The Global HIV/AIDS Epidemic, risk factors for transmission and Global response

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HIV Dept. July 2013

Data based in UNAIDS and WHO Global reports

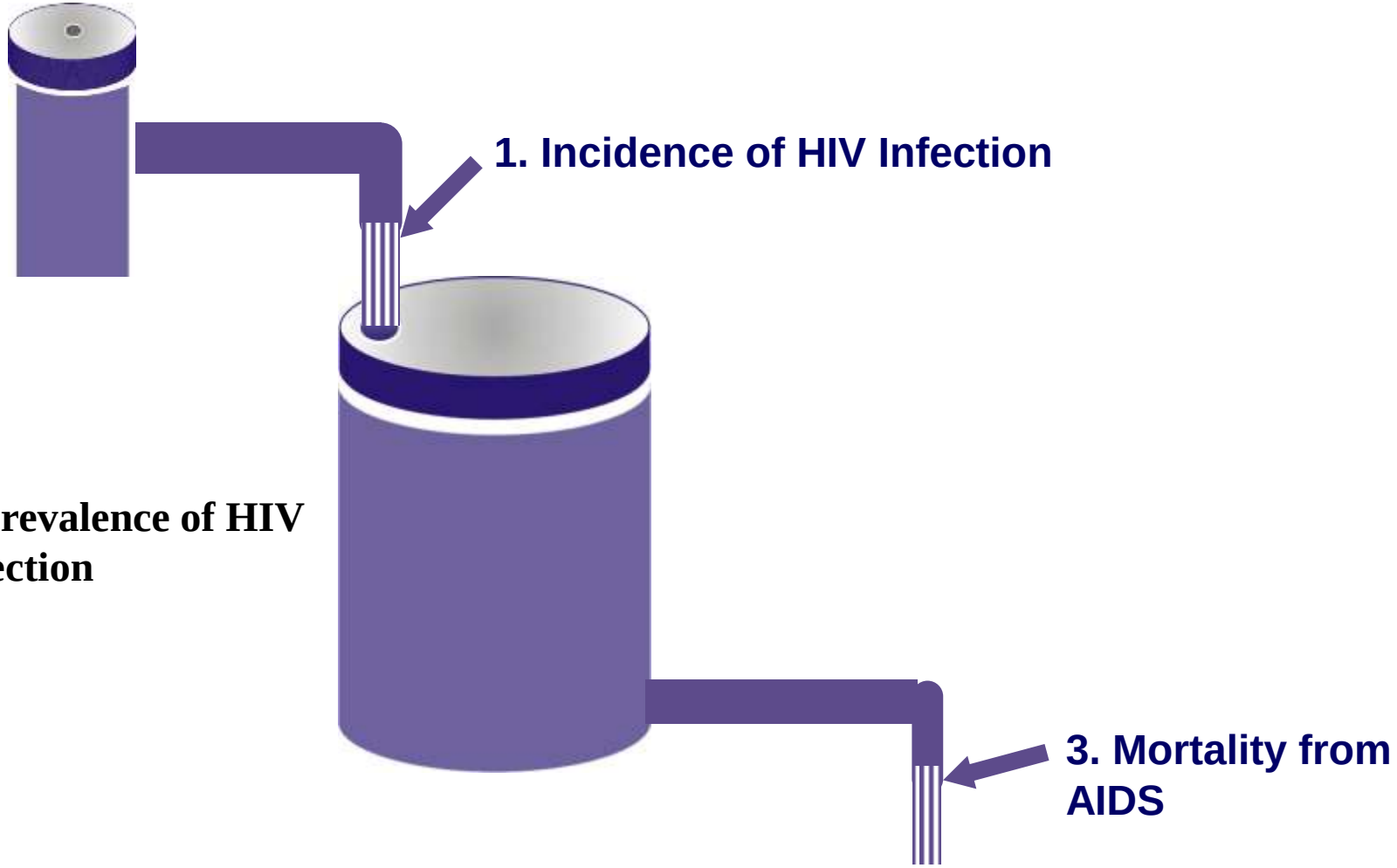
World Health Organization

Outline

- Basic concepts
- HIV transmission factors
- HIV surveillance and estimates
- HIV Prevention:
  - Male circumcision
  - Treatment as Prevention
- HIV treatment
- Conclusions

- Basic concepts

HIV epidemiology



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HIV incidence

- Incidence: Number of new HIV infections (number of people newly infected with HIV)

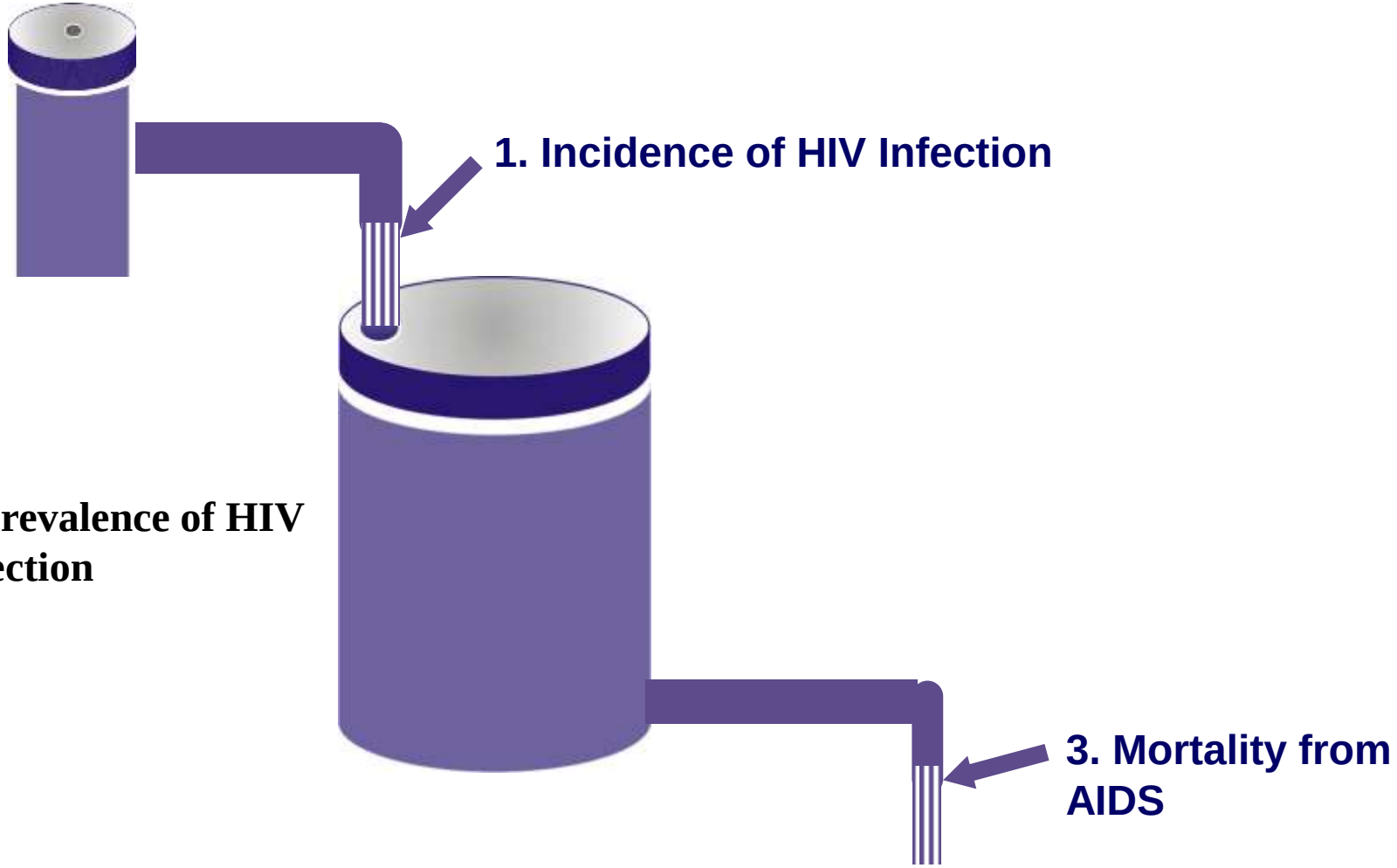
  usually per year

- Incidence rate: Rate of new HIV infections

  usually per 100 person-years

  usually per 100 susceptible persons [leaving out those already infected]

HIV epidemiology



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HIV prevalence

- Prevalence: Number of people with HIV infection

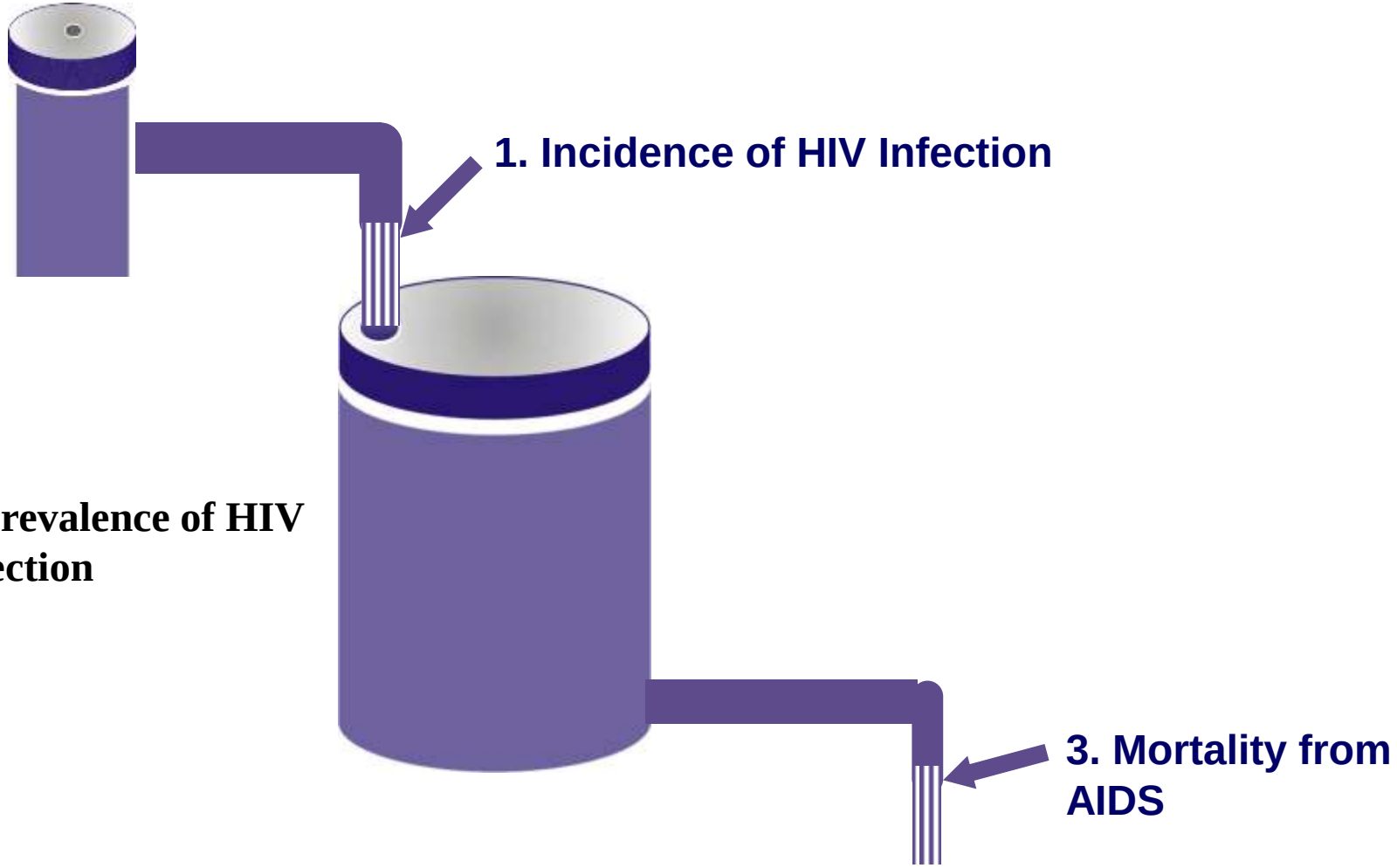
or "Number of people living with HIV - PLHIV"

usually per year

- Prevalence rate or Prevalence (%): Percentage of PLHIV per population

usually per 100 population

HIV epidemiology



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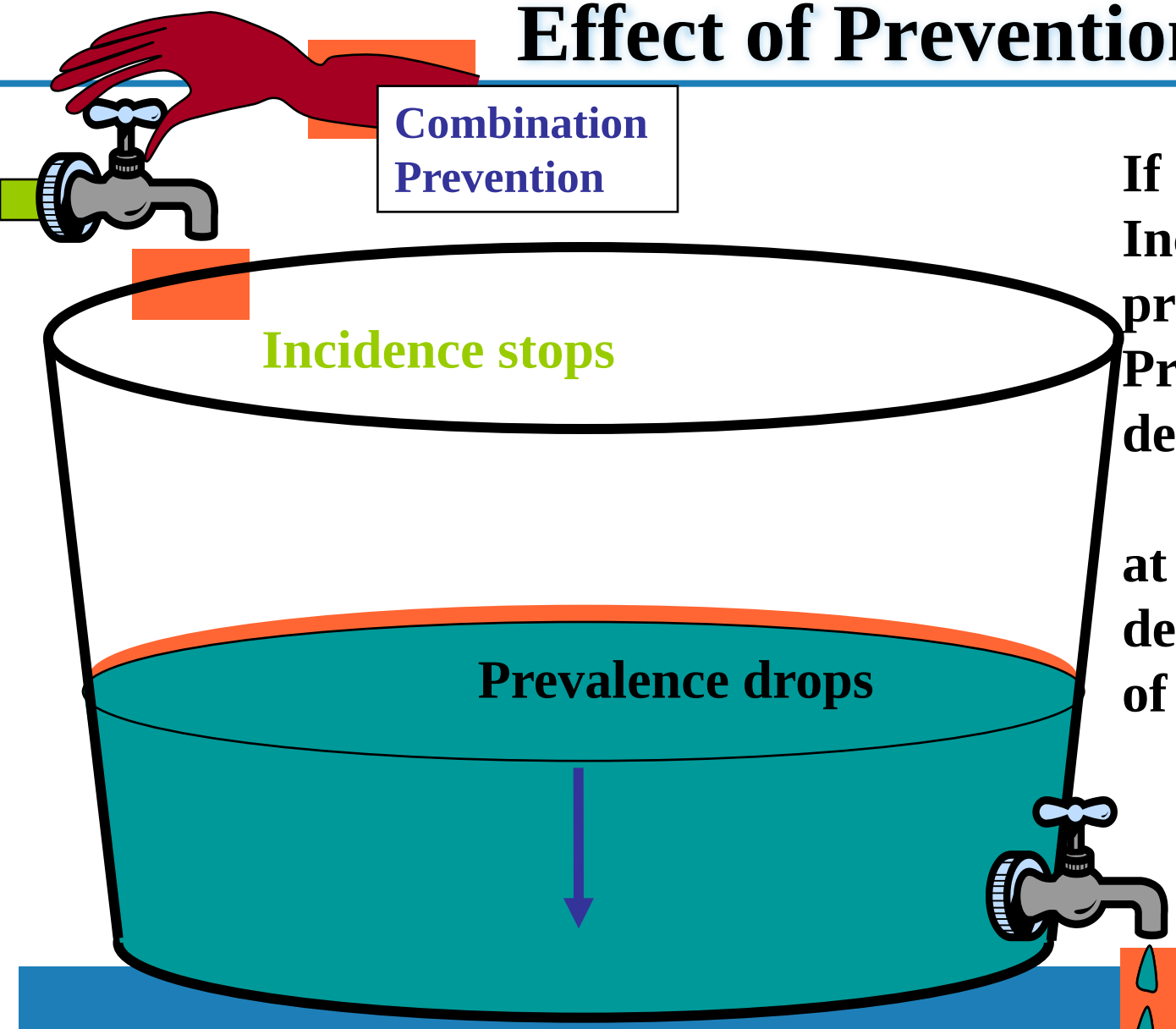
Effect of Prevention Only



If
Incident cases are prevented,
Prevalence will decline –

at a rate equal to the death rate
of infected people.

AIDS-related mortality

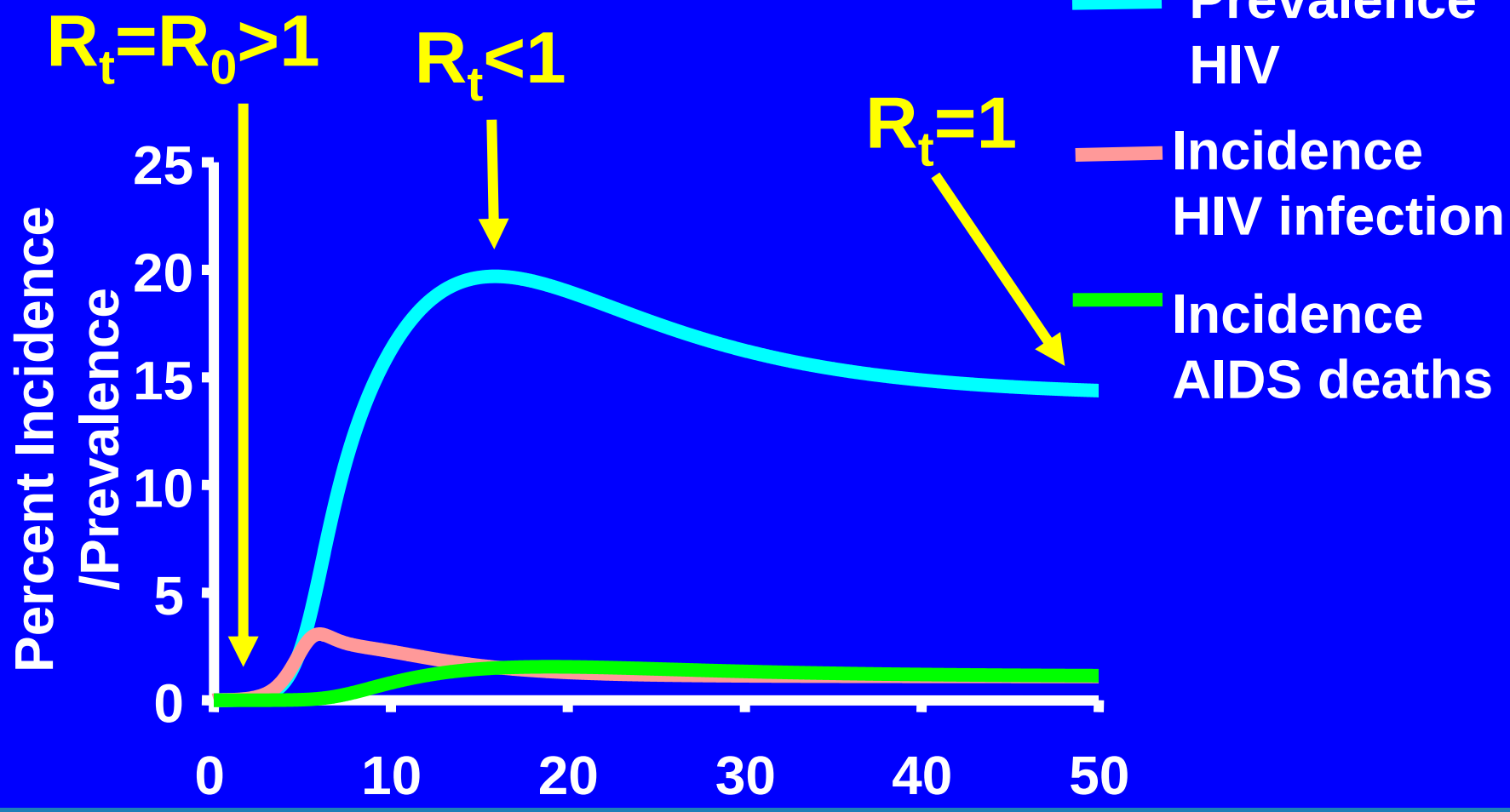
- Number of AIDS-related deaths

  usually per year
- AIDS-specific mortality rate:

