
Sexually transmitted infection, BBV and global health

BSc Global Health
31st October, 2011

Graham Cooke

Global burden of infectious disease

	Number of deaths (millions)	% of all deaths	% of all DALYs*
All infectious and parasitic diseases	9.5	16.2	19.8
Lower respiratory infections	4.2	7.1	6.2
Diarrhoeal diseases	2.2	3.7	4.8
→ HIV/AIDS	2.0	3.5	3.8
Tuberculosis	1.5	2.5	2.2
Malaria	0.9	1.5	2.2
Childhood infections** (inc measles)	0.9	1.4	2.0
Measles	0.4	0.7	1.0
→ Hepatitis B & C	0.2	0.3	0.2
Neglected tropical diseases***	0.2	0.3	1.3
→ STIs excluding HIV	0.1	0.2	0.7

Source: Global Burden Disease 2004 Update, 2008. www.who.int/healthinfo/global_burden_disease/

* Disability Adjusted Life Year; ** Childhood infections includes pertussis, polio, diphtheria, measles, tetanus: *** NTDs defined later

Leading Causes of Death Due to Infectious Diseases, 2002

Lower respiratory infections	3.9 million
HIV/AIDS	2.8 million
Diarrhoeal diseases	1.8 million
Tuberculosis	1.6 million
Malaria	1.2 million
Measles	0.6 million

Source: World Health Report, 2004 WHO

HIV/AIDS

- Acquired immune deficiency syndrome
- Caused by human immunodeficiency virus (HIV-1) a retrovirus
- First recognised in 1981

Modes of transmission

HIV/AIDS

Modes of transmission

- Blood (transfusion of blood products, needlestick injury/ unsafe injecting)
- Sexual contact
- Mother to child (at birth and through breast milk)

HIV/AIDS global burden

- Prevalence

- 33.2 million people living with HIV
- 5% of adults in sub-Saharan Africa (but much higher in some population groups)
- 0.8% globally

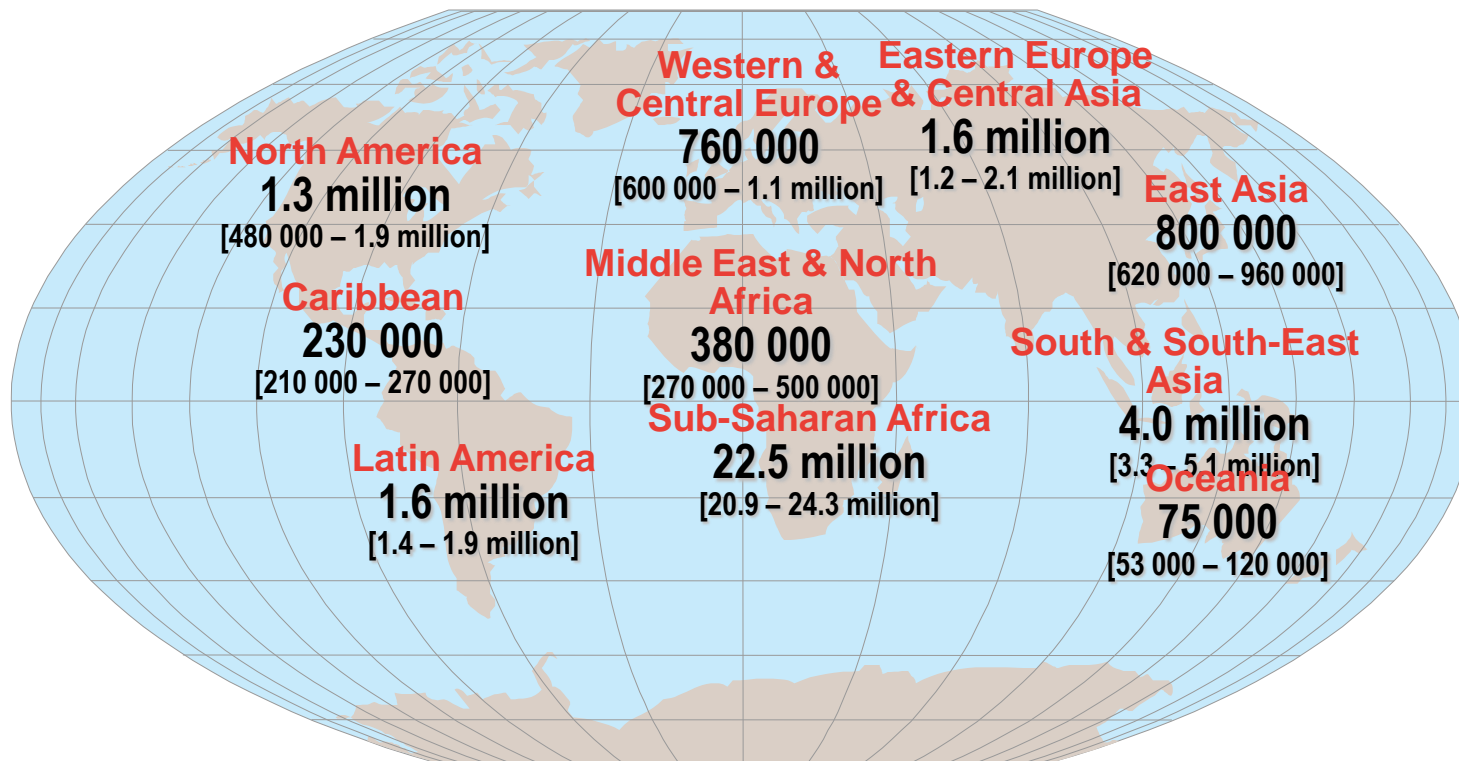
- Incidence

- 2.5 million new cases in 2007

- Mortality

- 2.1 million in 2007

Global distribution: people living with HIV, 2007



Total: 33.2 (30.6 – 36.1) million

Methods for control?

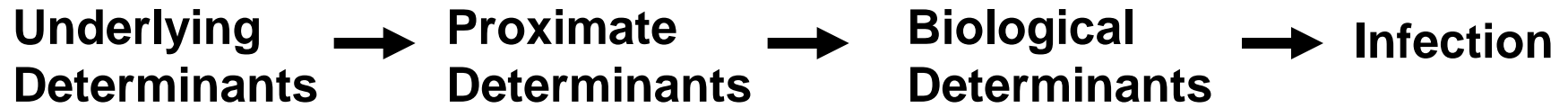
Control of HIV/AIDS

- Primary prevention
 - Change sexual behaviour, including condom promotion
 - Clean blood supply
 - Prevent mother to child transmission
 - Safe drug use
 - Vaccines, microbicides and PREP
- Secondary prevention
 - Testing and intervention to those infected
- Treatment with ARVs

Challenges for HIV control

- Social determinants
 - Sexual behaviour
 - Drug use
- Resources (financial and human)
 - For primary prevention
 - Treatment
 - Care

