



**Training Course in Sexual and Reproductive Health Research 2017**

**Module: Sexually transmitted infections, HIV/AIDS**

# ***Epidemiology of STIs: factors, numbers and surveillance***

I. Toskin (WHO)



**SRH** Department of Reproductive Health and Research



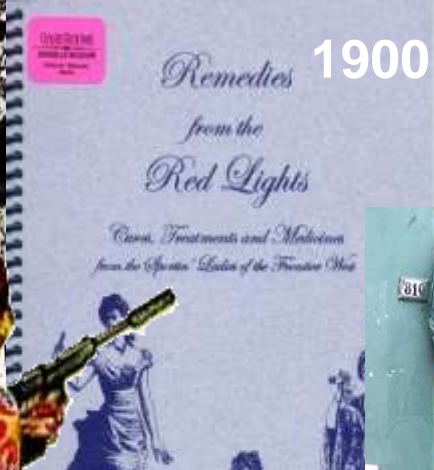
World Health  
Organization



# Overview of presentation

- ❑ Introduction: 3 – 6
- ❑ STI epidemiology: populations, transmission, determinants: 7 – 14
- ❑ Global and Regional STI Burden: 15 - 38
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- ❑ STI Epidemiology: region and country specific examples: 58 – 91
- ❑ WHO STI Library: 92 - 95

# ... and, since BC, the STIs epidemic



2003



1968



# Sexually Transmitted Infections, STIs

There are about **30 STIs** or disease syndromes that result from STIs

# STIs

## Bacteria

- ❑ Gonorrhoea (*Neisseria gonorrhoeae*)
- ❑ Chlamydia (*Chlamydia trachomatis*)
- ❑ Syphilis (*Treponema pallidum*)
- ❑ Chancroid (*Haemophilus ducreyi*)

## Viruses

- ❑ Genital warts and cervical—mainly--cancer (human papillomavirus)
- ❑ Genital herpes (herpes simplex virus)
- ❑ Hepatitis B (hepatitis B virus)

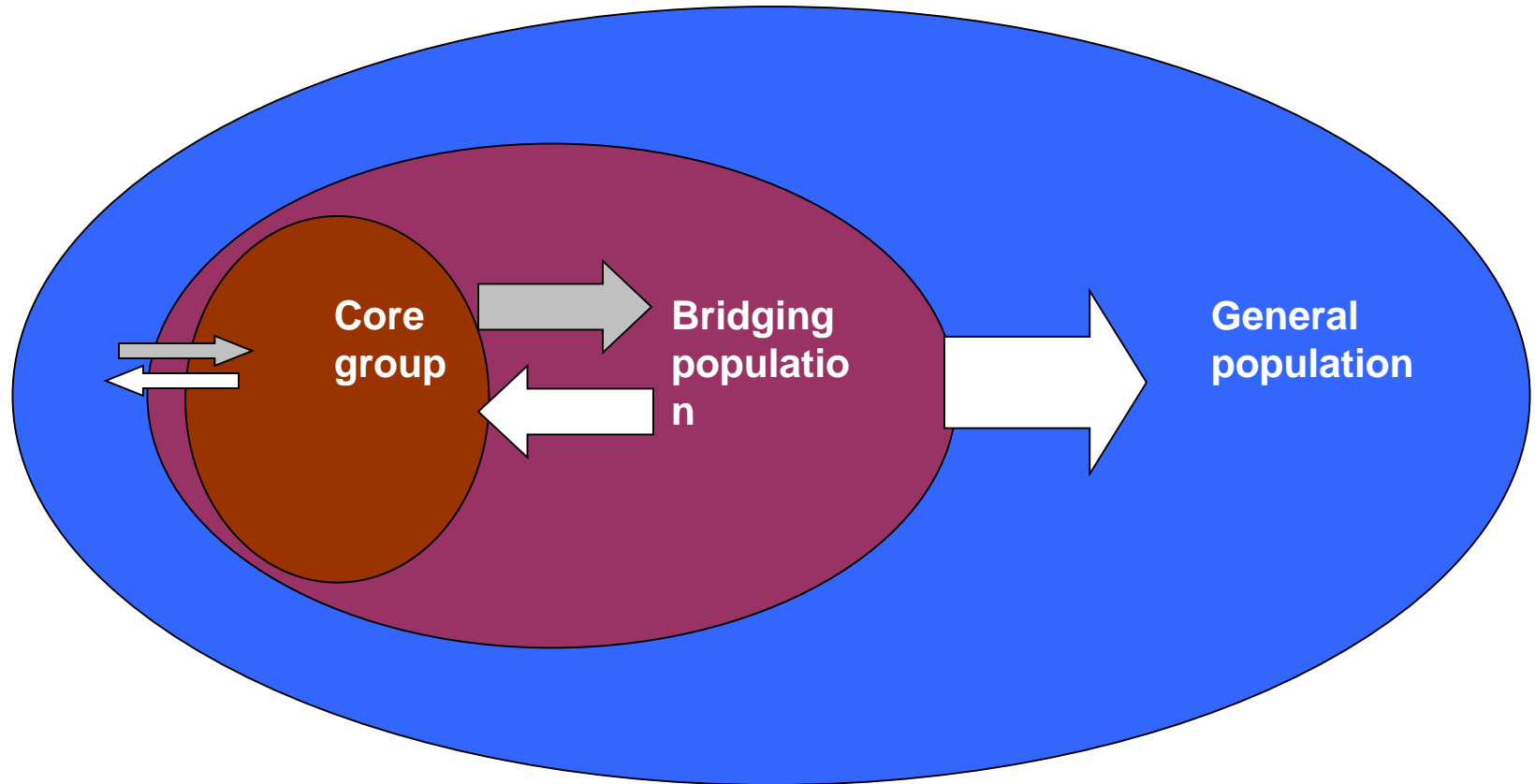
## Parasites

- ❑ Trichomoniasis (*Trichomonas vaginalis*)
- ❑ Pubic lice (*Phthirus pubis*)

# Since the 80's: HIV, the new, devastating, STI



# STI transmission dynamics at population level



# Rate of spread of STIs\*

$$R_o = \beta \times c \times D$$

$\beta$  - mean probability of transmission per exposure

C - mean rate of sexual partner change within the population

D - mean duration of infectiousness of the newly infected persons

If  $R_o < 1$ , the infection eventually disappears from the population!

\* May RM, Anderson RM., Transmission dynamics of HIV infection, Nature. 1987 Mar 12-18;326(6109):137-42.



# Average duration of infection for *Chlamydia* and *Neisseria gonorrhoeae*\*

<i>Infection</i>	<i>Asymptomatic and not treated</i>		<i>Symptomatic and treated</i>	
	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
<i>Chlamydia</i>	1.25 years	1.25 years	4 weeks	8 weeks
<i>Neisseria gonorrhoeae</i>	5 months	6 months	2 weeks	4 weeks

## Average duration of infection for individuals with Syphilis depending on stage in which they are treated\*

<b>Primary</b>	1 month
<b>Secondary</b>	3 months
<b>Latent</b>	3 years
<b>Tertiary</b>	15 years

\* World Health Organization. Prevalence and incidence of selected Sexually Transmitted Infections, *Chlamydia*, *Neisseria Gonorrhoeae*, Syphilis and *Trichomonas vaginalis*: Methods and Results used by WHO to generate 2005 estimates. WHO, Geneva 2010.

# Determinants of STIs epidemic\*

<i>Microenvironment</i>	<i>Macroenvironment</i>
•Biological	•Cultural, Social and Economic
- gender	- poverty
- age	- gender inequality
- coexistence of other STIs	- health seeking behaviours
	- silent on sex issues
- pregnancy	- stigma and discrimination
•Immunological	•Epidemiological
	- STIs prevalence
•Behavioural	
- age at coital debut	•Demographic
- multiple sexual partners	- population age structure
- sexual practices:	- sex ratio
- anal sex	
- sex during menstruation	•Political and structural
- male circumcision	
- drug or alcohol use	

- ! Some STIs increase the risk of HIV transmission

# Studies on sexually transmitted infection as risk factor for HIV transmission\*

Reference	Study population	Sexually transmitted infection studied	Relative risk	Odds ratio
<i>Plummer, 1991</i>	Female sex workers, Kenya	Chlamydia		<b>3.6</b>
<i>Laga, 1993</i>	Female sex workers, Democratic Republic of the Congo	Chlamydia Gonorrhoea Trichomoniasis		<b>3.6</b> <b>4.8</b> <b>1.9</b>
<i>Kassler, 1994</i>	Heterosexual cohort, United States of America	Gonorrhoea		<b>2.5</b>
<i>Craib, 1995</i>	Cohort of MSM, Canada	Rectal gonorrhoea		<b>3.18</b>
<i>Cameron, 1989</i>	Heterosexual men, Kenya	Mainly chancroid	<b>4.7</b>	
<i>Telzak, 1993</i>	Heterosexual men, United States of America	GUD, chancroid	<b>3.0</b>	
<i>Limpakarnjanarat, 1999</i>	Female sex workers, Thailand	Syphilis GUD and herpes		<b>3.7</b> <b>2.0 – 2.4</b>
<i>Mbizvo, 1996</i>	Antenatal care women, Zimbabwe	GUD + PID		<b>5.8</b>
<i>Bollinger, 1997</i>	Sexually transmitted infection clinic attendees, India	GUD		<b>4.2</b>
<i>Stamm, 1988</i>	MCM, United States of America	Herpes, syphilis	<b>3.3 – 8.5</b>	
<i>Holmberg, 1988</i>	MCM, United States of America	Herpes	<b>4.4</b>	
<i>Darrow, 1987</i>	MCM, United States of America	Syphilis	<b>1.5 – 2.2</b>	

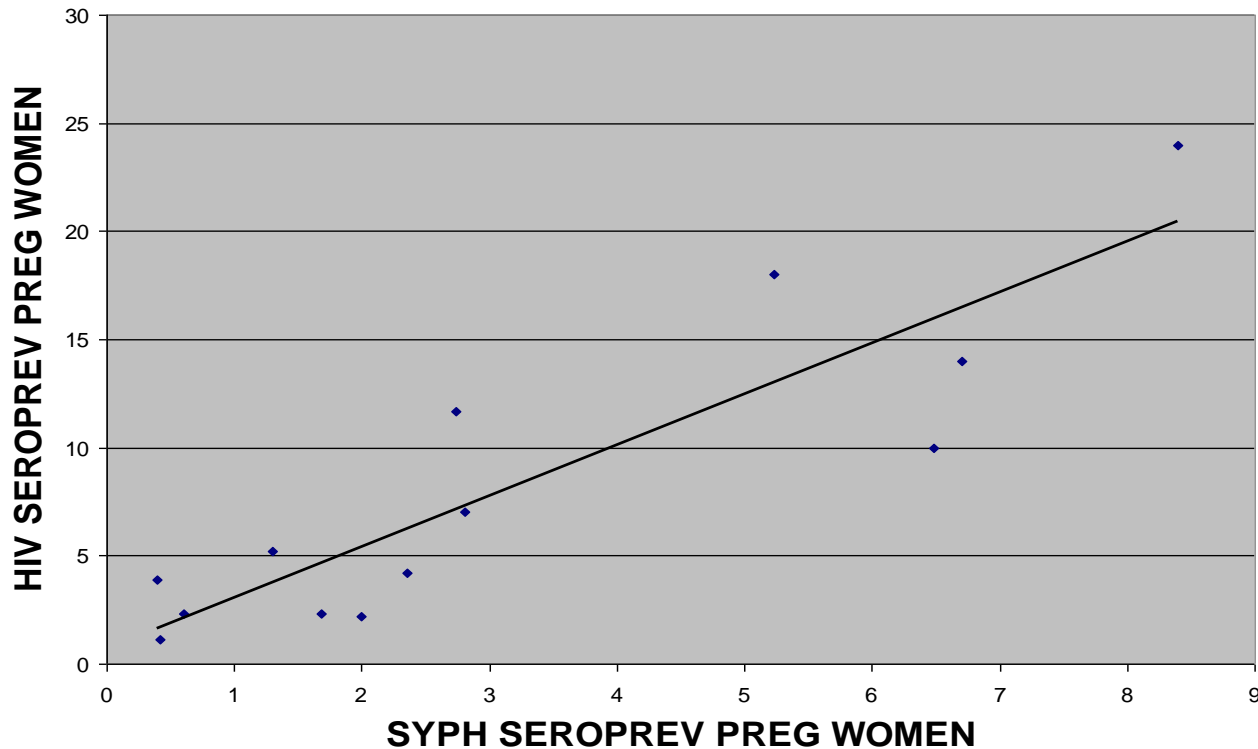
World Health Organization. Global Strategy for the prevention and control of sexually transmitted infections: 2006-2015. ISBN 9789241563475. Geneva 2007.

- ! Syphilis infection may increase the HIV viral load of co-infected patients, and may increase the risk of mother-to-child transmission of HIV\*

\* Victor Mwapasa et al, Maternal syphilis infection is associated with increased risk of mother-to-child transmission of HIV in Malawi, AIDS 2006, 20:1869-1877.

# HIV–Syphilis seroconcordance in pregnant women\*

## - African Region -



\* Stoner BP, Schmid G, Guraiib M, Adam T, Broutet N, .Use of maternal syphilis seroprevalence data to estimate the global morbidity of congenital syphilis, oral presentation ISSTD Congress 2005.

# STI Global Burden

## WHO approach to International STI "Surveillance"- Estimations

WHO did this in 1995,  
1999, 2005, 2008,  
and 2012



RESEARCH ARTICLE

### Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting

Lori Newman<sup>1\*</sup>, Jane Rowley<sup>2</sup>, Stephen Vander Hoorn<sup>2,3</sup>, Nalinka Saman Wijesooriya<sup>2</sup>, Magnus Unemo<sup>4</sup>, Nicola Low<sup>5</sup>, Gretchen Stevens<sup>6</sup>, Sami Gottlieb<sup>1</sup>, James Kiarie<sup>1</sup>, Marleen Temmerman<sup>1</sup>

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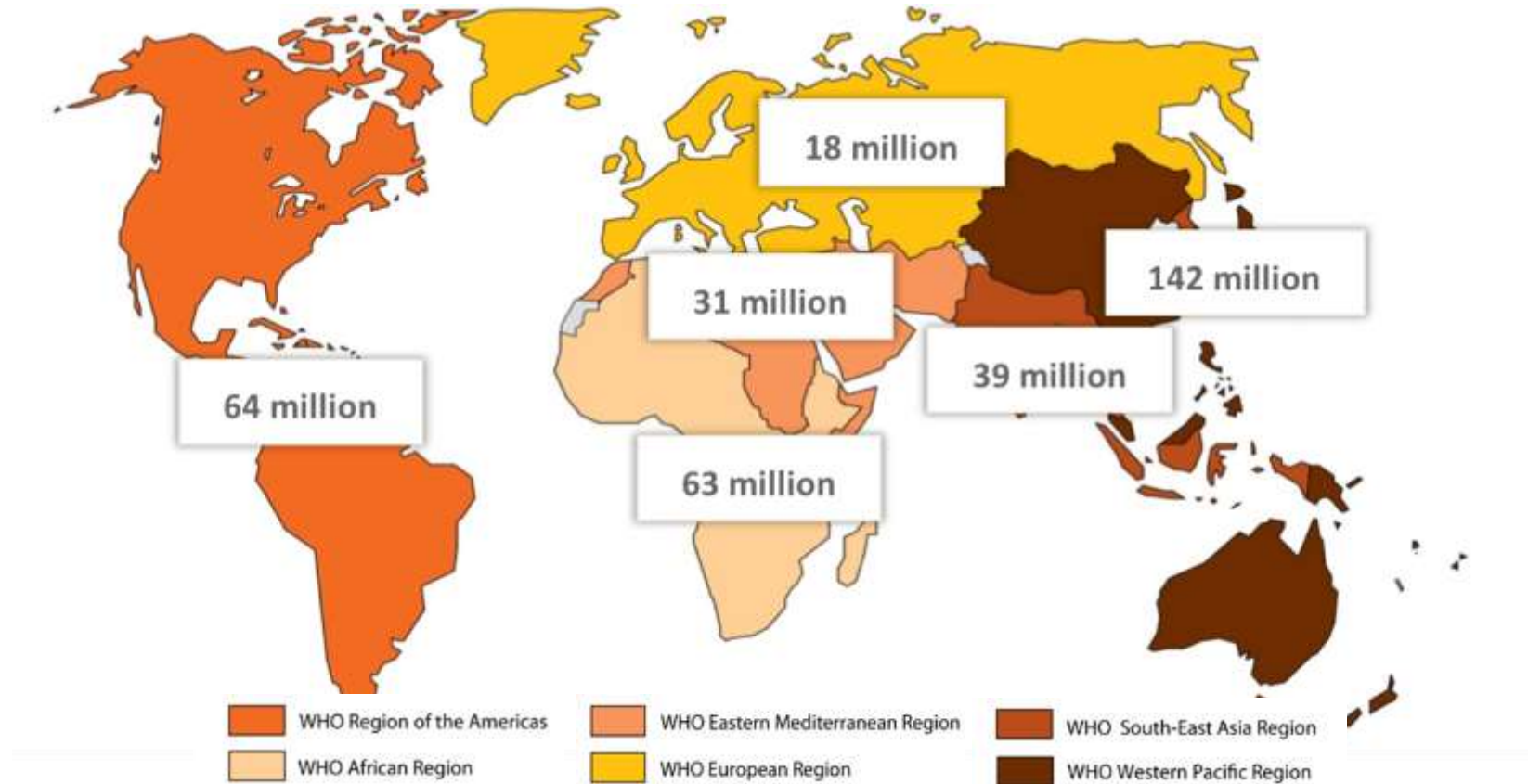


visit RHR at: <http://www.who.int/reproductive-health/>

visit WHO at: <http://www.who.int>

# Estimated new cases of curable STIs (WHO; 2012)

357 million new cases of curable STIs in 2012:

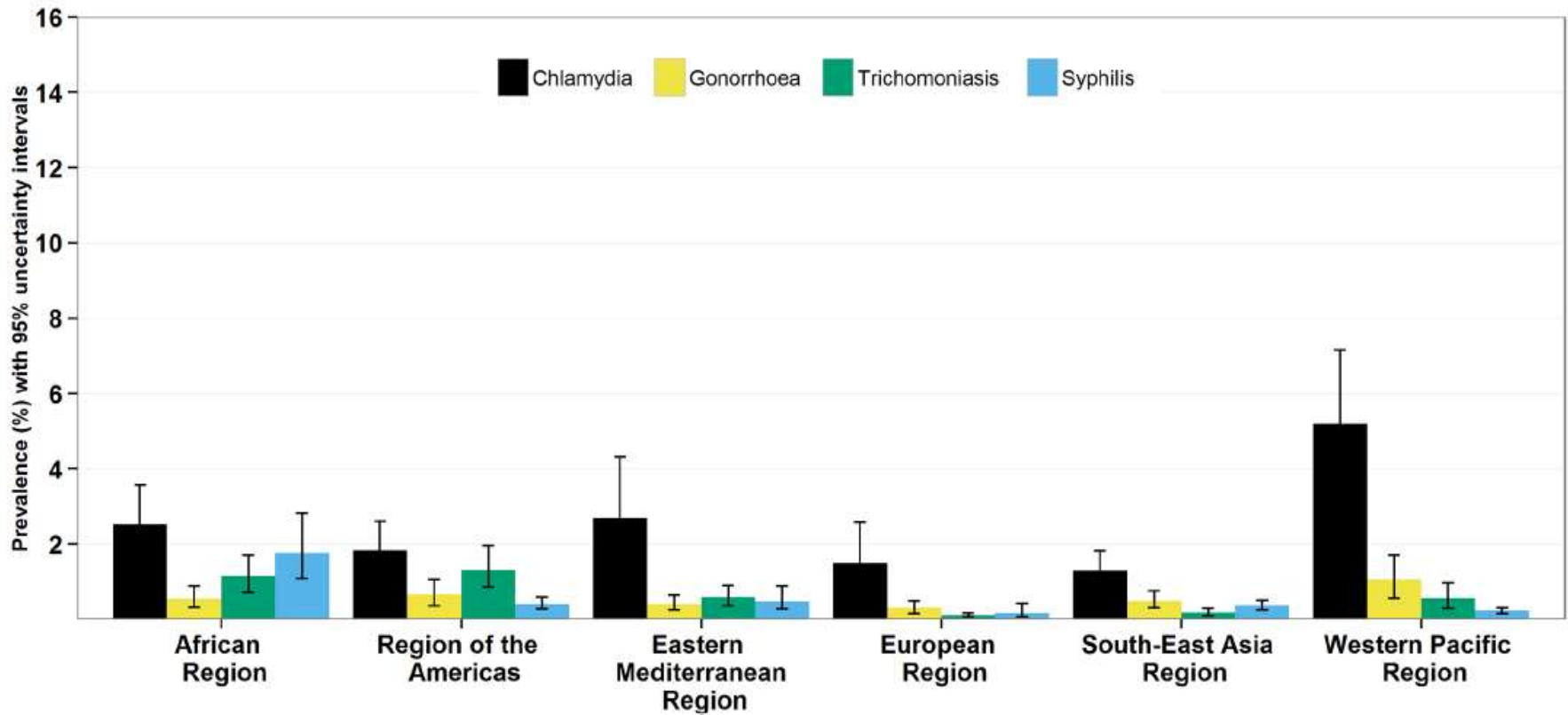


Source: L. Newman et al. *Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting*. PlosOne. December 2015.