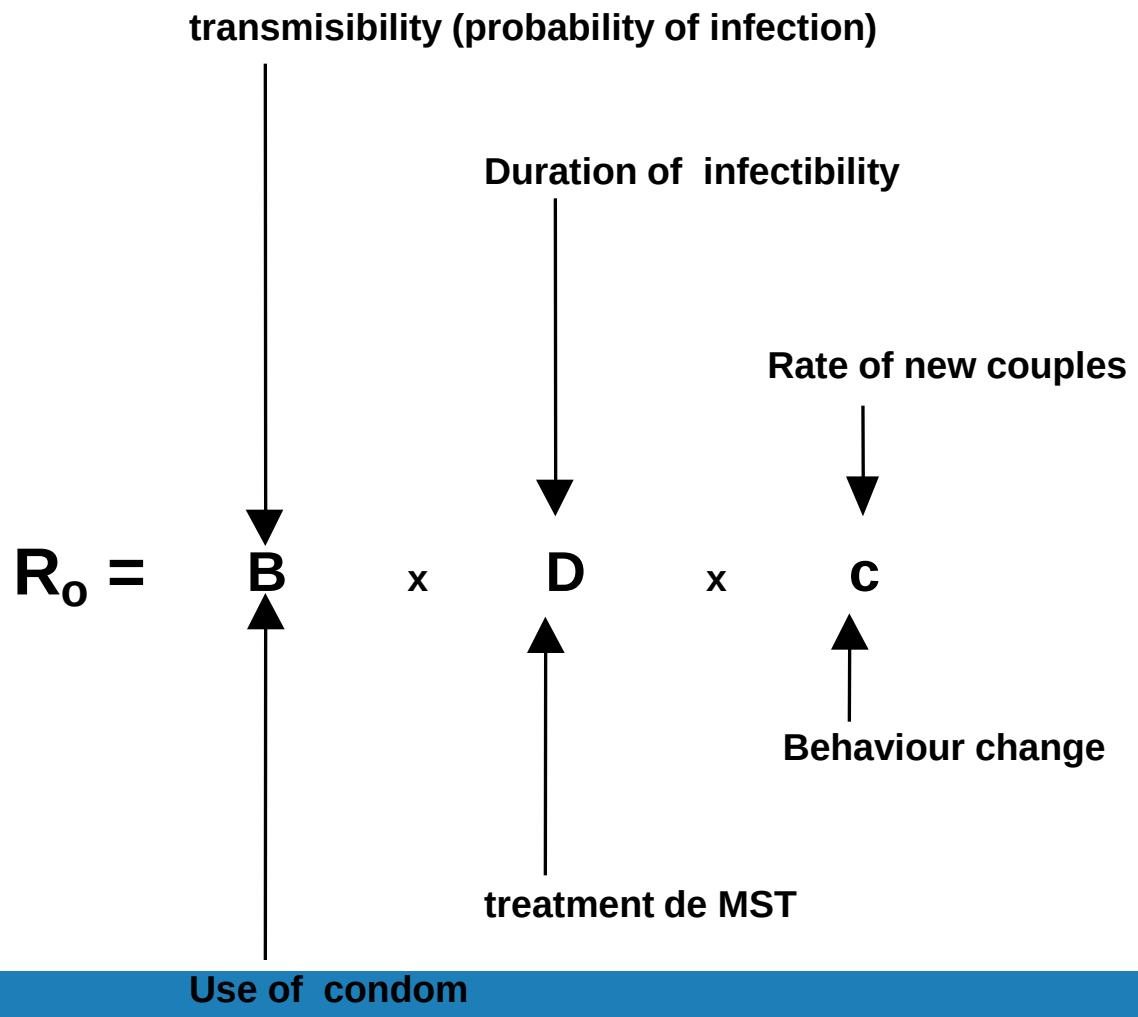
  usually per year

  per 100, 1,000 or 100,000 population
- Proportion of AIDS deaths: of all deaths, the percentage that are due to AIDS

The natural course of incidence and prevalence of a local HIV epidemic over time



Dinamics of epiemic dissemination: Basic rate of reproduction of and STI (R_0)



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- **What we know about HIV transmission and risk factors ?**

The Proximate-Determinants Framework

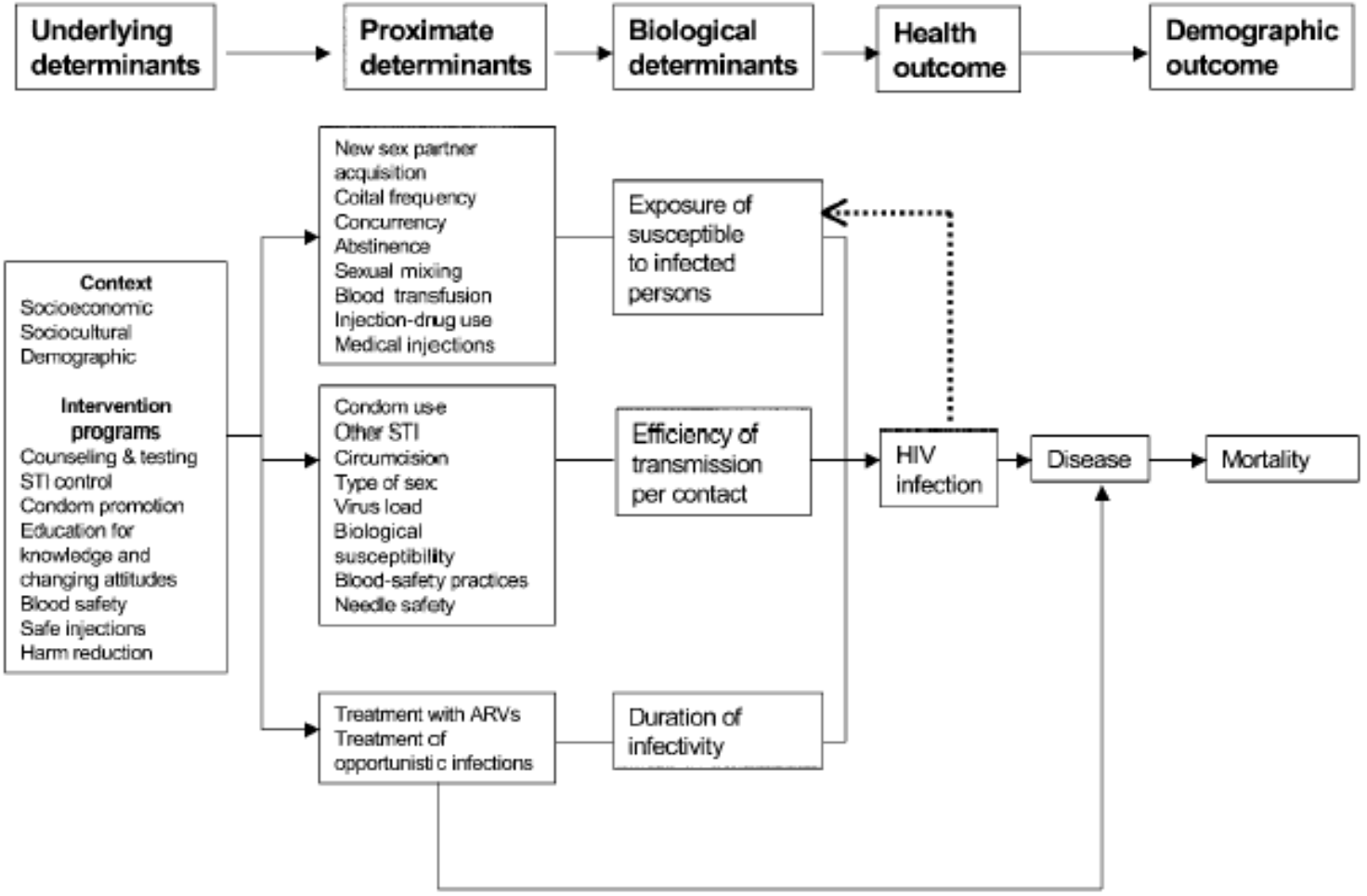

Figure 1. Proximate-determinants conceptual framework for factors affecting the risk of sexual transmission of HIV. ARVs, antiretrovirals; STI, sexually transmitted infection.

J. Ties Boermaa and Sharon S. Weir Integrating Demographic and Epidemiological Approaches to Research on HIV/AIDS: The Proximate-Determinants Framework Framework for HIV/AIDS Research • JID 2005:191 (Suppl 1) : S61

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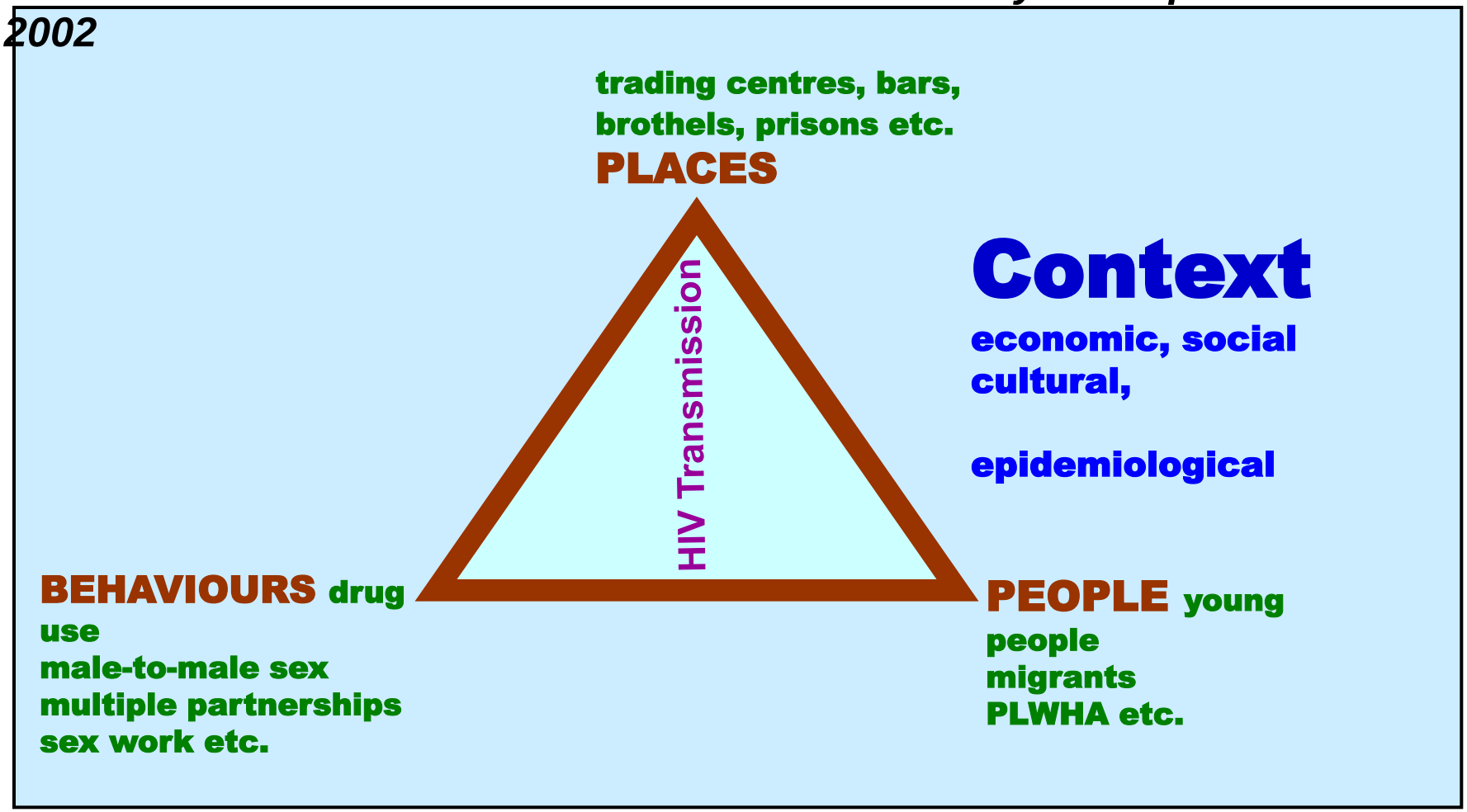
The new paradigm: HIV transmission does not occur at random, but is concentrated where risks come together

H Gayle MIP presentation 2002



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Classification of epidemics - classic

Low level

- Principle: Although HIV infection may have existed for many years, it has never spread to significant levels in any sub-population.
- Infection is largely confined to individuals with higher risk behaviour: e.g. sex workers, drug injectors, MSM. This suggests that networks of risk are rather diffuse (low levels of partner exchange or sharing of drug injecting equipment), or a very recent introduction of the virus.
- Numerical proxy: HIV prevalence has not consistently exceeded five percent in any defined sub-population.

Classification of epidemics - classic

Concentrated

- Principle: HIV has spread rapidly in a defined sub-population, but is not well-established in the general population.
- This suggests active networks of risk within the sub-population. The future course of the epidemic is determined by the frequency and nature of links between highly infected sub-populations and the general population.
- Numerical proxy: HIV prevalence consistently over five percent in at least one defined sub-population. HIV prevalence below one percent in pregnant women in urban areas

Classification of epidemics - classic

Generalised

- Principle: In generalised epidemics, HIV is firmly established in the general population.
- Although sub-populations at high risk may continue to contribute disproportionately to the spread of HIV, sexual networking in the general population is sufficient to sustain an epidemic independent of sub-populations at higher risk of infection.
- Numerical proxy: HIV prevalence consistently over one percent in pregnant women nation-wide.

Other classifications

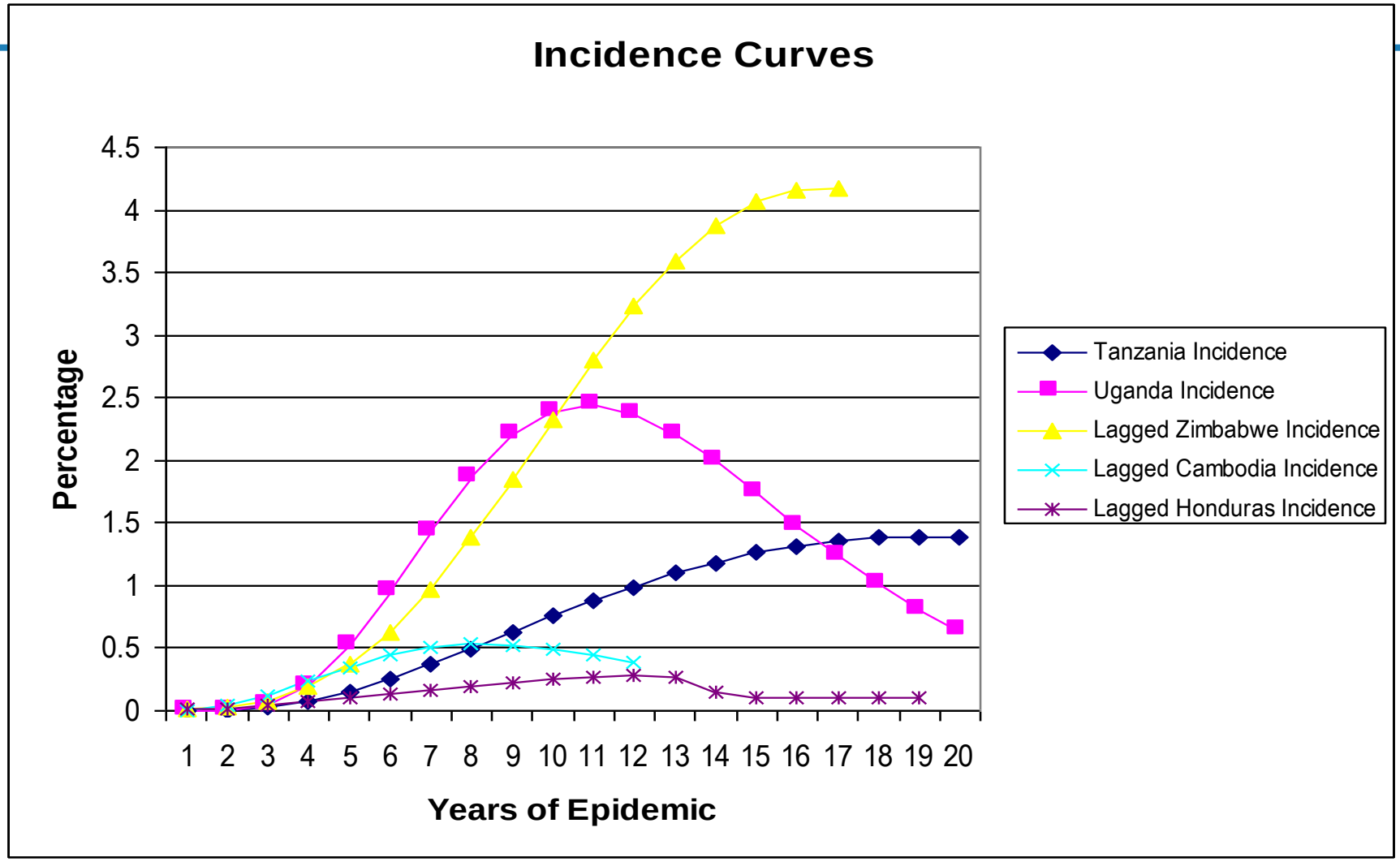
- UNAIDS: Low-level, Concentrated, Generalized, Hyperendemic
- Wilson & Halperin (Lancet 2008): “concentrated”, “generalised”, “potentially mixed”
- Mishra (PLoSOne 2012): “concentrated local”, “concentrated non-local”, “concentrated local and non-local”, “generalizing”, “mixed”
- …. and several others

Epidemiology definitions: other considerations

- Statistics often presented separately for adults and children (also because major modes of transmission are different)

- Mortality among PLHIV can be due to AIDS or to other causes (accident, flu, etc.)

- Incidence is not constant



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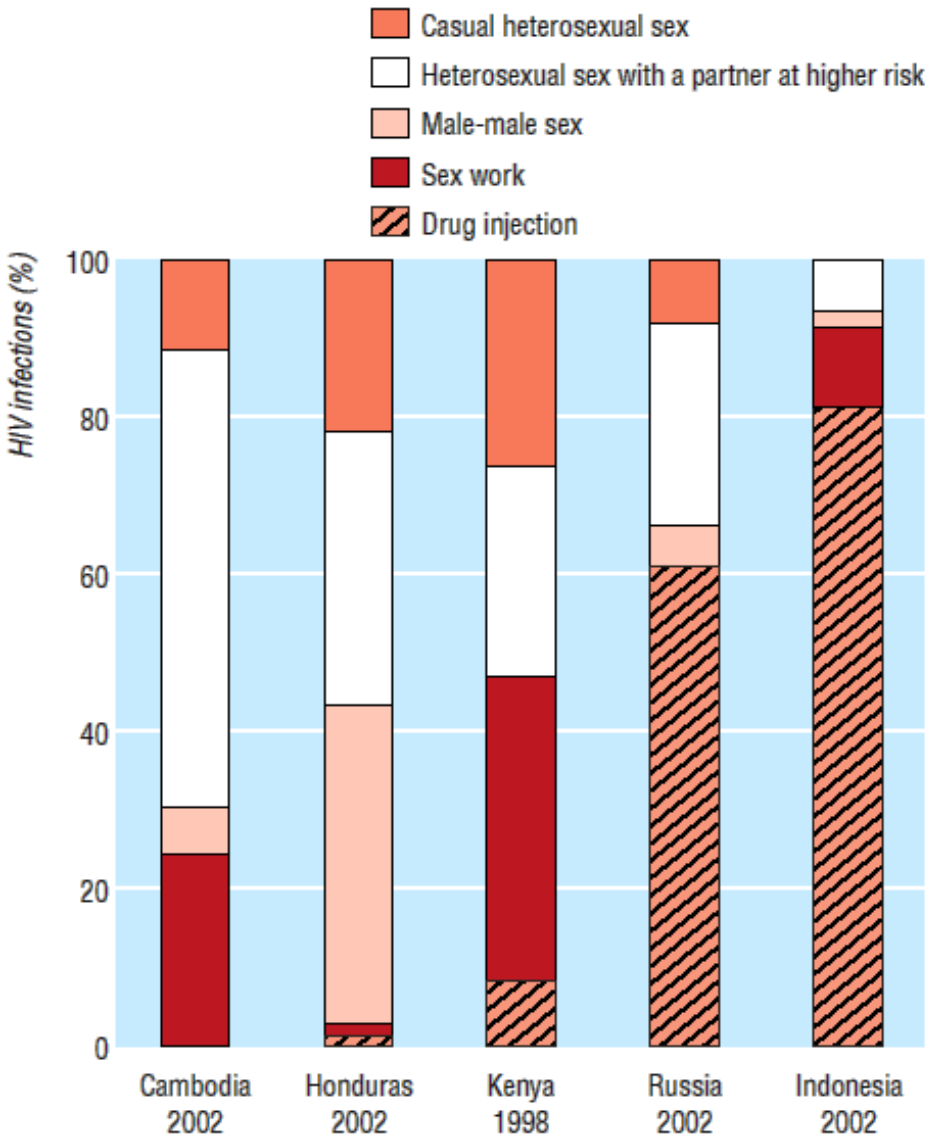
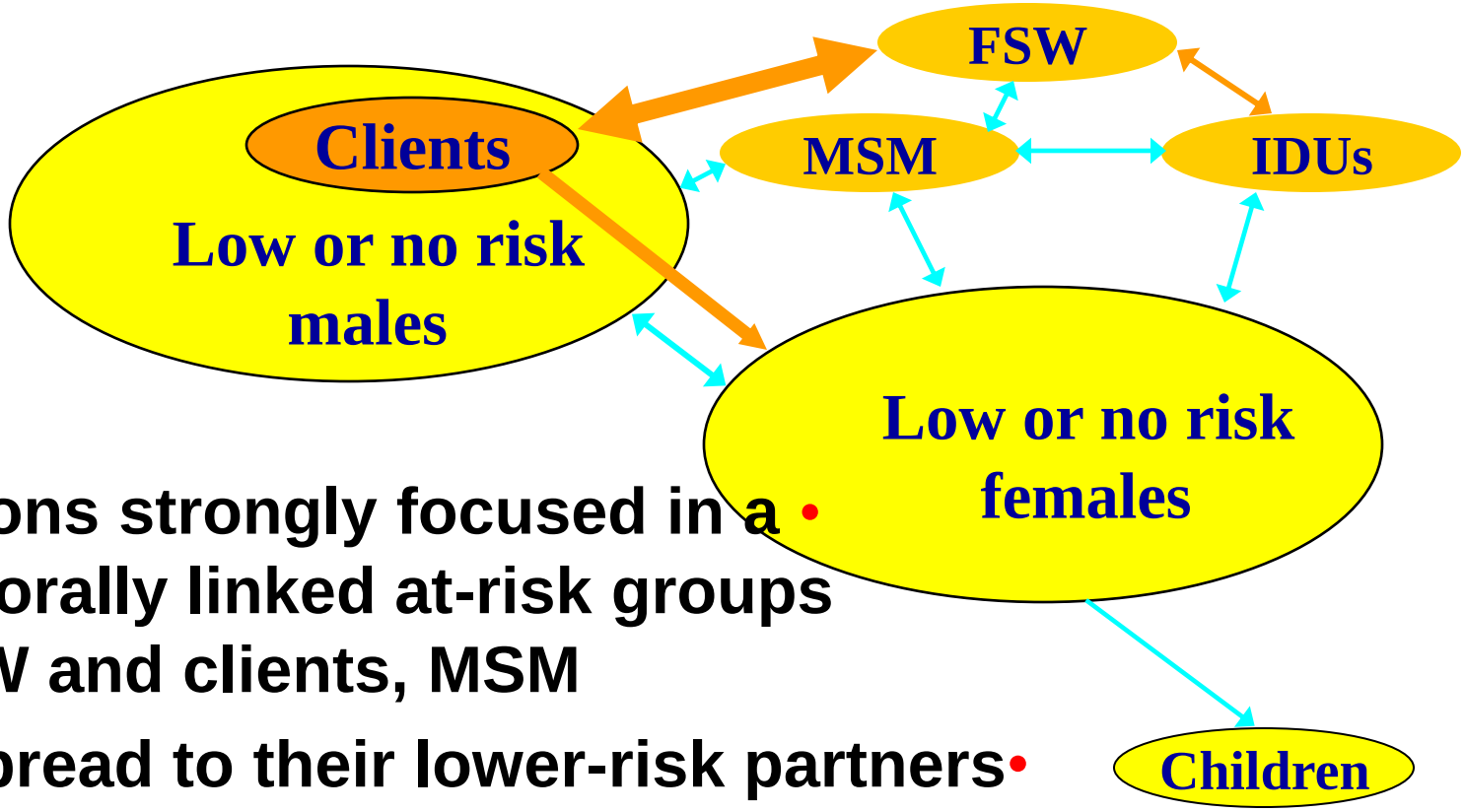