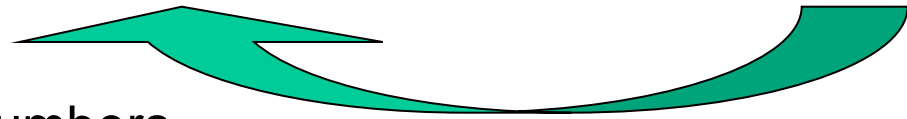
Proximate determinants framework



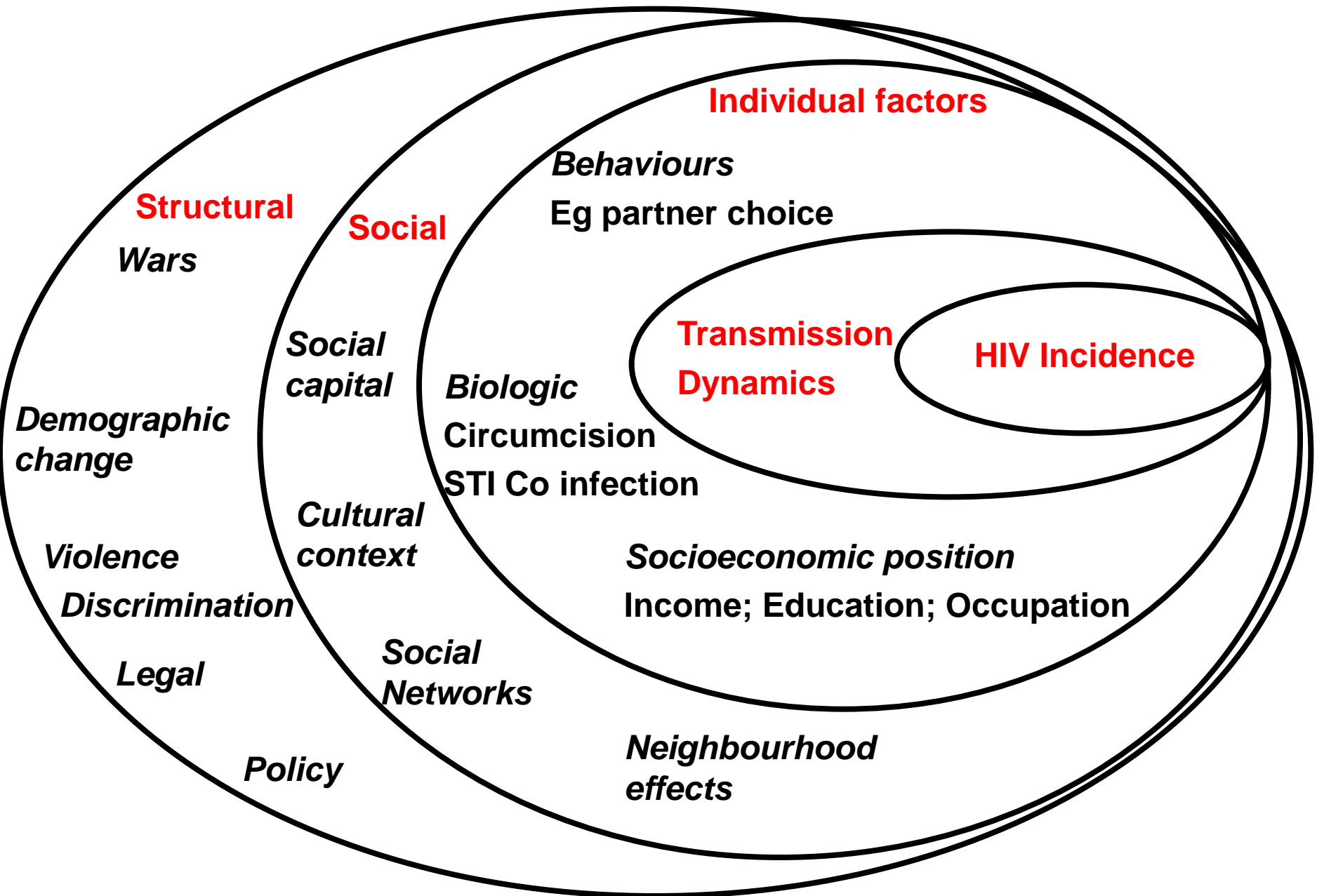
Age
Marital status
Religion
Education
Ethnic group
Socioeconomic Status
Job
Local community
Social locations
(beer halls, bath houses)
Believes, attitudes

Partner numbers
Frequency intercourse
Concurrent partners
STD prevalence
Partnership characteristics:
Partners age, regular or casual
Condom use
Sexual practices
Circumcision

Exposure susceptible to infected
Per contact transmission probability
Duration of infectiousness

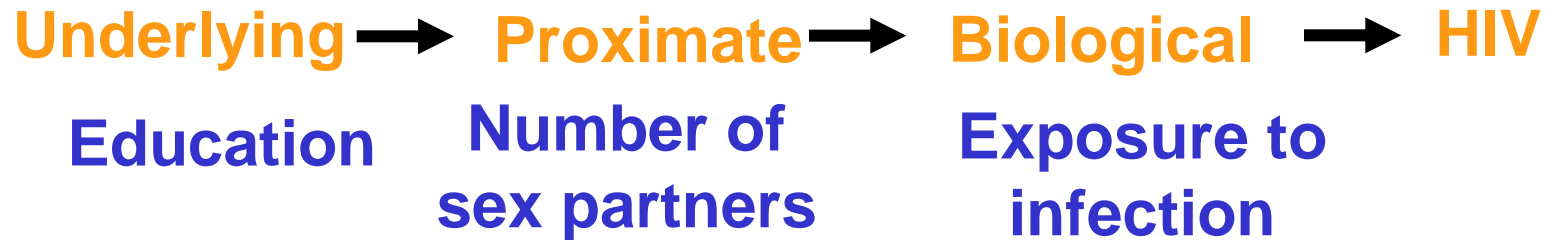


Poundstone et al 2004 The social epidemiology of human immunodeficiency virus/acquired immunodeficiency virus. *Epidemiologic Reviews* 2004



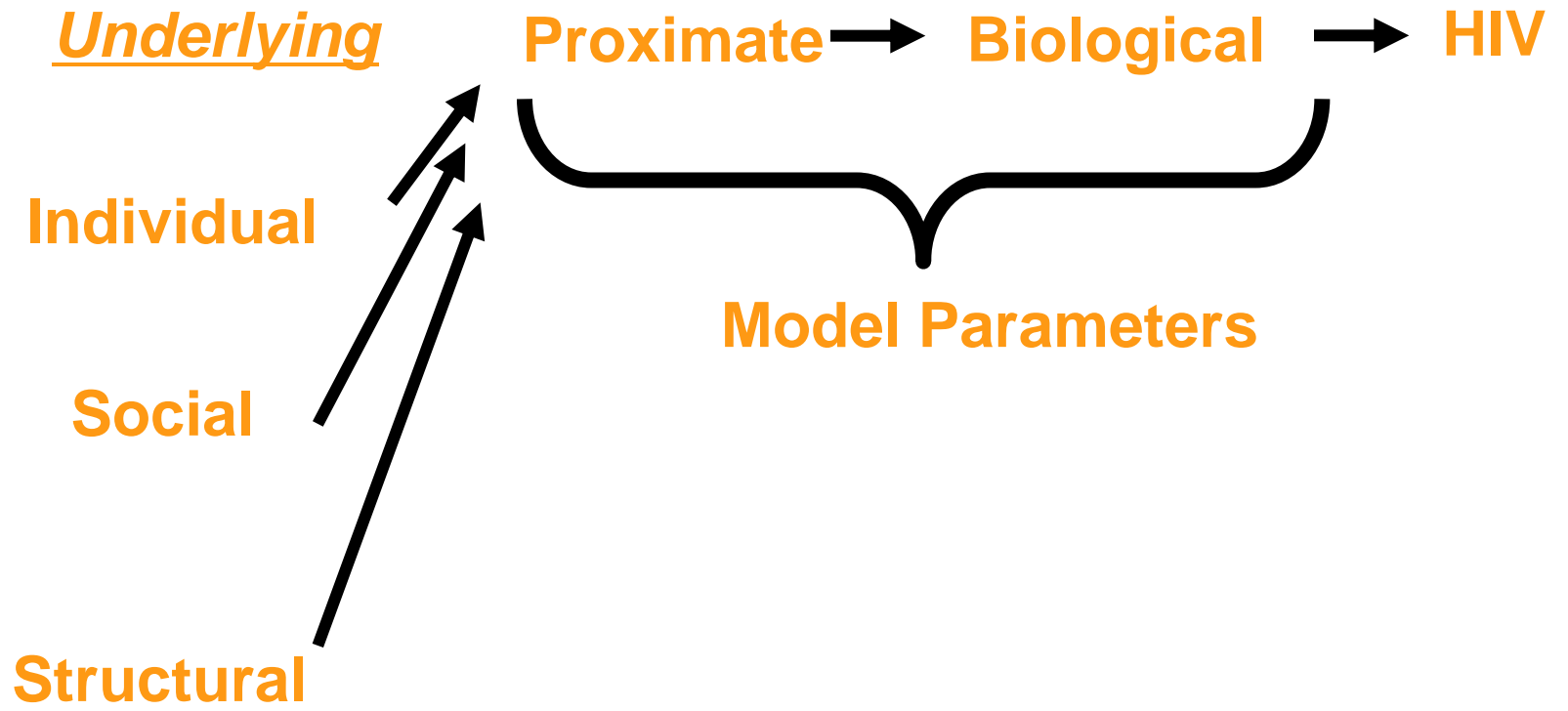
A framework is required to understand both the individual and the populations risk of HIV