<http://dx.doi.org/10.1371/journal.pone.0143304>



# Estimated prevalence (and 95%) of four curable STIs amongst adults (15-49 years) by WHO region, (WHO 2012)\*



\* Source: L. Newman et al. Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting. PlosOne. December 2015. <http://dx.doi.org/10.1371/journal.pone.0143304>

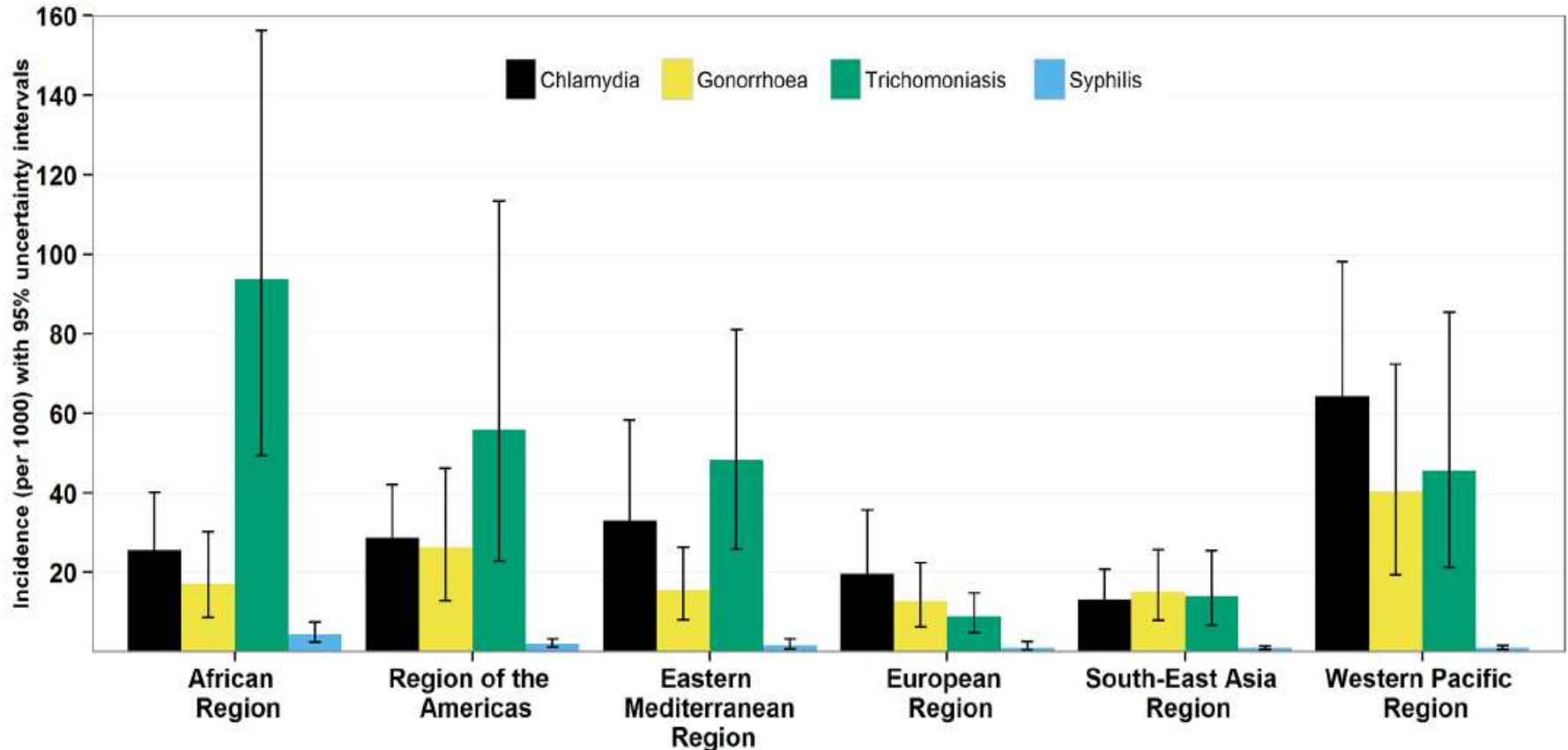
# Estimated prevalence by infection and World Bank classification. (WHO 2012)\*

	Classification	Chlamydia	Gonorrhoea	Trichomoniasis	Syphilis
<b>Females</b>	High-income economies	3.0%	0.3%	1.9%	0.2%
	Upper-middle income economies	6.9%	1.2%	6.9%	0.3%
	Lower-middle income economies	2.4%	0.6%	3.5%	0.5%
	Low-income economies	2.9%	1.1%	7.8%	1.3%
	<b>Female total</b>	<b>4.2%</b>	<b>0.8%</b>	<b>5.0%</b>	<b>0.5%</b>
<b>Males</b>	High-income economies	2.4%	0.3%	0.6%	0.2%
	Upper-middle income economies	4.2%	1.0%	0.7%	0.3%
	Lower-middle income economies	1.6%	0.5%	0.3%	0.5%
	Low-income economies	2.0%	0.5%	0.8%	1.3%
	<b>Male total</b>	<b>2.7%</b>	<b>0.6%</b>	<b>0.6%</b>	<b>0.5%</b>

Note: Estimates by World Bank classification are not identical to those by geographic region as three countries are not classified by World Bank and were therefore excluded: Cook Islands, Niue, and Nauru.

\* Source: L. Newman et al. *Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting*. PlosOne. December 2015. <http://dx.doi.org/10.1371/journal.pone.0143304>

# Estimated new cases (and 95% UI) of four curable STIs amongst adults (15-49 years) by WHO region, (WHO 2012)\*



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# Estimated incidence ('000) by infection and World Bank classification. (WHO 2012)\*

Sex	Classification	Chlamydia	Gonorrhoea	Trichomoniasis	Syphilis
Females	High-income economies	9,109	2,525	3,194	374
	Upper-middle income economies	5,168	5,214	11,843	695
	Lower-middle income economies	13,465	7,858	16,753	879
	Low-income economies	40,712	18,498	36,329	822
	<b>Female total</b>	<b>68,455</b>	<b>34,095</b>	<b>68,120</b>	<b>2,769</b>
Males	High-income economies	11,423	3,707	2,999	389
	Upper-middle income economies	4,203	2,986	13,330	689
	Lower-middle income economies	11,701	10,432	18,869	905
	Low-income economies	35,149	27,060	39,240	842
	<b>Male total</b>	<b>62,477</b>	<b>44,185</b>	<b>74,438</b>	<b>2,825</b>

Note: Estimates by World Bank classification are not identical to those by geographic region as three countries are not classified by World Bank and were therefore excluded: Cook Islands, Niue, and Nauru.

\* Source: L. Newman et al. *Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting*. PlosOne. December 2015. <http://dx.doi.org/10.1371/journal.pone.0143304>

- ! In pregnancy, untreated early syphilis will result in a stillbirth rate of 25% and be responsible for 14% of neonatal deaths – an overall perinatal mortality of about 40%.

World Health Organization. Global Strategy for the prevention and control of sexually transmitted infections: 2006-2015. ISBN 9789241563475. Geneva 2007.

# Syphilis prevalence rates amongst pregnant women in Africa

<b>Country</b>	<b>Prevalence</b>	<b>Studied population</b>	<b>Reference</b>
<b>Botswana</b>	4,8	pregnant women attending ANC clinic	Romoren M, et al., 2007
<b>Democratic Republic of Congo</b>	0	pregnant women attending ANC clinic	Kinoshita-Moleka R, et al., 2008
<b>Mozambique</b>	4,7	pregnant women attending ANC clinic	Lujan et al, 2008
<b>Nigeria</b>	1,87	pregnant women attending ANC clinic for first visit	Federal Ministry of Health, Nigeria: 2005 National HIV/Syphilis seroprevalence sentinel survey among pregnant women attending ANC clinics. April 2006
<b>Tanzania</b>	1,6	women attending one of 6 ANC clinics, 15-49 y.o.	Yahya-Malima et al, 2008
<b>Uganda</b>	1,6	pregnant women attending booking visit at Entebbe district hospital, 15-40 y.o.	Tann CJ et al, 2006
<b>Zambia</b>	6,8	pregnant women attending ANC clinic, 14-44 y.o.	Zambia antenatal clinic sentinel surveillance report: 1994-2004. (2005).

- ! Worldwide, up to 4000 newborn babies become blind every year because of eye infections attributable to untreated maternal gonococcal and chlamydial infections.

World Health Organization. Global Strategy for the prevention and control of sexually transmitted infections: 2006-2015. ISBN 9789241563475. Geneva 2007.

# Neisseria gonorrhoeae prevalence studies among pregnant women

<b>Country</b>	<b>Prevalence</b>	<b>Studied population</b>	<b>Reference</b>
<b>Botswana</b>	3	pregnant women attending one of 13 ANC clinics	Romoren M, et al., 2007
<b>China</b>	0,8	pregnant women; 1st ANC visit	Chen XS et al, 2006
<b>Democratic Republic of Congo</b>	0,4	pregnant women attending ANC clinic	Kinoshita-Moleka R, et al., 2008
<b>Fiji</b>	1,7	ANC clinic attendees in Suva	Cliffe SJ et al, 2008
<b>Ghana</b>	0,6	pregnant women attending ANC at Korle Bu teaching hospital	Apea-Kubi et al, 2004
<b>Kenya</b>	1,2	pregnant women attending ANC clinic	Moses S et al, 2003
<b>Lao</b>	0,8	pregnant women (<20 weeks) at first visit to Sethiathirath or MCH hospital	Thammalangsy S et al, 2006
<b>Mongolia</b>	6,1	10 randomly selected ANC clinicals	Report from MOH Mongolia, 2007
<b>Mozambique</b>	2,5	pregnant women attending ANC clinic	Lujan et al, 2008
<b>Nepal</b>	2,3	Women who are 6 week postpartum with live birth residing in rural southeastern Nepal	Christian P et al, 2005
<b>South Africa</b>	8	pregnant women attending ANC clinic	Sturm PDJ et al, 2004
<b>Tonga</b>	2,5	ANC clinic attendees attending central hospital	Cliffe SJ et al, 2008
<b>Zimbabwe</b>	1,1	pregnant women attending ANC clinic	Mbizvo EM et al, 2001



# *Chlamydia* prevalence studies among pregnant women


<i>Country</i>	<i>Prevalence</i>	<i>Population</i>	<i>Reference</i>
<b>Botswana</b>	8	13 ANC clinics	Romoren M, et al., 2007
<b>Brazil</b>	9,4	ANC clinic - diverse emo and socio economic backgrounds, 11-47 y.o.	Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Programa Nacional de DST e Aids. 2008
<b>China</b>	10,1	pregnant women; 1st ANC visit	Chen XS et al, 2006
<b>Fiji</b>	29	ANC clinic attendees in Suva	Cliffe SJ et al, 2008
<b>Ghana</b>	3	pregnant women attending ANC at Korle Bu teaching hospital	Apea-Kubi et al, 2004
<b>Ireland</b>	3,7	pregnant women - asymptomatic, 15 – 50 y.o.	McMillan et al, 2006
<b>Japan</b>	3,7	pregnant women, 14-46 y.o.	Shimano S et al, 2004
<b>Lao</b>	9,6	pregnant women (<20 weeks) at first visit to Sethiathirath or MCH hospital	Thammalangsy S et al, 2006
<b>Mozambique</b>	4,1	Pregnant women attending antenatal clinic	Lujan et al, 2008

- ! Untreated gonococcal and chlamydial infections in women will result in pelvic inflammatory disease in up to 40% of cases. One in four of these will result in infertility.

World Health Organization. Global Strategy for the prevention and control of sexually transmitted infections: 2006-2015. ISBN 9789241563475. Geneva 2007.

# *Chlamydia* prevalence studies in different populations

<i>Country</i>	<i>Prevalence</i>	<i>Studied population</i>	<i>Reference</i>
<b>France</b>	1,6 female	General population, 18 – 44 y.o.	ANRS. INED. INSERM. Quoted in ECDC Technical Report: Review of Chlamydia Control Activities in EU Countries. May 2008
	1,4 male		
<b>Japan</b>	6,8 female	students from nine schools (5 universities and 4 professional schools) located in the suburbs of Miyazaki City included students sexually active and not, 18-35 y.o.	Imai H et al, 2004
<b>Korea</b>	5 male	sexually and not sexually active university students, 18-25 y.o.	Lee SJ et al. 2005
<b>Luxembourg</b>	2,3 female	High school students, under 25 y.o.	ECDC. 2008. Technical Review of Chlamydia Activities in EU Countries
	0,9 male		
<b>Netherlands</b>	2,5 female	General population, 15 – 29 y.o.	Van Bergen J et al, 2005
	1,5 male		
<b>New Zealand</b>	2,7 female	university students, 18-25 y.o.	Baker M et al, 2005
<b>Norway</b>	6,7 female	General population, 18 – 25 y.o.	Steen et al, 2008 Referenced in ECDC
	5,8 male		
<b>Sweden</b>	4,6 female	General population, 15 - 35 + y.o.	Novak DP & Karlsson RB, 2006
	6 male		
<b>Thailand</b>	7,5 female	students at 2 vocational colleges, 15- 21 y.o.	Whitehead et al, 2008
	6 male		

- 
- Trichomoniasis in the era of new generation diagnostics (LCR and PCR).

Whether the level of prevalence of TV infection has been underestimated?

World Health Organization. Global Strategy for the prevention and control of sexually transmitted infections: 2006-2015. ISBN 9789241563475. Geneva 2007.

# Trichomoniasis prevalence studies amongst pregnant women

<i>Country</i>	<i>Prevalence</i>	<i>Studied population</i>	<i>Reference</i>
<b>Australia</b>	7,2	cohort of women attending aboriginal and islander health services in Townsville (provincial urban centre)	Panaretto KS et al, 2006
<b>China</b>	3,2	pregnant women; 1st ANC visit	Chen XS et al, 2006
<b>Lao</b>	1,8	pregnant women (<20 weeks) at first visit to Sethiathirath or MCH hospital, Population	Thammalangsy S et al, 2006
<b>Mongolia</b>	6,7	10 randomly selected ANC clinics	Report from MOH Mongolia, 2007
<b>Samoa</b>	20,8	pregnant women; out of the women living in villages outside of Apia on the main island of Upolu (28, 68.2%), with the remainder living in Apia (132, 31.4%).	Sullivan EA et al, 2004

# Prevalence of pathogens in cases with urethral discharge in seven countries\*

Country	Prevalence (%)				Negative for all four pathogens (%)	No. of specimens
	<i>Neisseria gonorrhoeae</i>	<i>Chlamydia trachomatis</i>	<i>Trichomonas vaginalis</i>	<i>Mycoplasma genitalium</i>		
Benin	65.1	8.1	8.1	10.5	20.9	86
Burkina Faso	81.0	15.0	12.0	11.0	11.0	100
Côte d'Ivoire	51.9	21.0	2.5	14.8	25.9	81
Ghana	52.4	10.5	19.0	10.5	23.8	105
Guinea	51.5	13.4	4.1	12.4	28.9	97
Mali	53.1	10.4	24.0	8.3	30.2	96
Senegal	77.7	16.0	24.5	3.2	10.6	94
<b>Total</b>	<b>61.9</b>	<b>13.4</b>	<b>13.8</b>	<b>10.0</b>	<b>21.5</b>	<b>659</b>
P-values	< 0.001	0.21	<0.001	0.24	0.001	

Percentages for countries add up to more than 100% due to multiple infections.  
P-values indicate the level of significance of intercountry variation.

\*Pepin J, et al. Etiology of urethral discharge in West Africa: The role of *Mycoplasma genitalium* and *Trichomonas vaginalis*. Bull World Health Organ 2001; 79: 118-126.

- ! Herpes Simplex Virus Type II is responsible for over two-third of all episodes of genital herpes and more than 5% of recurrent cases.

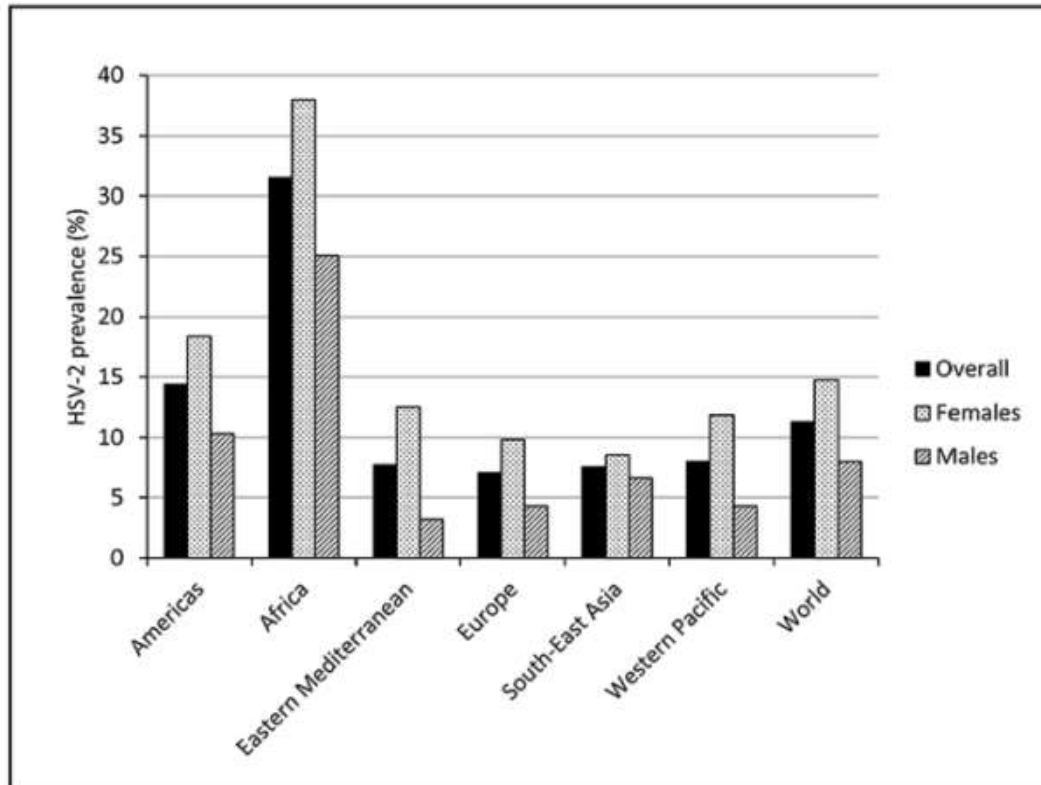
Corey L, et al. Genital herpes simplex virus infections: current concepts in diagnosis, therapy, and prevention. *Ann Intern Med* 1983; 98: 958-972.

# Herpes simplex virus type 2

417 million people 15-49 year old living with HSV-2

11.3% global prevalence

19.2 million new infections

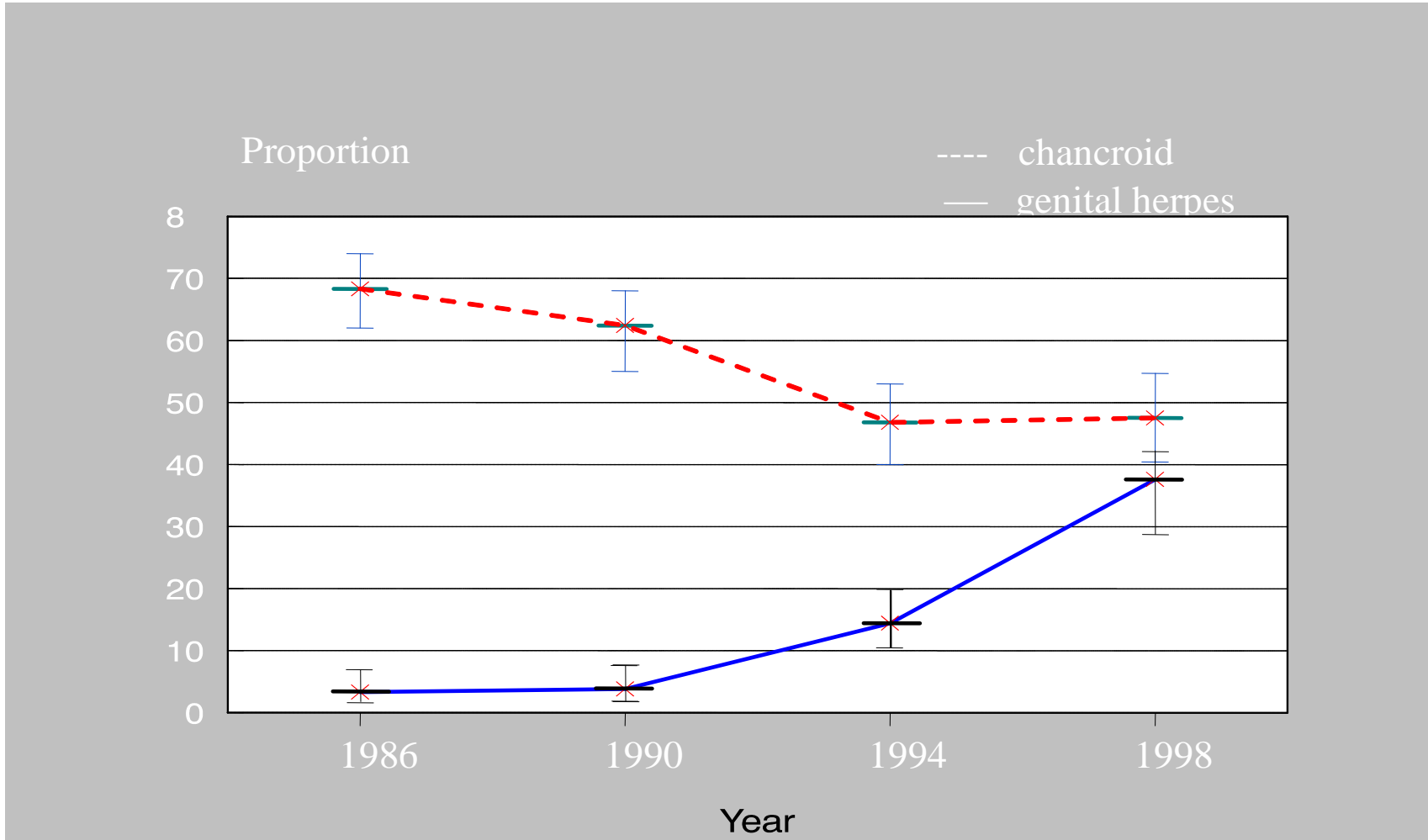


Source: K. Looker et al. *Global Estimates of Prevalent and Incident Herpes Simplex Virus Type 2 Infections in 2012.*



- ! Chancroid, caused by *Haemophilus ducreyi*, is a common cause of genital ulcer in developing countries, particularly in sub Saharan Africa, Caribbean and south-east Asia

# Etiology of Genital Ulcer (Chancroid and Genital Herpes) by year of study in South Africa

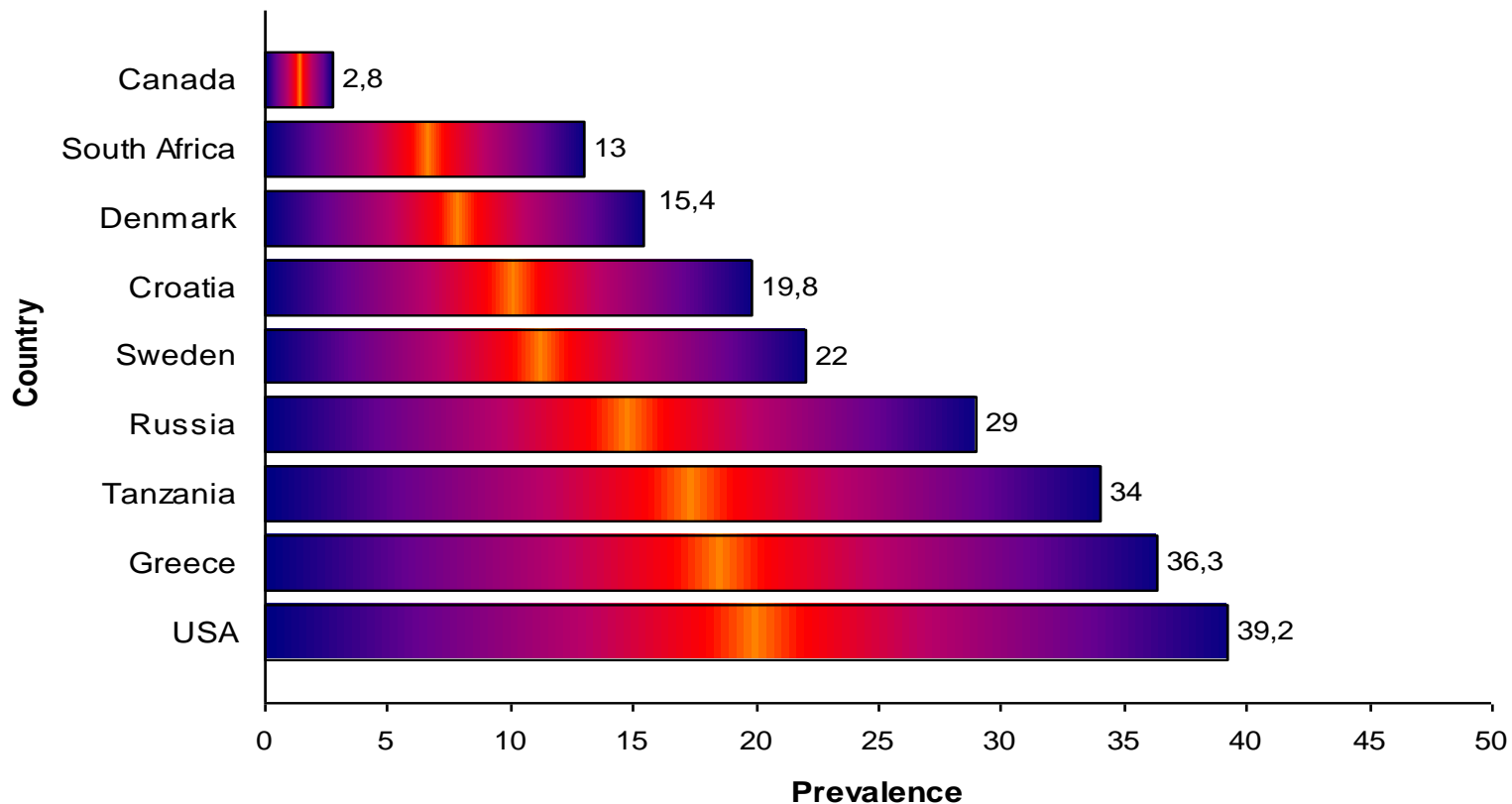


Source: WHO, Report of an Expert Consultation on Improving the Management of Sexually Transmitted Infections, 2001

- ! New vaccines against human papilloma virus infection could stop the untimely death of approximately 240 000 women from cervical cancer every year in resource-poor settings.