Fig 1 Distribution of new HIV infections by type of exposure in selected countries, 1998-2002. Data on behaviour and HIV prevalence drawn from references 7-17

New infections by type of exposure

Source: Pisani et al. BMJ 2003; 326: 1384-7

Concentrated epidemics all follow similar patterns…



- New infections strongly focused in a few behaviorally linked at-risk groups - IDUs, FSW and clients, MSM
- And then spread to their lower-risk partners
- Little generalized spread

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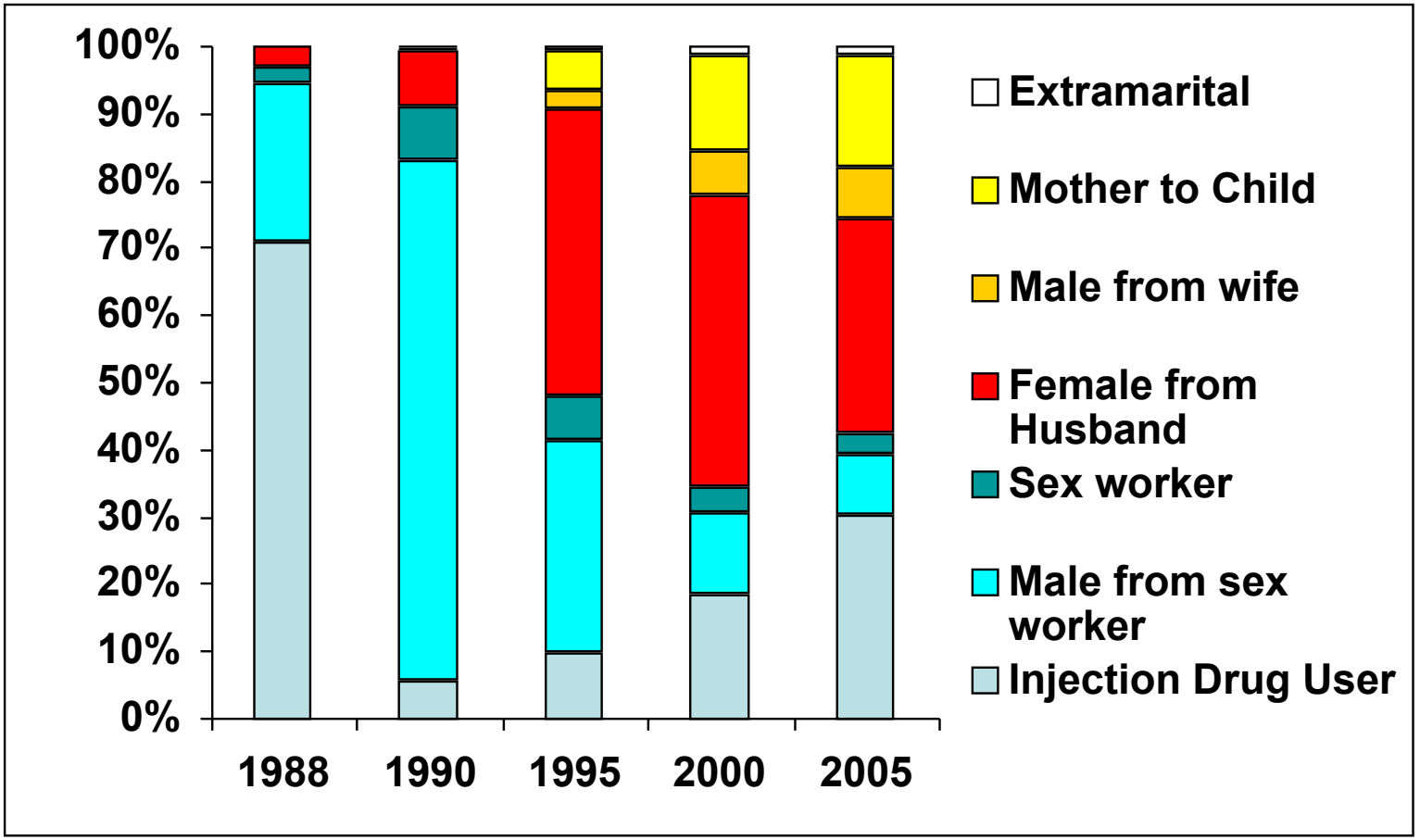
Thailand: changes of modes of tranmission



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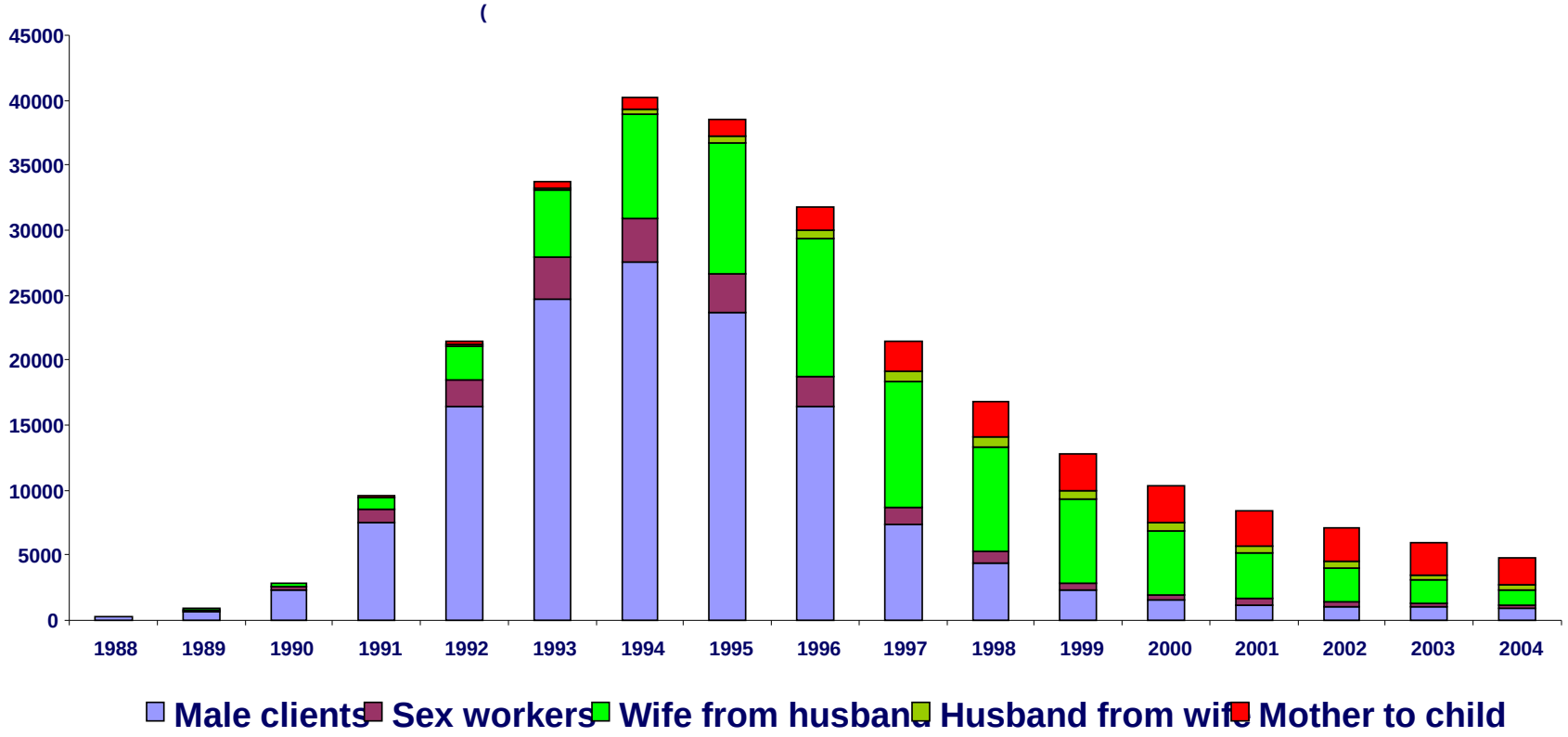
Number of infections per year and mode of transnmission, Cambodia, 1988-2004



Source: Peerapatanapokin and Brown, using Asia Epidemic Model

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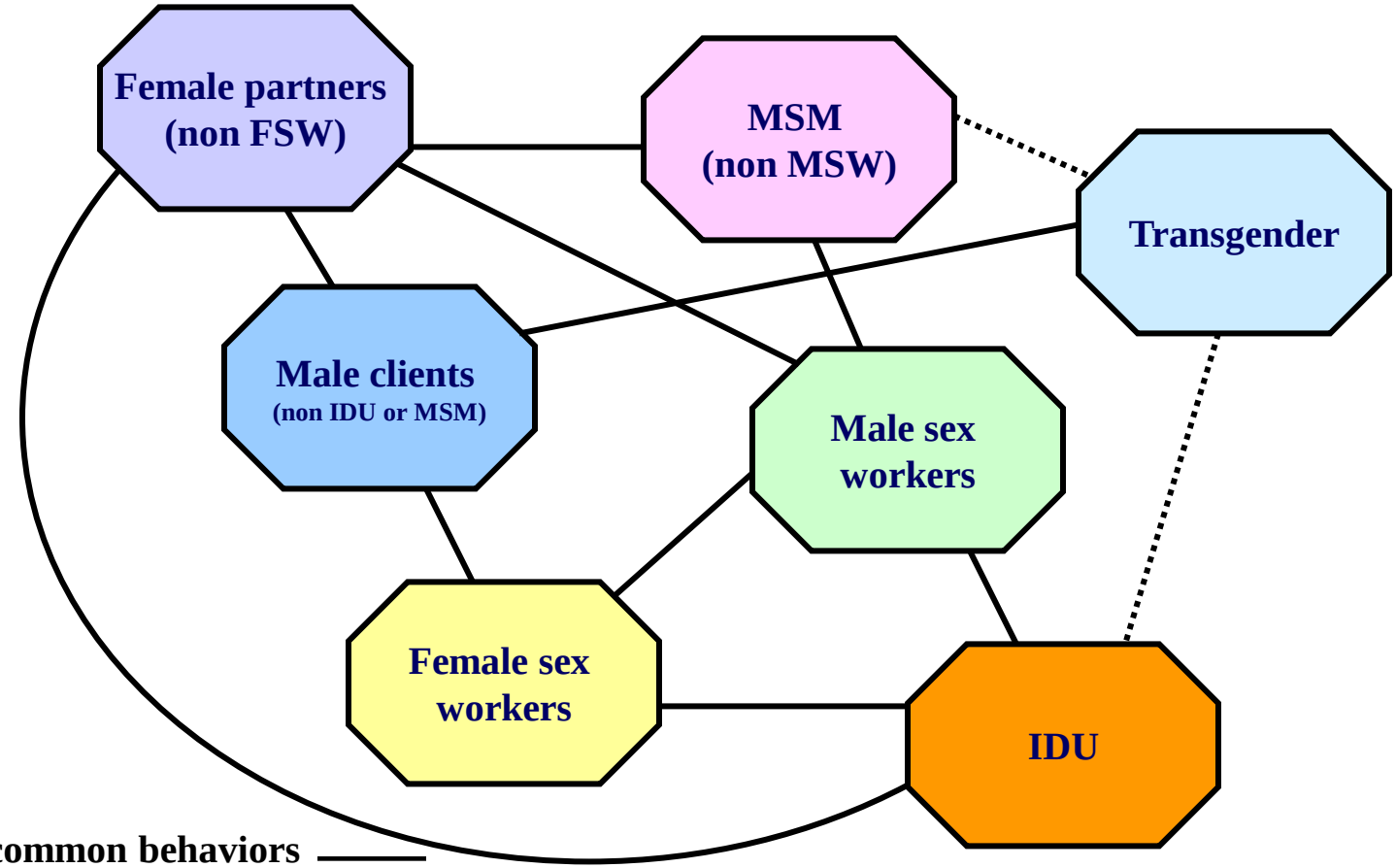
Sexual and drug taking networks are frequently complex and intertwined.
A "one size fits all" approach to addressing behavioral risk
rarely addresses local realities.



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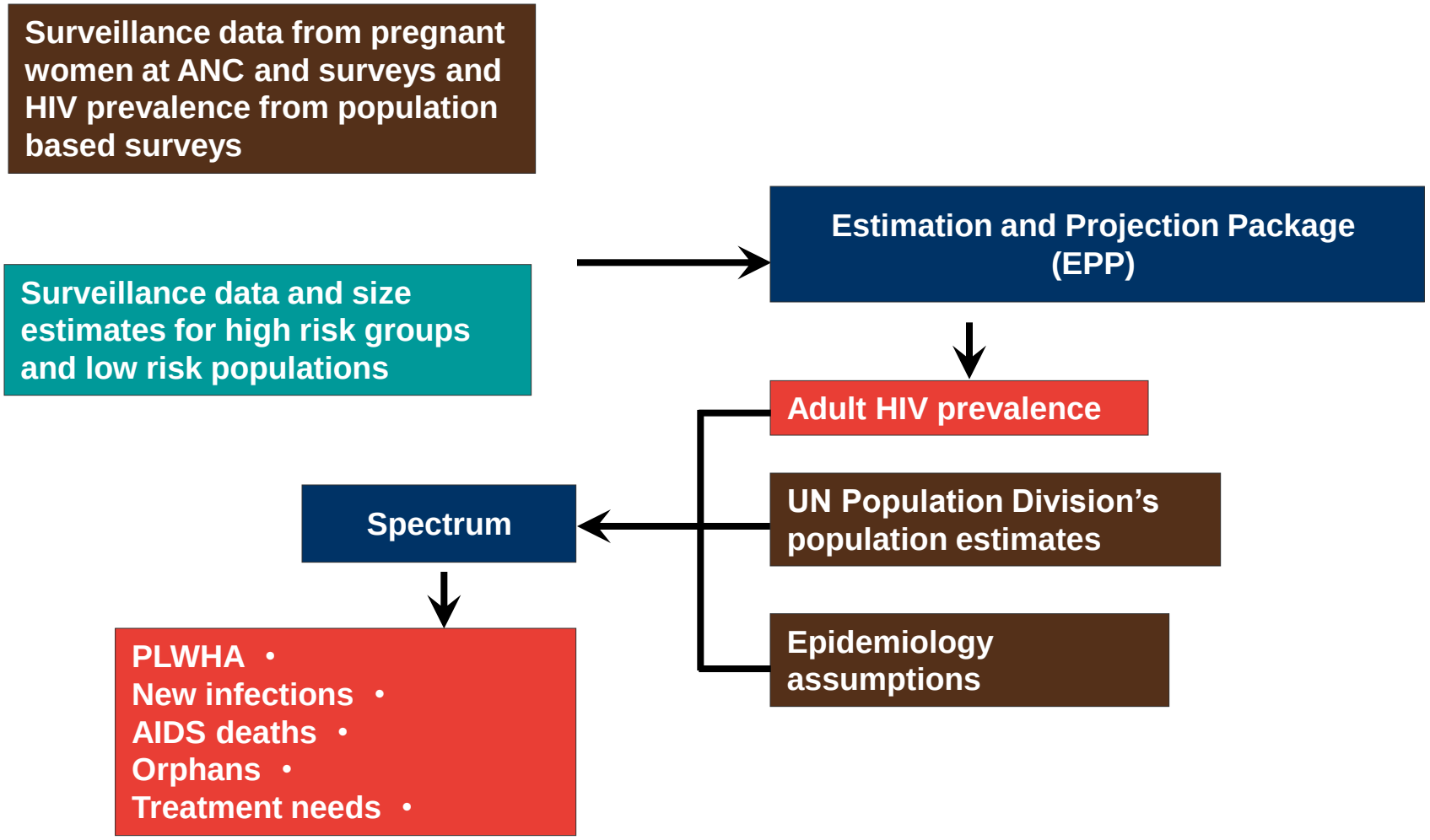
- Where we are with the HIV epidemic: HIV surveillance and estimates

Overview for HIV Estimates



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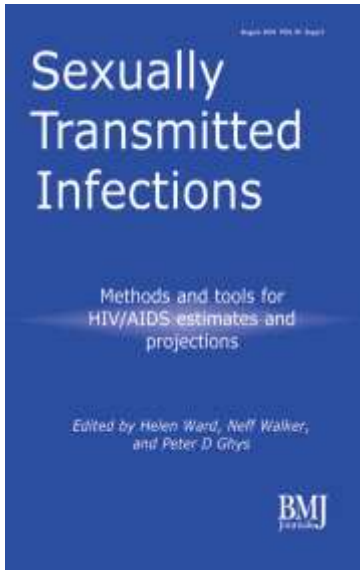
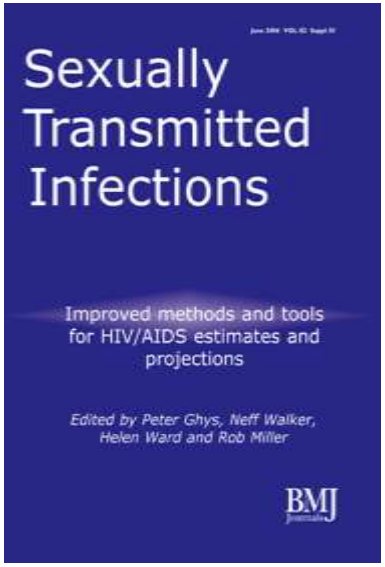
Dissemination of Documentation: tools and methods