Proximate determinants framework (Gregson/Boerma & Weir)



Social epidemiology framework (Poundstone et al)





Hepatitis B and C

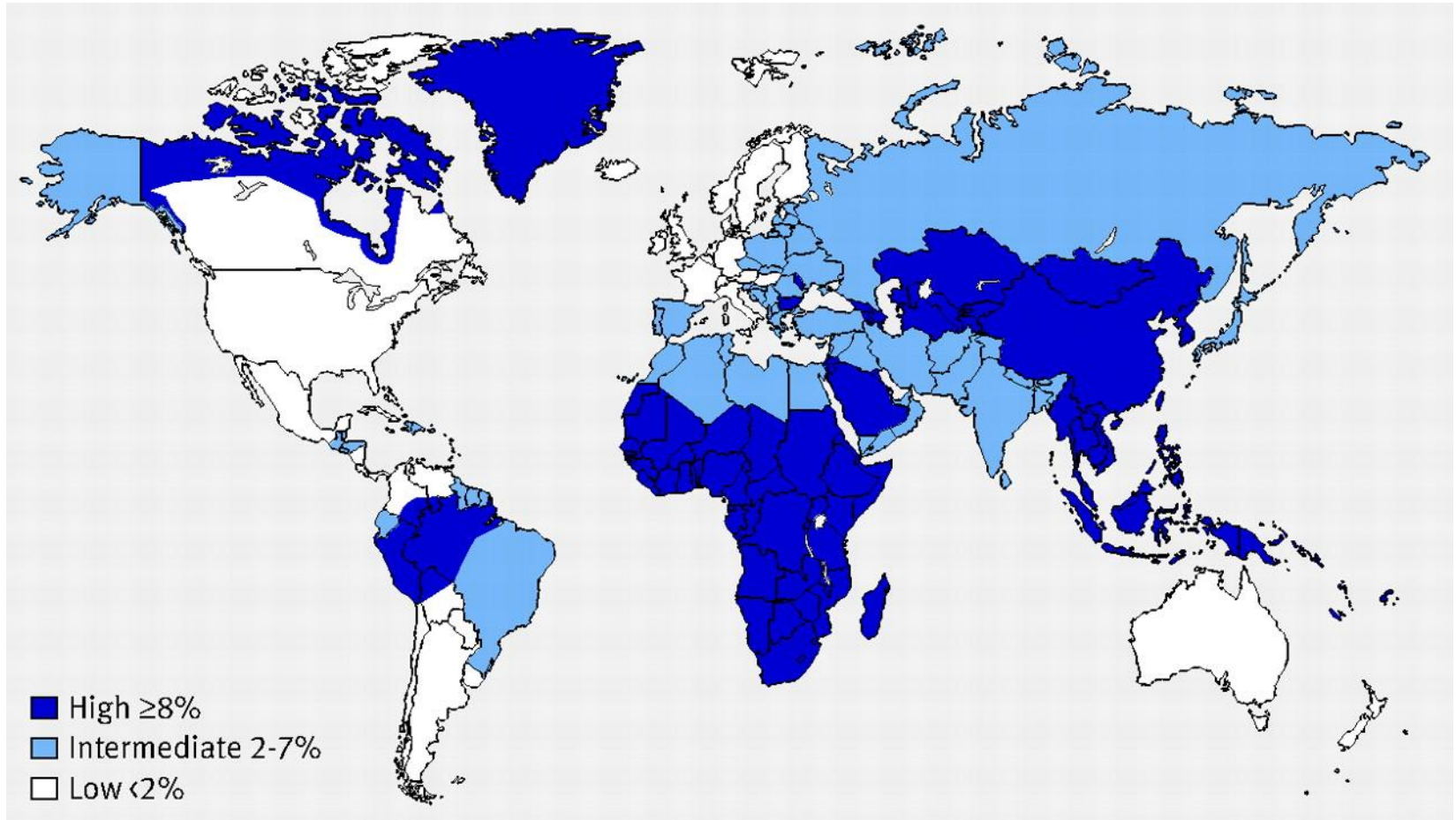
High prevalence of viral infection globally

Some similarities of transmission, globally sexual transmission not dominant route

Both contribute to substantial global morbidity and mortality from chronic liver disease, cirrhosis, and hepatocellular carcinoma

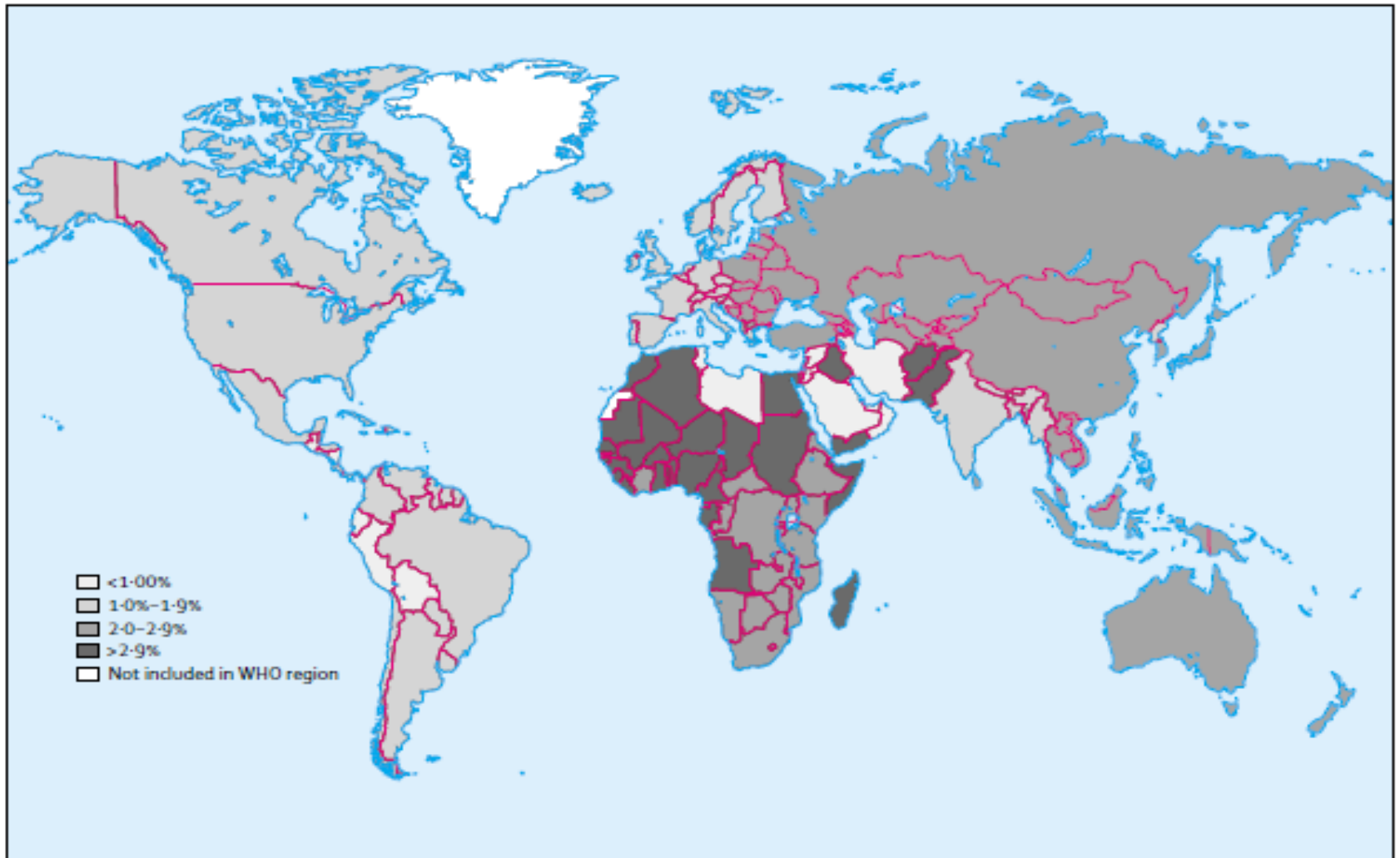
HBV vaccination widely implemented, HCV no effective vaccine on horizon

Prevalence of hepatitis B surface antigen worldwide, 2006.