World Health Organization. Global Strategy for the prevention and control of sexually transmitted infections: 2006-2015. ISBN 9789241563475. Geneva 2007.

# Human papilloma virus, prevalence studies among female population, 1995-2001\*



\* **Sexually Transmitted Infections.** Ivonne Camaroni, Antonio Gerbase. Chapter 4 « Global Epidemiology of Sexually Transmitted Infections », PP 27-43.

- ! Risk of contracting gonorrhoea, syphilis and HPV is higher among uncircumcised men than among circumcised ones.

# Circumcision reduces the prevalence and incidence of Multiple High-Risk Papillomavirus infections in HIV-positive Men (Uganda, 2007)

## Incidence of Single and Multiple HR-HPV infections over 24 Months, by Study Arm\*

	No.(%) of samples with infection, by study arm		IRR, intervention vs control (95% CI)
	Intervention (n=81)	Control (n=93)	
<b>New HR-HPV Infections</b>			
≥1 HR-HPV genotype infection	34 (42.0)	53 (57.0)	0.74 (0.54 – 1.01)
Single HR-HPV genotype infection	26 (32.1)	30 (32.2)	1.00 (0.65 – 1.53)
Multiple HR-HPV genotype infections	8 (9.9)	23 (24.7)	0.40 (0.19 - 0.84)

**Note.** – Samples are those that had amplifiable cellular or viral DNA at both enrolment and follow-up CI, confidence interval; IRR incidence risk ratio.

\*David Serwadda et al. Circumcision of HIV-Infected Men: Effects on High-Risk Human Papillomavirus Infections in Randomized Trial in Rakai, Uganda. The Journal of Infectious Diseases 2010; 201(10):000-000.

**!** We Really Do Not Know How Common  
**Congenital Syphilis Is**

**We Rely on Estimating the Numbers of Pregnant Women with Syphilis**

**And Multiply That By Estimating the Proportion of These Women with an Affected Fetus/Infant**



# Use of Maternal Syphilis Seroprevalence Data to Estimate the Global Morbidity of Congenital Syphilis\*

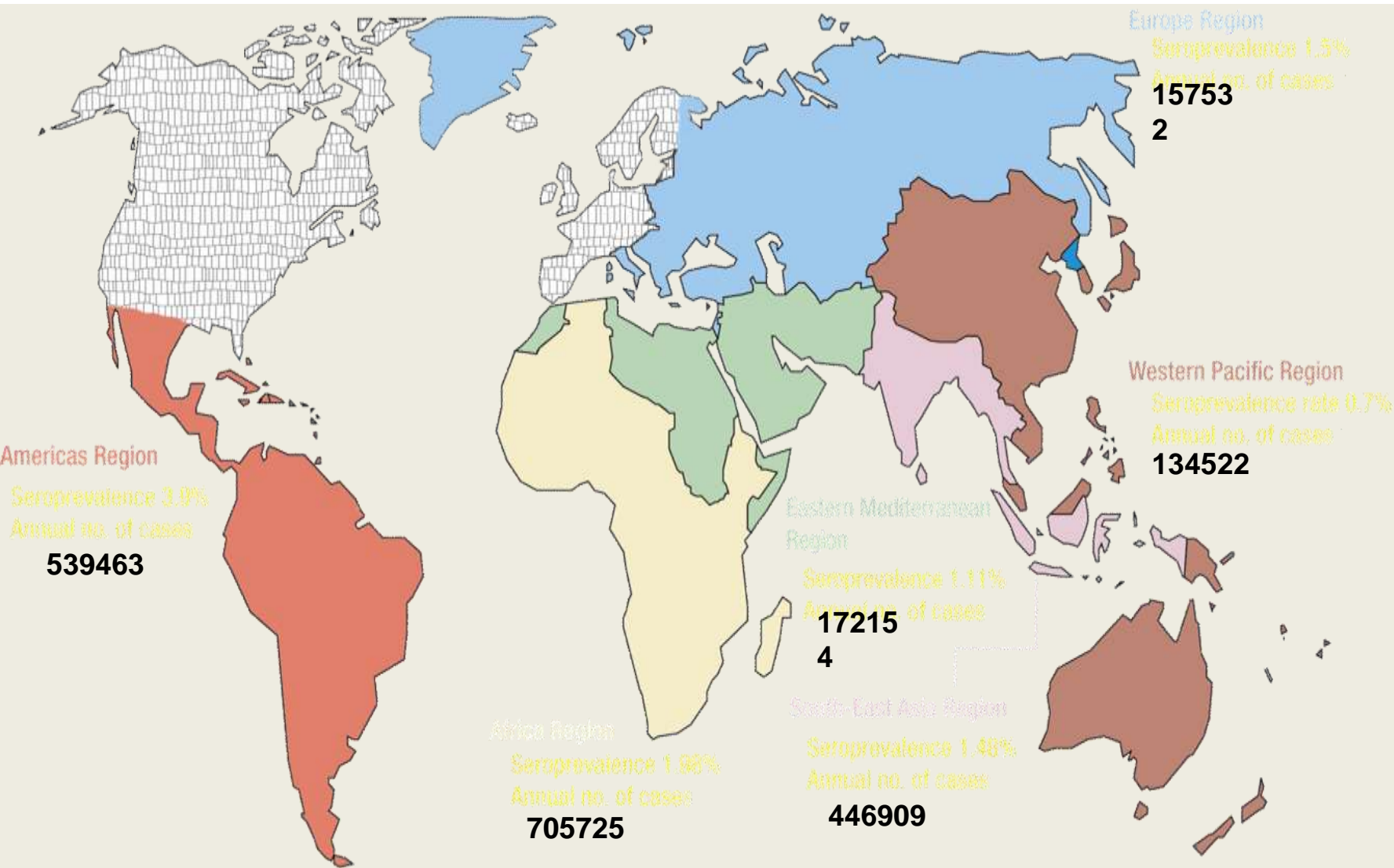
- ❑ Identified all published reports of syphilis seroprevalence in pregnant women, 1997-2003
- ❑ Constructed region-specific prevalence rates for maternal syphilis
- ❑ Using three models of the proportion of these women with an affected fetus/infant, to estimate the number of foetuses/infants infected

\*Schmid GP, Stoner BP, Hawkes S, Broutet N. Sex Transm Dis (June 2007)

# 2005 WHO Estimates of maternal syphilis seroprevalence

- Data from studies done between 1997 – 2003:
  - 215 studies
  - 31 countries
  - total 431,452 women tested
- Overall prevalence was 1.76%.
- Estimation of 2,156,304 women with positive syphilis serology using regional estimate
- 95% CI= 1,559,888 - 2,751,032

# Regional Estimates of Maternal Syphilis Seroprevalence



Conservative of STI <sup>3</sup>	More Conservative	Mid Range	Less
	Watson-Jones <sup>1</sup>	Schulz	Global Burden
	2002	1987	2000
Proportion of seropositive women with:			
A. Untreated syphilis	0.95*	1.0	1.0
B. High serologic titer ( $\geq 1:8$ )	0.73	--	--
C. Adverse pregnancy outcome due to syphilis**	0.49	0.65	0.75
Global Annual No. of Congenital Syphilis Cases (calculated as 2.1 million maternal cases x A x B x C)	713,600	1,365,000	1,575,000

Watson-Jones D et al. J Infect Dis 2002;186:940

<sup>2</sup>Schulz K et al Genitourin Med 1987;63:320

<sup>3</sup>WHO (www.who.int)

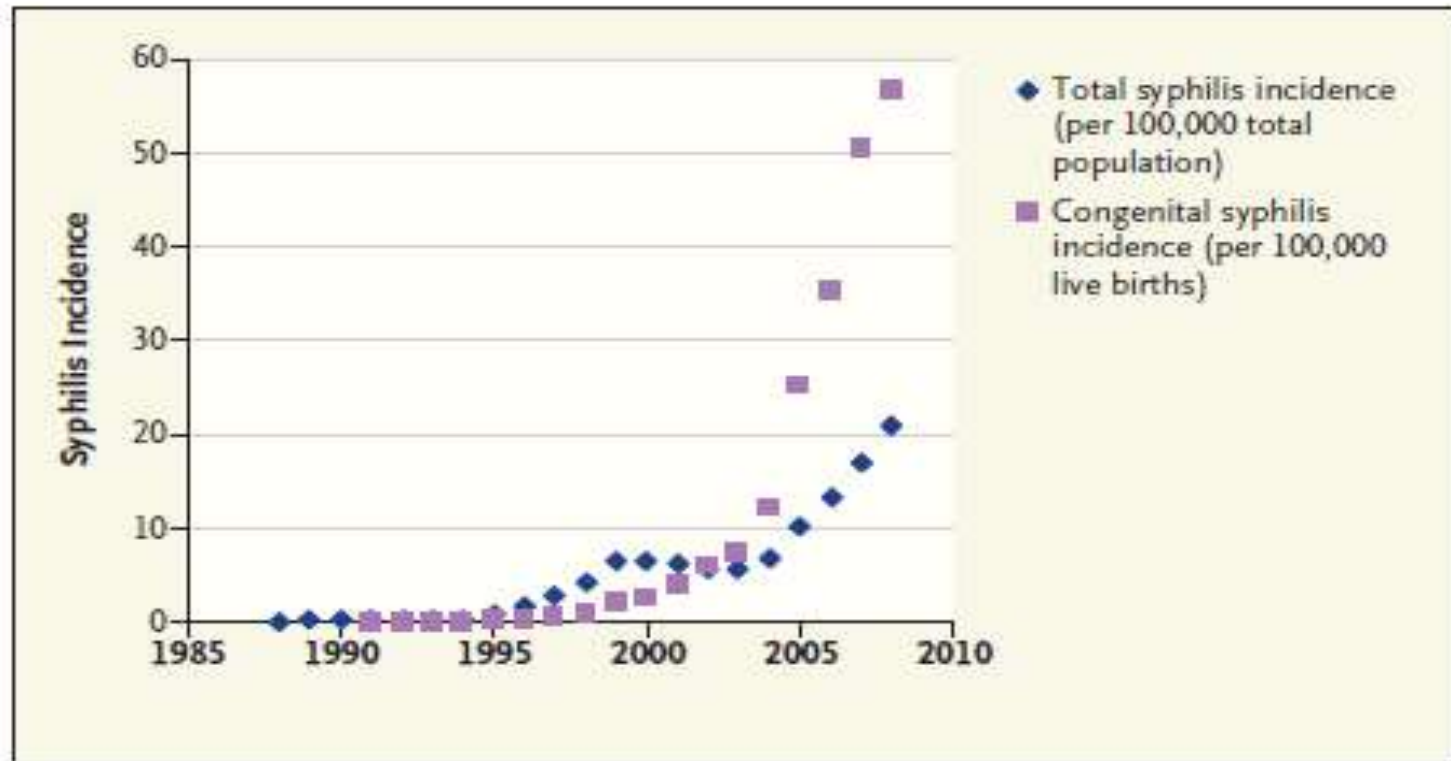
\*not included in original Watson-Jones model

\*\*includes miscarriage / fetal loss, perinatal death, prematurity / low birthweight, neonatal infection

**While Numbers Vary, and Estimates are Estimates, the Numbers of Women and Children Infected are "High"**

**In many parts of the world, syphilis is common!**

# Reported Overall Incidence of Syphilis per 100,000 Population and Incidence of Congenital Syphilis per 100,000 Live Births in



Data are from the National Center for STD Control in Nanjing, China.

\*Joseph D., et al, Syphilis and Social Upheaval in China, N Engl J Med 2010; 362:1658-1661

# Screening of syphilis antenatal mothers Malaysia, 2002-2008\*

YEAR	2002		2003		2004		2005		2006		2007		2008	
New antenatal attendances in the public health facilities	445,283		382,345		381,921		379,461		388,388		381,686		396,951	
Number screened for syphilis	280,303		285,723		298,248		292,624		311,505		365,851		372,749	
Percentage screened for syphilis	62.95%		74.73%		79.09%		77.12%		80.20%		95.9%		94.0%	
Confirmed syphilis (TPHA+)	239	0.08 %	276	0.09 %	262	0.09 %	295	0.10 %	273	0.09 %	303	0.08 %	287	0.08 %

\*Source : AIDS/STI Section, Ministry of Health. Malaysia Family Health Development Division, Ministry of Health.

# Antimicrobial Resistance

*Status quo* or new challenges!?



# The clinical implications of persistent gonococcal infections

## In adults

- Pelvic inflammatory disease (PID)
- Chronic pelvic pain
- Ectopic pregnancy
- Spontaneous abortions
- Post-partum infections
- Infertility (male & female)
- Increased HIV transmission
- Epididymitis
- Orchitis
- Urethral strictures

## In children

- Stillbirths
- Prematurity, low birth weight
- Conjunctivitis and blindness



# Antimicrobial resistance in *Neisseria gonorrhoeae*

- ❑ **Penicillins**
- ❑ **Tetracyclines**
- ❑ **Aminoglycosides (gentamicin, kanamycin)**
- ❑ **Quinolones (norfloxacin, ciprofloxacin)**
- ❑ **Macrolides (azithromycin)**
- ❑ **Cephalosporins (ceftriaxone, cefixime)**

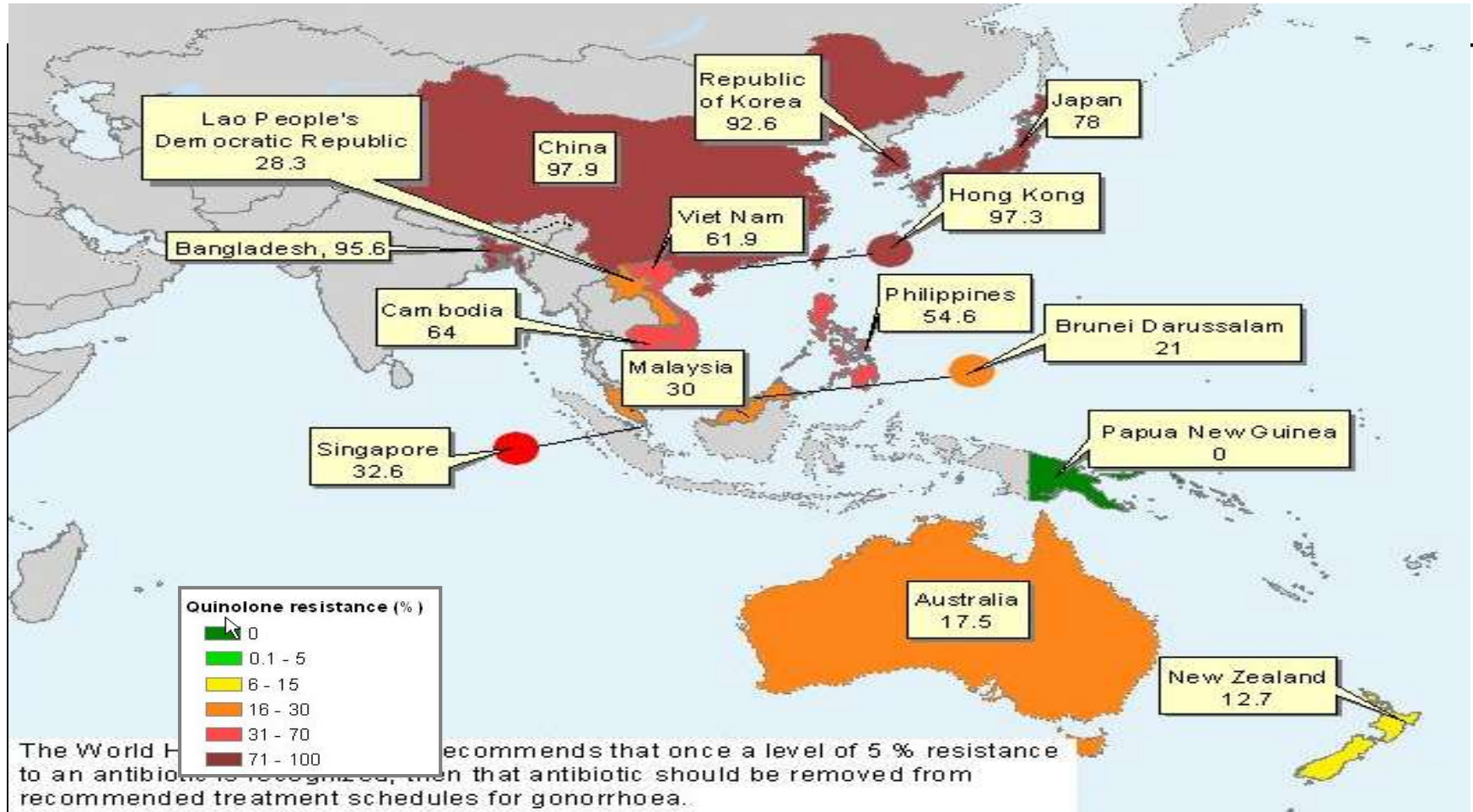
# Penicillin resistance in 9048 strains of *N. gonorrhoeae* in 22 Asian countries in 2008

Country	n	PPNG		CMRP		All Pen R	
		No.	%	No.	%	No.	%
Australia	3110	373	12%	994	32	1367	44%
*#Bhutan	161					161	100%
Brunei	351	201	70.5%	44	12.5%	245	69.8%
China	1403	543	38.7%	ND^			
Fiji	320	20	6.3%	11	3.4%	31	9.7%
Hong Kong SAR	1393	434	31.2%	169	12.1%	603	43.3%
*India	60	20	33.3%	5	8.3%	25	41.7%
Japan	328	2	0.6%	88	26.8%	90	27.4%
Korea	141	18	12.8%	77	54.6%	95	67.4%
#Lao PDR	9					7#	78%
Malaysia	43	23	53.5%	0	0.0%	23	53.5%
Mongolia	91			3	3.3%	3	3.3%
*Myanmar	12	2	16.7%	8	66.7%	10	83.3%
New Caledonia	152	0	0.0%	2	1.3%	2	1.3%
New Zealand	258	6	2.3%	57	22.1%	63	24.4%
Papua New Guinea	32	20	62.5%	2	6.3%	22	68.8%
Philippines	84	76	90.5%	0	0.0%	76	90.5%
*Sri Lanka	34	18	52.9%	1	2.9%	19	55.9%
Singapore	160	90	56.3%	12	7.5%	102	63.8%
*@Thailand	733	592	80.8%	45/53	84.9%		
Tonga	14	1	7.1%	0	0.0%	1	7.1%
Vietnam	153	40	26.1%	9	5.9%	49	32%