2006



2008

2010

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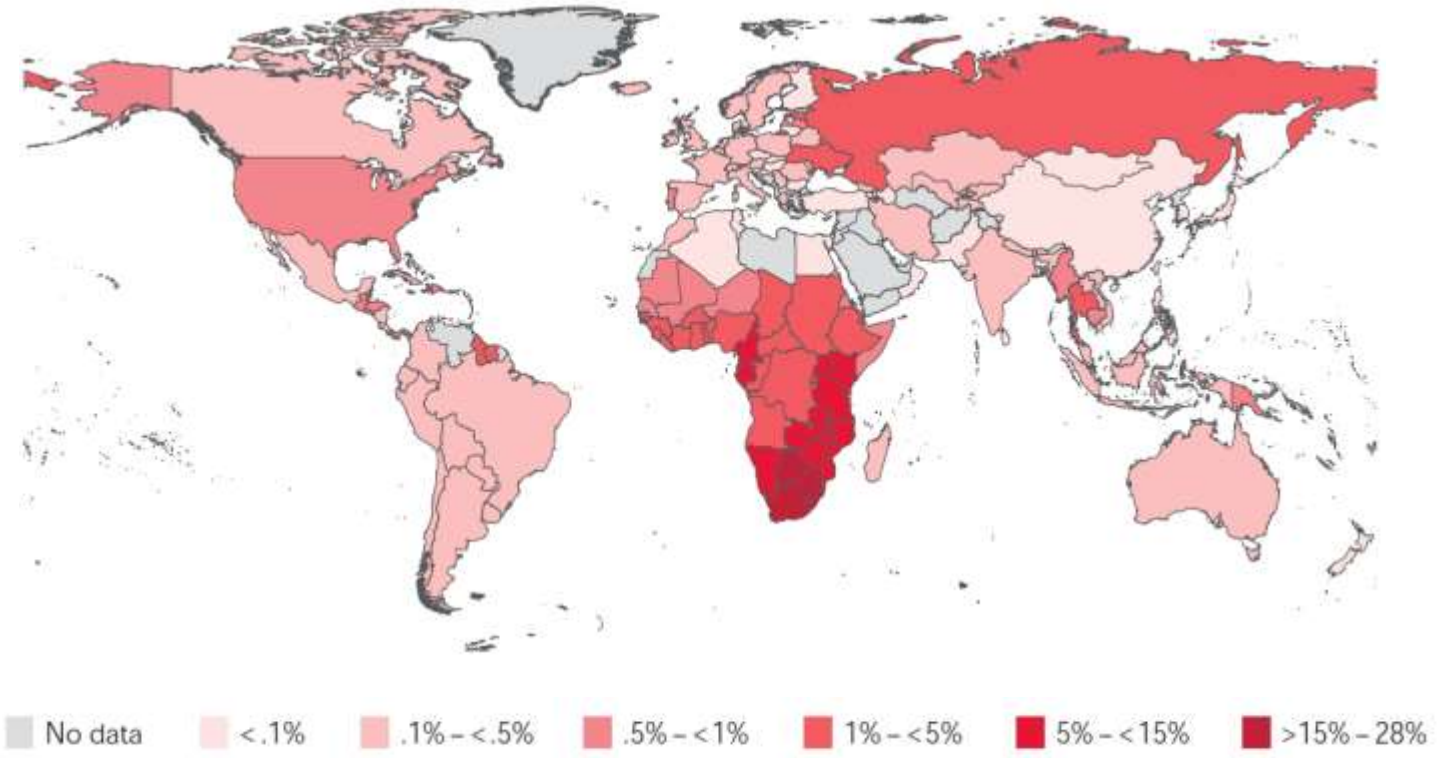
Figure 2.4

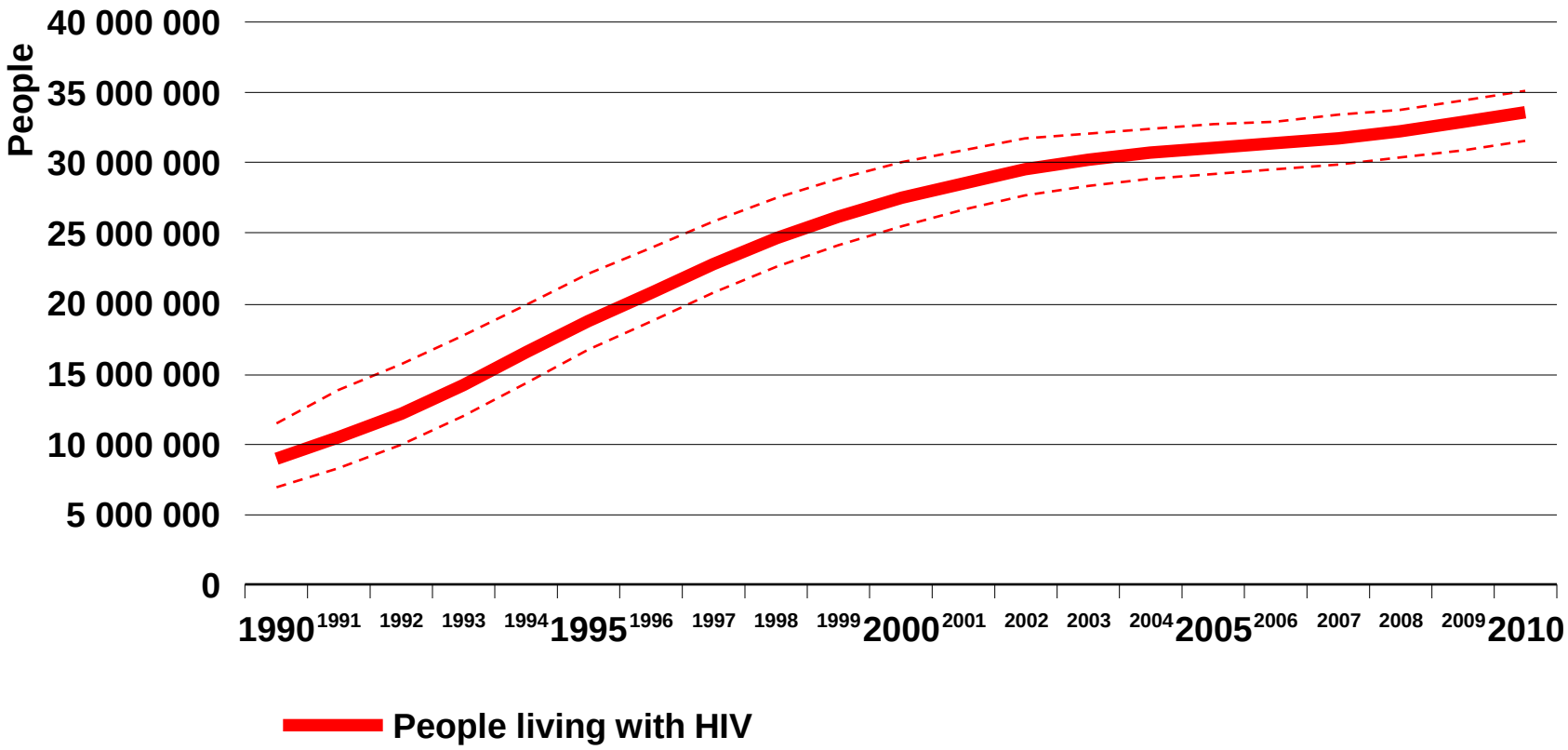
Global prevalence of HIV, 2010



Source:
UNAIDS.

World Health Organization

People living with HIV



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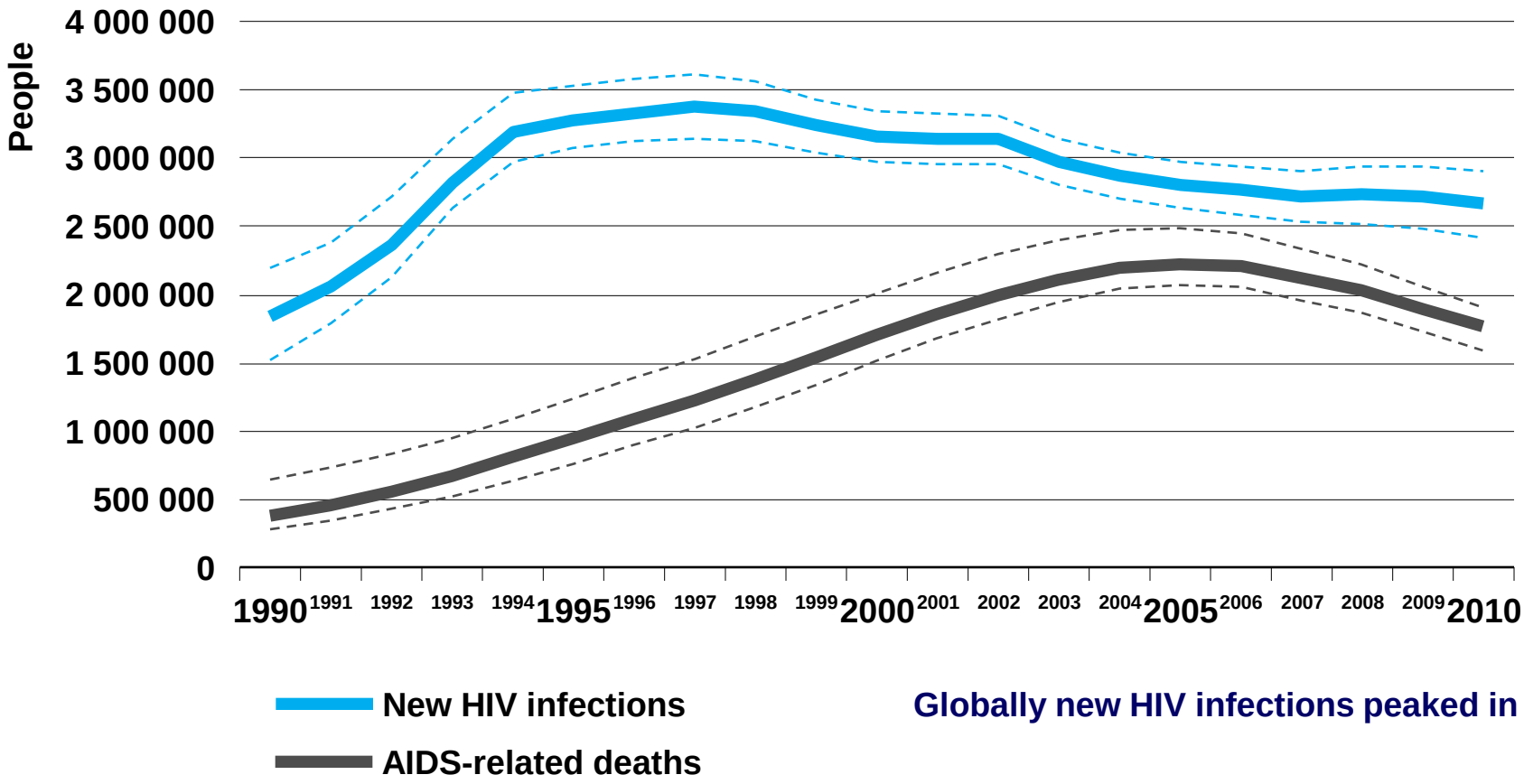
New HIV infections and AIDS-related deaths



Globally new HIV infections peaked in 1997.

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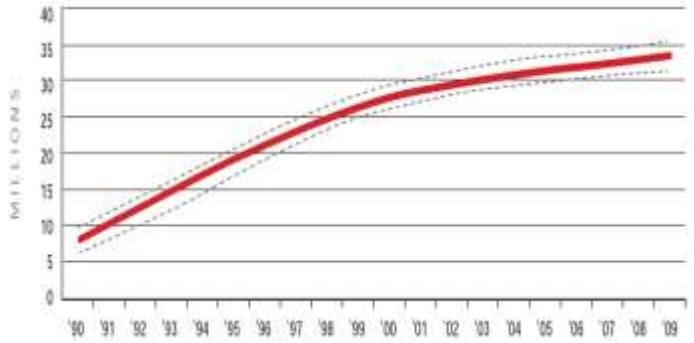
Figure 2.5

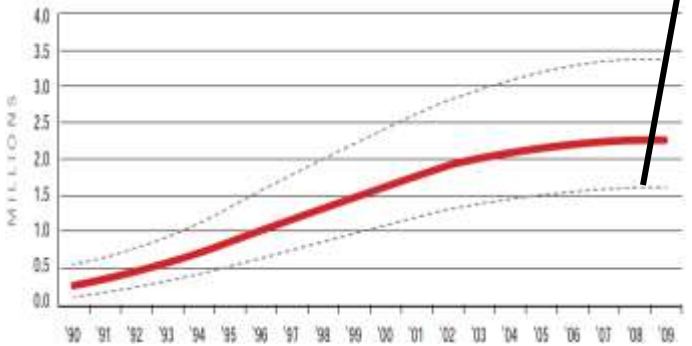
Global HIV trends, 1990 to 2009

All Children estimates have larger ranges

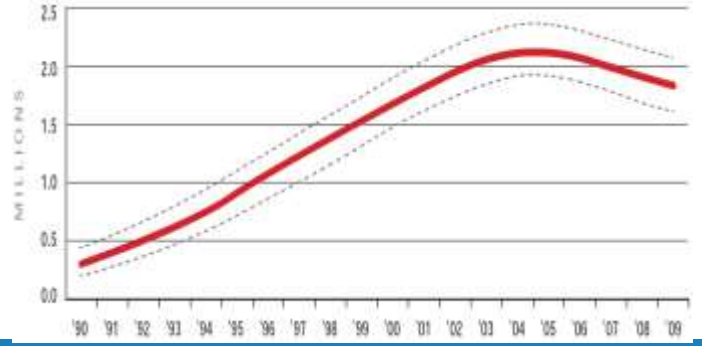
Number of people living with HIV



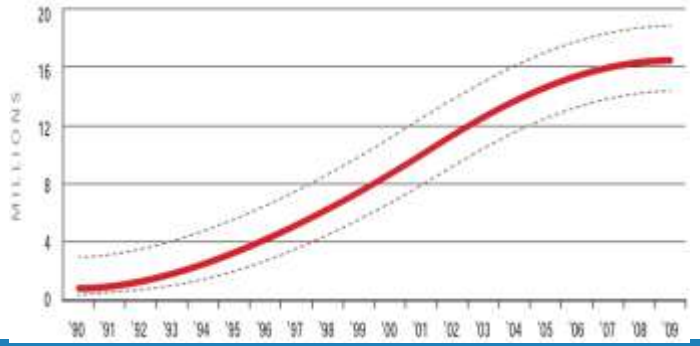
Number of children living with HIV



Adult and child deaths due to AIDS



Number of orphans due to AIDS



Dotted lines represent ranges, solid lines represent the best estimate.

Source:
UNAIDS.

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Regional HIV and AIDS statistics, 2010 and 2001

Regional estimates of adults and children newly infected with HIV, people living with HIV, and AIDS-related deaths

		Adults and children living with HIV	Adults and children newly infected with HIV	Adult prevalence (%)	Adult and child deaths due to AIDS	Young people (15–24) prevalence (%)	
						Male	Female
SUB-SAHARAN AFRICA	2010	22.9 million [21.6–24.1 million]	1.9 million [1.7–2.1 million]	5.0 [4.7–5.2]	1.2 million [1.1–1.4 million]	1.4 [1.1–1.8]	3.3 [2.7–4.2]
	2001	20.5 million [19.1–22.2 million]	2.2 million [2.1–2.4 million]	5.9 [5.6–6.4]	1.4 million [1.3–1.6 million]	2.0 [1.6–2.7]	5.2 [4.3–6.8]
MIDDLE EAST AND NORTH AFRICA	2010	470 000 [350 000–570 000]	59 000 [40 000–73 000]	0.2 [0.2–0.3]	35 000 [25 000–42 000]	0.1 [0.1–0.2]	0.2 [0.1–0.2]
	2001	320 000 [190 000–450 000]	43 000 [31 000–57 000]	0.2 [0.1–0.3]	22 000 [9700–38 000]	0.1 [0.1–0.2]	0.1 [0.1–0.2]

Regional HIV and AIDS statistics, 2010 and 2001

Regional estimates of adults and children newly infected with HIV, people living with HIV, and AIDS-related deaths

		Adults and children living with HIV	Adults and children newly infected with HIV	Adult prevalence (%)	Adult and child deaths due to AIDS	Young people (15–24) prevalence (%)	
						Male	Female
SOUTH AND SOUTH-EAST ASIA	2010	4.0 million [3.6–4.5 million]	270 000 [230 000–340 000]	0.3 [0.3–0.3]	250 000 [210 000–280 000]	0.1 [0.1–0.2]	0.1 [0.1–0.1]
	2001	3.8 million [3.4–4.2 million]	380 000 [340 000–420 000]	0.3 [0.3–0.4]	230 000 [200 000–280 000]	0.2 [0.2–0.2]	0.2 [0.2–0.2]
EAST ASIA	2010	790 000 [580 000–1.1 million]	88 000 [48 000–160 000]	0.1 [0.1–0.1]	56 000 [40 000–76 000]	<0.1 [<0.1–<0.1]	<0.1 [<0.1–<0.1]
	2001	380 000 [280 000–530 000]	74 000 [54 000–100 000]	<0.1 [<0.1–0.1]	24 000 [16 000–45 000]	<0.1 [<0.1–<0.1]	<0.1 [<0.1–<0.1]

Regional HIV and AIDS statistics, 2010 and 2001

Regional estimates of adults and children newly infected with HIV, people living with HIV, and AIDS-related deaths

		Adults and children living with HIV	Adults and children newly infected with HIV	Adult prevalence (%)	Adult and child deaths due to AIDS	Young people (15–24) prevalence (%)	
						Male	Female
OCEANIA	2010	54 000 [48 000–62 000]	3300 [2400–4200]	0.3 [0.2–0.3]	1600 [1200–2000]	0.1 [0.1–0.1]	0.2 [0.1–0.2]
	2001	41 000 [34 000–50 000]	4000 [3300–4600]	0.2 [0.2–0.3]	1800 [1300–2900]	0.1 [0.1–0.2]	0.2 [0.2–0.3]
LATIN AMERICA	2010	1.5 million [1.2–1.7 million]	100 000 [73 000–140 000]	0.4 [0.3–0.5]	67 000 [45 000–92 000]	0.2 [0.1–0.4]	0.2 [0.1–0.2]
	2001	1.3 million [1.0–1.7 million]	99 000 [75 000–130 000]	0.4 [0.3–0.5]	83 000 [50 000–130 000]	0.2 [0.1–0.6]	0.1 [0.1–0.2]

Regional HIV and AIDS statistics, 2010 and 2001 (4/6)

Regional estimates of adults and children newly infected with HIV, people living with HIV, and AIDS-related deaths

		Adults and children living with HIV	Adults and children newly infected with HIV	Adult prevalence (%)	Adult and child deaths due to AIDS	Young people (15–24) prevalence (%)	
						Male	Female
CARIBBEAN	2010	200 000 [170 000–220 000]	12 000 [9400–17 000]	0.9 [0.8–1.0]	9000 [6900–12 000]	0.2 [0.2–0.5]	0.5 [0.3–0.7]
	2001	210 000 [170 000–240 000]	19 000 [16 000–22 000]	1.0 [0.9–1.2]	18 000 [14 000–22 000]	0.4 [0.2–0.8]	0.8 [0.6–1.1]
EASTERN EUROPE AND CENTRAL ASIA	2010	1.5 million [1.3–1.7 million]	160 000 [110 000–200 000]	0.9 [0.8–1.1]	90 000 [74 000–110 000]	0.6 [0.5–0.8]	0.5 [0.4–0.7]
	2001	410 000 [340 000–490 000]	210 000 [170 000–240 000]	0.3 [0.2–0.3]	7800 [6000–11 000]	0.3 [0.2–0.3]	0.2 [0.1–0.2]

Regional HIV and AIDS statistics, 2010 and 2001 (5/6)

Regional estimates of adults and children newly infected with HIV, people living with HIV, and AIDS-related deaths

		Adults and children living with HIV	Adults and children newly infected with HIV	Adult prevalence (%)	Adult and child deaths due to AIDS	Young people (15–24) prevalence (%)	
						Male	Female
WESTERN AND CENTRAL EUROPE	2010	840 000 [770 000–930 000]	30 000 [22 000–39 000]	0.2 [0.2–0.2]	9900 [8900–11 000]	0.1 [0.1–0.1]	0.1 [<0.1–0.1]
	2001	630 000 [580 000–690 000]	30 000 [26 000–34 000]	0.2 [0.2–0.2]	10 000 [9500–11 000]	0.1 [0.1–0.1]	0.1 [0.1–0.1]
NORTH AMERICA	2010	1.3 million [1.0–1.9 million]	58 000 [24 000–130 000]	0.6 [0.5–0.9]	20 000 [16 000–27 000]	0.3 [0.2–0.6]	0.2 [0.1–0.4]
	2001	980 000 [780 000–1.2 million]	49 000 [34 000–70 000]	0.5 [0.4–0.7]	19 000 [15 000–24 000]	0.3 [0.2–0.4]	0.2 [0.1–0.3]

Regional HIV and AIDS statistics, 2010 and 2001 (6/6)

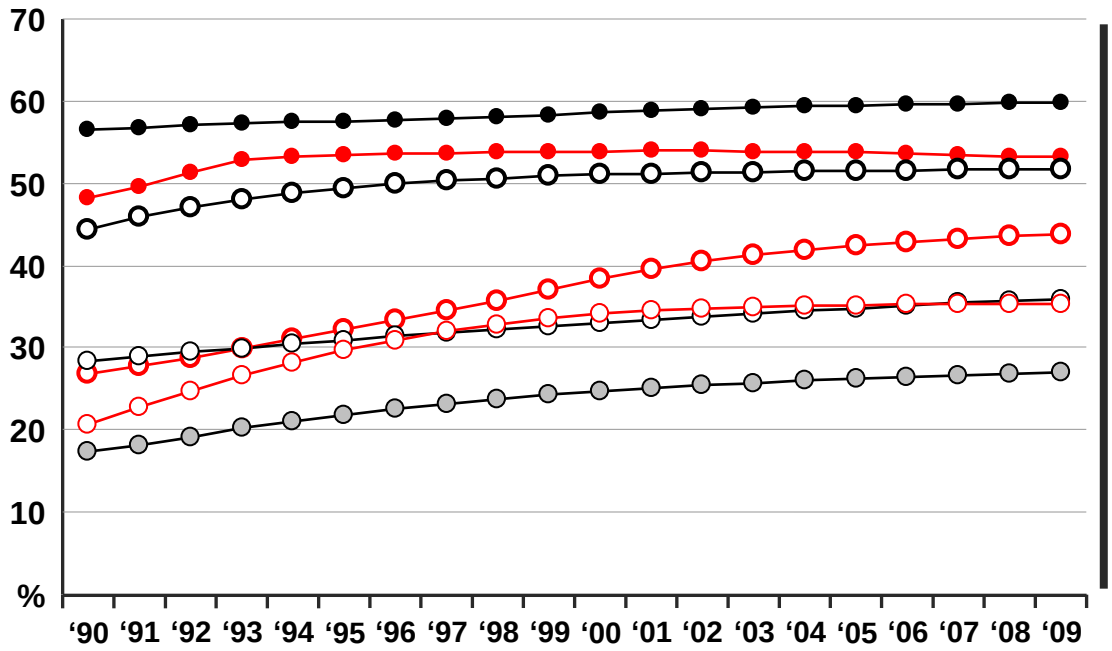
Regional estimates of adults and children newly infected with HIV, people living with HIV, and AIDS-related deaths

		Adults and children living with HIV	Adults and children newly infected with HIV	Adult prevalence (%)	Adult and child deaths due to AIDS	Young people (15–24) prevalence (%)	
						Male	Female
TOTAL	2010	34.0 million [31.6–35.2 million]	2.7 million [2.4–2.9 million]	0.8 [0.8–0.8]	1.8 million [1.6–1.9 million]	0.3 [0.3–0.3]	0.6 [0.5–0.6]
	2001	28.6 million [26.7–30.9 million]	3.1 million [3.0–3.3 million]	0.8 [0.7–0.8]	1.9 million [1.7–2.2 million]	0.4 [0.4–0.4]	0.8 [0.7–0.8]

Figure 2.6

Trends in women living with HIV

Proportion of people 15 years and older living with HIV who are women, 1990–2009.