Cooke G S et al. *BMJ* 2010;340:bmj.b5429

Hepatitis C



Hepatitis C

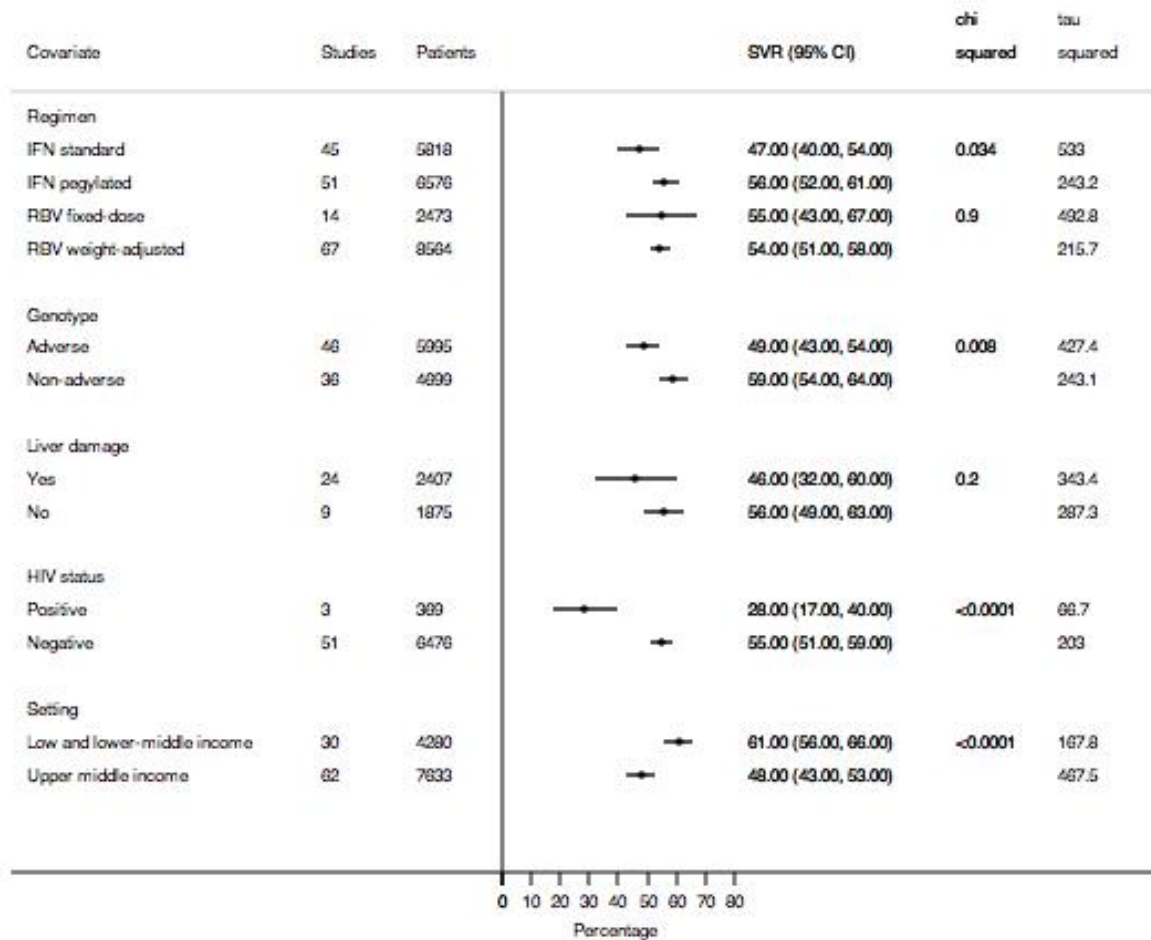
RNA flavivirus transmitted by MTCT, infected needles, blood transfusion

No effective vaccination

Tests widely available and well validated, including point of care

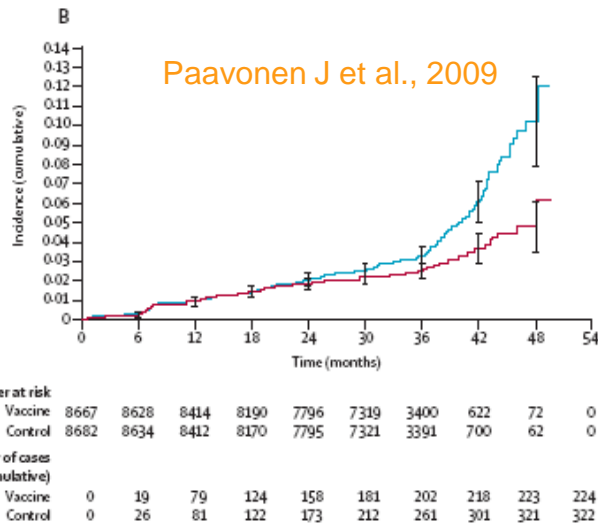
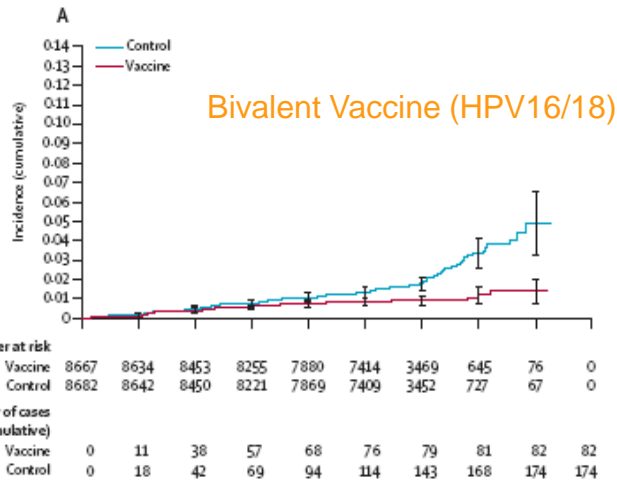
Treatment available and becoming more effective but logistically difficult