# Quinolone resistance in 8731 strains of *Neisseria gonorrhoeae* in 20 Asian countries in 2008

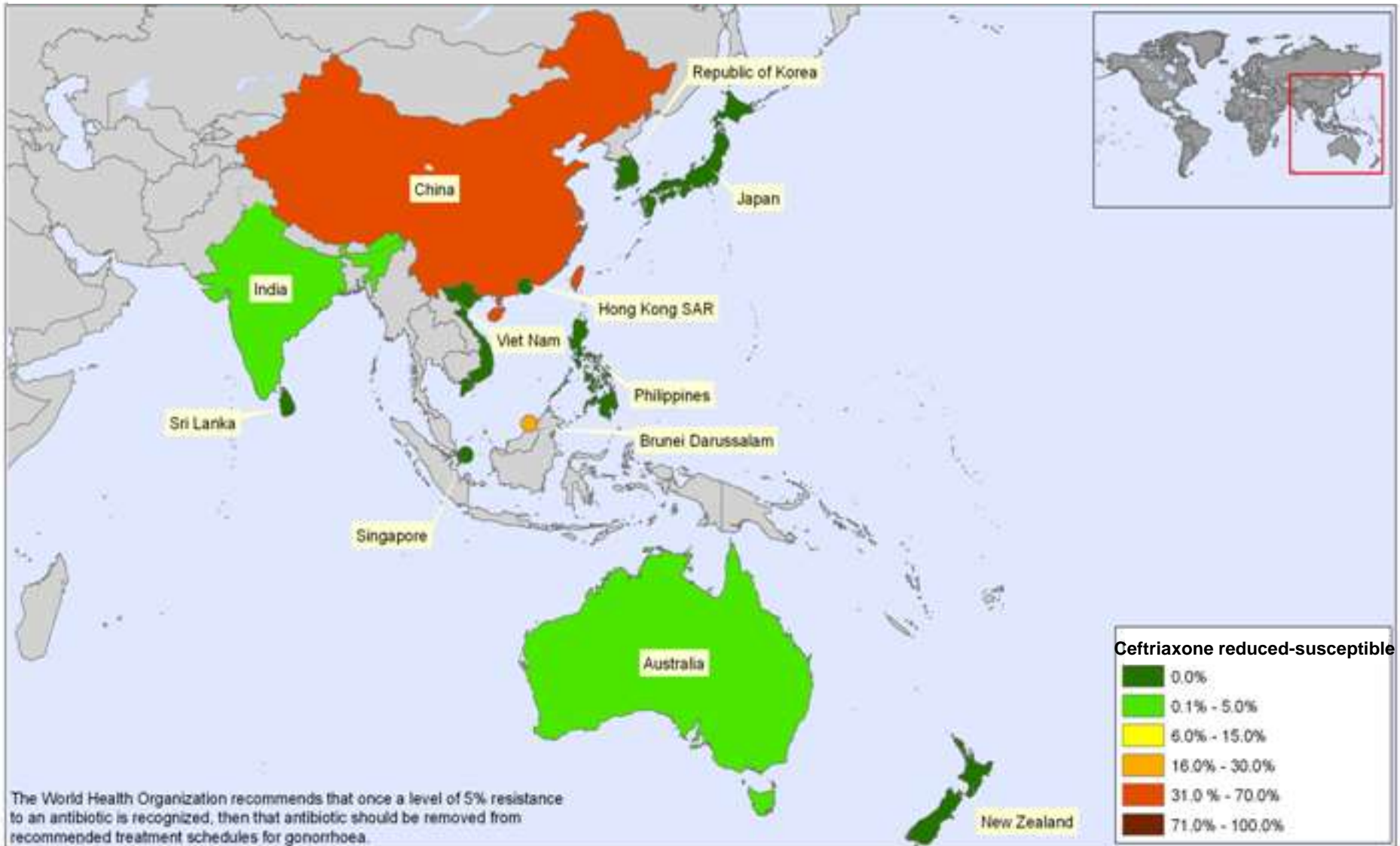
Country	n	Less susceptible		Resistant		All QRNG	
		No.	%	No.	%	No.	%
Australia	3110	34	1.1%	1651	53.1%	1685	54.2%
*Bhutan	161					153	95%
Brunei	353	92	26.1%	168	47.6%	260	73.7%
China	1403	53	3.8%	1348	96.1%	1401	99.9%
Hong Kong SAR	1393	12	0.9%	1362	97.80%	1374	98.6%
*India	60	10	16.7%	50	83.3%	60	100.0%
Japan	328	14	4.3%	240	73.2%	254	77.4%
Korea	141	29	20.6%	106	75.2%	135	95.7%
Lao PDR	9			1	11%	1	11%
Malaysia	43	6	14%	29	67.4%	35	81.4%
Mongolia	91	35	38.5%	34	37.4%	69	75.8%
*Myanmar	12	4	33.3%	6	50.0%	10	83.3%
New Caledonia	152	2	1.3%	3	2.0%	5	3.3%
New Zealand	258	2	0.8%	53	20.5%	55	21.3%
Papua New Guinea	32	0	0.0%	0	0.0%	0	0.0%
Philippines	84	4	4.8%	68	81.0%	72	85.7%
*Sri Lanka	34	0	0.0%	26	76.5%	26	76.5%
Singapore	160	10	6.3%	119	74.4%	129	80.6%
*Thailand	754	162	21.5%	570	75.6%	732	97.1%
Vietnam	153	5	3.3%	147	96.0%	152	99.3%

# Antimicrobial Resistance: Quinolone resistance (%)



Source: Global Atlas (CDS/WHO)

# Ceftriaxone reduced-susceptibility strains of *Neisseria gonorrhoeae* – WHO/WPR/SEAR, 2006



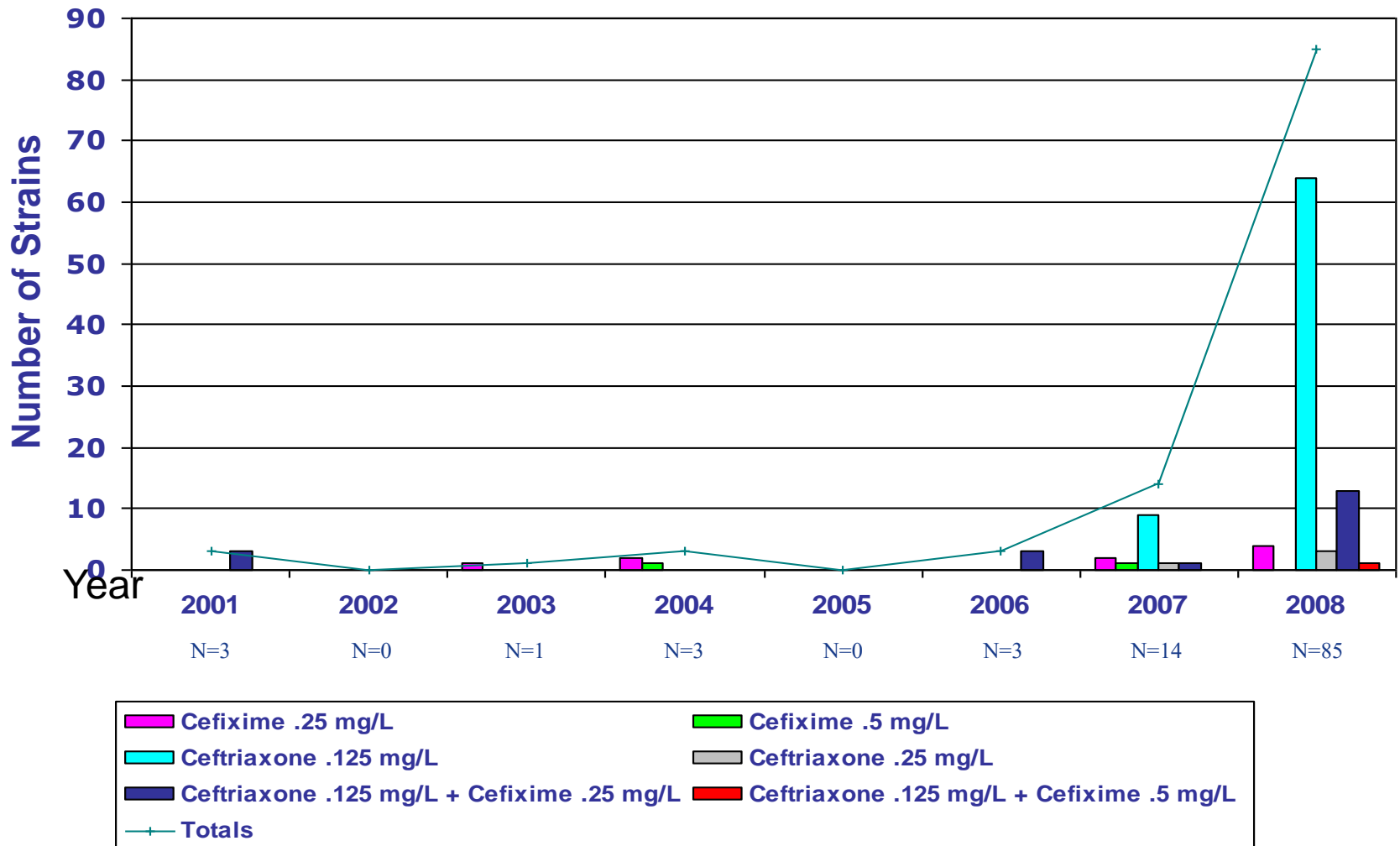
The World Health Organization recommends that once a level of 5% resistance to an antibiotic is recognized, then that antibiotic should be removed from recommended treatment schedules for gonorrhoea.

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. © WHO 2008. All rights reserved.

Data Source: National Ministry of Health/WHO  
Map Production: Public Health Mapping and GIS  
World Health Organization

# *N. gonorrhoeae* strains with decreased susceptibility to Cephalosporins\*

Cefixime (0.25 mg/l and 0.5 mg/L) and Ceftriaxone (0.125 mg/L and 0.25 mg/L) MICs



\*Source: Public Health Agency of Canada

# Modal ceftriaxone MICs – Europe data

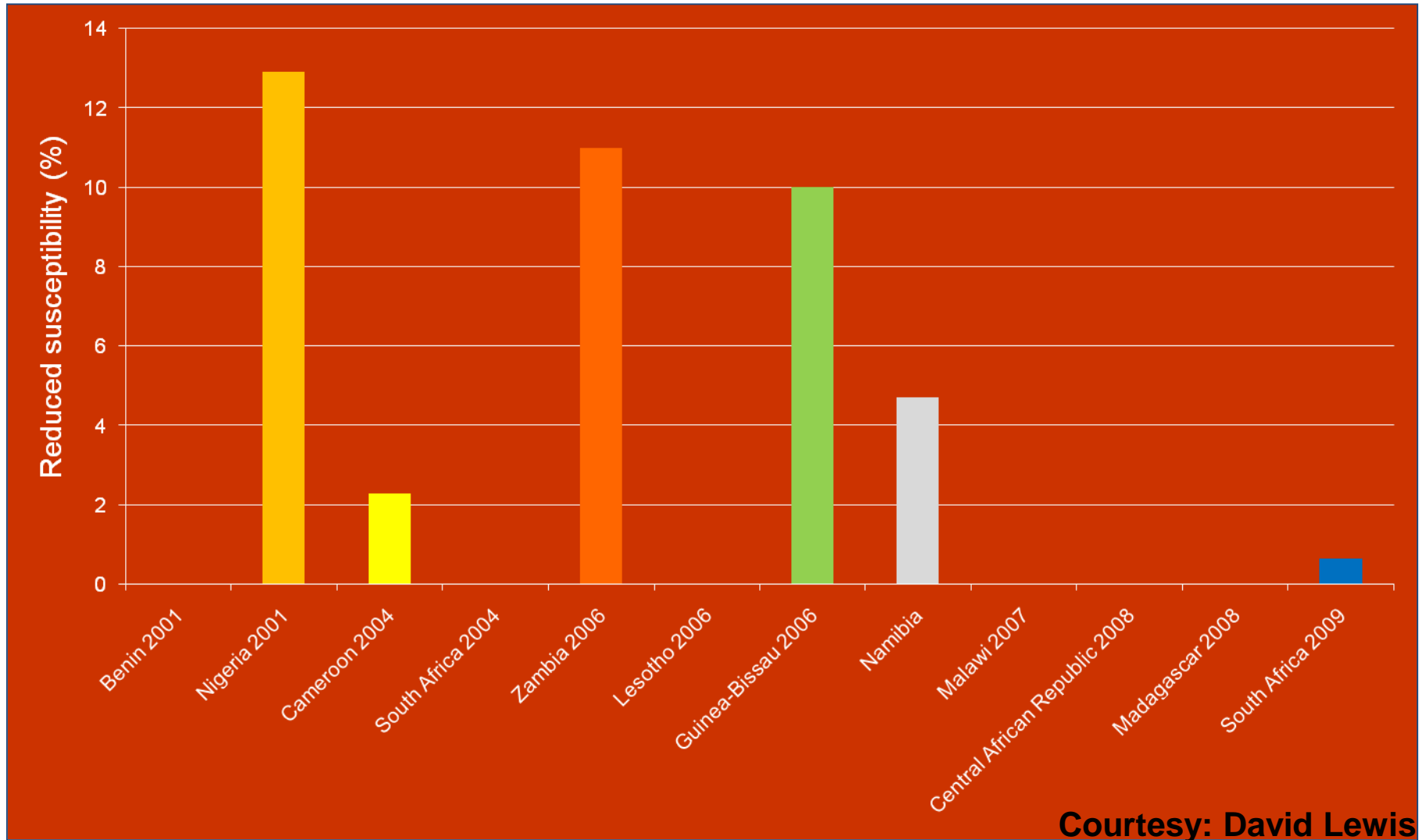
	2004	2006	2007	2008	Fold increase (1 <sup>st</sup> to last year)
Austria	0.004	<0.002	0.016	0.016	4
Belgium	<0.002	<0.002	<0.002	0.008	4
Denmark	<0.002	0.016	0.016	0.016	8
England/Wales	<0.002	<0.002	<0.002	0.004	2
Netherlands	<0.002	0.016	0.008	0.004	2
Portugal	<0.002	0.004	0.004	0.004	2
Scotland	0.004	0.004	0.004	0.008	2
Slovenia		0.004	0.004	0.016	4
Spain	<0.002	0.008	0.004	0.004	2
Sweden	0.004	0.008	0.008	0.008	2
France	<0.002		0.016	0.004	2
Germany			0.016	0.008	Decrease
Greece	<0.002		0.004	0.004	2
Italy	<0.002		0.008		4
Malta			0.016	0.032	2

MICs rounded up to full dilution  
<0.002 = 0.002 for fold calculation

Courtesy: Cathy Ison



# Decreased susceptibility to ceftriaxone - Africa (2001-2009)



Courtesy: David Lewis

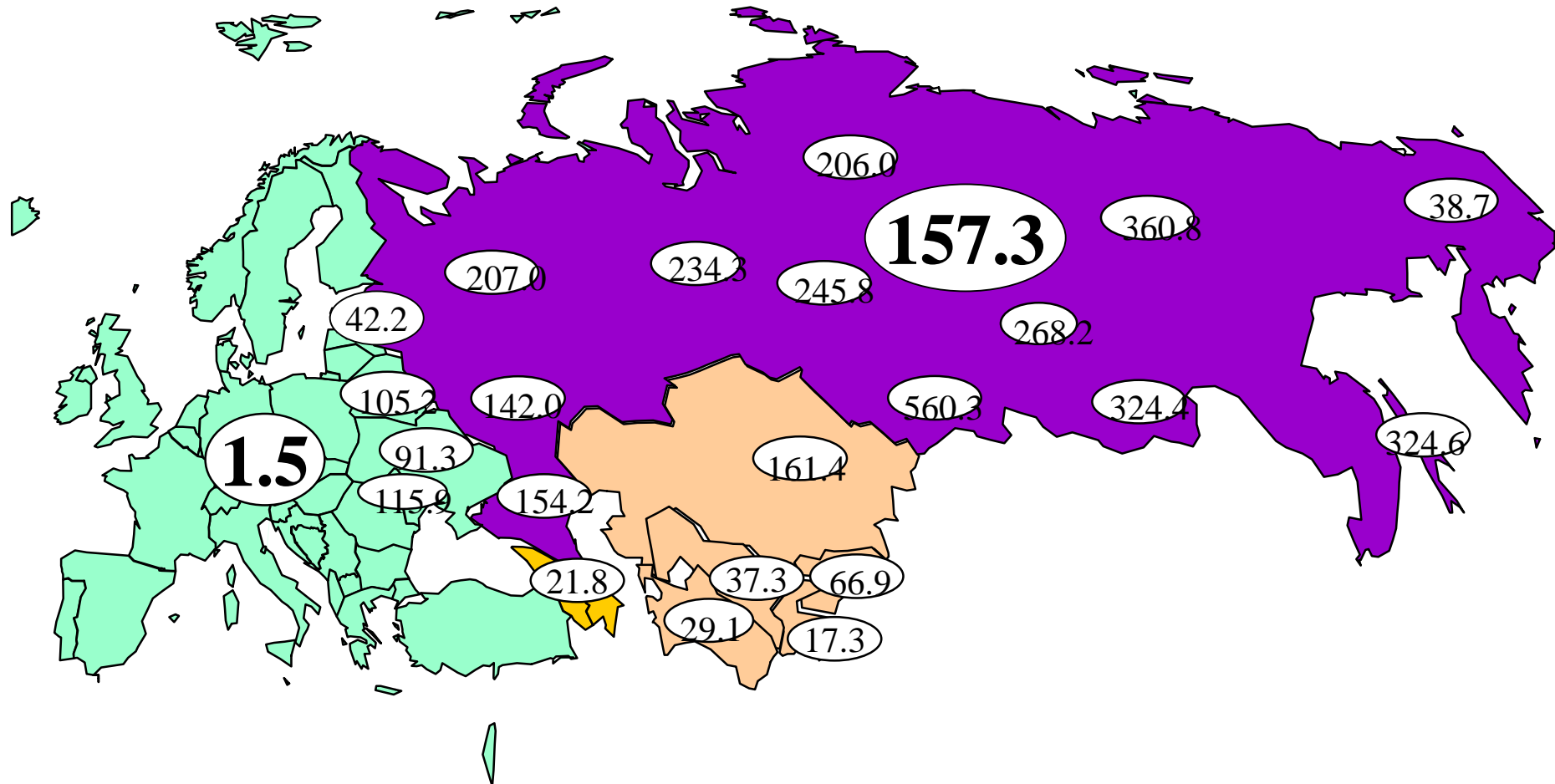
# The STI Epidemic, Eastern Europe and Central Asia

**Late 1990s**

**Things are not the same anymore!**

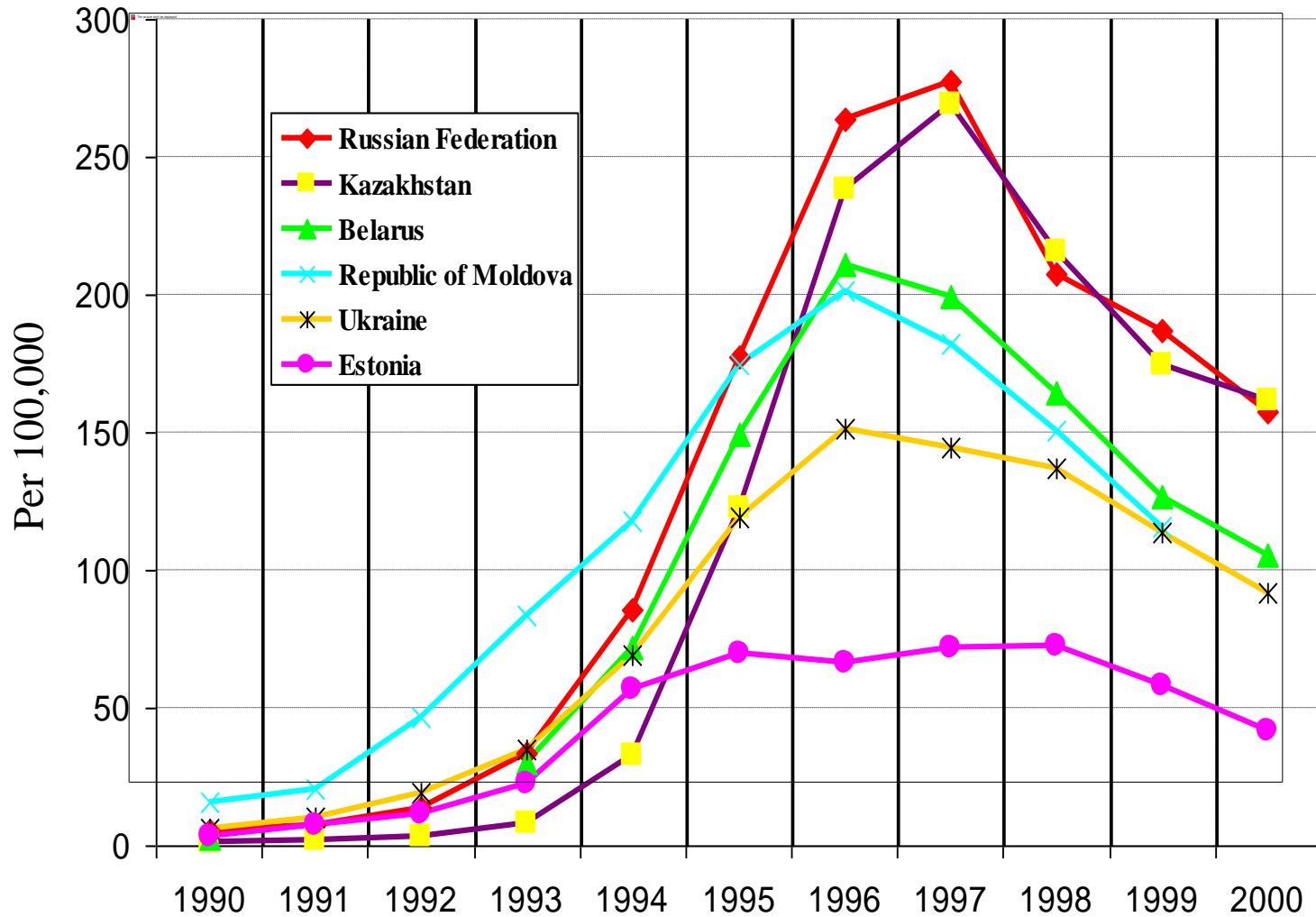
# Incidence of syphilis in the WHO EURO Region 1999/2000