More than 50% Women

- Sub-Saharan Africa
- Caribbean
- GLOBAL
- Eastern Europe and Central Asi
- Central and South America
- Asia
- Western and Central Europe and North America

Source: UNAIDS.

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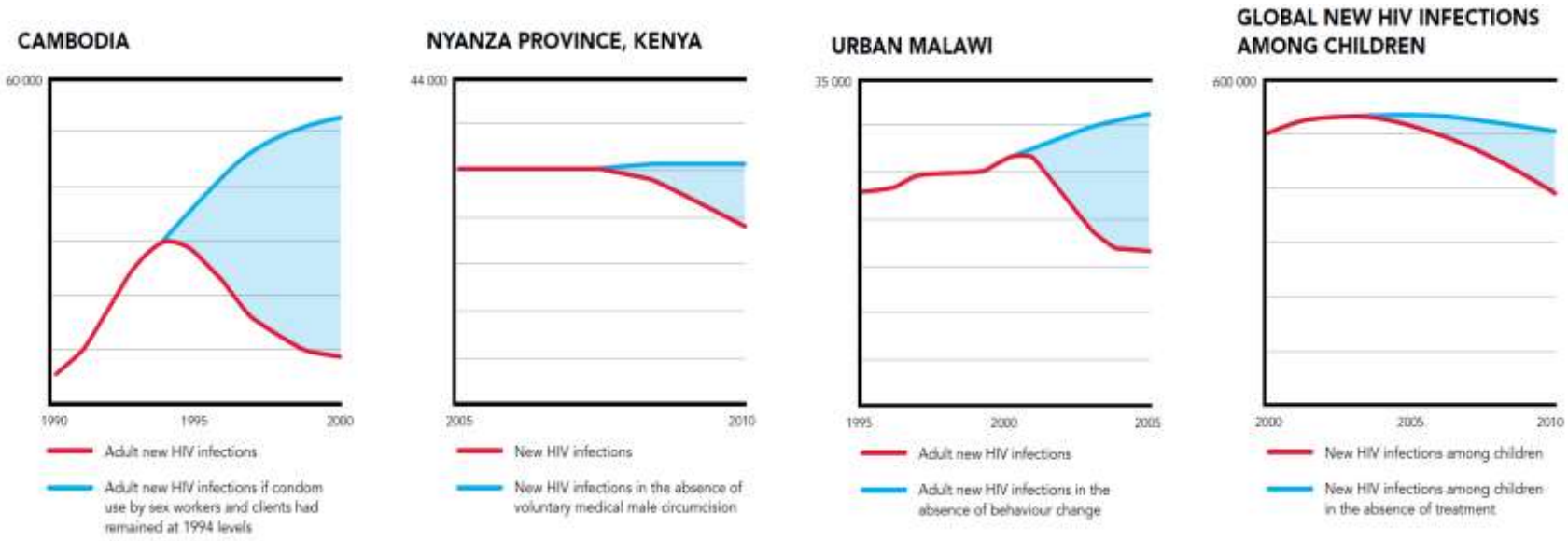
New HIV infection trends

The course of new HIV infections, compared to estimates if key changes had not happened



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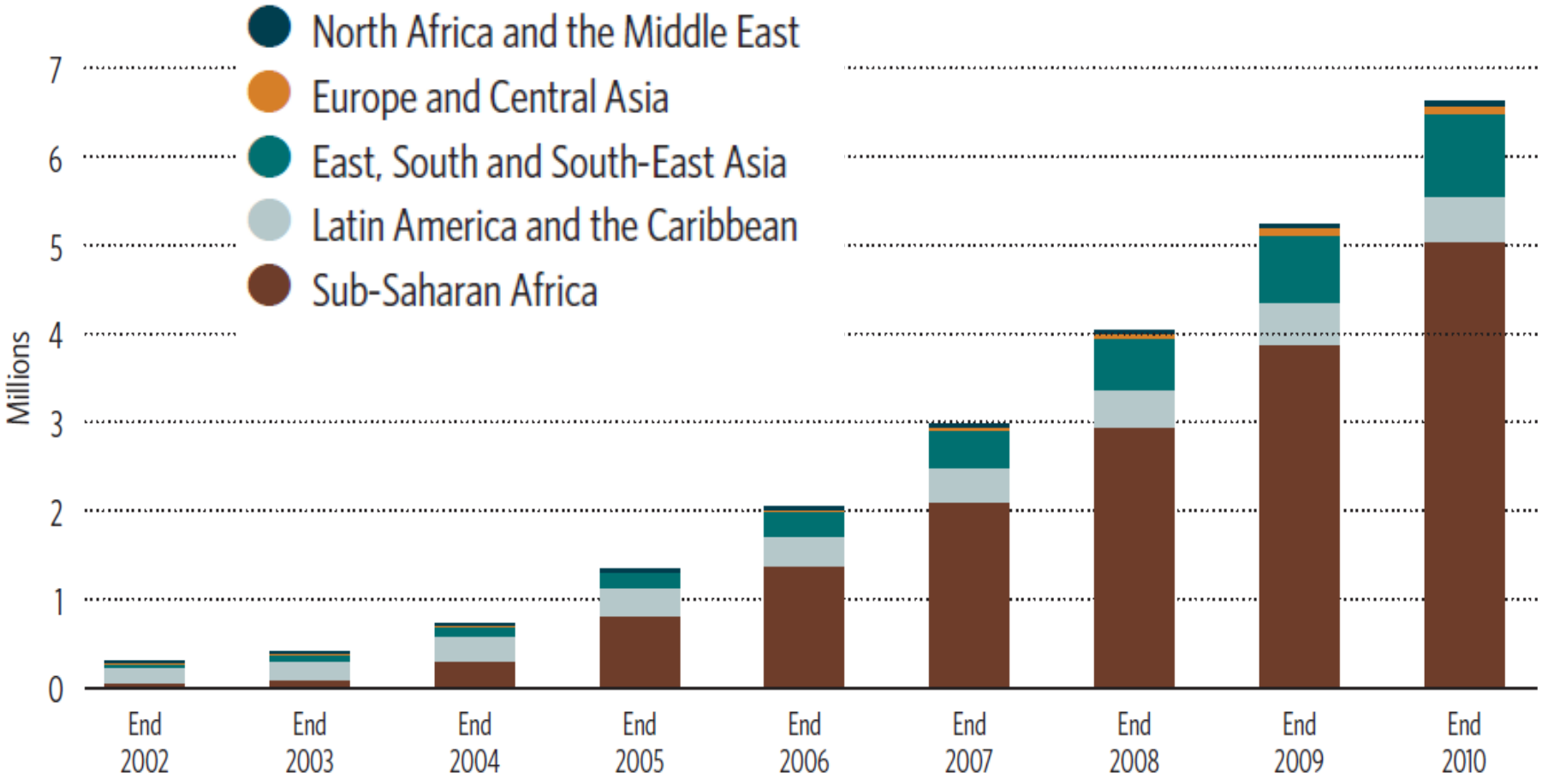
GLOBAL HIV/AIDS RESPONSE

Epidemic update and health sector progress towards Universal Access

Progress Report 2011

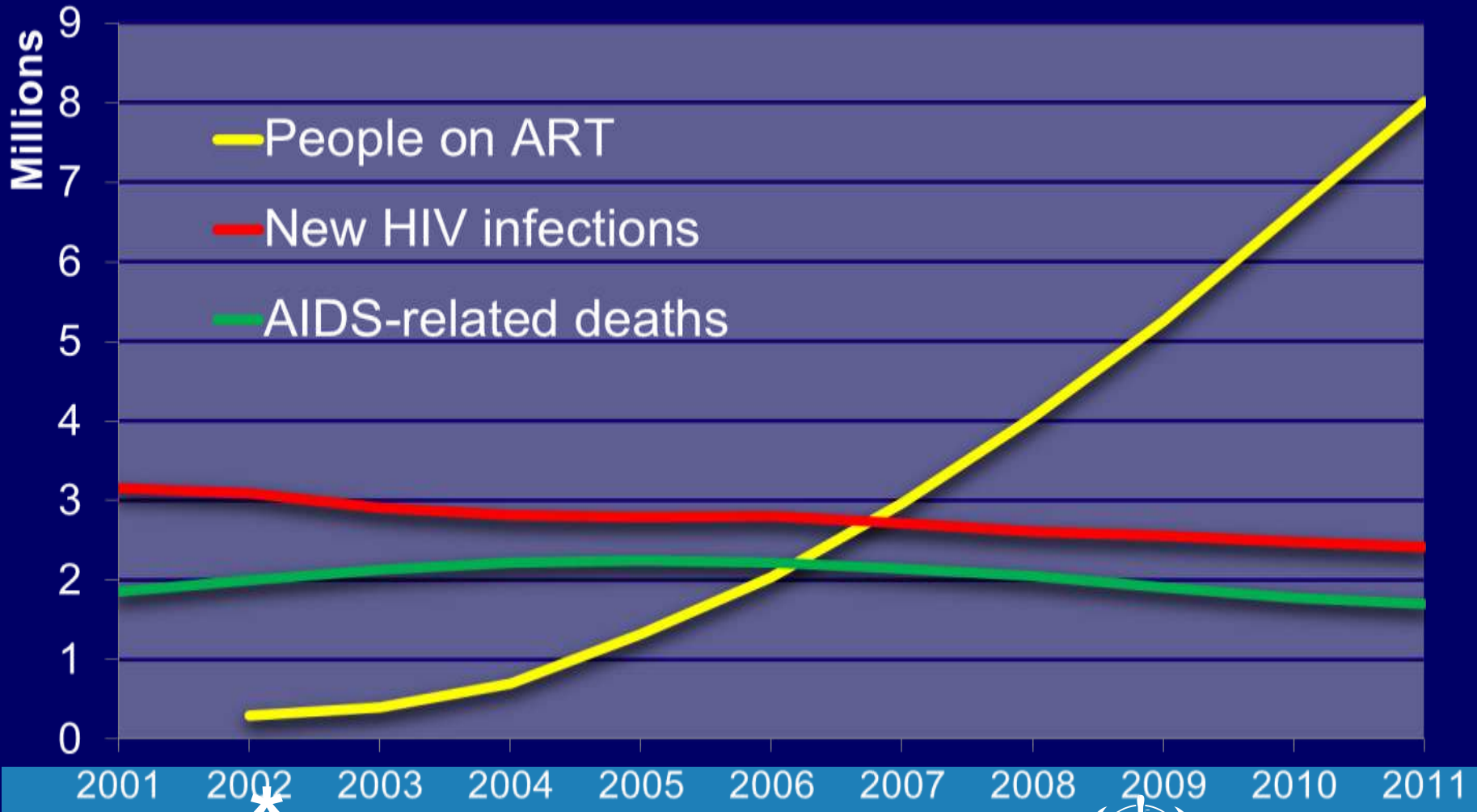
World Health Organization UNAIDS unicef

Number of people receiving antiretroviral therapy in low- and middle-income countries, by region, 2002–2010



World Health Organization

Scale-up of ART, number of AIDS deaths and new HIV infections in LMIC*, 2001–2011



* LMIC = Low- and middle-income countries

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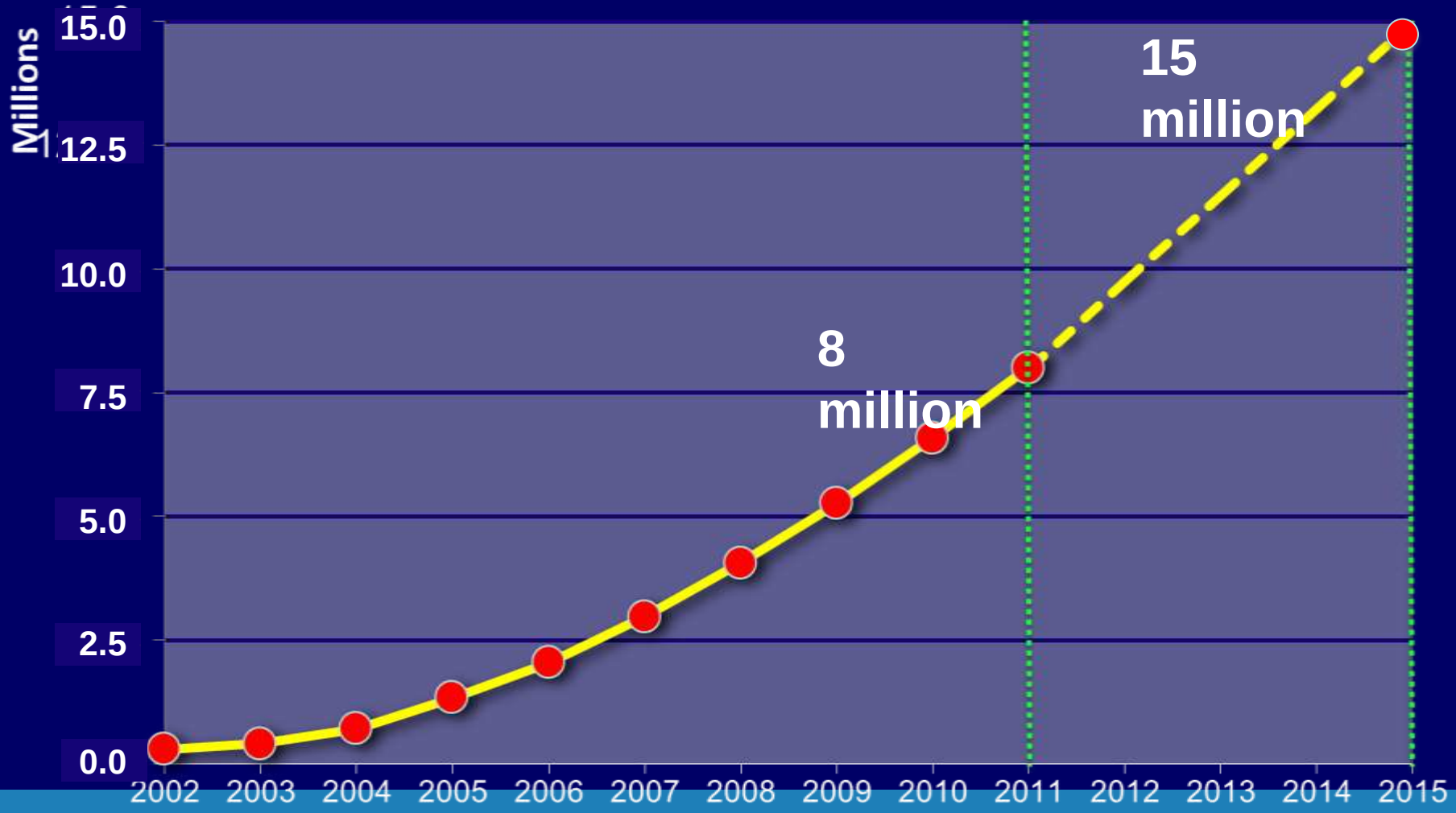
8 million on ART by end 2011
…15 million is achievable !



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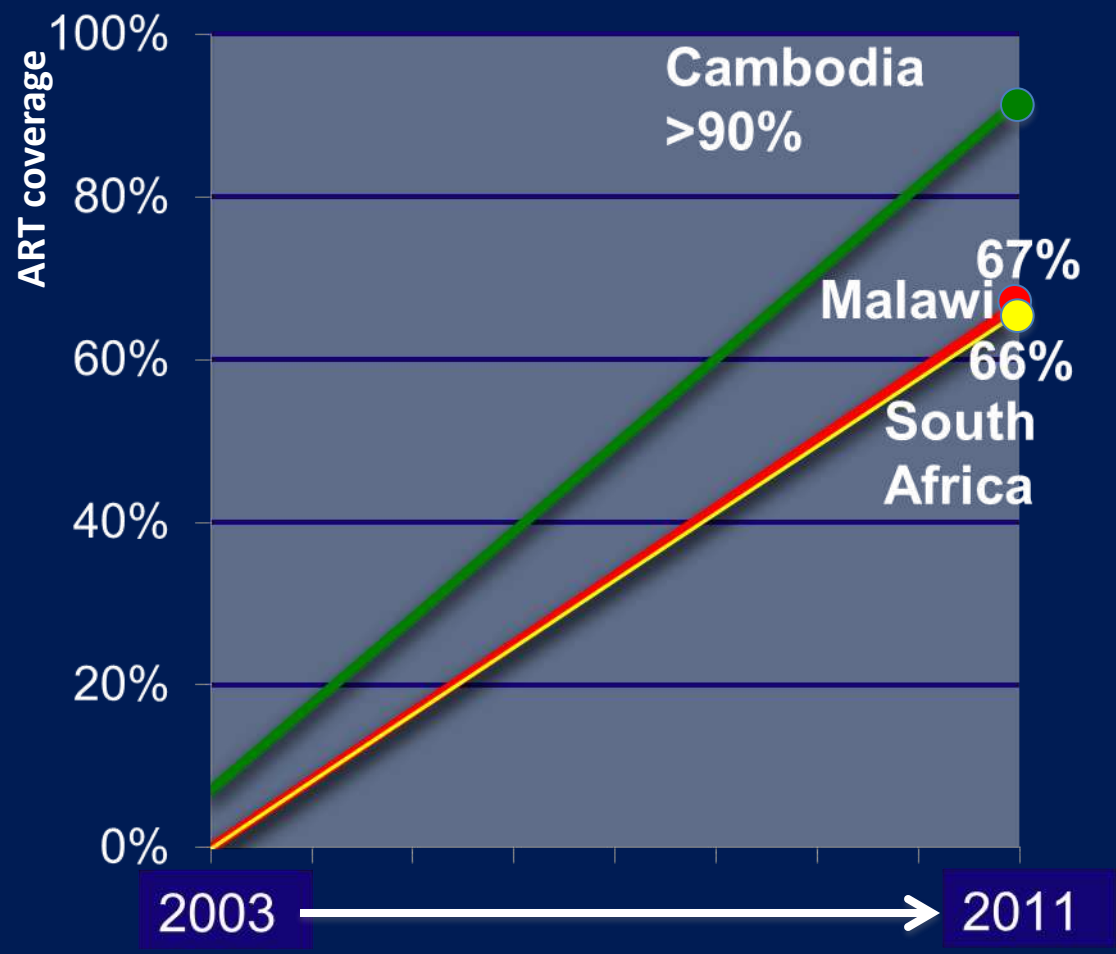
ART scale-up: three success stories

- High-level commitment and resources
- Proactive approaches to HIV testing
- Innovation in service delivery
- Integration
  Task-shifting
  Community-based services