Hepatitis C treatment in LMIC



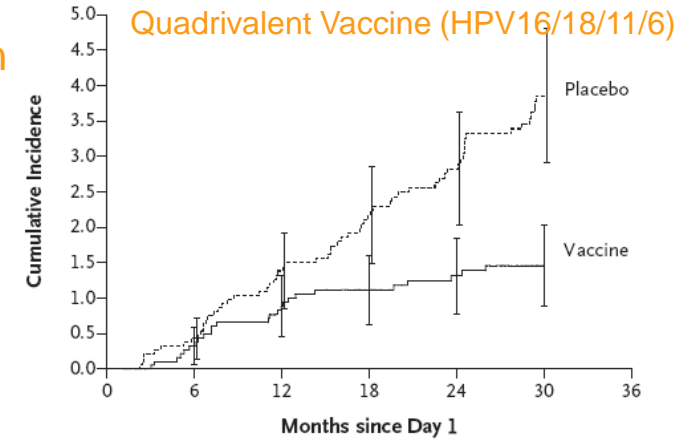
HPV

Girls / Women

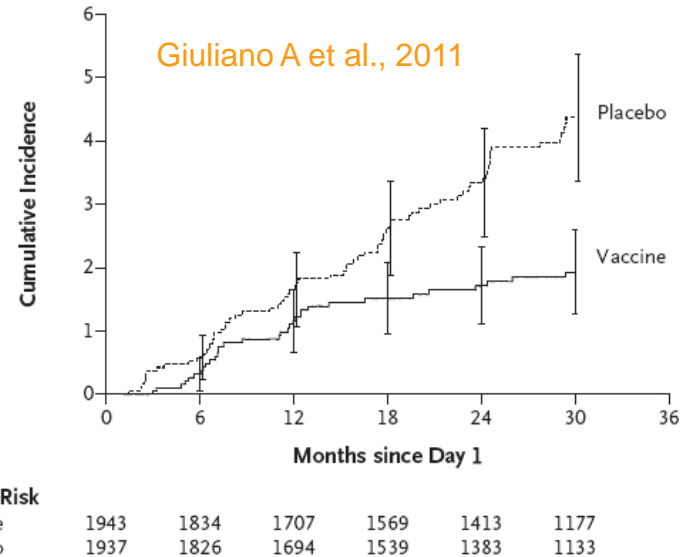


A EGL Related to HPV Types 6, 11, 16, or 18 in the Intention-to-Treat Population

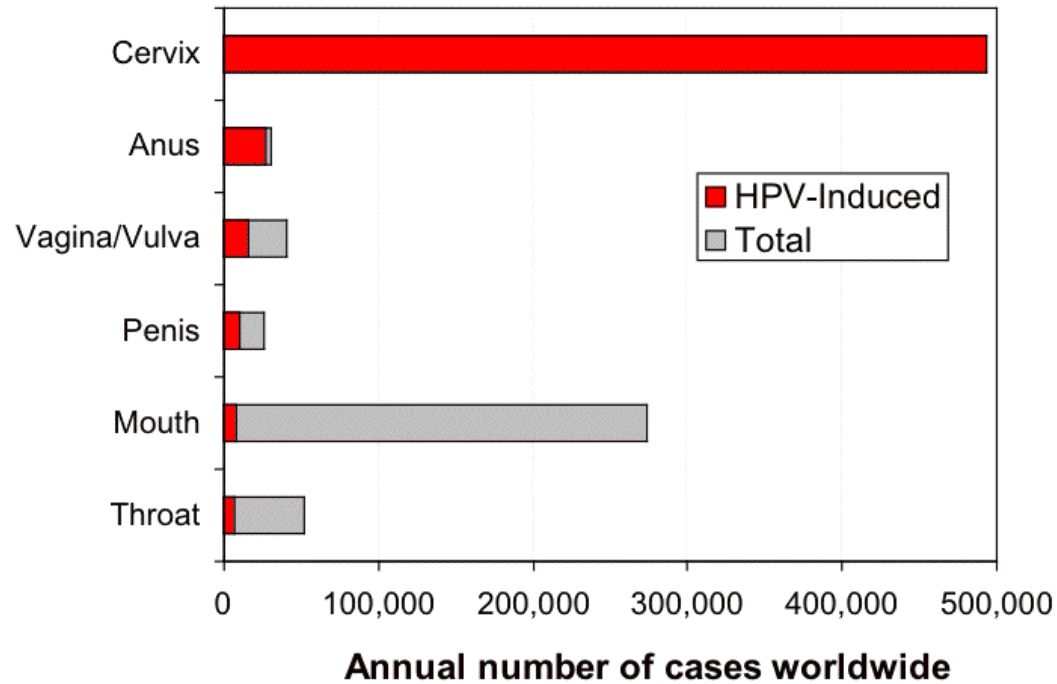
Boys / Men



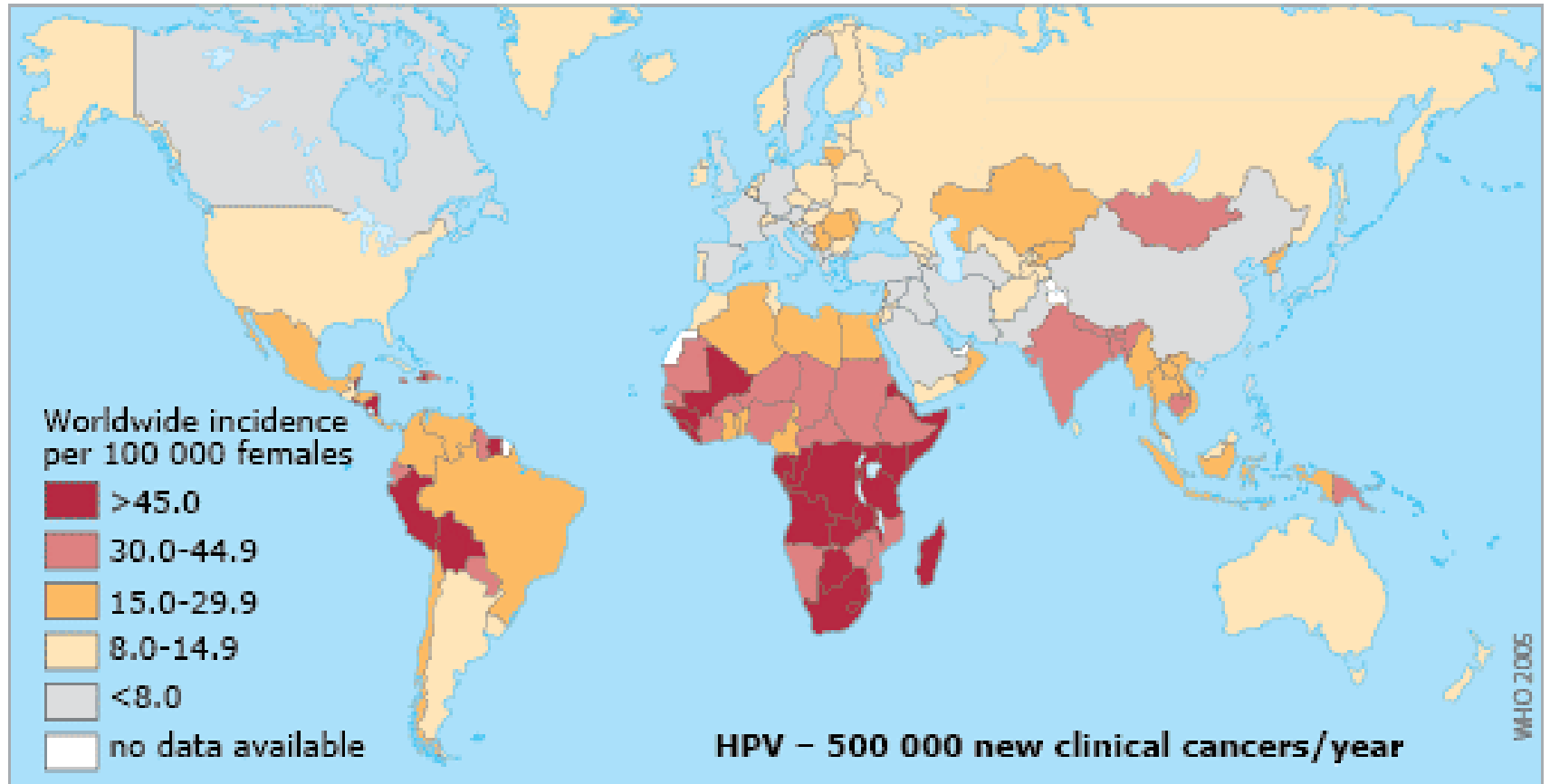
B EGL Related to Any HPV Type in the Intention-to-Treat Population