- rate per 100,000 population -



# Incidence of syphilis in Belarus, Estonia, Kazakhstan, Moldova, Russia, Ukraine, 1990-2000

- rate per 100 000 -



# The STI Epidemic, Eastern Europe and Central Asia

**Late 1990s**

**Things are not the same anymore!**

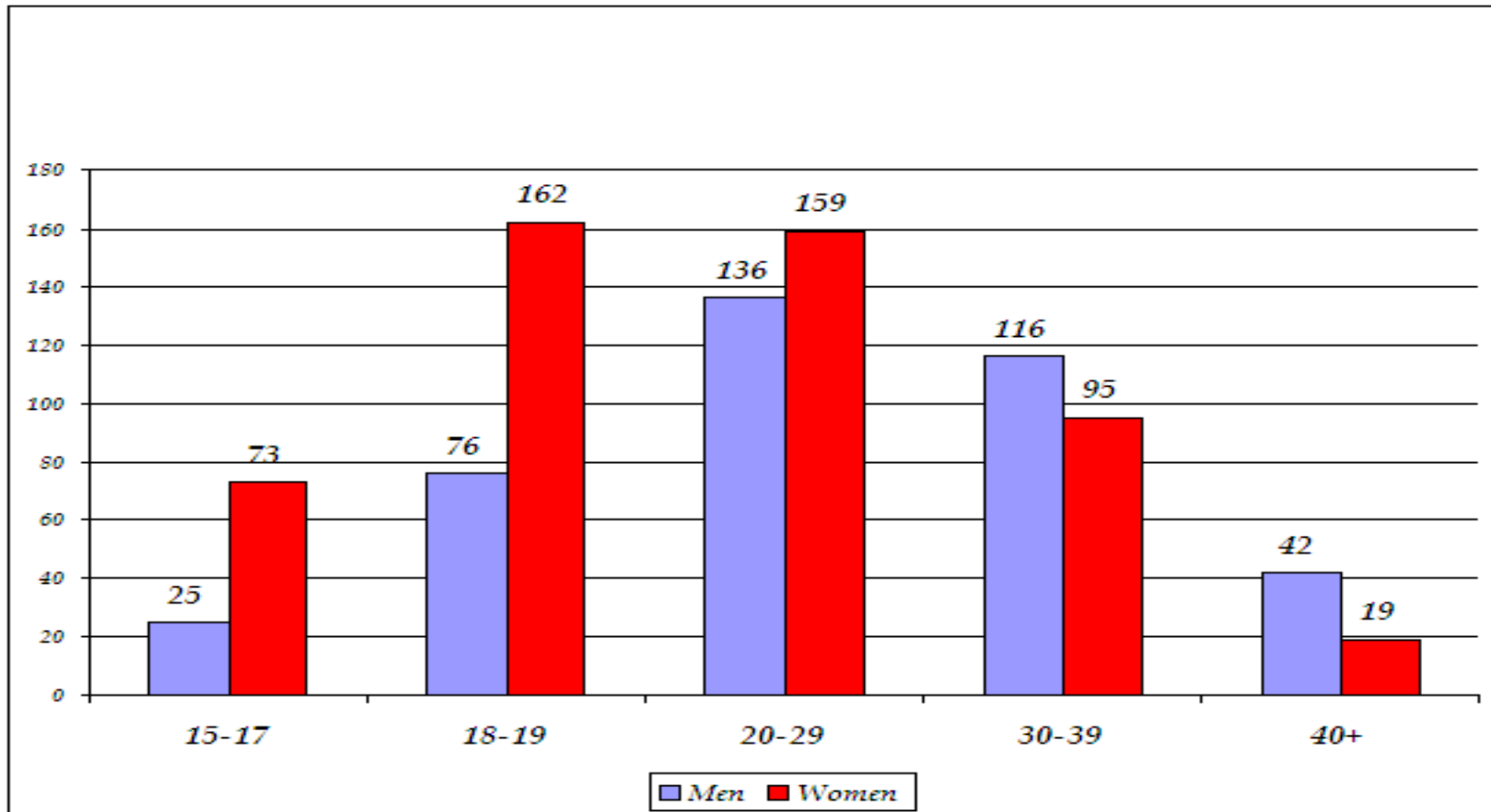
**BUT....**

# Prevalence and incidence of *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, syphilis, and *Trichomonas vaginalis* in Kyrgyzstan (2005-2009)\*

	2005		2006		2007		2008		2009	
	prevalence	Incident cases per 10000	prevalence	Incident cases per 10000	prevalence	Incident cases per 10000	prevalence	Incident cases per 10000	prevalence	Incident cases per 10000
<b>Syphilis</b>	2006	39,2	1691	32,7	1332	25,6	1165	22,9	1201	22,3
<b><i>Neisseria gonorrhoeae</i></b>	1414	27,6	1188	23,0	1170	22,5	1030	20,2	851	15,8
<b><i>Chlamydia trachomatis</i></b>	3412	66,7	3659	70,9	3312	63,6	2167	41,3	3382	62,8
<b><i>Trichomonas vaginalis</i></b>	7534	147,3	7020	135,9	6878	132,1	4831	92	6580	122,2

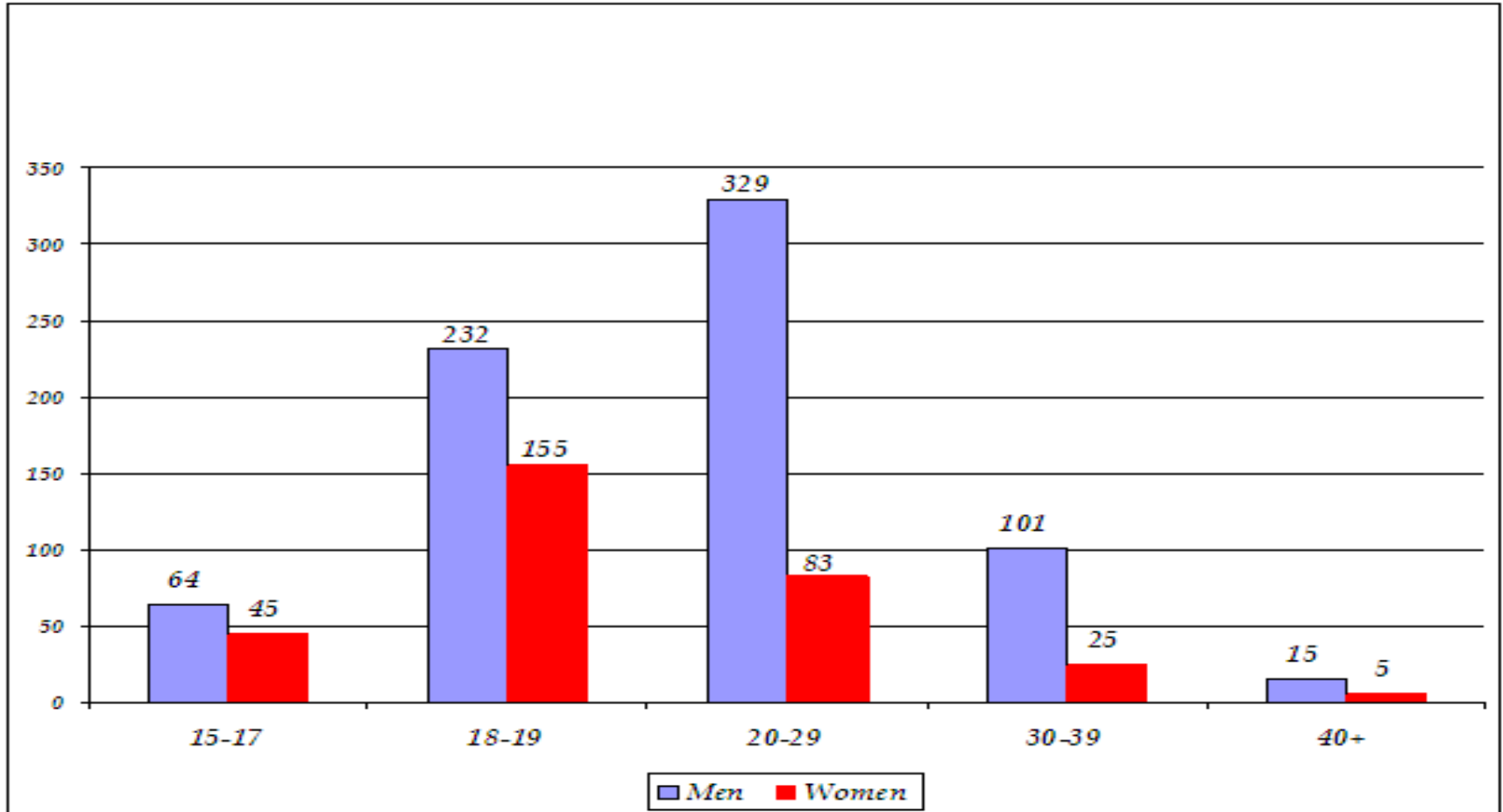
\*Source : Ministry of Health, Kyrgyzstan.

# Incidence rate of syphilis by age groups and sex in the Russian Federation (2009)\* (per. 100,000 population)



\* Source: *Здравоохранение в России. 2009: Стат.сб./Росстат.* - М., 2009. - 365 с.

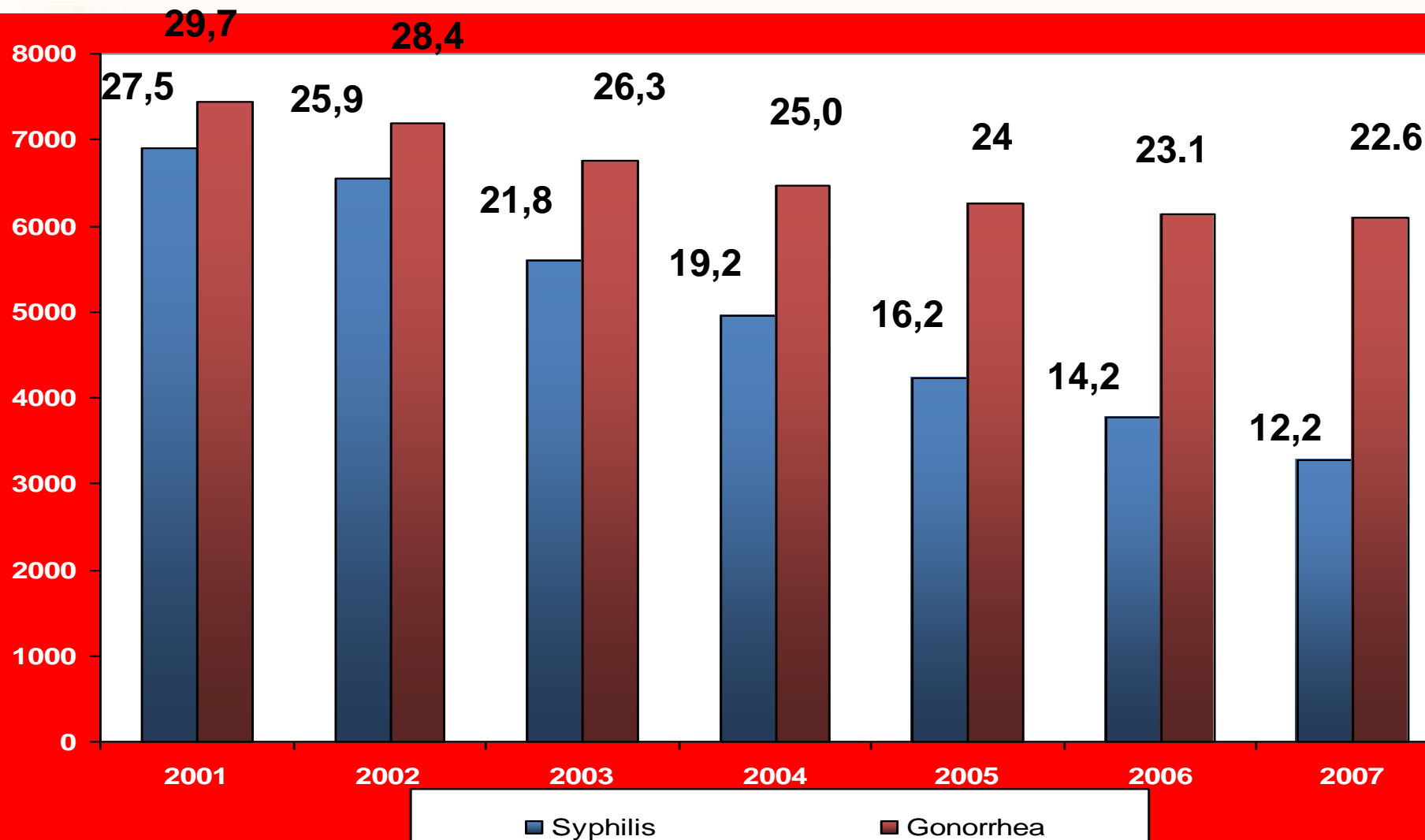
# Incidence rate of gonorrhoea by age groups and sex in the Russian Federation (2009)\* (per. 100,000 population)



\* Source: *Здравоохранение в России. 2009: Стат.сб./Росстат.* - М., 2009. - 365 с.



# Estimated Incidence of syphilis and gonorrhoea in Uzbekistan (per 100.000 population)\*



\*Source: Prof. Saidkasim Arifov. CURRENT STATUS OF STI SERVICES IN UZBEKISTAN. 24th Conference on Sexually transmitted infections and HIV/AIDS- IUSTI Europe 2008. September 4-6, 2008. Milan, Italy

# Reported cases of *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, syphilis, and *Trichomonas vaginalis* in Ukraine (1997-2007)\*

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Siphilis</b>	147,1	138,4	113,9	91,5	77,1	63,8	54,7	48,7	42,0	34,3	29,9
<b><i>Neisseria gonorrhoeae</i></b>	60,1	55,6	55,4	52,7	50,6	46,5	42,8	40,8	38,6	33,0	29,8
<b><i>Chlamydia trachomatis</i></b>	31,7	48,1	47,3	67,5	70,1	61,5	65,8	68,9	72,5	78,1	75,7
<b><i>Trichomonas vaginalis</i></b>	284,3	312,7	304,6	330,8	329,1	300,3	290,2	279,3	272,2	251,0	245,3

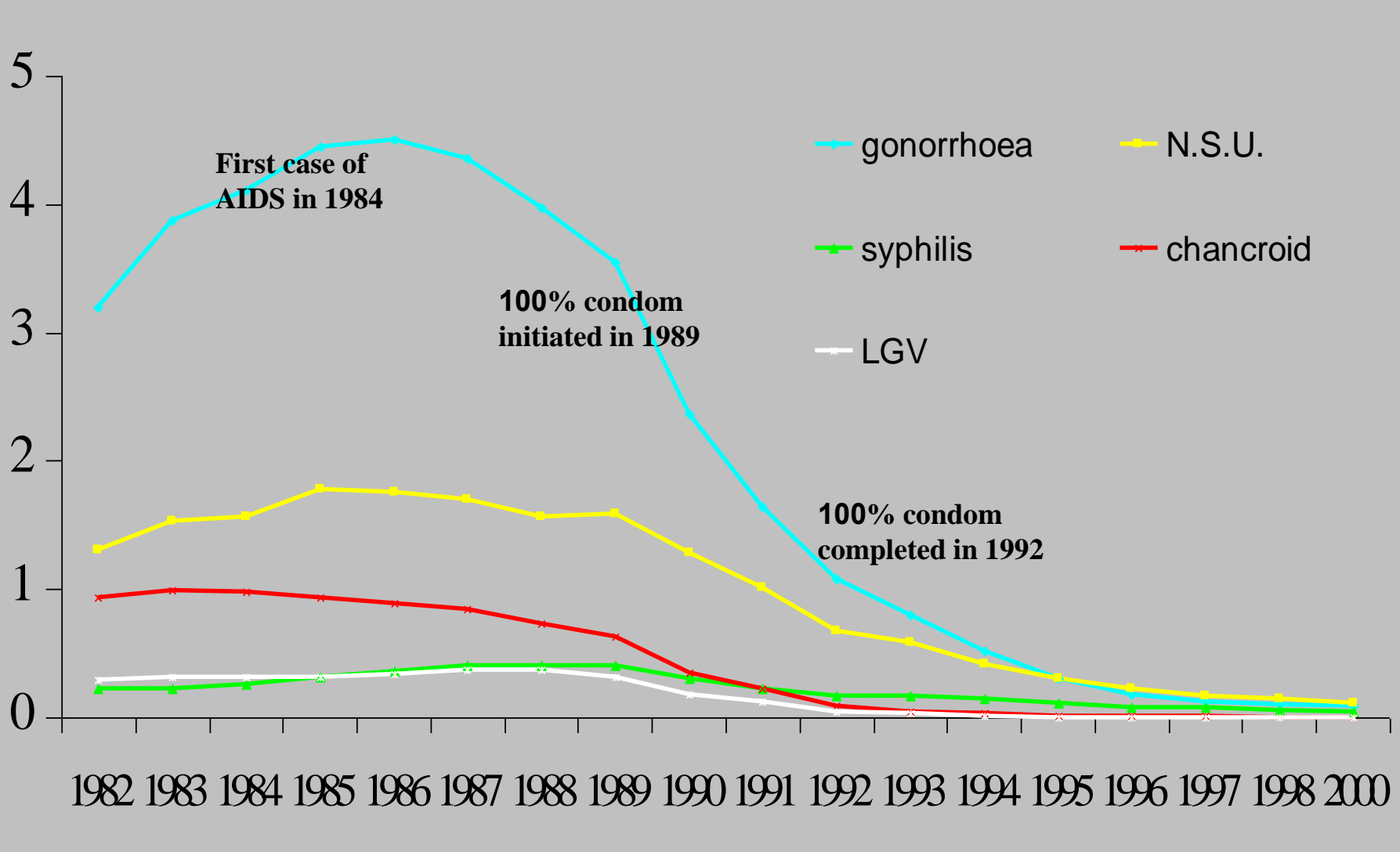
\*Adapted from: Г. И. Мавров, А.Е. Нагорный, Г.П.Чинов. "ИНФЕКЦИИ, ПЕРЕДАЮЩИЕСЯ ПОЛОВЫМ ПУТЕМ И ПРОБЛЕМА СЕКСУАЛЬНОГО И РЕПРОДУКТИВНОГО ЗДОРОВЬЯ НАЦИИ". Клінічна імунологія, алергологія, інфектологія. 2010.- №1 (спецвипуск).- С. 5-14.

# Thailand 100% Condom Use Programme

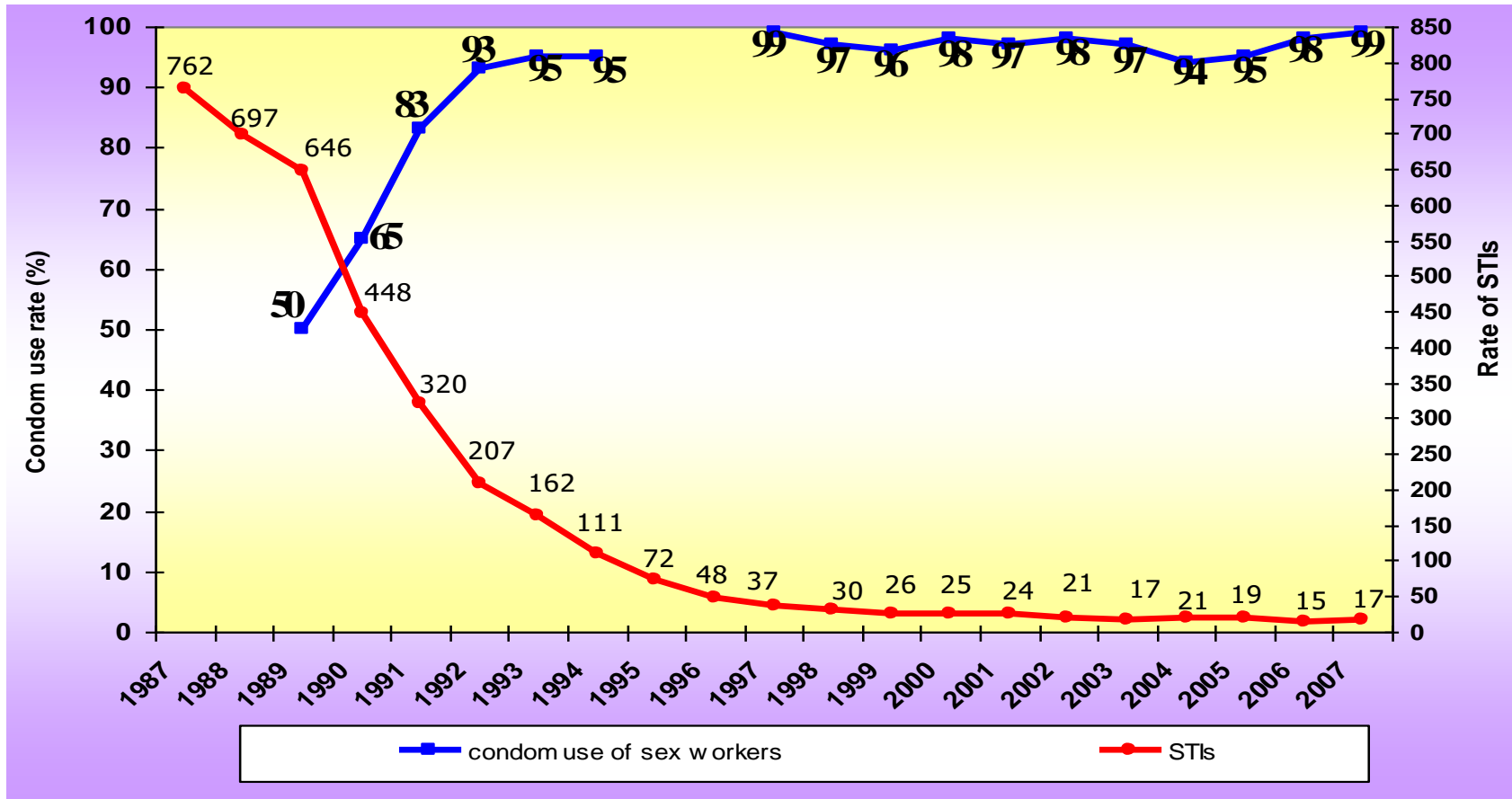


Dr Chavalit Mangkalaviraj, Bangrak Hospital, Bangkok Thailand. “ The HIV Epidemic – how Thailand cut back its STI rates in the light of the HIV epidemic” 16th International Against Sexually Infection, Bali, Indonesia May 4-6, 2010.

