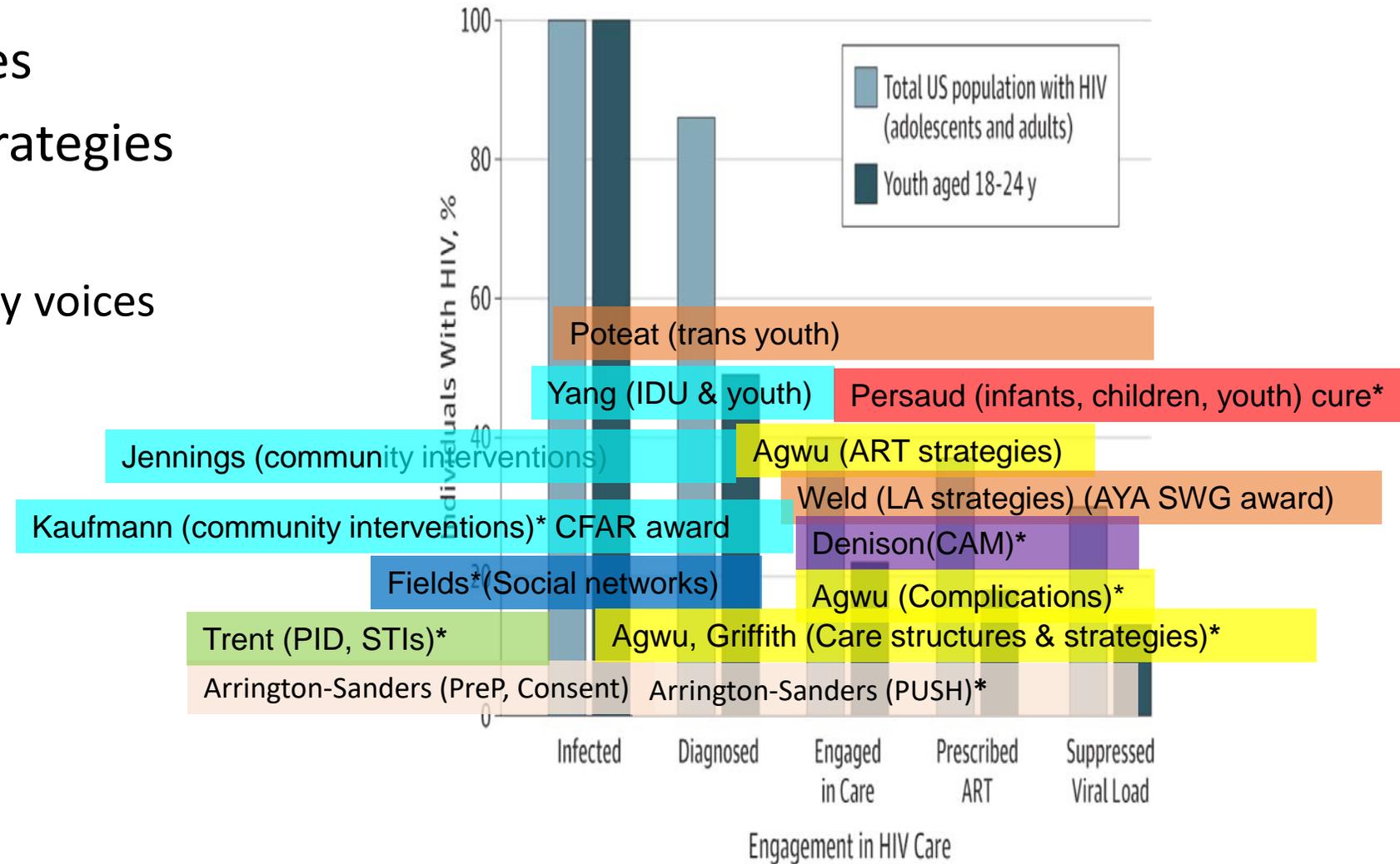
Where should the Science be moving?

- Multimodal strategies & approaches for treatment, prevention, remission
 - Biologics (e.g., monoclonal ab, activated T cells)
 - Other agents (e.g., latency reversing agents)
 - ART next gen (e.g., long-acting, different delivery modes)
- Predicting and addressing complications
 - Longitudinal cohorts, biomarkers, surrogates
- Behavioral and community interventions
 - Improved finding & targeting strategies
- Implementation science
- Optimizing care models
 - Rapid initiation
 - Alternative “venues” for care delivery
 - Tech
- Personalized medicine?
 - Proteonomics, Metabolomics, microbiome



Focusing on youth: JHU Projects and Initiatives

- Multidisciplinary approaches
- Multimodal, cross sector strategies
- Relevant & specific
 - Include youth and community voices
- Real world
- Creative & innovative
- Increased targeted funding
- Ethics & regulatory
- Advocacy & guidelines



*NIH-funded

Acknowledgements

Funding:



The Youth!!



ACE team

IPC/PAHAP

Bartlett Clinic (Keruly, Moore, Nolan)

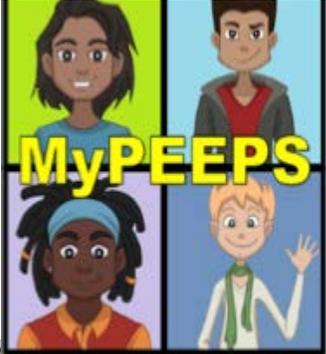
JHU HIV Clinical Research team (IMPAACT, ATN, Cure)

Trent, Persaud, Arrington-Sanders, Anderson, Collensen-Streng

Farmer, Griffith, Lee, Hsu, Weld



Gebo, Moore, Fleishman, Yehia, Berry, Gaur, Korthuis, Rutstein,
Voss, Monroe, co-investigators, sites, and participants



No assumption of HIV status should be made; f