HPV and cancer



HPV and cervical cancer

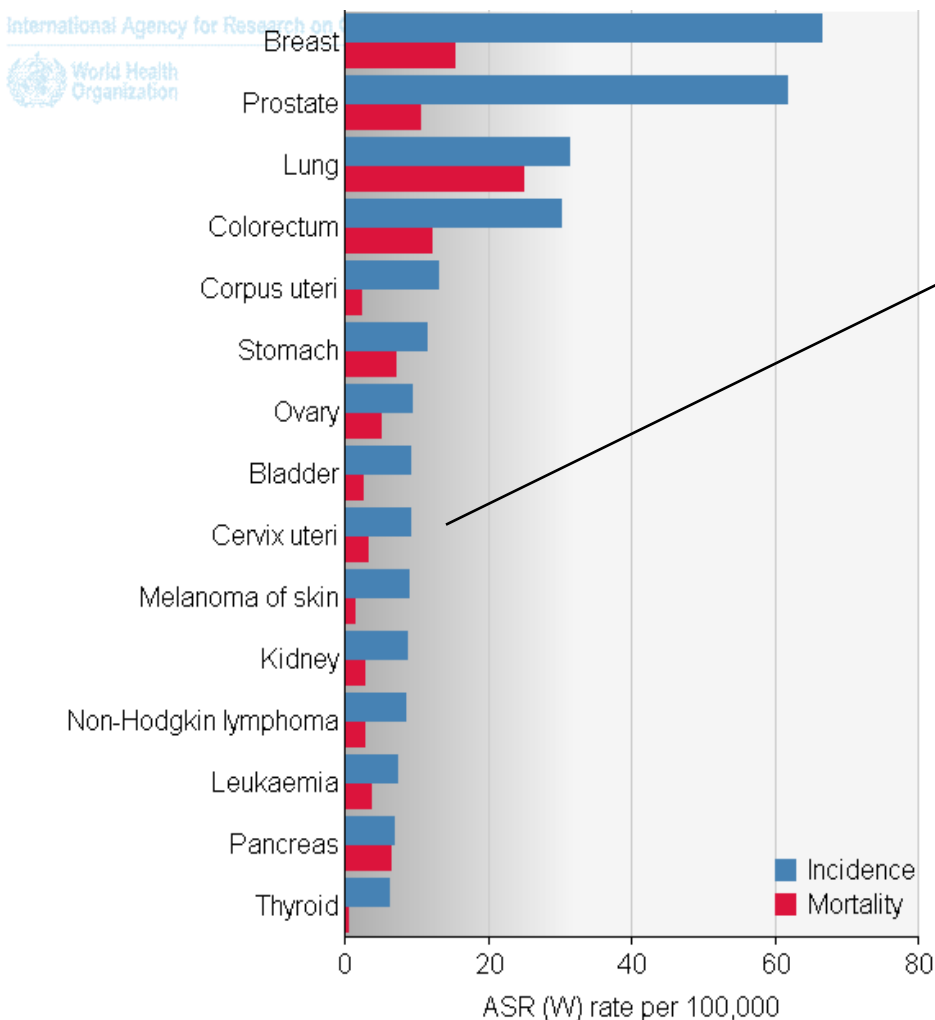


Newly licensed vaccines

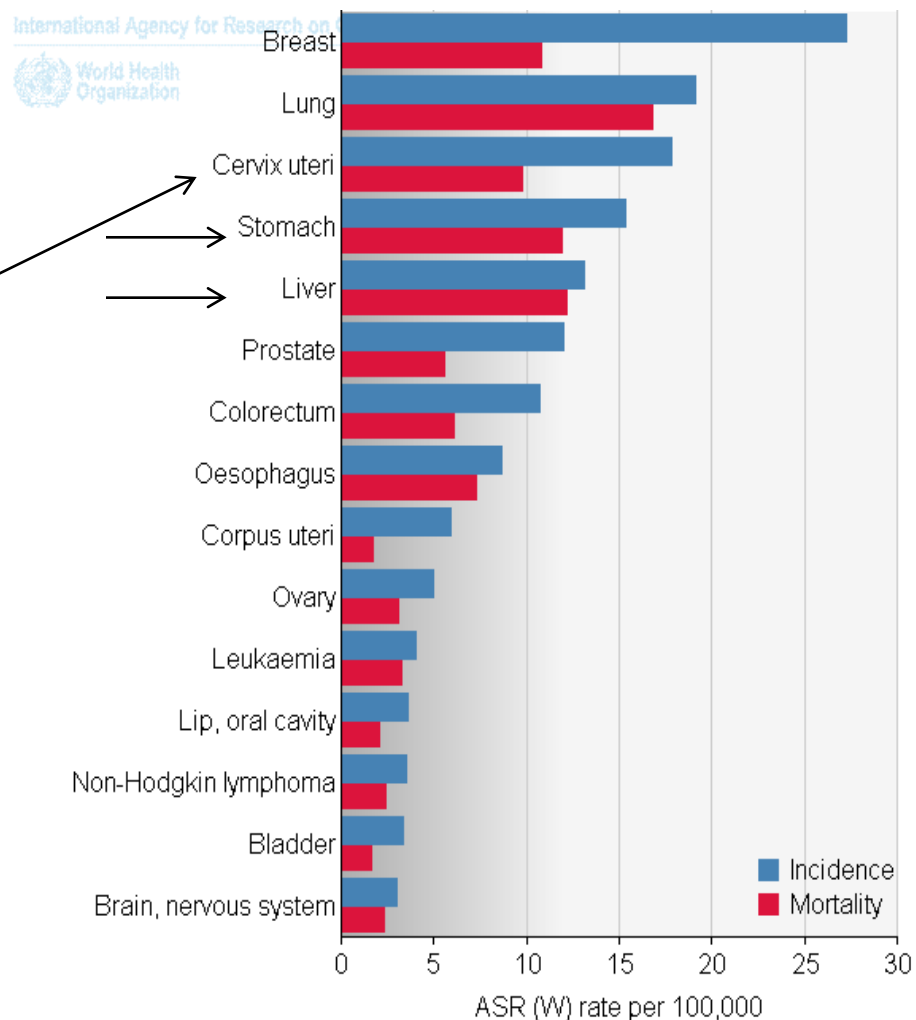
- Cervarix (GSK)
- Gardasil (Merck)

Pre-approved by GAVI

Global burden of cancer associated with infection



High income countries



Low income countries

What are the other major STIs?

Major Sexually Transmitted diseases

Bacterial:	Acute Disease	Severe disease
<i>Treponema pallidum</i>	1° , 2° & latent syphilis	Gumma; Neurosyphilis; Cardiovascular syphilis
<i>Neisseria gonorrhoeae</i>	Inflammation	Infertility; Ectopic pregnancy
<i>Chlamydia trachomatis</i>	Inflammation	Infertility; Ectopic pregnancy
<i>D-K</i>	Lymphogranuloma venereum	Strictures,
<i>L1-3</i>		
<i>Haemophilus ducreyi</i>	Genital Ulcer Disease	

Major Sexually Transmitted diseases

Virus	Acute Disease	Major disease
Human immunodeficiency virus (HIV-1)	Febrile illness	AIDS
Human Papilloma Virus (HPV)	Genital warts (6/11)	Cervical cancer (16/18 etc)
Herpes Simplex Virus types 1 and 2 (HSV-1, HSV-2)	Genital ulcers	Neonatal herpes
Protozoa		
<i>Trichomonas vaginalis</i>	Inflammation	

Global burden - incidence

- 340 million new cases of curable STI globally (1999).
- In the UK over 700,000 new diagnoses in GUM clinics each year, including
 - >100,000 cases of chlamydia
 - 79,000 new diagnoses of genital warts (HPV)
 - 20,000 cases of gonorrhoea.
- There were an estimated 23.6 million new HSV-2 infections globally (2003).