# Incidence of STDs in Thailand (1982-2000)



# Number of reported STIs cases and Condom use Rate Among sex workers in Thailand : 1987- 2007(Rate : 100,000 population)



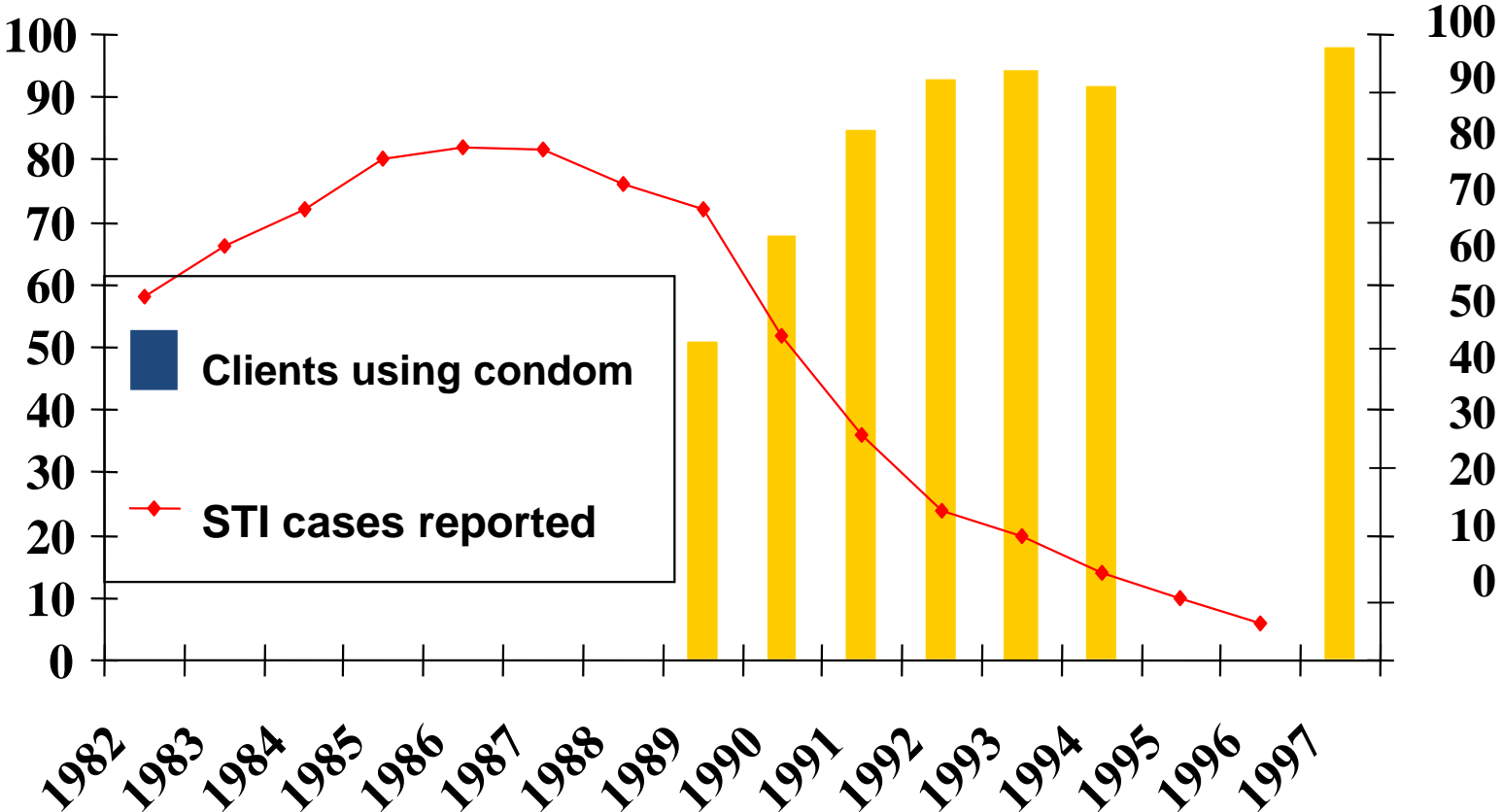
Source : National Surveillance and Bureau of AIDS, TB & STIs  
Department of Disease Control, Ministry of Public Health

Dr Chavalit Mangkalaviraj, Bangrak Hospital, Bangkok Thailand. " The HIV Epidemic – how Thailand cut back its STI rates in the light of the HIV epidemic" 16th International Against Sexually Infection, Bali, Indonesia May 4-6, 2010.

# Clients Using Condoms and STI Cases Reported - Thailand

STI cases reported ( thousands)

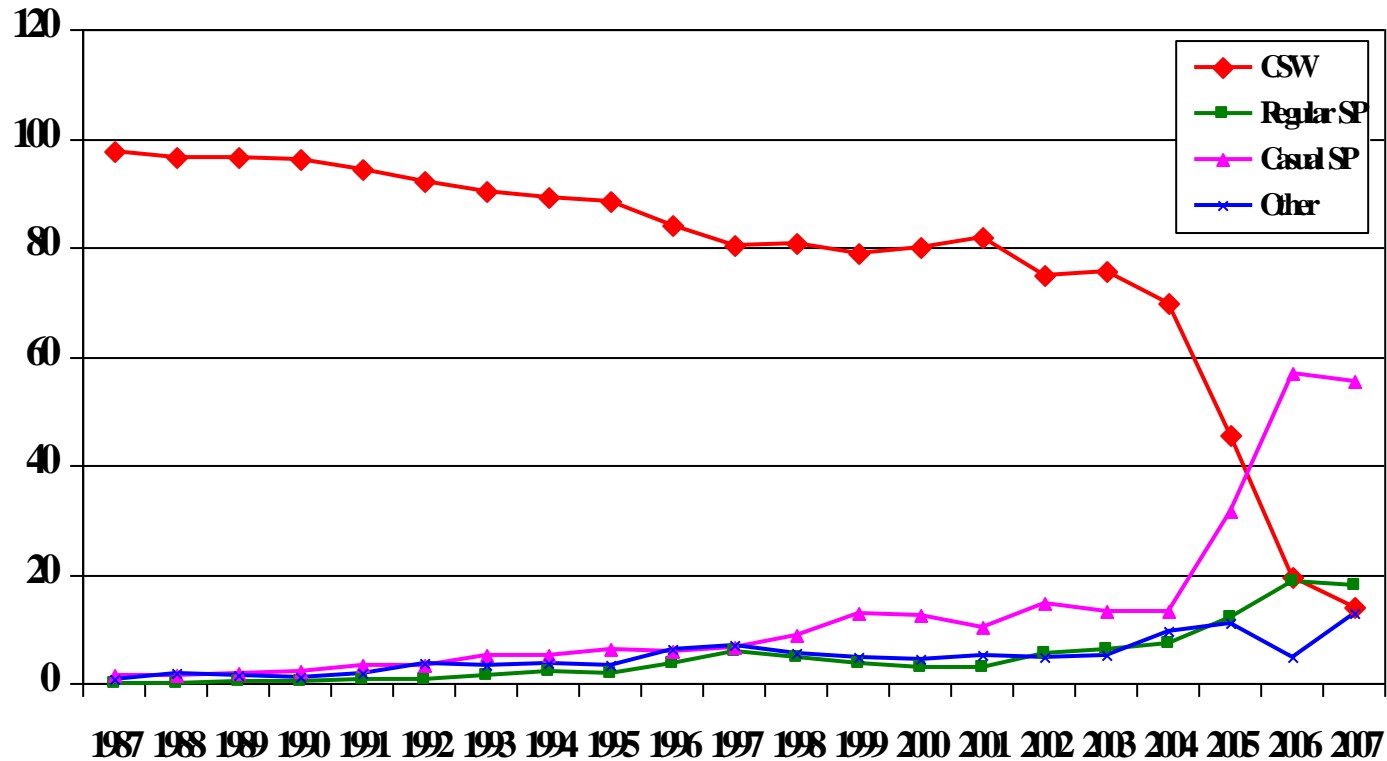
% using condoms



Source: Sentinel Serosurveillance, Division of Epidemiology, Ministry of Public Health.



# Sources of infection in Male STDs patients Thailand, 1987-2007\*



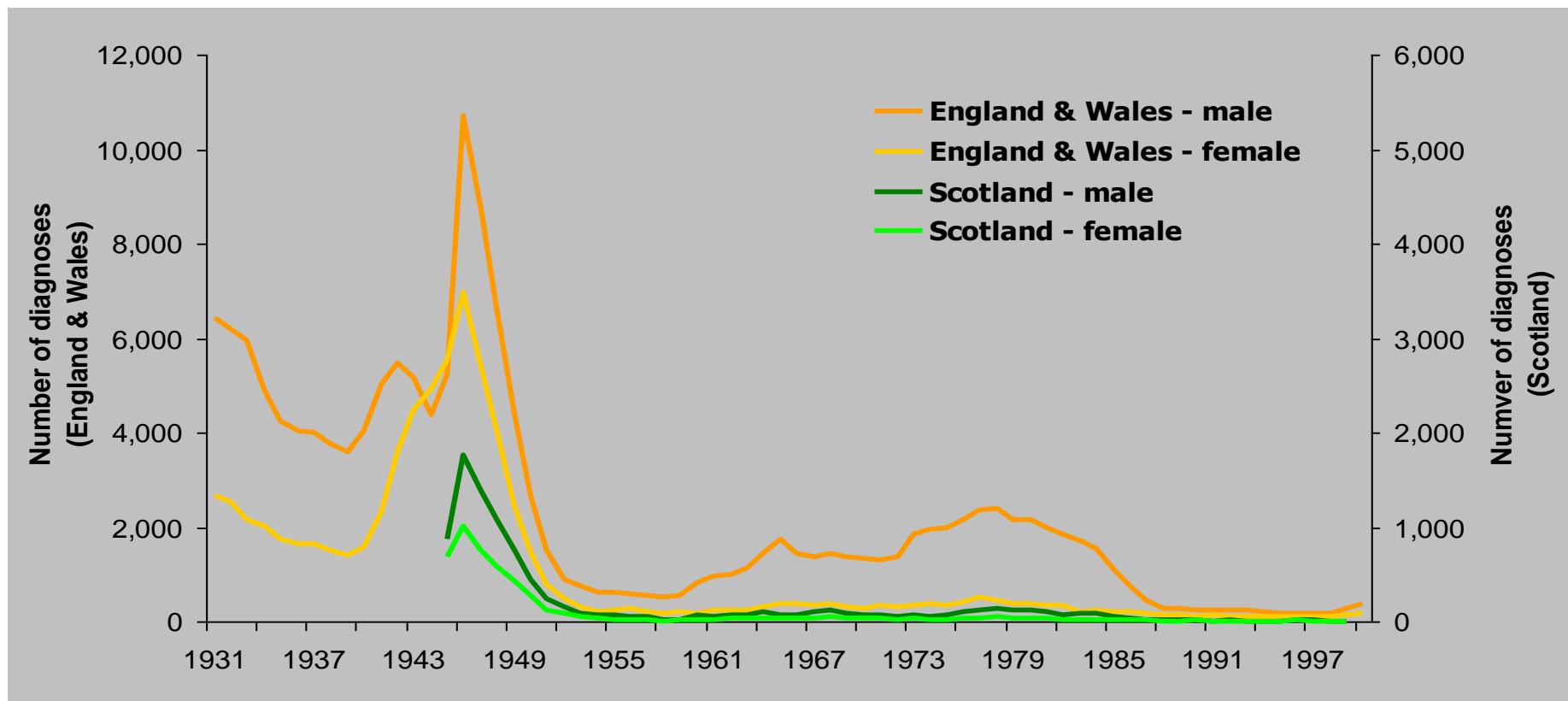
\*Dr Chavalit Mangkalaviraj, Bangrak Hospital, Bangkok Thailand. "The HIV Epidemic – how Thailand cut back its STI rates in the light of the HIV epidemic" 16th International Against Sexually Infection, Bali, Indonesia May 4-6, 2010.

# The STI Epidemic, Western Europe, North America and Australia

Whether we are **missing something!**?



# Diagnoses of syphilis (primary, secondary and latent in the first 2 years of infection) seen in GUM clinics, England, Scotland# and Wales, 1931 to 2000\*



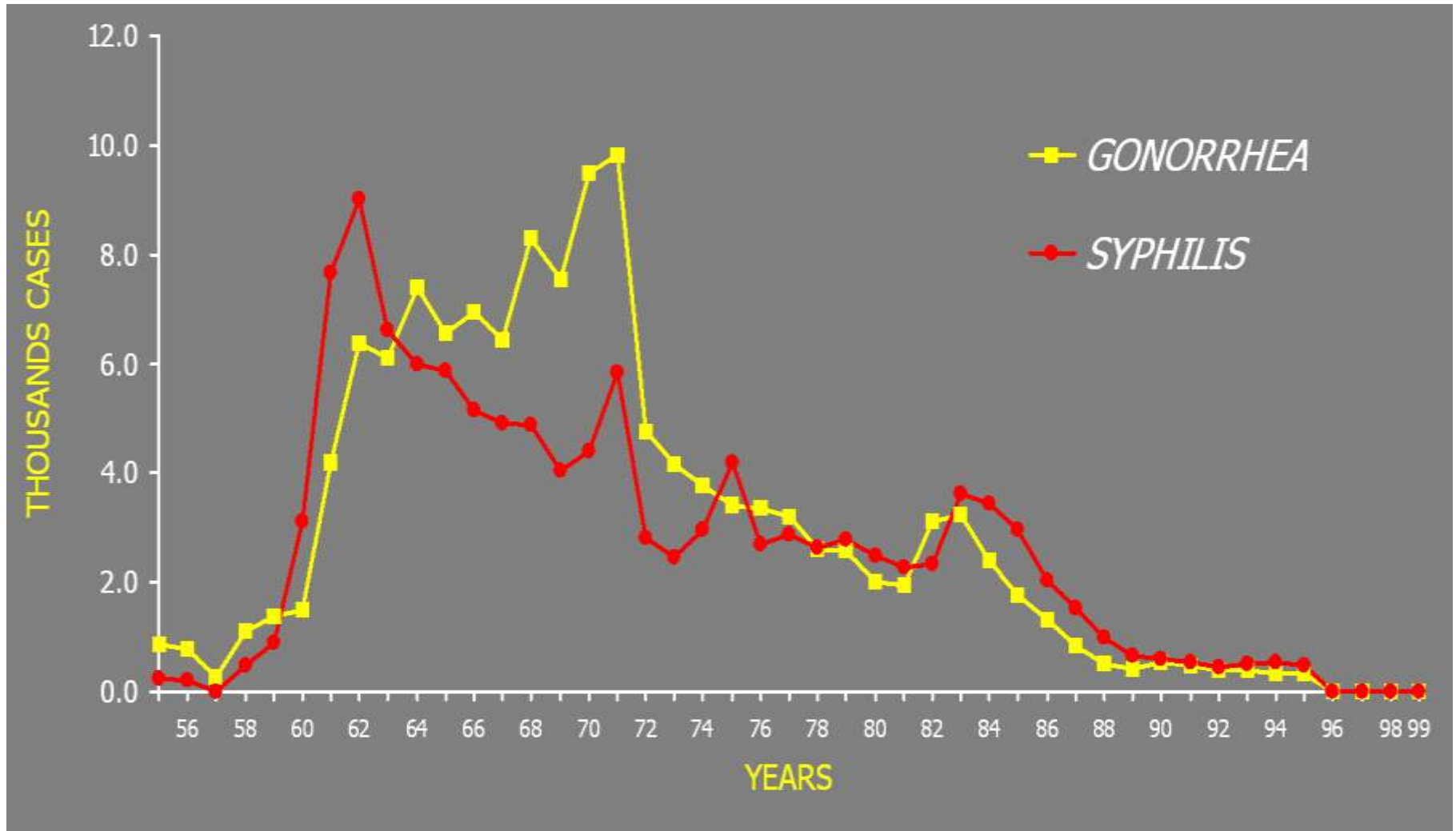
Source: PHLS, UK

# Equivalent Scottish data are not available prior to 1945 and for 2000

\*As Northern Ireland data from the time period 1931 to 2000 are incomplete they have been excluded from this figure

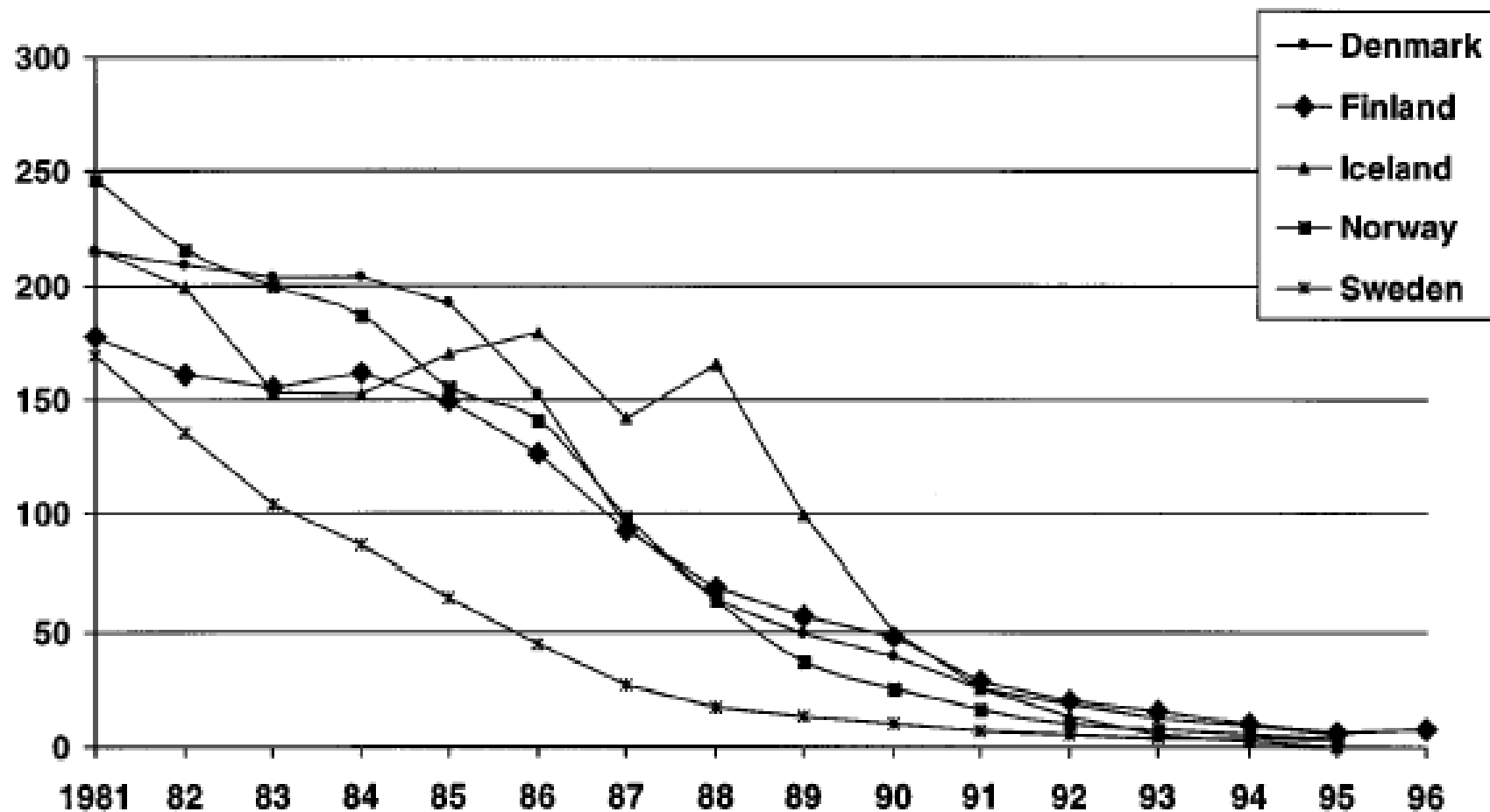
# Gonorrhoea and syphilis in Italy

## Mandatory notifications, 1955-1999



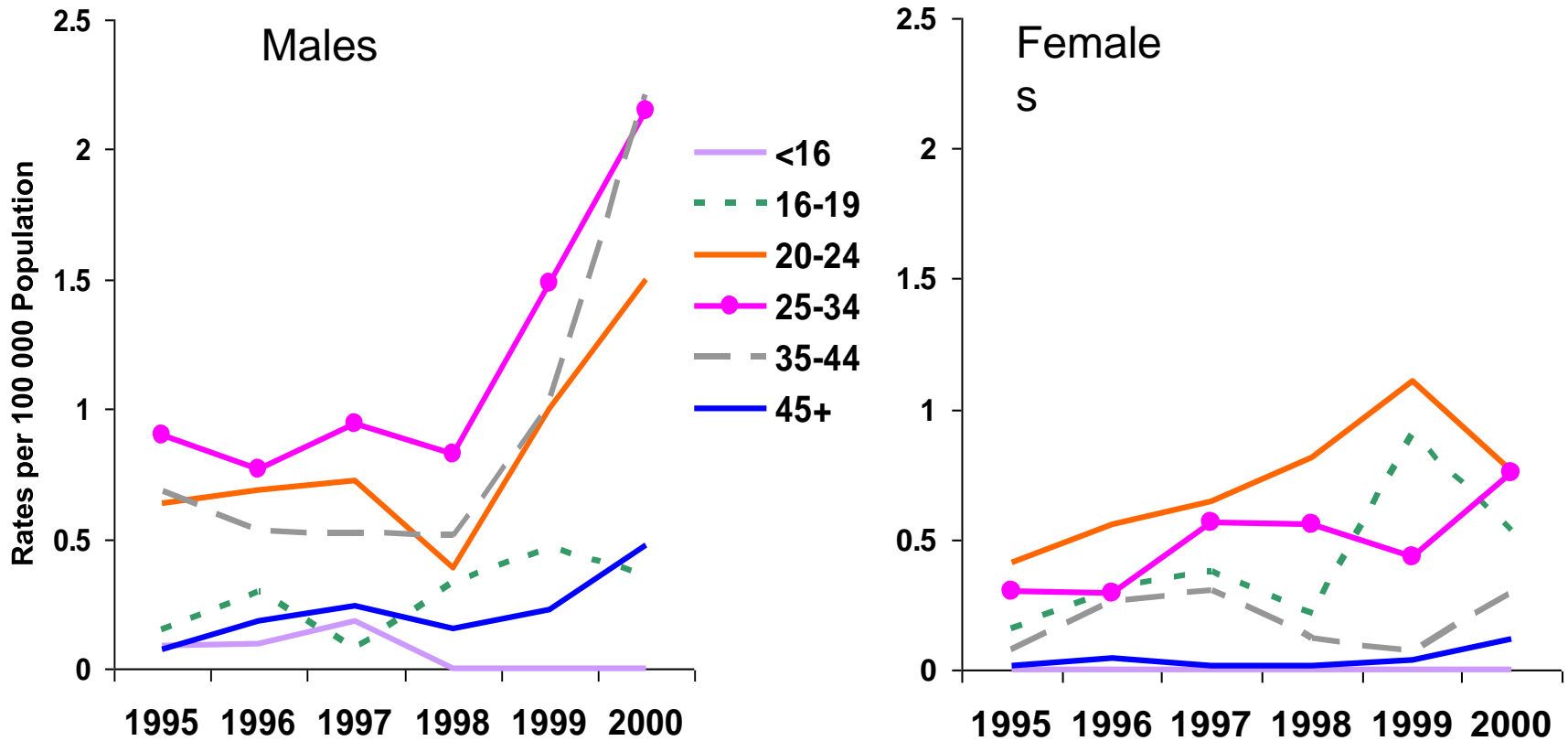
Source: Suligo et al.