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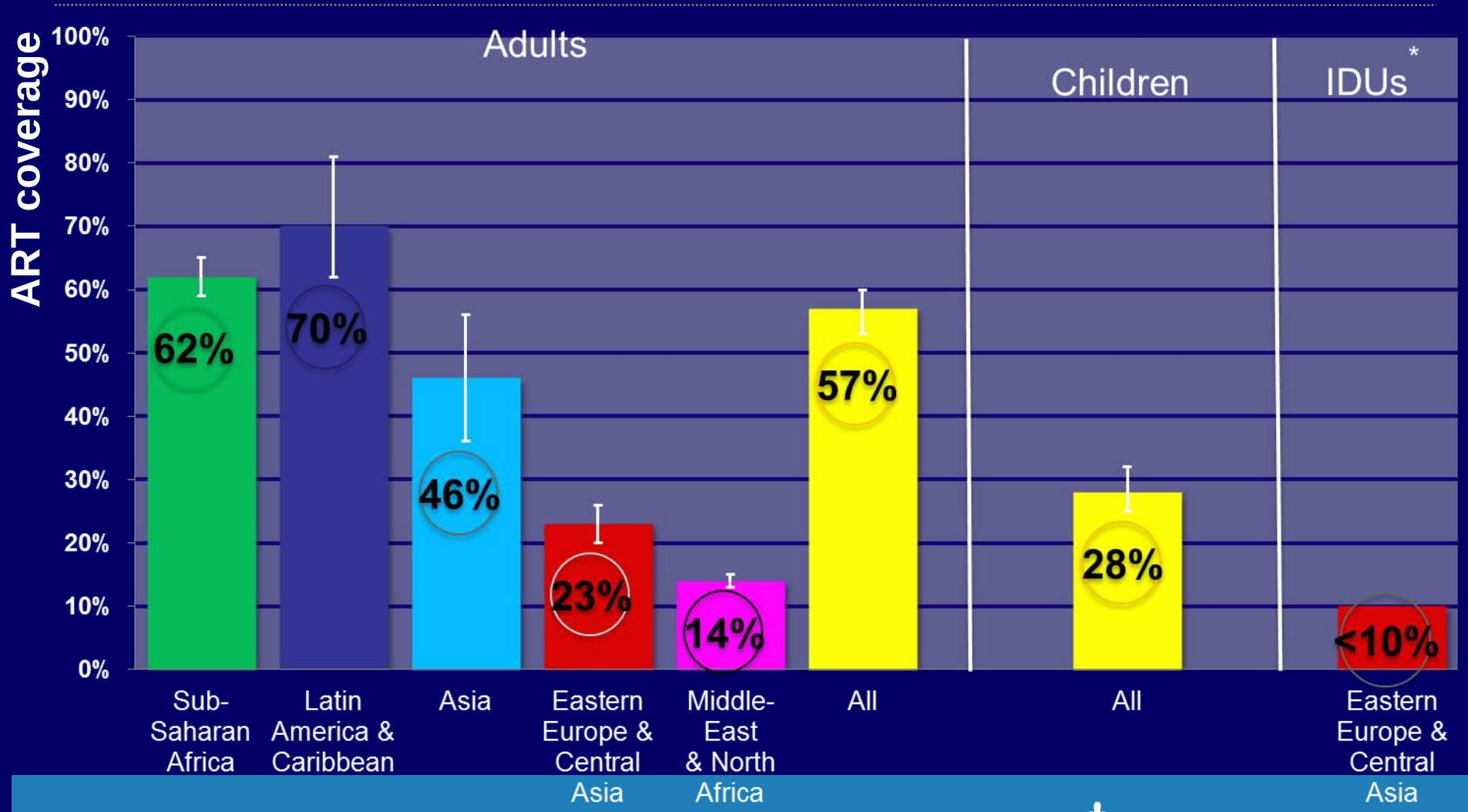
Disparities in ART coverage between regions and populations



*** 2010 HIV case reporting (18 countries)**

World Health Organization

Proportion of eligible population receiving antiretroviral therapy in low- and middle-income countries at the end of 2010

Rapid increases in ART coverage are helping more countries achieve universal access to treatment, care and support.

0%–19%

Afghanistan	Mauritius
DR Congo	Nepal
Djibouti	Pakistan
Egypt	Somalia
Iran	Sudan
Kyrgyzstan	Tajikistan
Latvia	Tunisia
Madagascar	Ukraine
Maldives	

20%–39%

Algeria	Indonesia
Angola	Kazakhstan
Armenia	Lebanon
Azerbaijan	Liberia
Bangladesh	Lithuania
Bhutan	Malaysia
Bolivia	Mauritania
Bulgaria	Mongolia
Burundi	Morocco
Cameroon	Myanmar
CAR	Niger
Chad	Nigeria
China	Panama
Colombia	Poland
Côte d'Ivoire	Rep. of Moldova
Eq Guinea	Russian Fed
Fiji	Sao Tome and Principe
Gambia	Serbia
Ghana	Sierra Leone
Hungary	Sri Lanka
India	Uzbekistan

40%–59%

Belarus	Malawi
Belize	Mali
Benin	Mozambique
Burkina Faso	Oman
Cape Verde	Papua New Guinea
Congo	Peru
El Salvador	Philippines
Eritrea	Senegal
Gabon	South Africa
Guatemala	Suriname
Guinea	Togo
Guinea-Bissau	Turkey
Haiti	Uganda
Honduras	UR Tanzania
Jamaica	Venezuela
Lao PDR	Viet Nam
Lesotho	Zimbabwe

60%–79%

Argentina	Mexico
Brazil	Paraguay
Costa Rica	Romania
Dominican Rep	Swaziland
Ecuador	Thailand
Ethiopia	Uruguay
Georgia	Zambia
Kenya	

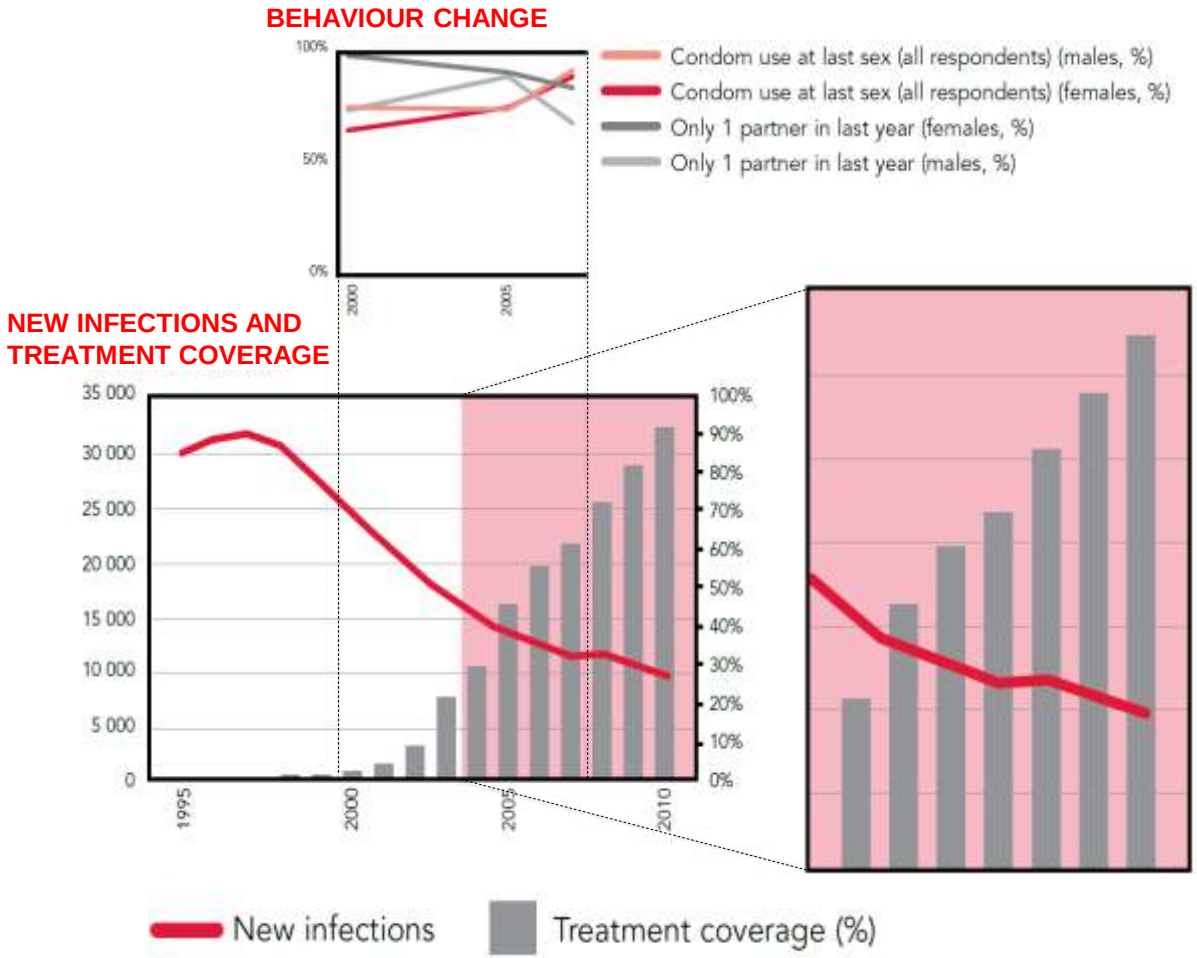
>80%

Botswana	Guyana
Cambodia	Namibia
Chile	Nicaragua
Comoros	Rwanda
Croatia	Slovakia
Cuba	

***Source*: UNAIDS and WHO, 2011.**

World Health Organization

New infections, behaviour change and treatment coverage in Botswana

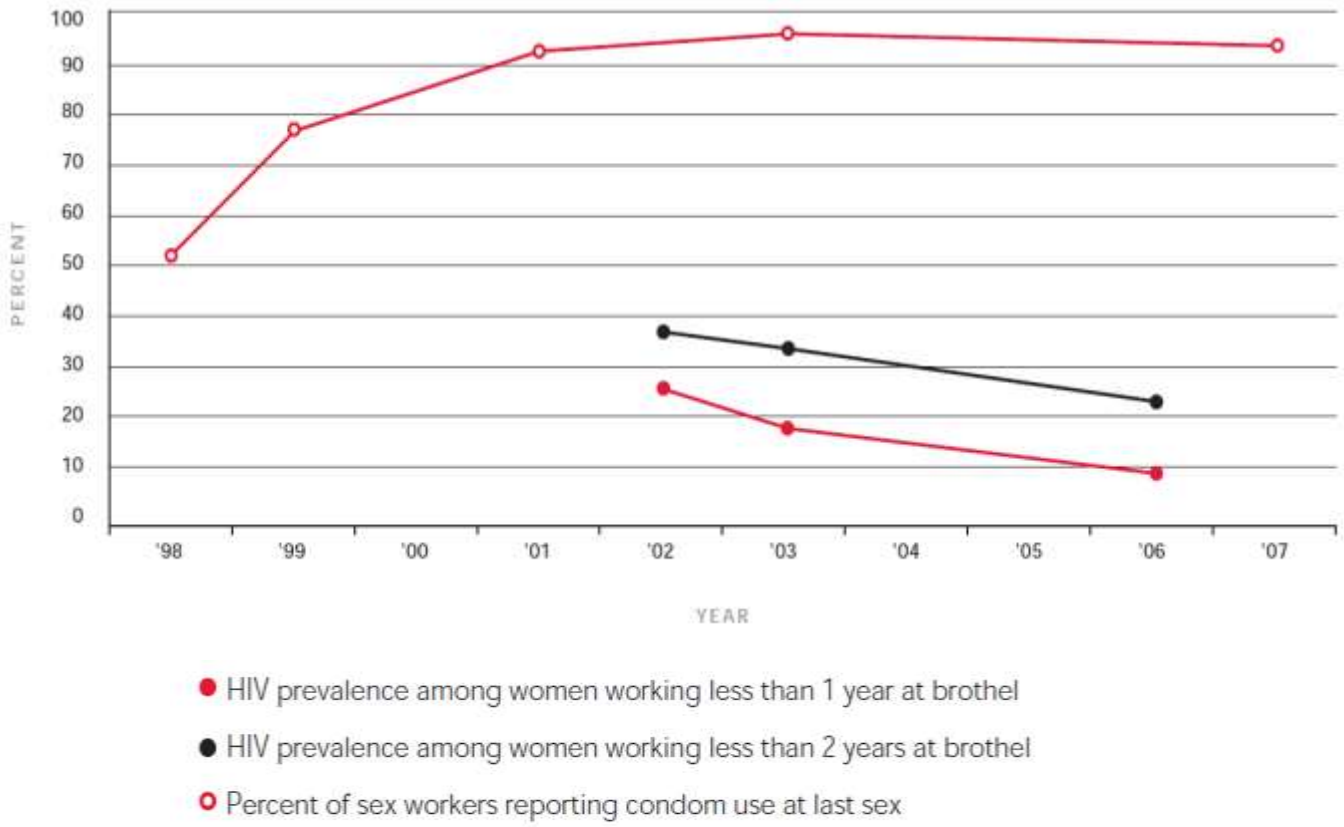


Source: Botswana AIDS indicator surveys; UNAIDS; WHO.

World Health Organization

Condom use and HIV prevalence among sex workers in Cambodia

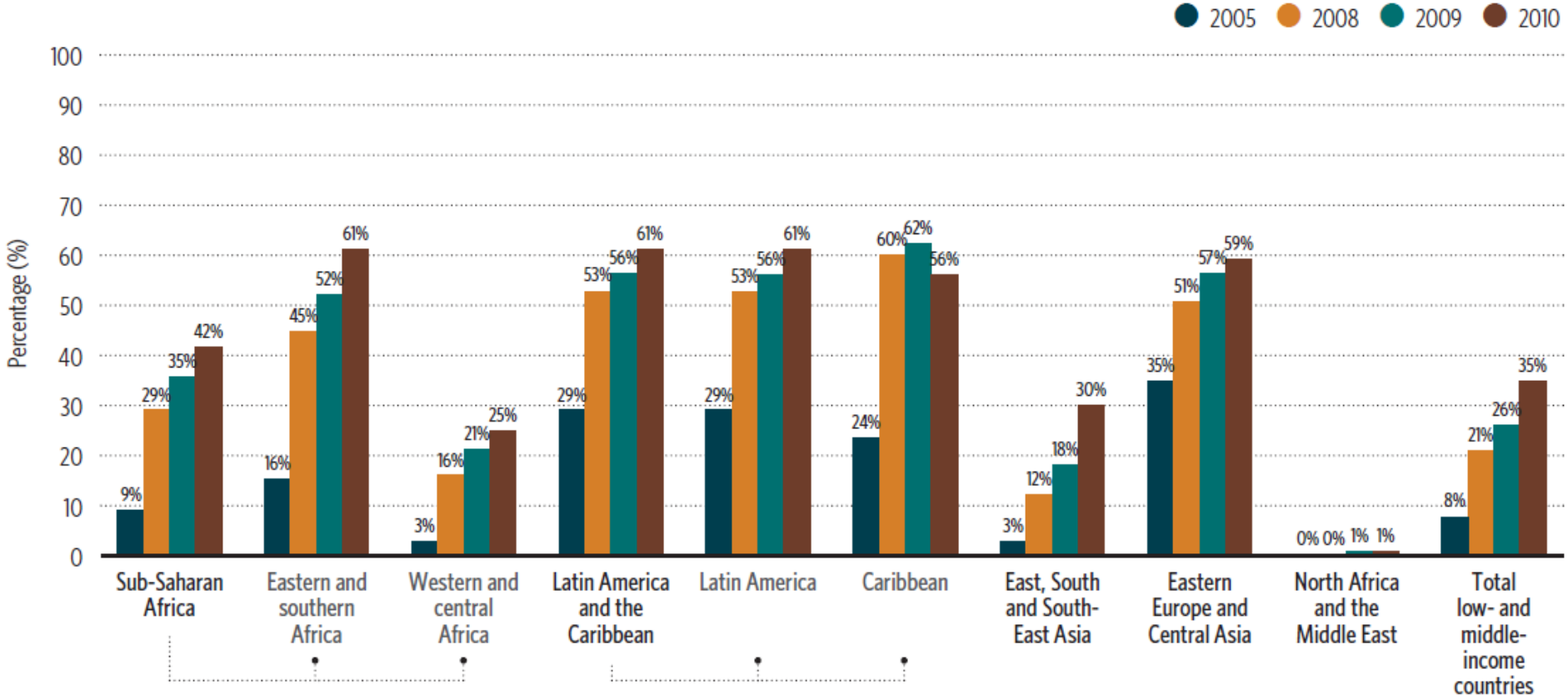
Percentage of sex workers using condoms and HIV prevalence among brothel-based sex workers in Cambodia
by length of time involved in sex work, 1998–2007.



Source: M Mahy, C Chhea, T Saliuk, O Varetska, R Lyerla (2010). A proxy measure for HIV incidence among populations at increased risk to HIV Vol 2(1):8, Journal of HIV/AIDS Surveillance and Epidemiology.

Ecological aossociations and the difficulties of evidence for preventio

Percentage of pregnant women who received an HIV test in the past 12 months in low- and middle-income countries by region, 2005 and 2008–2010



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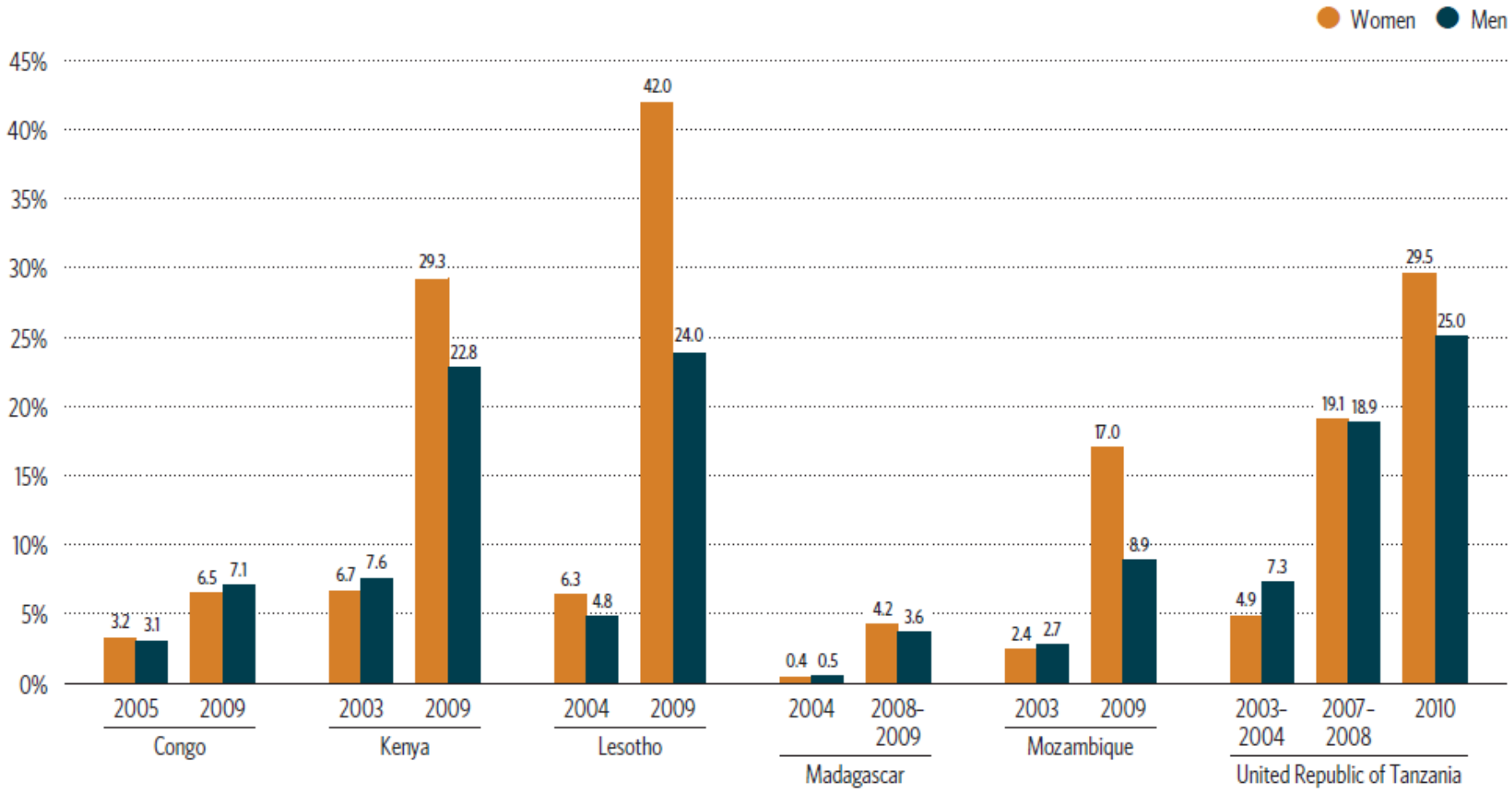
Percentage of women and men who received an HIV test and test results in the 12 months preceding the survey in countries with repeat population surveys, 2003–2010



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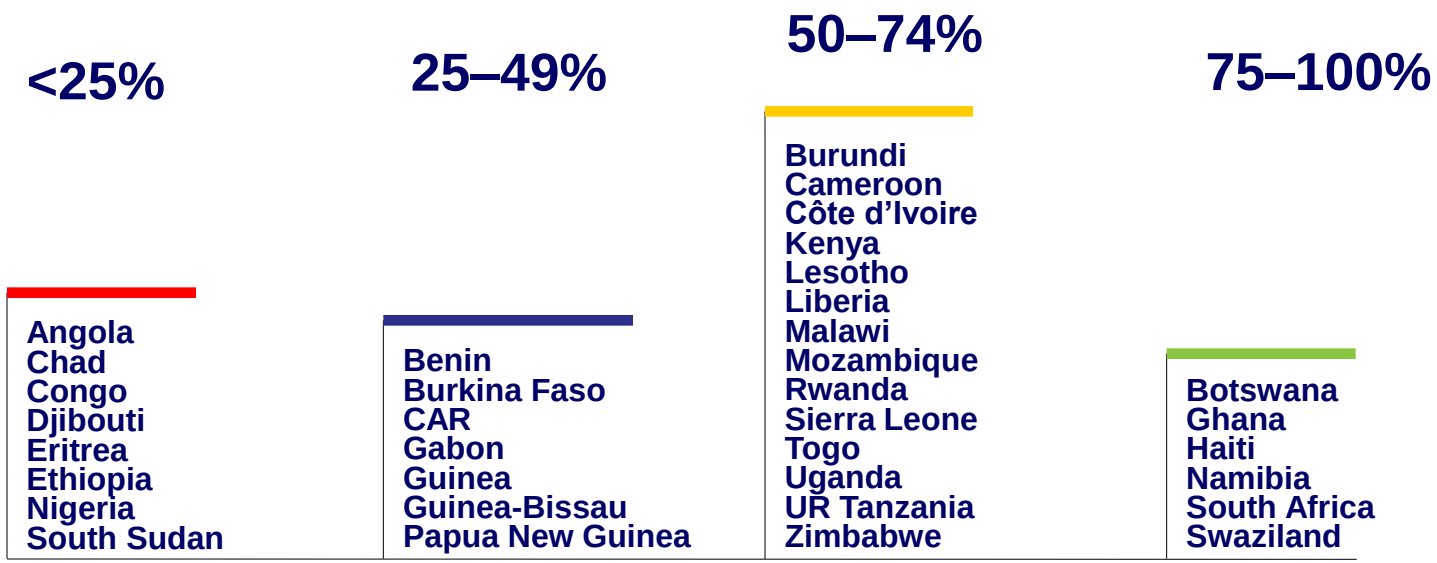
Scale-up possible:
Example of Elimination of new infections in children

More than half of pregnant women covered by ART in countries with a generalized epidemic, 2011



Source: 2012 country progress reports (www.unaids.org/cpr) and UNAIDS estimates.