Prevalence

- prevalence > reported incidence as many are asymptomatic, undiagnosed
- For curable, bacterial STI, estimated prevalence ranges
 - 2% (for 15-49 year olds) in Western Europe
 - 12% in Sub-Saharan Africa
 - The number of adults living with HSV-2 infection worldwide is estimated to be 536 million (2003).
- In the UK, the prevalence of genital chlamydia is 10% in 16 – 24 year olds

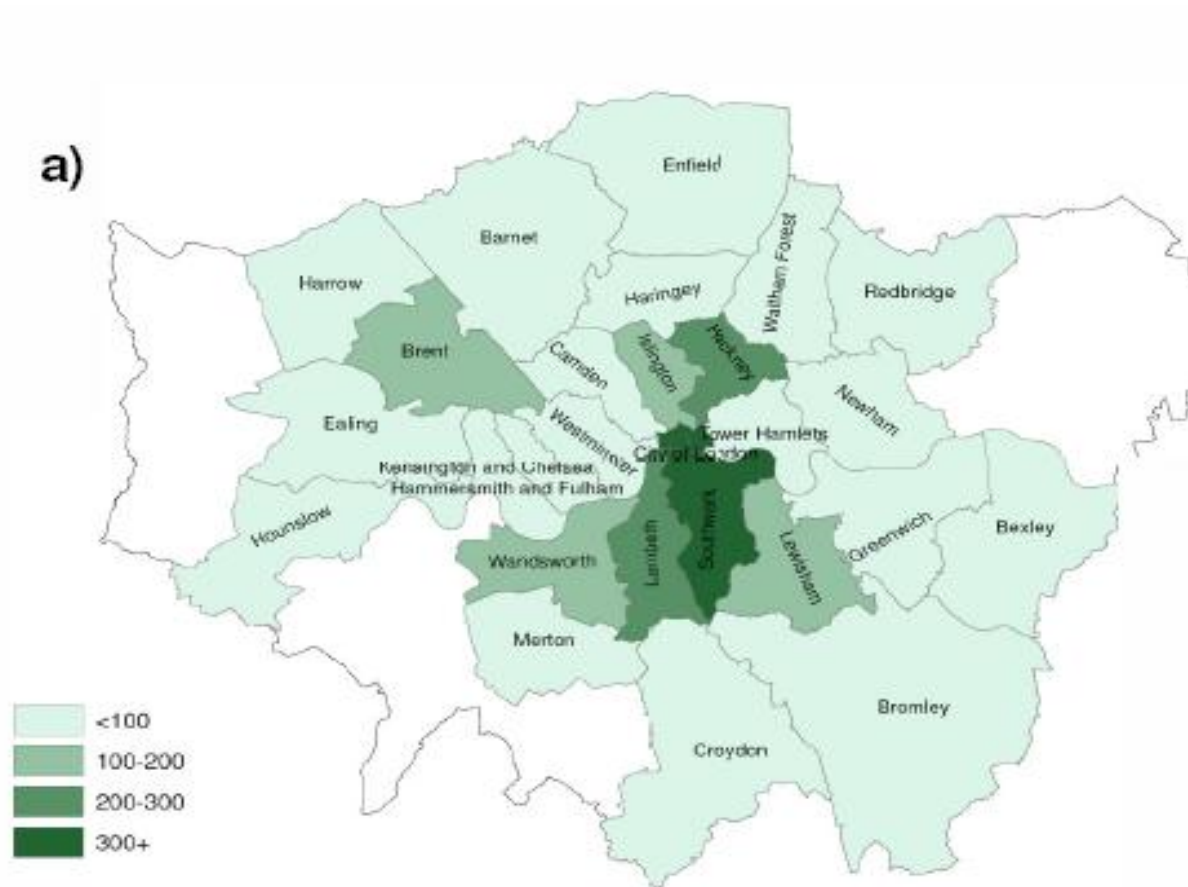
Burden

- **Mortality:**
 - Estimated 0.1 million deaths annually from STI other than HIV
- **Morbidity**
 - primarily measured in terms of reproductive morbidity.
 - 5.1 million YLDs (Years lost due to disability) in women (2002)
 - 1.9m in men

Broad risk factors for STIs

- Geographical area
- Age (women aged 15 – 24, men aged 25 – 34)
- Gender/ sexual orientation/ethnicity
- Sexual behaviour
 - Numbers and types of sexual partners
 - Unprotected sex

Incidence of gonorrhoea (per 100,000) in heterosexuals, London, 2005*

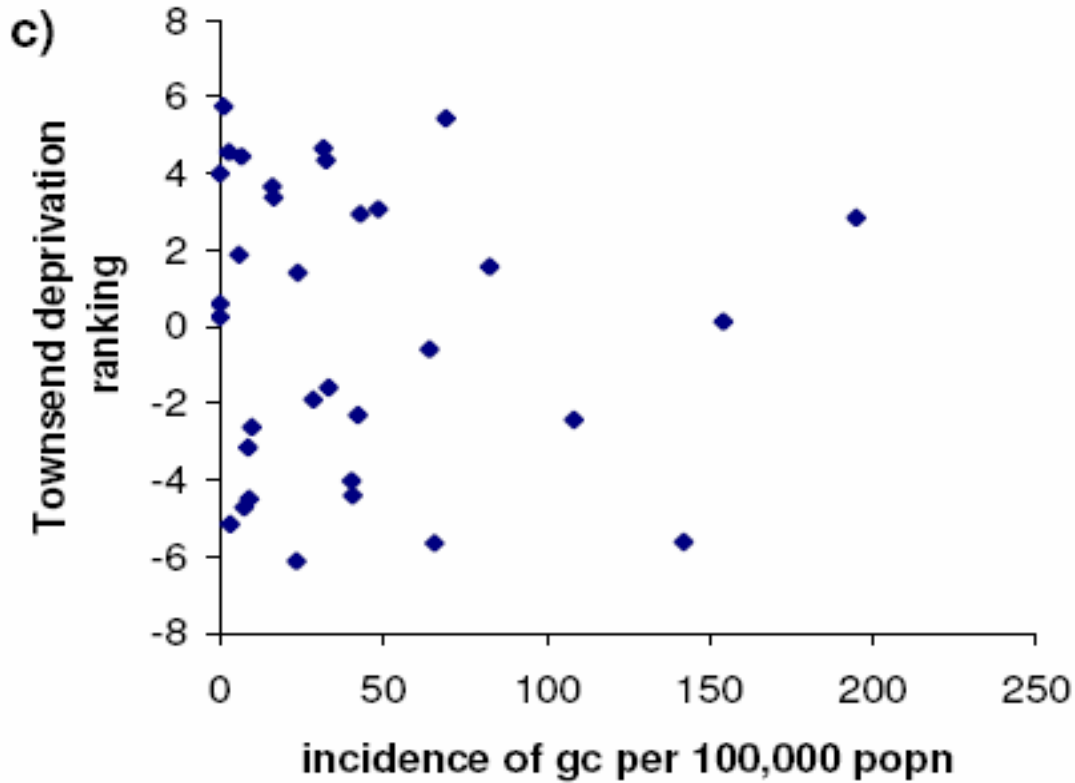


Risley C, Ward H, Choudhury et al. Geographic and demographic clustering of gonorrhoea in London