# Annual incidence of gonorrhoea per 100 000 population in Nordic countries (1981 – 1996)



Source: Adler, Meheus, *JEADV* 2000;14:370 - 377

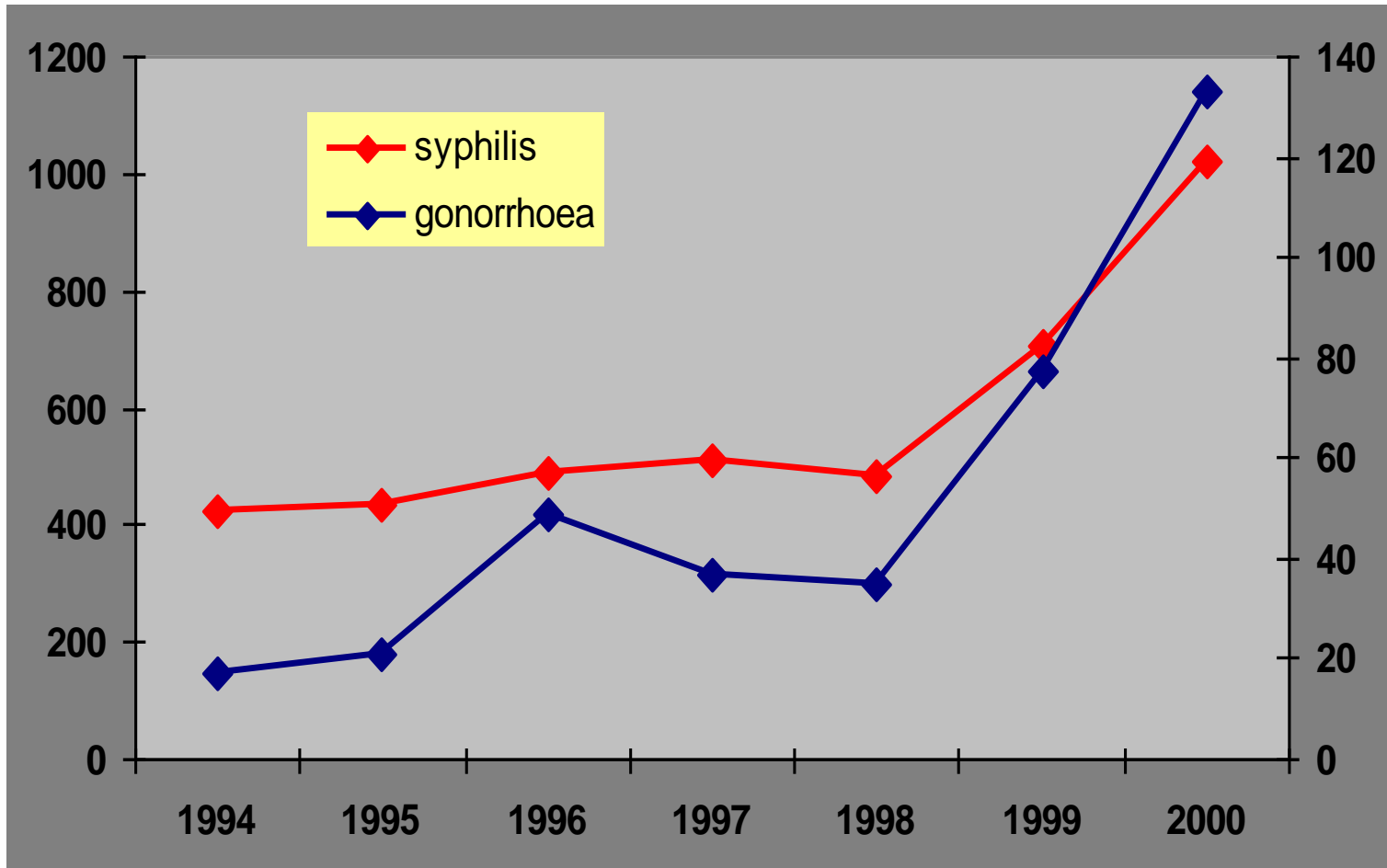
# Diagnoses of infectious syphilis (primary and secondary) in GUM clinics by sex and age group, UK: 1995-2000\*



\*Data are unavailable from Scotland for 2000 and from N.Ireland for 1996 & 1997

Source: ESSTI/PHLS, UK

# Netherlands: Gonorrhoea and syphilis, STD clinic (annual reports, GG&GD, Amsterdam).

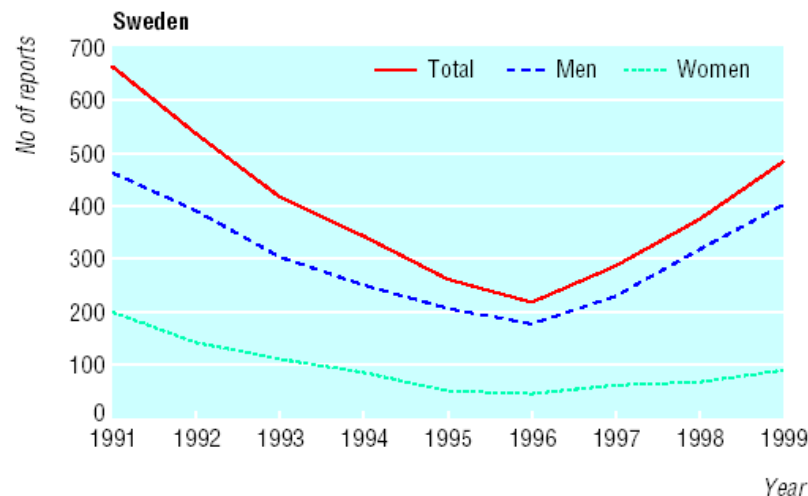
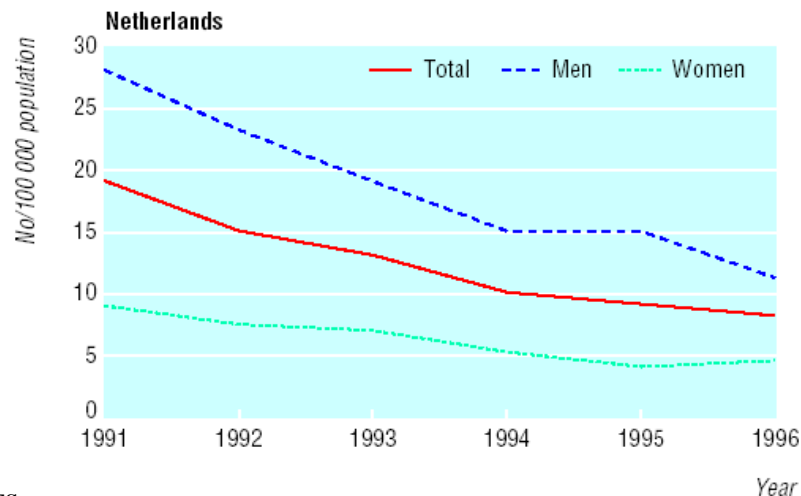
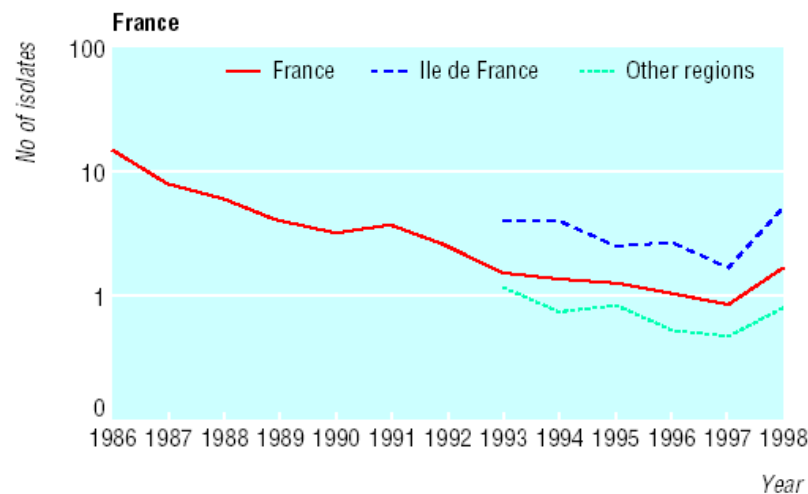
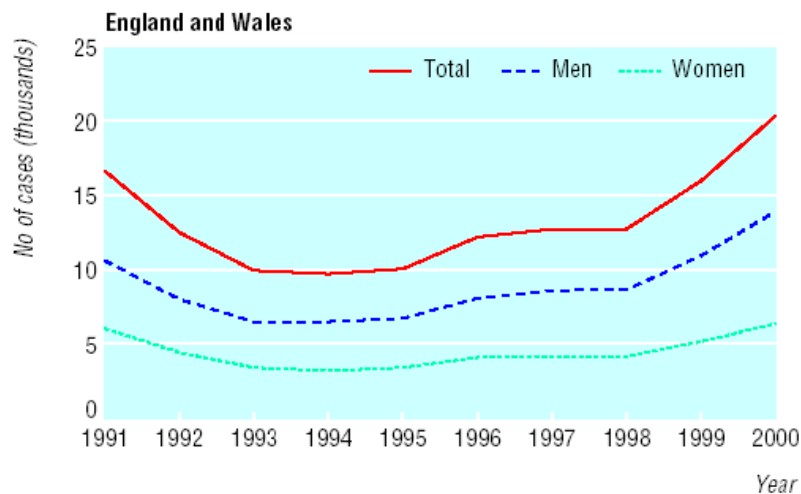


GO: 1999: + 46%; MSM 59% heter 16% fem 66%; 2000: + 45%; 33% 56% 72%

Lues: 1999: + 120%; MSM 333% heter 54% fem 40%; 2000: + 63% (MSM 136%)

Source: ESSTI/PHLS, UK

# Trends in gonorrhoea in England and Wales, France, the Netherlands, and Sweden



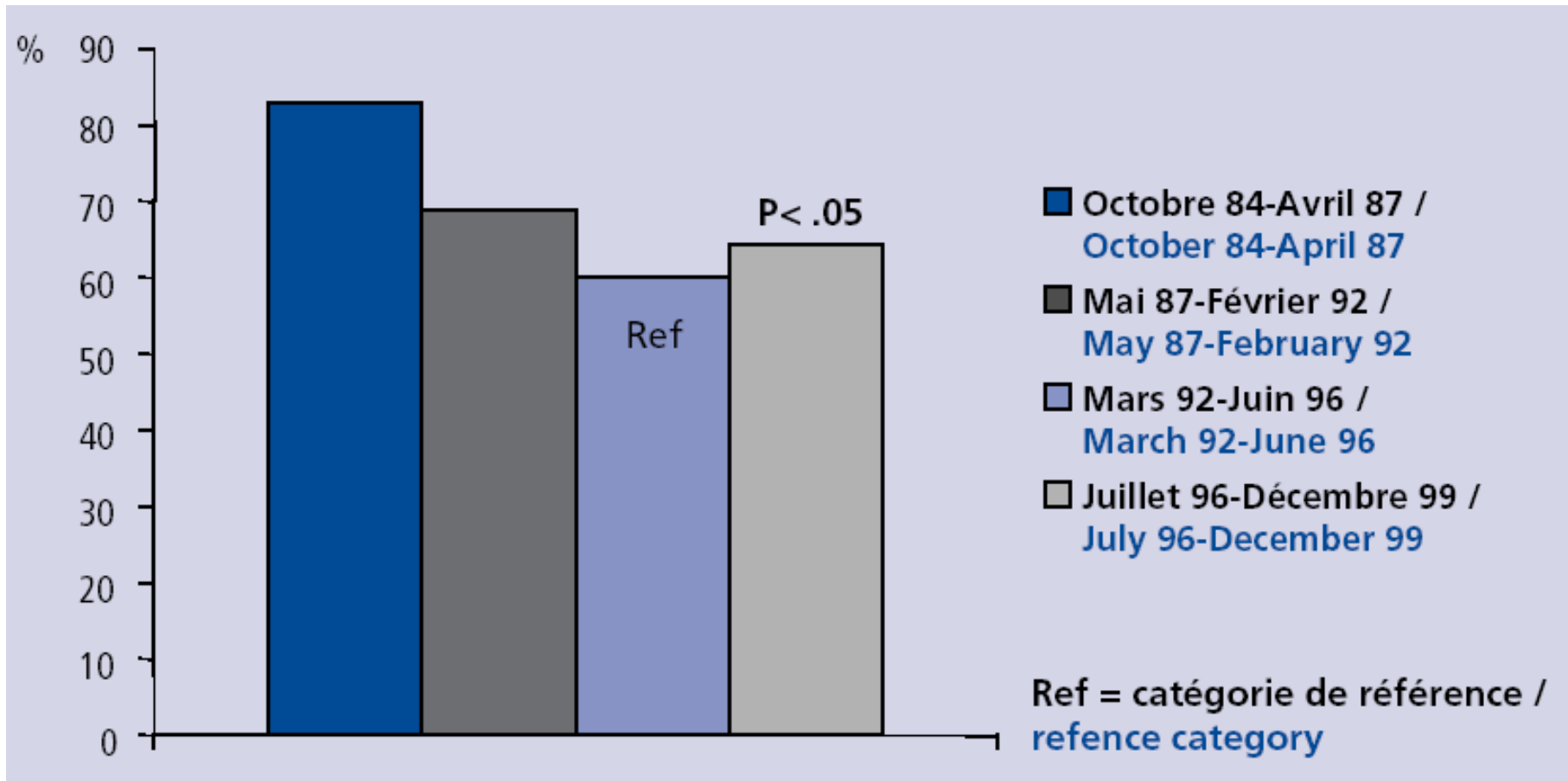
**SOURCES:**

England and Wales: cases of gonorrhoea seen in GUM clinics, 1991-2000; France: trends in gonococcal infections in RENAGO laboratories, 1991-1999

Netherlands: notified cases of gonorrhoea per 100 000 inhabitants, 1976; Sweden: number of clinically reported *Neisseria gonorrhoeae* cases, 1991-1999 (adapted from Smittskyddsinstitutet (Swedish Institute for Infectious Disease Control). *Smittsamma Sjukdomar 1999*. Stockholm: Smittskyddsinstitutet, 2000)

Source: Nicoll & Hamers, *BMJ* 2002;324:1324-7

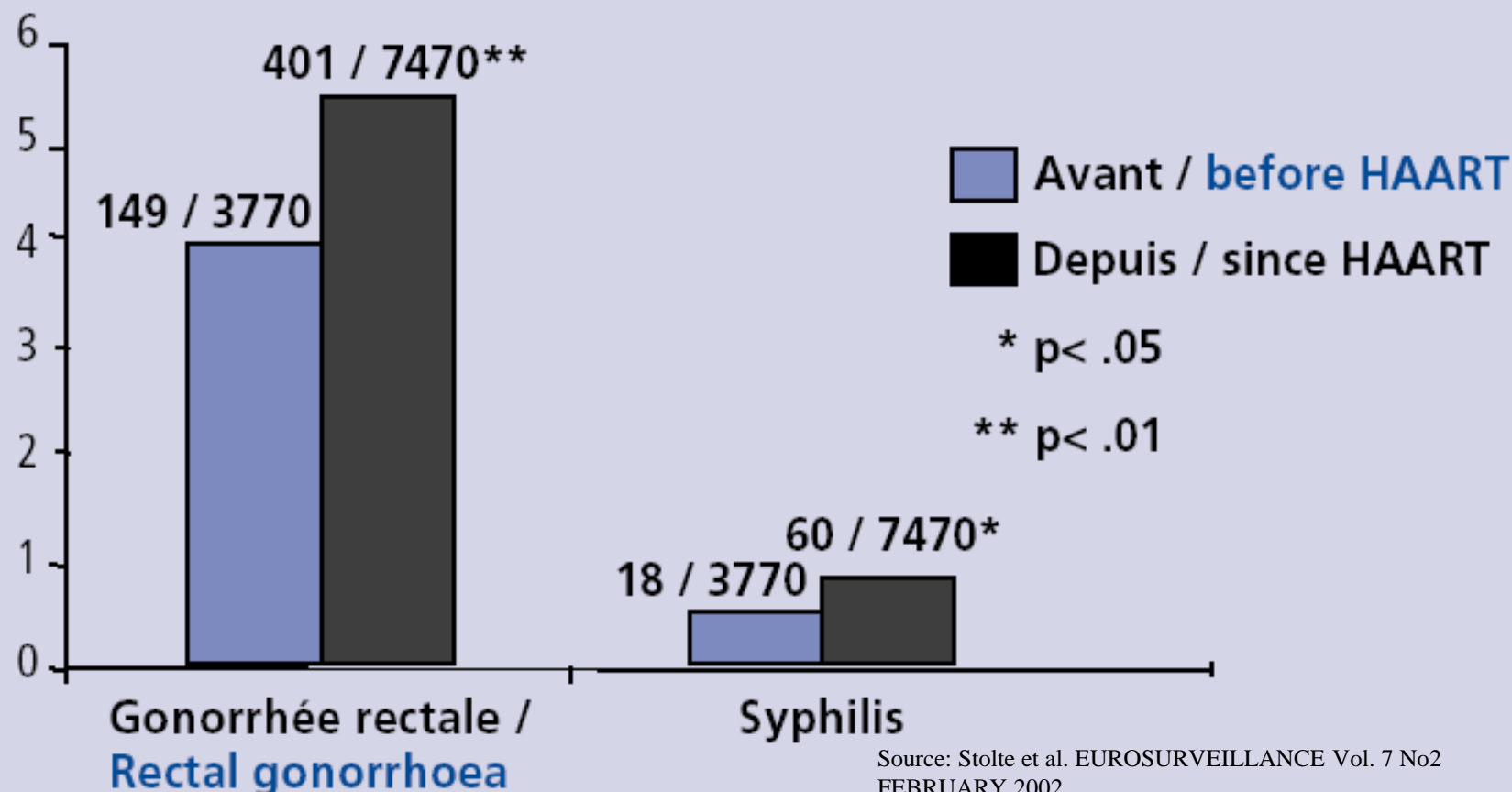
# Percentage of unprotected anal intercourse among HIV-negative young (< 35 years) homosexual men (n=877), Amsterdam, 1984-1999



Source: Stolte et al. EUROSURVEILLANCE Vol. 7 No2  
FEBRUARY 2002

# Relative numbers (infection rate) of rectal gonorrhoea and early syphilis diagnosed among homo- and bisexual men before and after the introduction of anti HIV therapies, Amsterdam STD outpatients clinic, 1994-1999

Taux d'infection / Infection rate (%)