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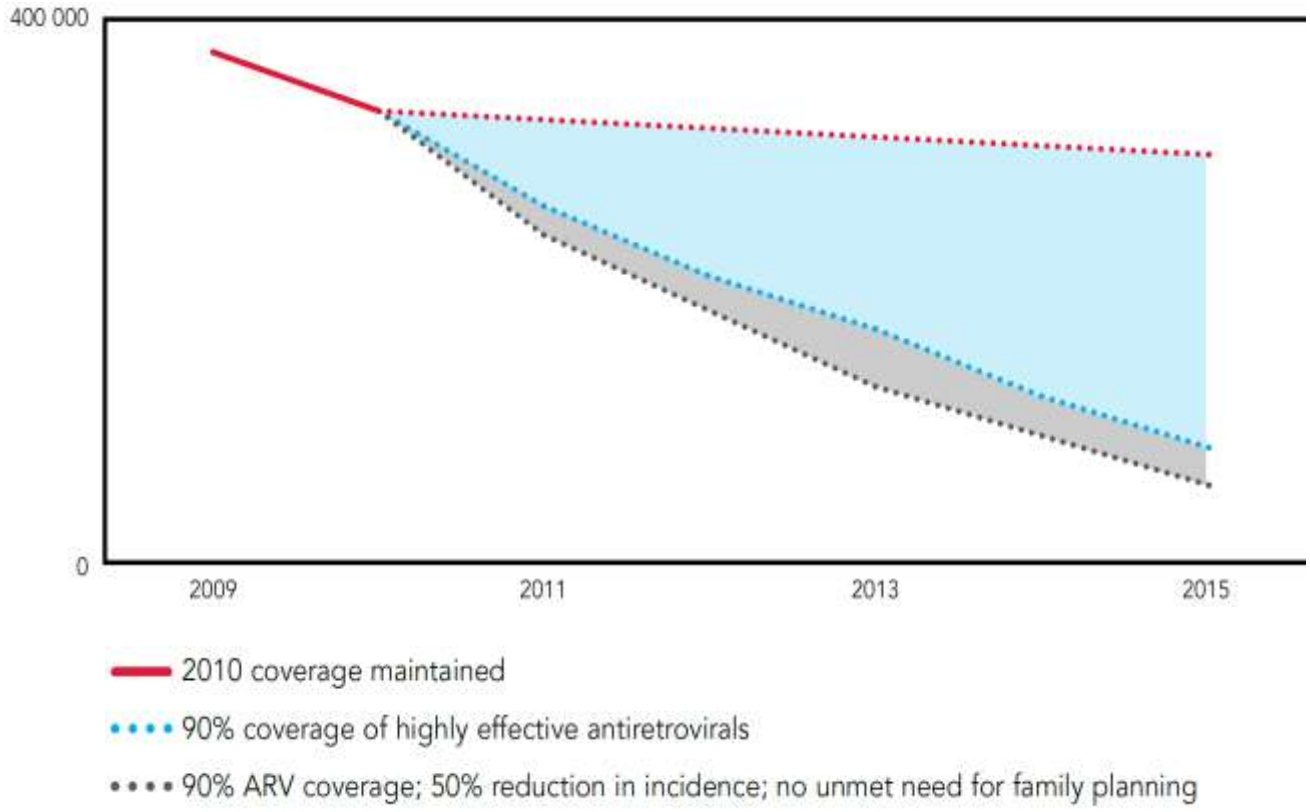
Estimated percent of pregnant women living with HIV who receive effective antiretroviral regimens, in 22 priority countries

0%–39%	40%–79%	>80%
	Cameroon	
	Côte d'Ivoire	
Angola	Ghana	
Burundi	Kenya	
Chad	Mozambique	Botswana
DR Congo	Uganda	Lesotho
India	UR Tanzania	Namibia
Malawi	Zambia	South Africa
Nigeria	Zimbabwe	Swaziland

***Note*: no estimate is available for Ethiopia**

***Source*: UNAIDS, UNICEF and WHO, 2011.**

New HIV infections among children: Scenarios for 21 priority countries



***Note*: These 21 countries, plus India, comprise the 22 priority countries in the *Global Plan Towards the Elimination of New HIV infections Among Children and Keeping Their Mothers Alive*.**

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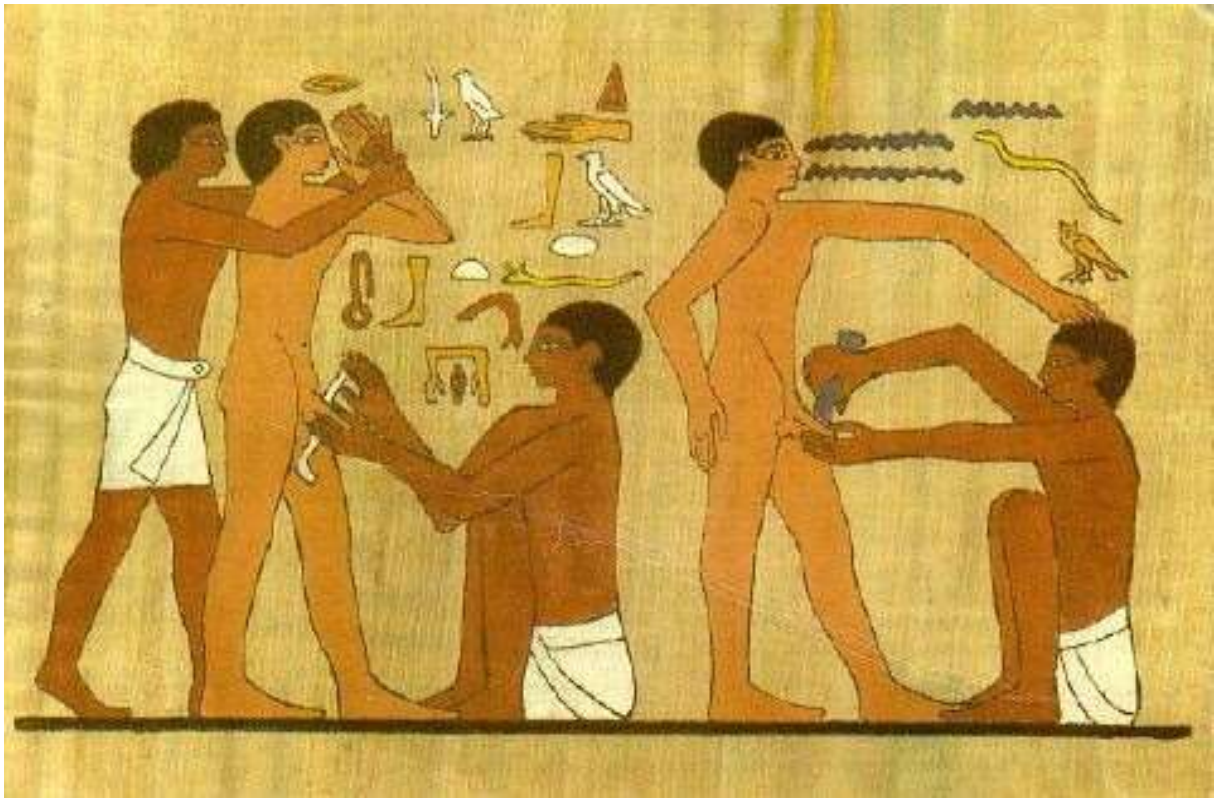
Outline

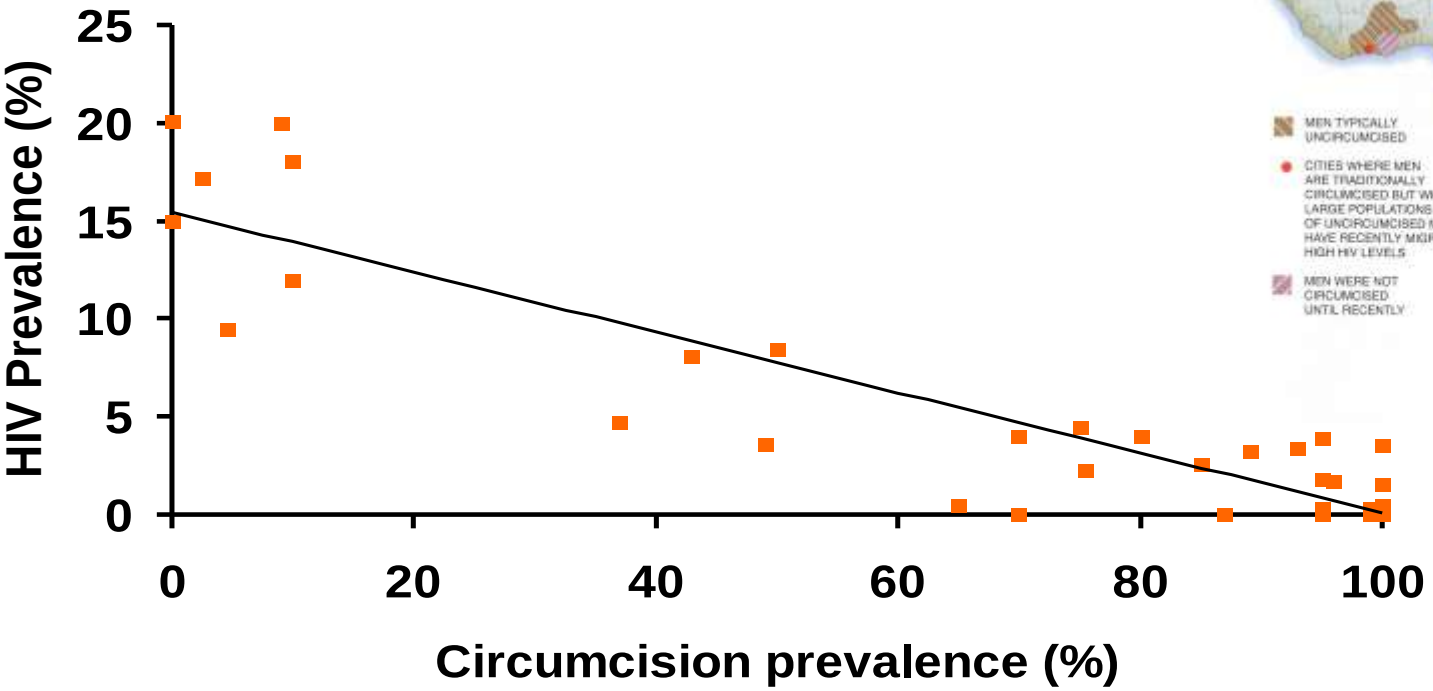
- HIV Prevention:
  - Male circumcision
  - Treatment as Prevention

HIV prevention through male circumcision



Research: ecological studies
HIV seroprevalence in 37 African cities and proportion of males circumcised

Source: Bongaarts, AIDS 1989



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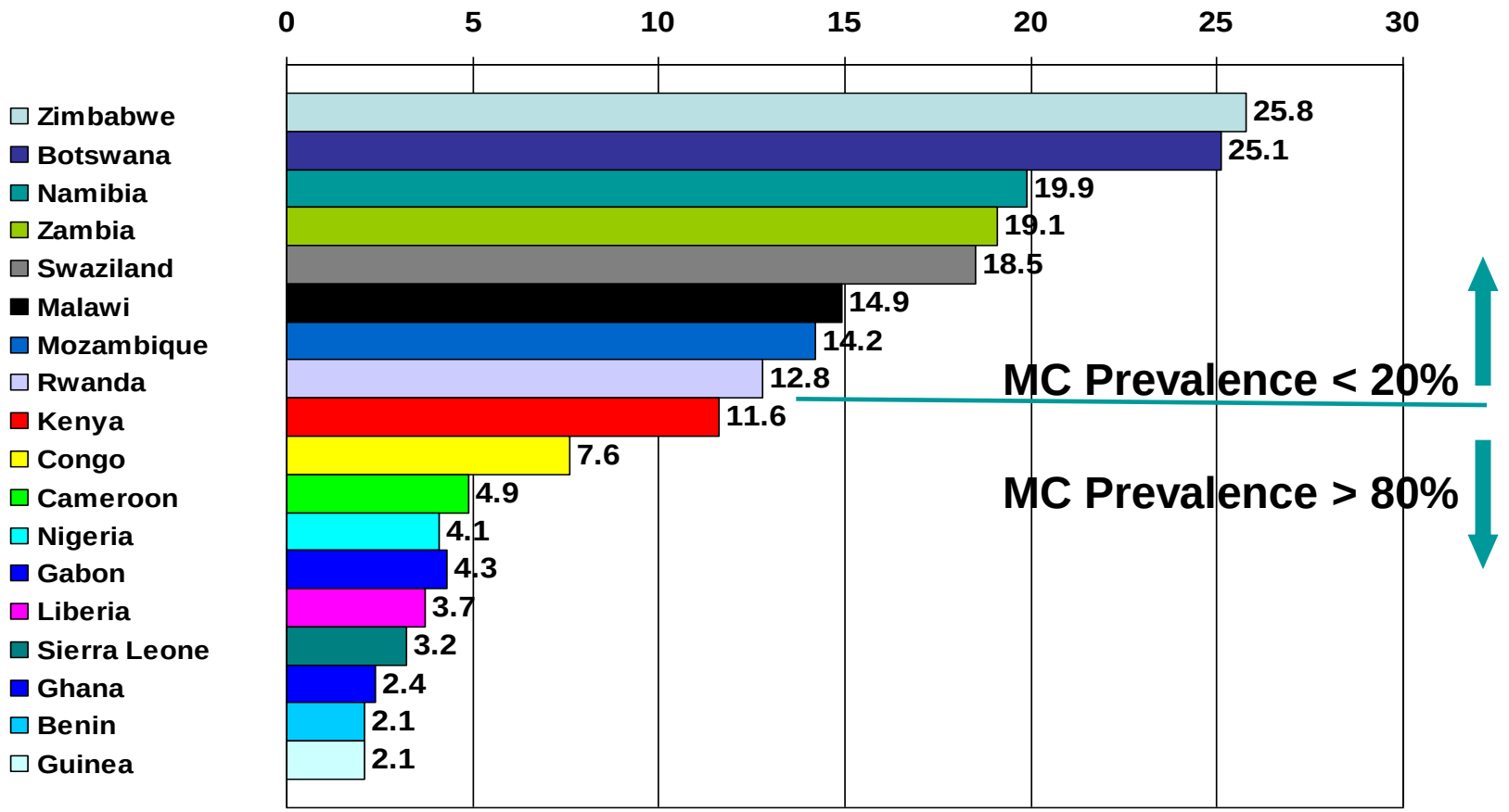
1999

MC and HIV prevalence: geographic variation in Africa

Adapted from Halperin & Bailey, *Lancet* 1999; 354: 1813



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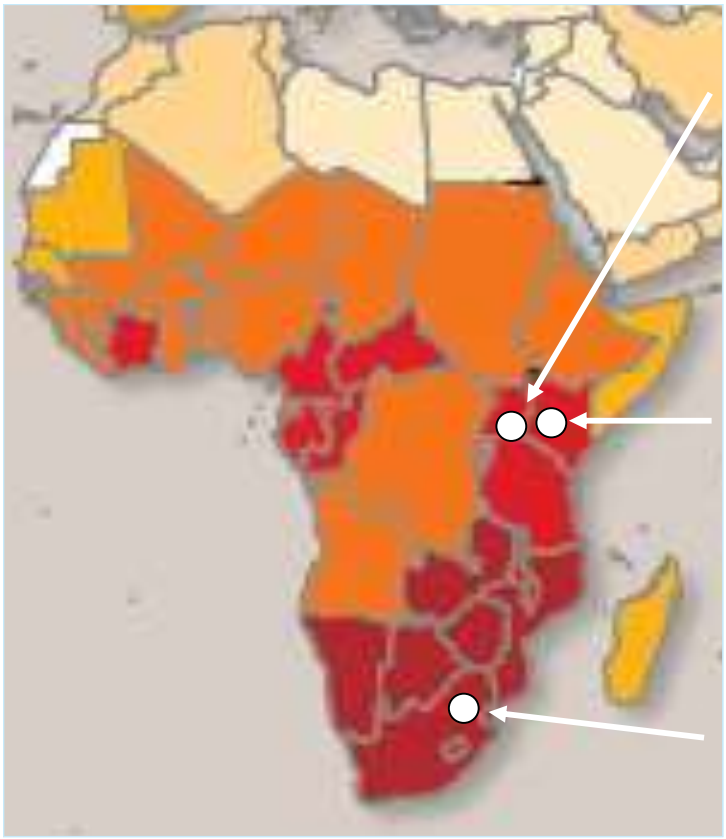
2005 - 6

Randomised controlled trials of MC to reduce HIV infection completed



Source: 2006 Report on the global AIDS epidemic (UNAIDS, May 2006)

Rakai, Uganda

Gray *et. al.* (2007)

Lancet; 369: 657 – 66

Kisumu, Kenya

Bailey *et. al.* (2007)

Lancet; 369: 643 – 56

Orange Farm, South Africa

Auvert *et. al.* (2005)