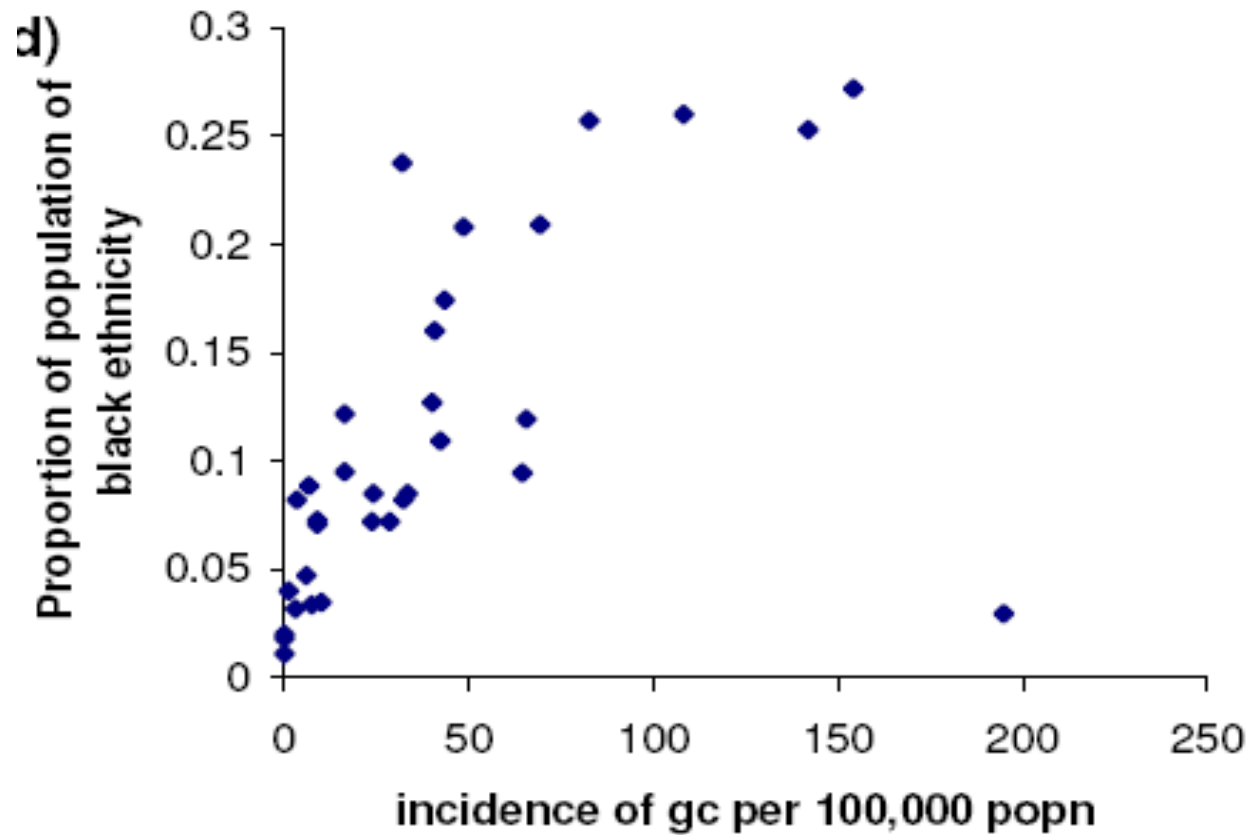
Incidence of gonorrhoea (per 100,000) in MSM, London, 2005



Gonorrhoea and deprivation, London 2005



Gonorrhoea and ethnicity, 2005



Interaction between Herpes and HIV

Ano-genital herpes

- Rising incidence in UK
- Fever, Dysuria, Malaise
- Inguinal lymphadenopathy
- Pain++
- ♂ Vesicular rash penis, peri-anal, anal
- ♀ Vulva, vagina and cervix
- Perineum, upper thigh, buttocks
- Herpes meningitis 4-8% of primary genital herpes
- Sacral radiculomyelitis – urinary retention



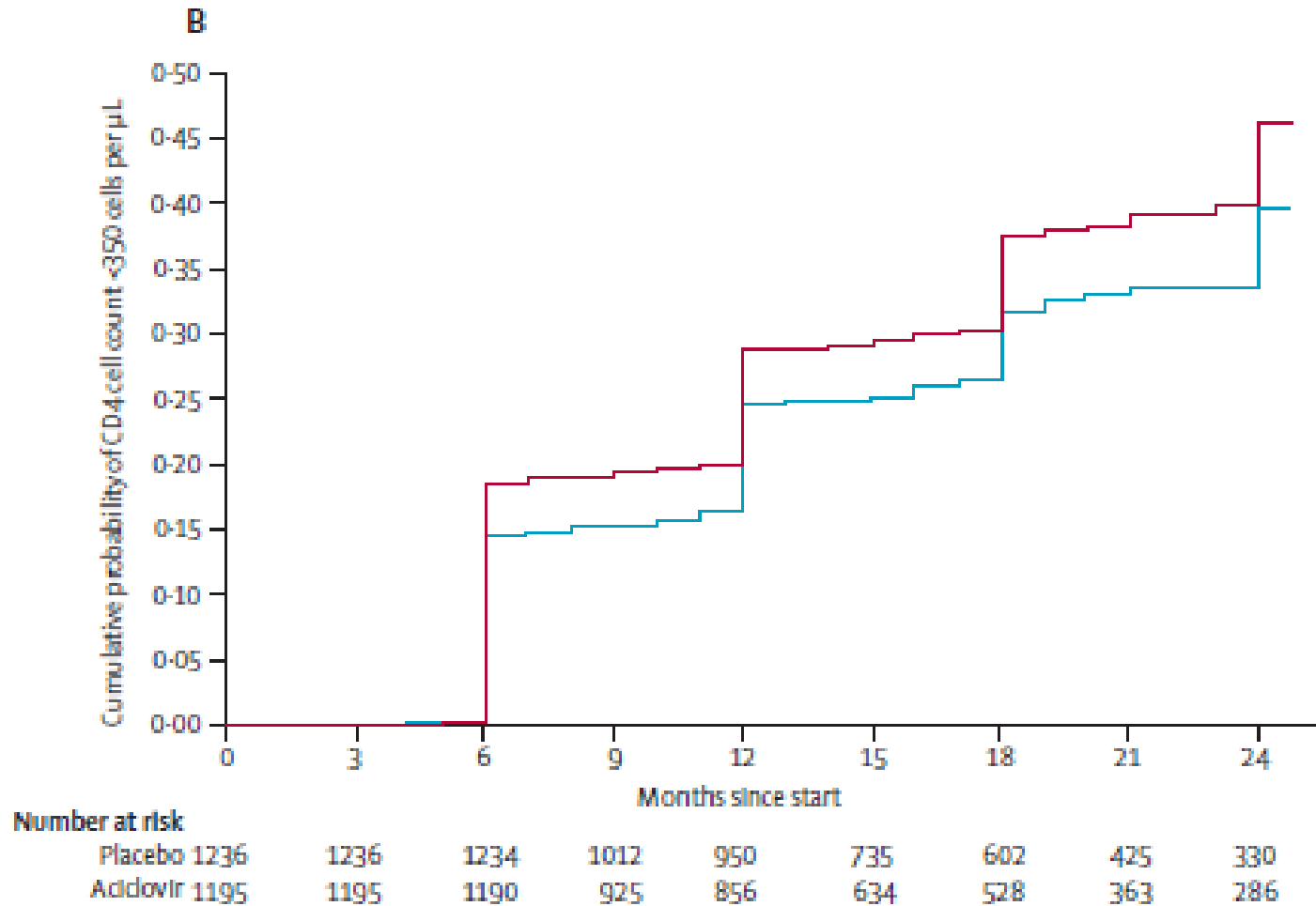
HSV and HIV-1

- HSV prevalence high in areas worst affected by HIV-1 (70-90%)
- HSV suppressive therapy can reduce HIV viral load (and hence could reduce transmission and/or progression)

HSV suppression reduces HIV-1 viral load (Nagot et al 2007)

	Baseline		Treatment				
	Placebo	VACV	Placebo	VACV			
Plasma HIV-1 RNA							
Mean quantity — log ₁₀ copies/ml	4.65	4.33	4.76	3.93	-0.86	-0.45	<0.001
					(-1.18 to -0.54)	(-0.62 to -0.29)	
95% CI	4.53 to 4.77	4.17 to 4.49	4.64 to 4.89	3.76 to 4.10			

HSV suppression reduced risk of disease progression by 19%
 (Lingappa, Lancet 2010)



Blue: aciclovir 400mg bd

But although HIV-1 suppression is replicated, does not reduce transmission (Celum, 2010)