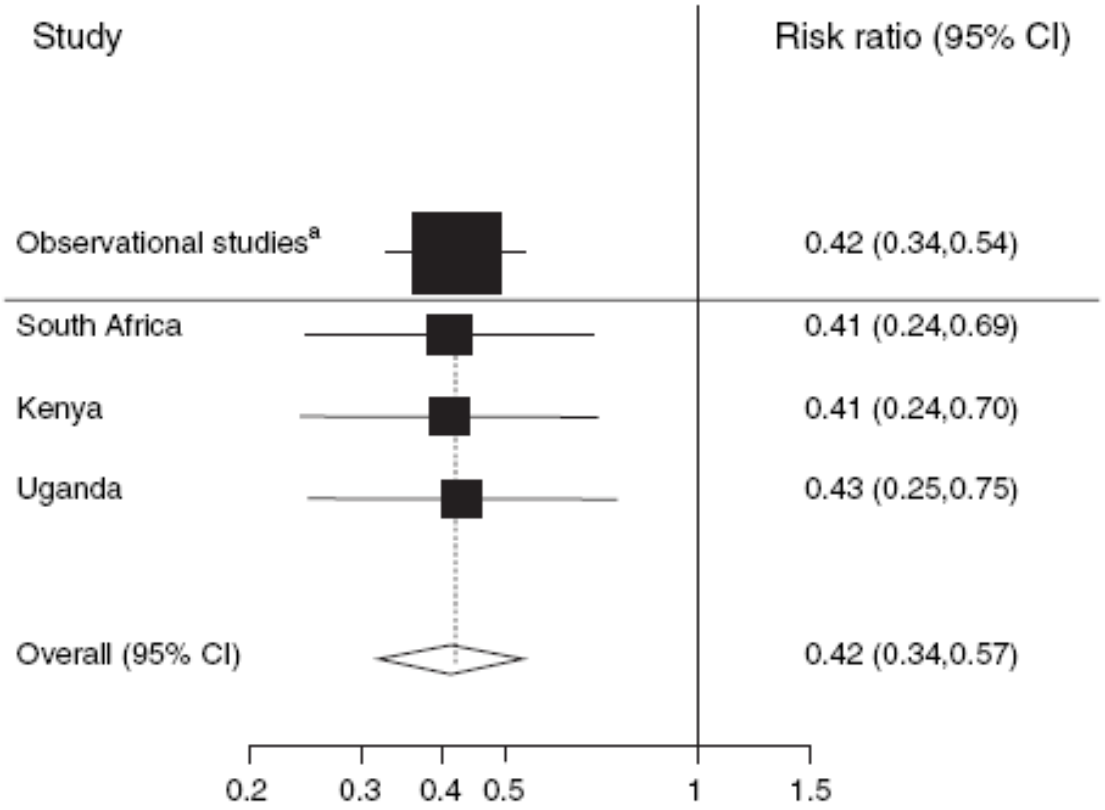
PLoS Med; 2 (11): e298

Completed Efficacy Trials of Interventions for Prevention of Sexual Transmission of HIV (by Oct 2011)

Intervention	Completed	Efficacious
Behavioral, social	8	0
Cervical barriers	1	0
Male circumcision (heterosexuals)	3	3 (Orange Farm, Rakai, Kisumu – protective effect for males)
STI treatment	6	1 (Mwanza)
HSV-2 suppression	3	0
PrEP (oral TDF± FTC - MSM, transgender, heterosexuals)	4	3 (iPrEx, TDF-2, Partners PrEP)
ART for HIV+ partner (HIV heterosexual serodiscordant couples)	1	1 (HTPN052)
Microbicides (Nonoxynol 9, C31G,Cellulose sulphate, PC-515, Buffer Gel, PRO 2000, TDF vaginal gel)	12	1 (CAPRISA 004 - TDF vaginal gel)
HIV vaccines (rgp 120, M RK Ad5, RV 144)	4	1 (Thai RV 144)
TOTAL	43	10

Evidence summary

Overall 60% reduction in risk



Weiss et al, AIDS. 2008;22(5):567-74

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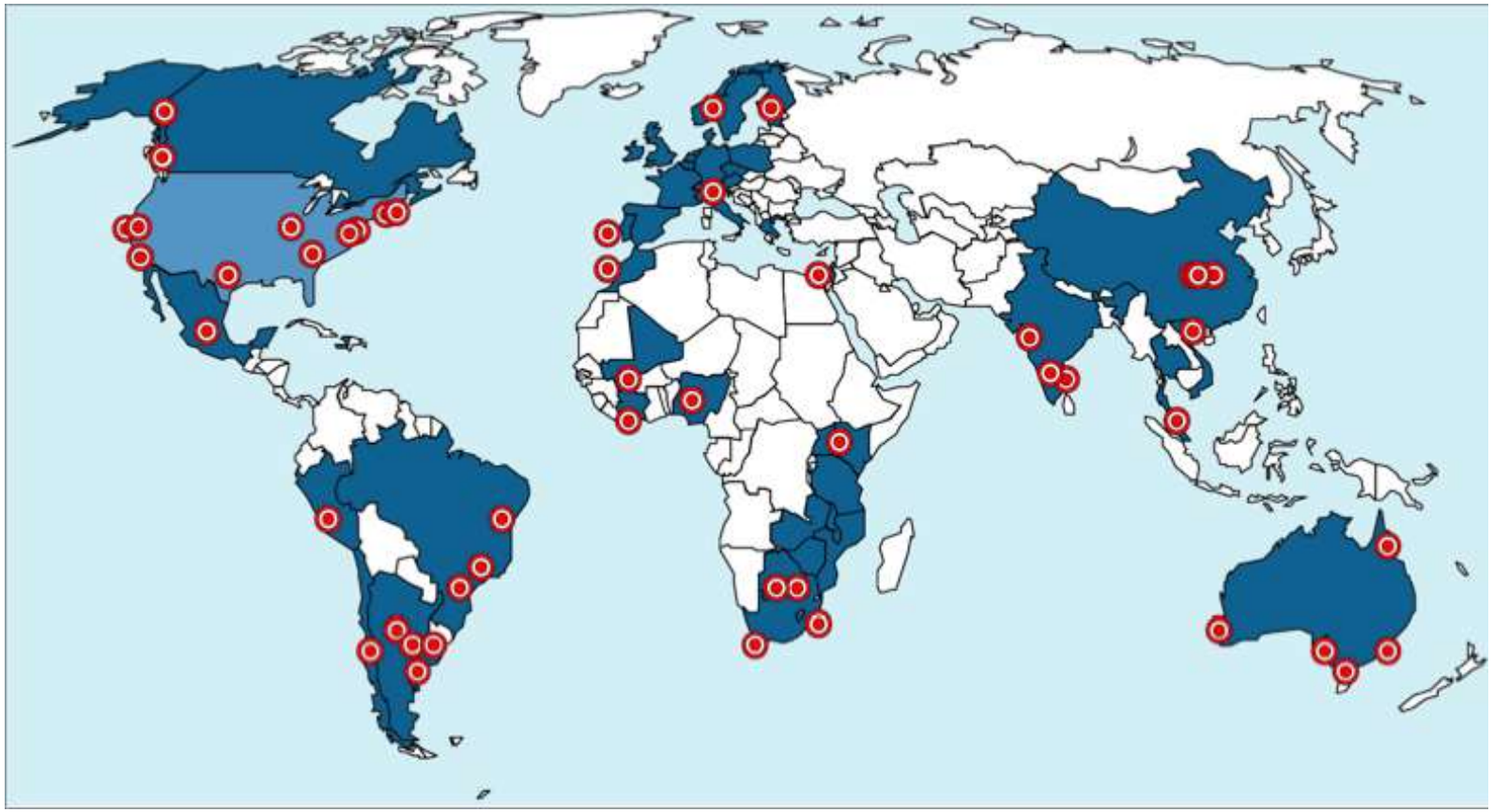
Current Issues

Strategic use of antiretrovirals

Antiretroviral Treatment as HIV Prevention:

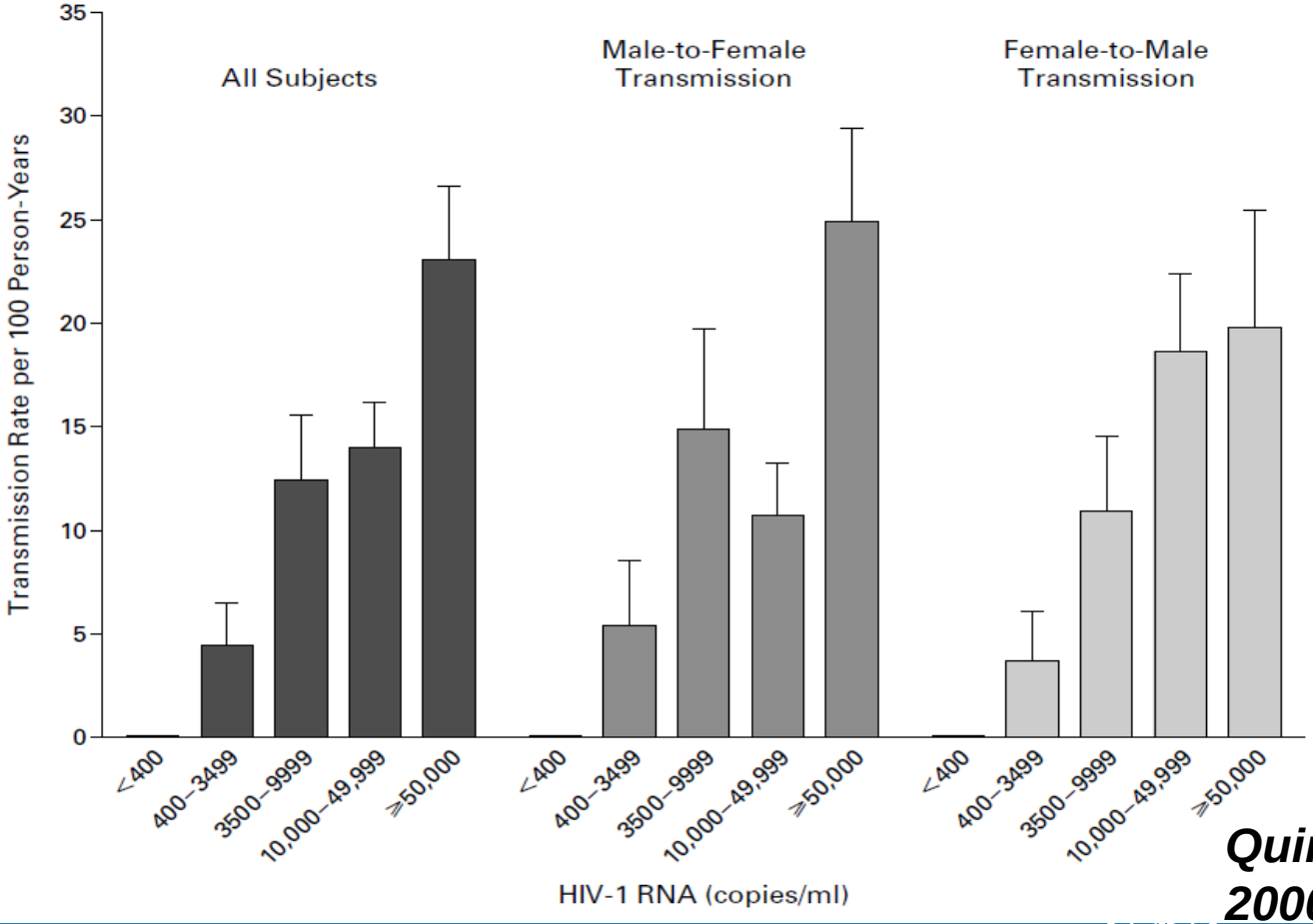
Geographical distribution of ART for prevention studies



Dark blue represents countries conducting ART in prevention research, light blue represents country-wide efforts (United States, Swaziland), red dots represent selected study sites within countries (some countries had too many sites to represent on this graphic)

Source: Granich et al 2011

Rakai Study of viral load and HIV transmission



Quinn et al, NEJM 2000

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Evidence from HPTN 052

1763 HIV-discordant couples in 9 countries, CD4=250-550

Randomized to immediate or deferred treatment

Stopped for efficacy

39 HIV-ve partners were infected of which 29 were linked virologically to the infected partner

Of these 29 only 1 was in the immediate treatment group HR = 0.04 (95% CI: 0.01–0.27)

Also significant reduction in morbidity endpoints in treated individuals – HR for serious clinical endpoints **=** 0.59 (95% CI: 0.40-0.88)

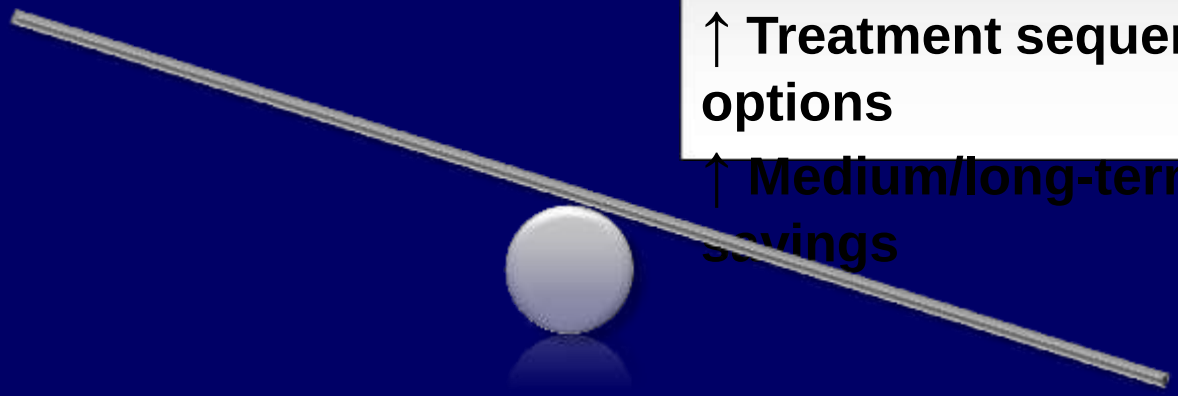
Balance of evidence favours earlier initiation of ART

Delayed ART

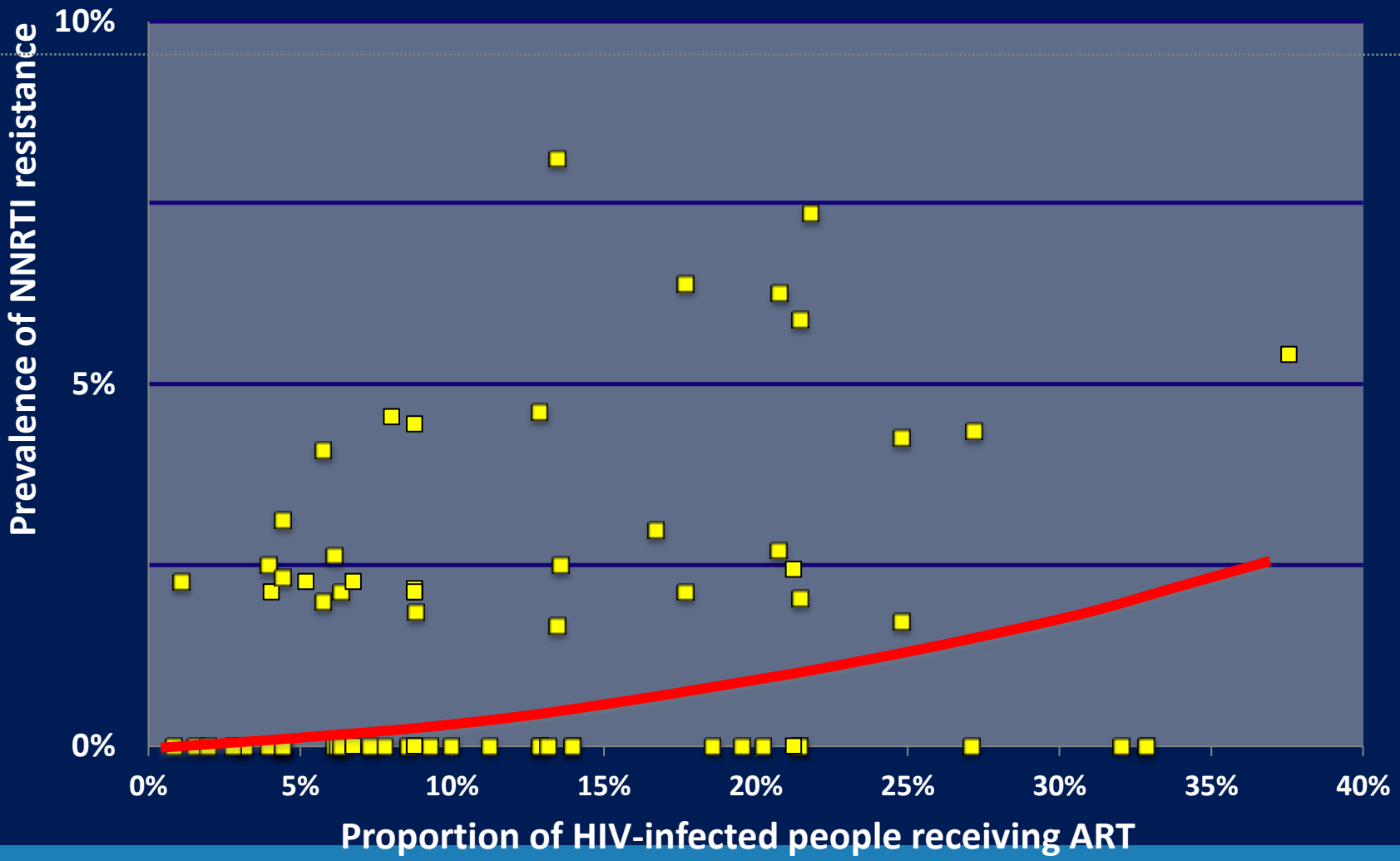
- ↓ Drug toxicity
- ↓ Resistance
- ↓ Upfront costs
- Preservation of Tx options

Earlier ART

- ↑ Clinical benefits (AIDS- and non-AIDS related)
- ↓ HIV and TB transmission
- ↑ Potency, durability, tolerability
- ↑ Treatment sequencing options
- ↑ Medium/long-term cost savings



Relationship between transmitted resistance to NNRTI drugs and ART coverage in LMIC



Source: HIV drug resistance report, WHO, 2012

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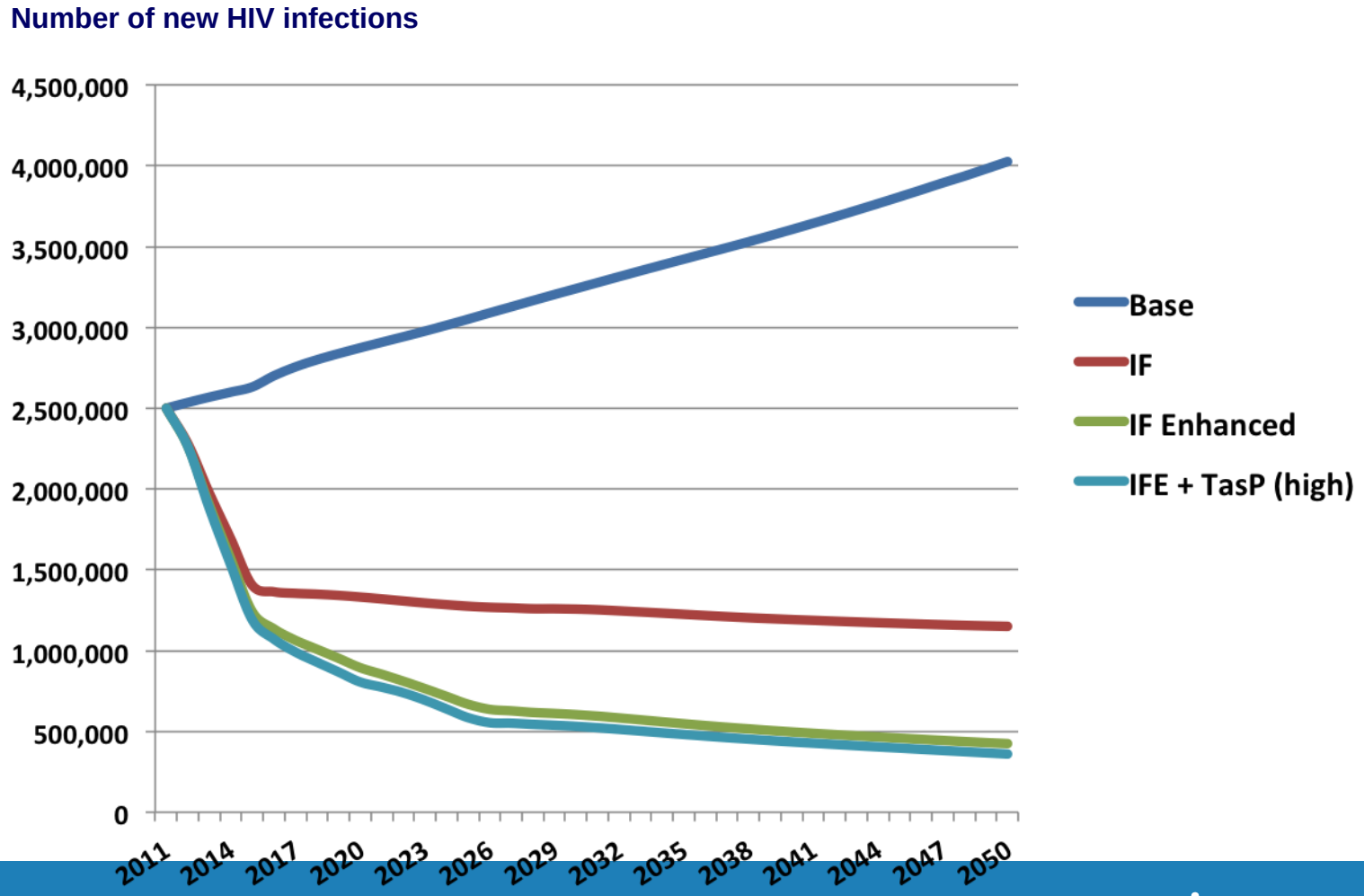
Going to Zero? The 2011 Investment Framework Combination prevention and treatment (new guidelines)



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Conclusions

- HIV epidemic stable and declining but with increasing in some geographical areas or populations
- Improved national response in LMIC
- MC as a tool in SSA for prevention
- Treatment as Prevention strategies
- New Comprehensive WHO guidelines in 2013 on the use of ARVs