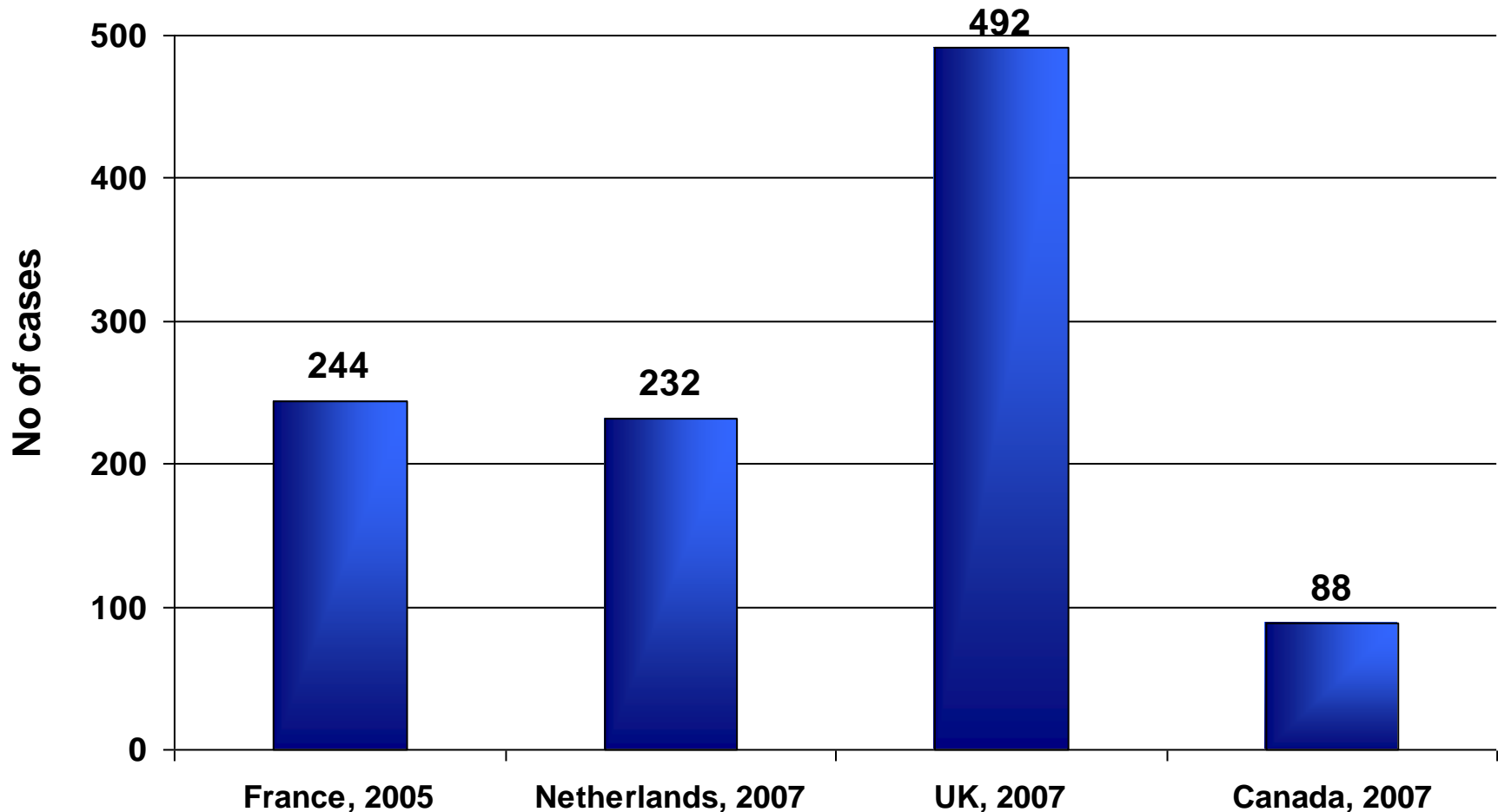


Source: Stolte et al. EUROSURVEILLANCE Vol. 7 No2  
FEBRUARY 2002



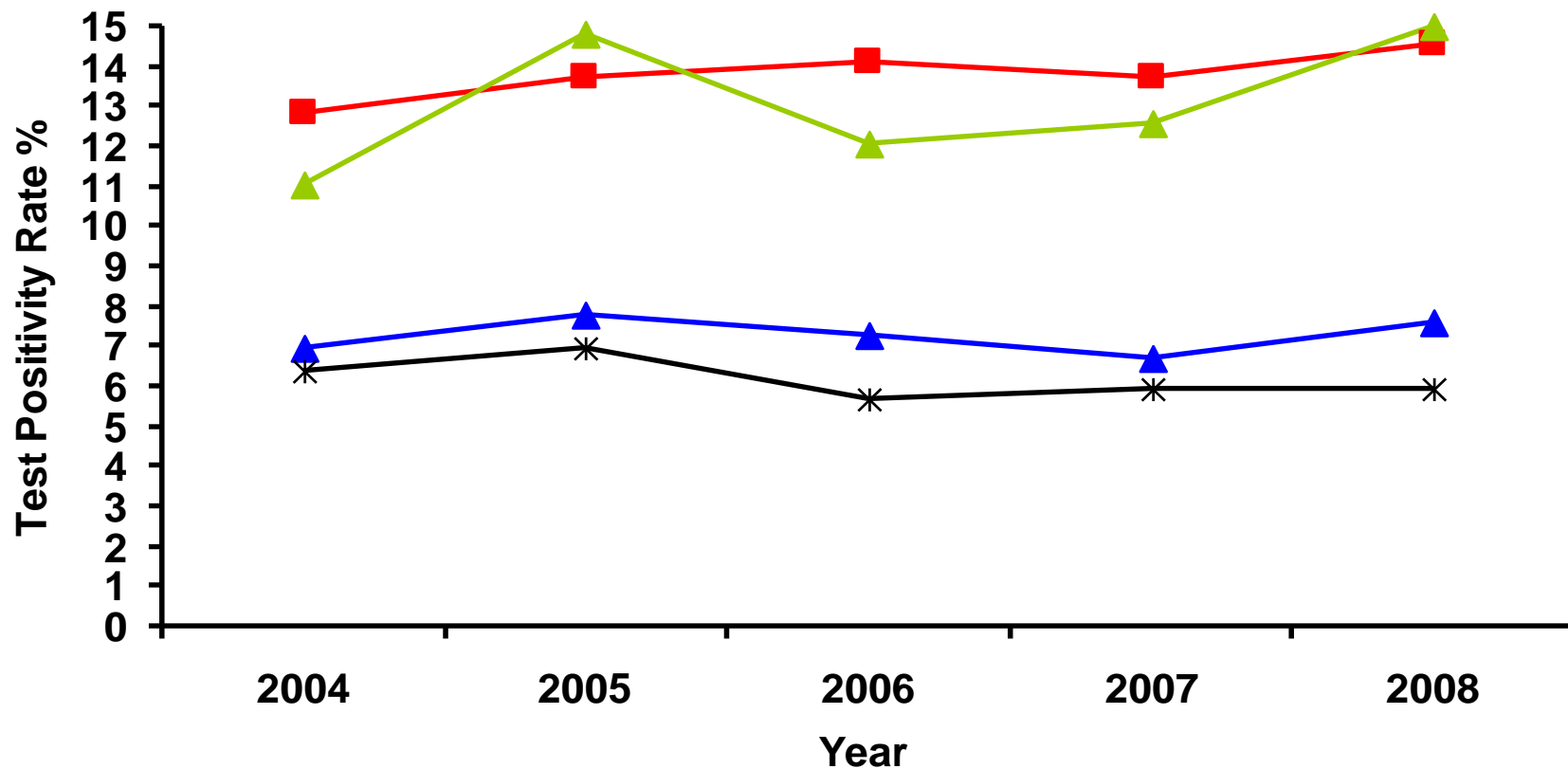
- ! Recent outbreaks of proctitis due to **Lymphogranuloma Venereum** among men who have sex with men in Western Europe, North America and Australia.

# Number of LGV proctitis reported in Europe, North America, 2005-2007\*



Martin-Iguacel R, et al. Lymphogranuloma venereum proctocolitis: a silent endemic disease in men who have sex with men in industrialised countries. *Eur J Clin Microbiol Infect Dis*. 2010 Aug;29(8):917-25

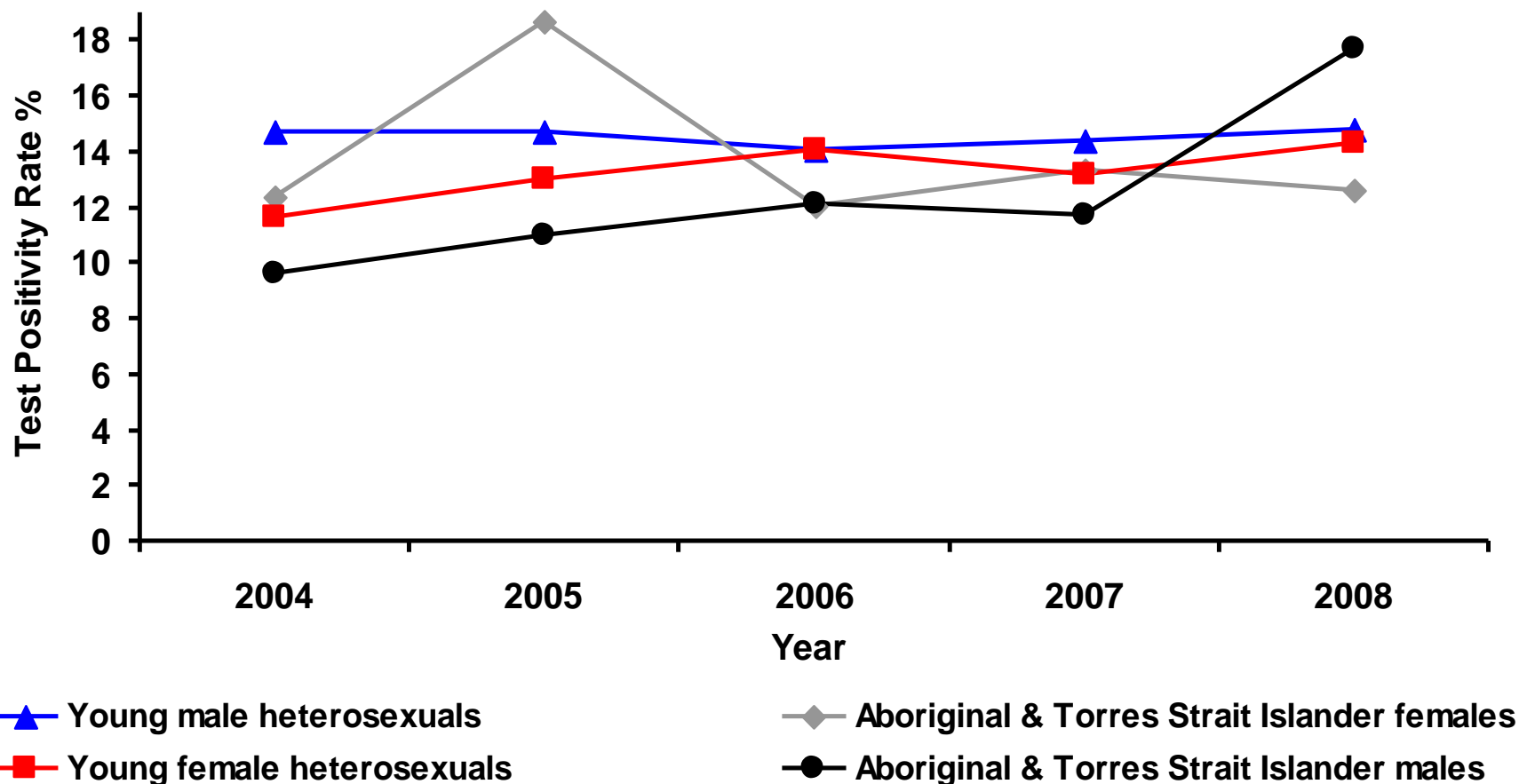
# Chlamydia positivity rates, by priority population, Australia, 2004-2008\*



■ Heterosexuals < 25yo      ▲ MSM  
▲ Aboriginal & Torres Strait Islanders      ✱ Sex Workers

\*Prof Basil Donovan. National Centre in HIV Epidemiology and Clinical Research University of New South Wales; and Sydney Sexual Health Centre, Sydney Hospital. "CHLAMYDIA". 16th International Against Sexually Infection, Bali, Indonesia May 4-6, 2010.

# Chlamydia positivity rates by priority population and sex, Australia, 2004-2008\*



\*Prof Basil Donovan. National Centre in HIV Epidemiology and Clinical Research University of New South Wales; and Sydney Sexual Health Centre, Sydney Hospital. "CHLAMYDIA". 16th International Against Sexually Infection, Bali, Indonesia May 4-6, 2010.

# Characteristics of women with and without *Trichomonas vaginalis* (TV) by PCR\*

- Australia, 2008 -

Characteristic	Women with TV n=17	Women without TV N=339	P Value**
Mean age (years)	33.4	30.7	0.221
Culturally and linguistically diverse***	11 (65%)	104 (31%)	0.003
Condoms always	2 (24%)	25 (22%)	0.892
>1 partner last 3 months	6 (35%)	95 (28%)	0.516
Commercial sex workers	5 (29%)	58 (17%)	0.195
Concomitant STI****	2 (12%)	24 (7%)	0.469
<b>Signs and symptoms</b>			
Dysuria	7 (41%)	59 (17%)	0.014
Vaginal discharge	11 (65%)	143 (42%)	0.067
Bacterial vaginosis*****	6 (35%)	79 (23%)	0.258

\*\* p Values <0.05 are statistically significant.

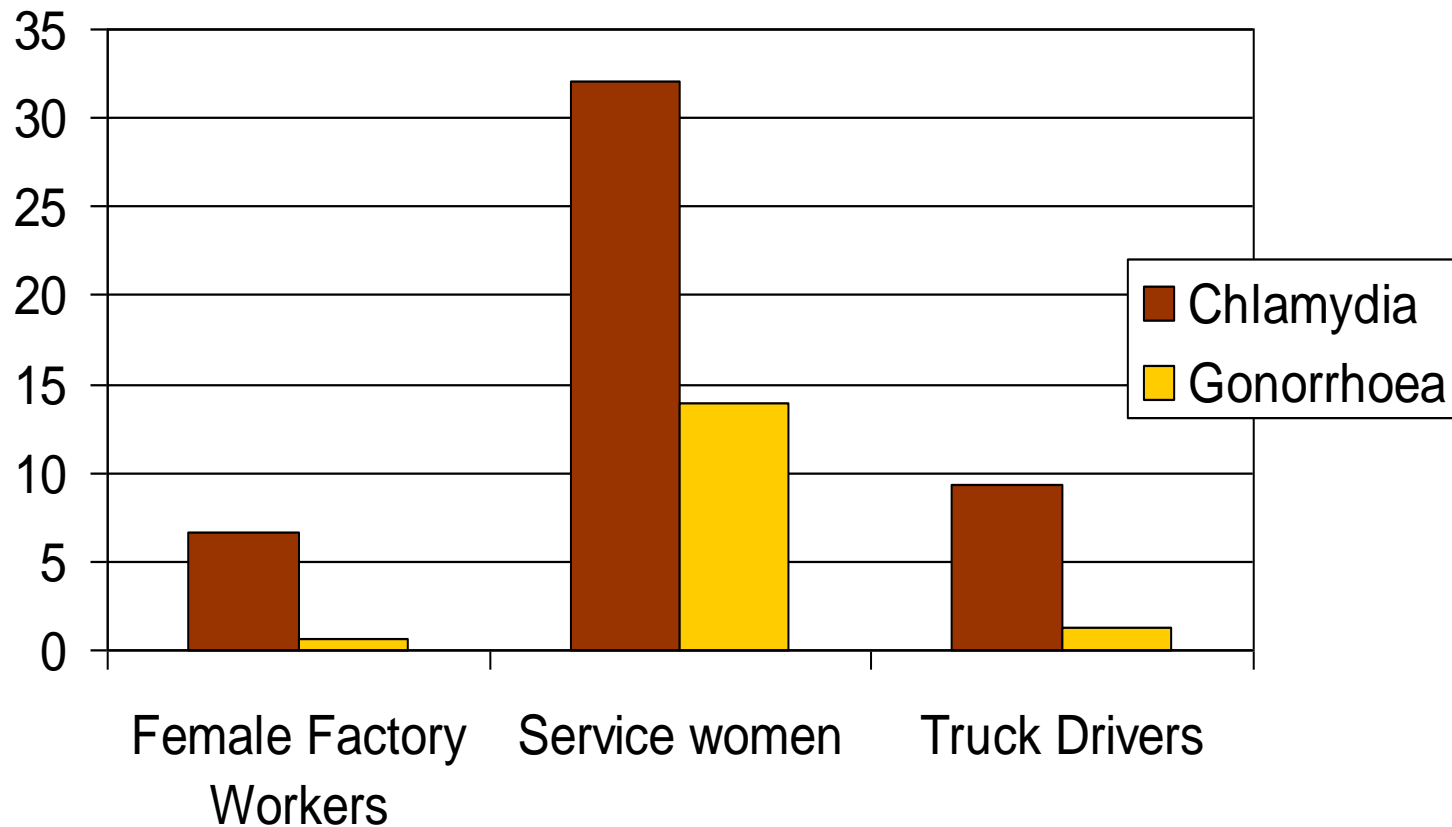
\*\*\* Defined as women identifying at clinic registration as preferring a language other than English, speaking a language other than English at home, or identifying a non-English ethnic background.

\*\*\*\* Concomitant chlamydia or gonorrhoea.

\*\*\*\*\* Defined by Nugent score on Gram stain of high vaginal swab.

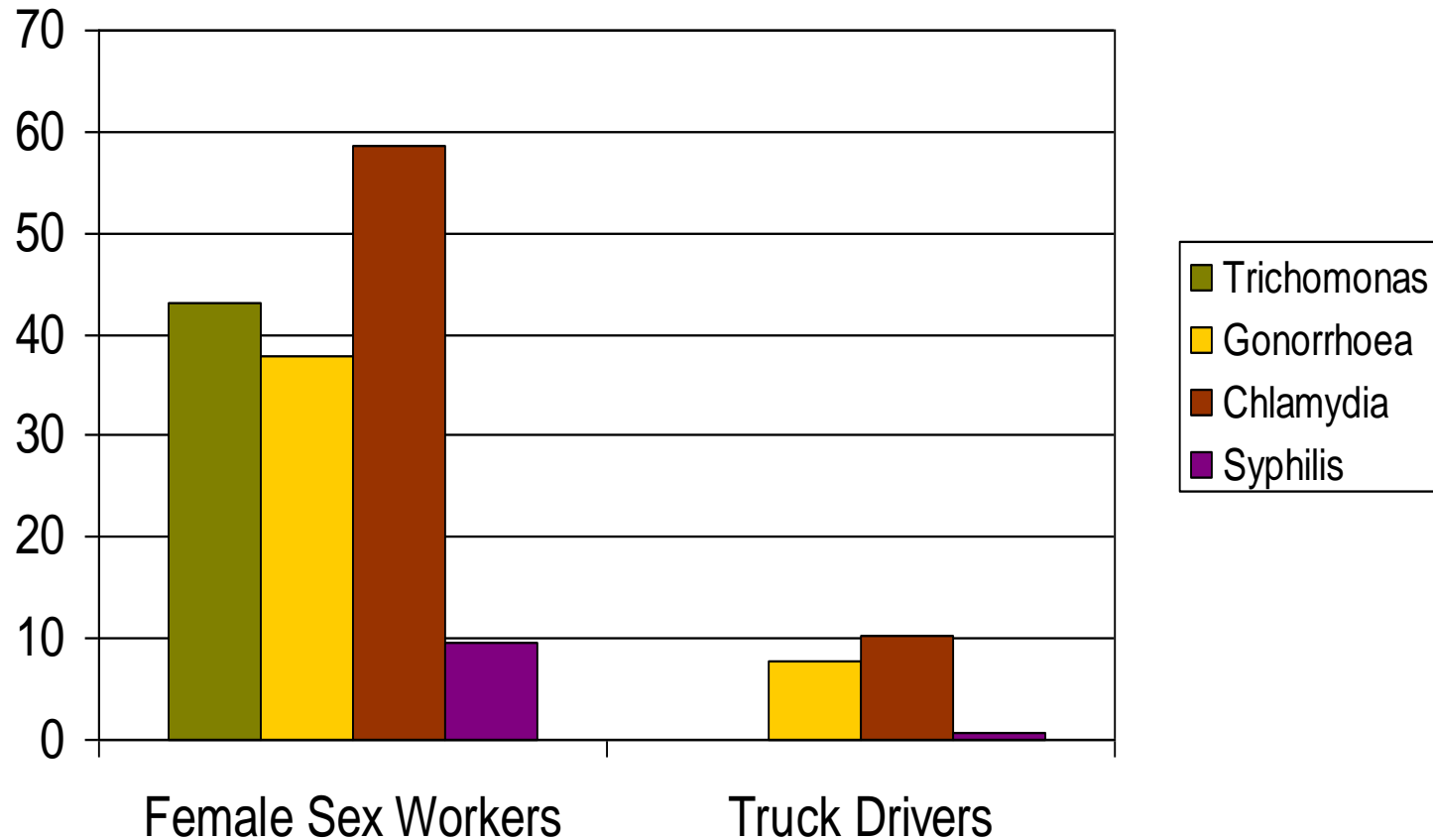
\*Lusk MJ, et al., *Trichomonas vaginalis*: underdiagnosis in urban Australia could facilitate re-emergence, *Sex Transm Infect.* 2010 Jun;86(3):227-30. Epub 2009 Nov 1.

# National level prevalence assessment studies: Lao People's Democratic Republic, 2001\*



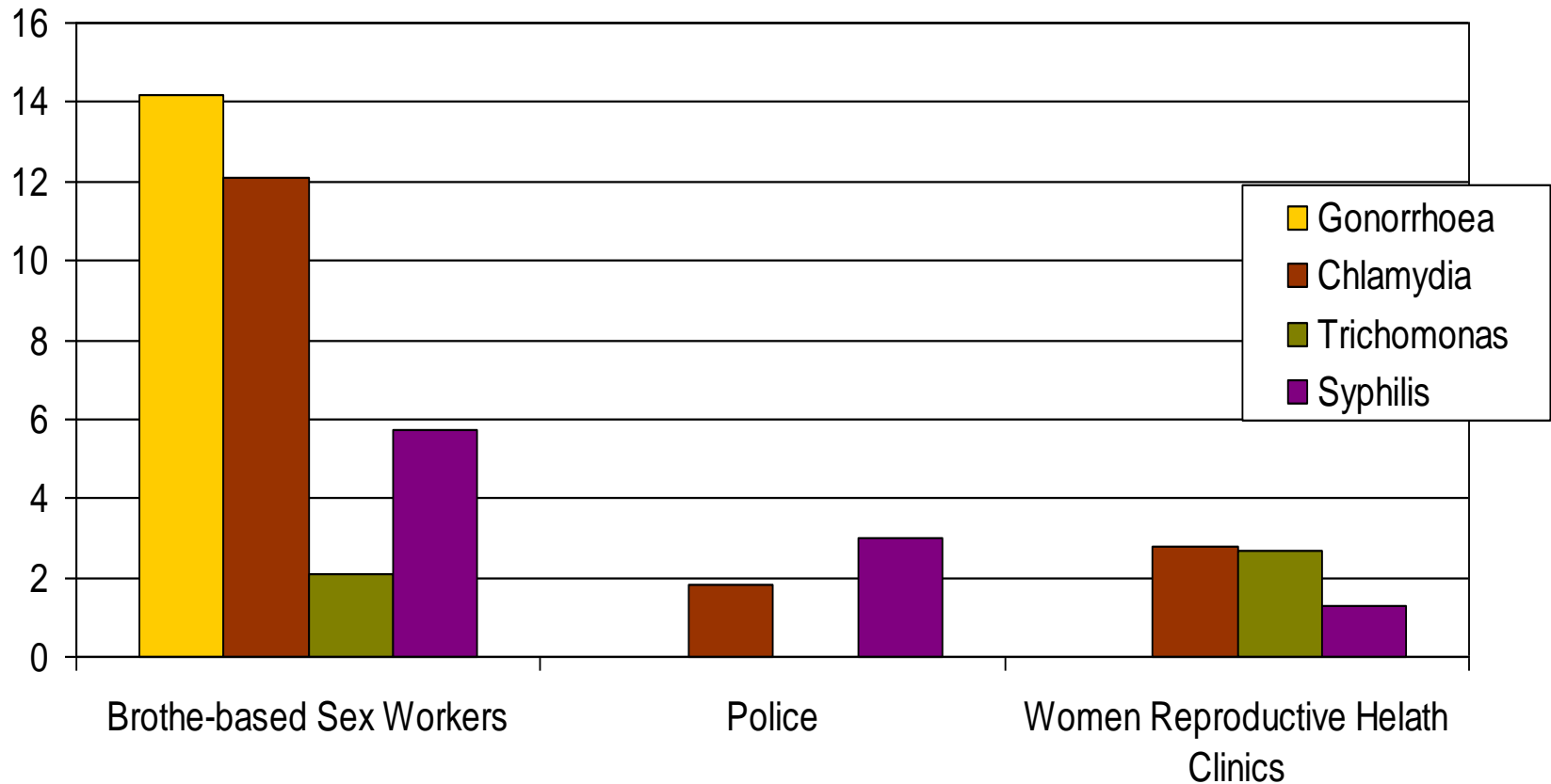
\*Adapted from: HIV Surveillance Survey (HSS) and Sexually Transmitted Infection Period Prevalence Survey (SPPS)

# National level prevalence assessment studies: People's Republic of China, 2000\*



Adapted from: Prevalence survey of STIs among female Sex Workers and Truck Drivers in China 1999-2000

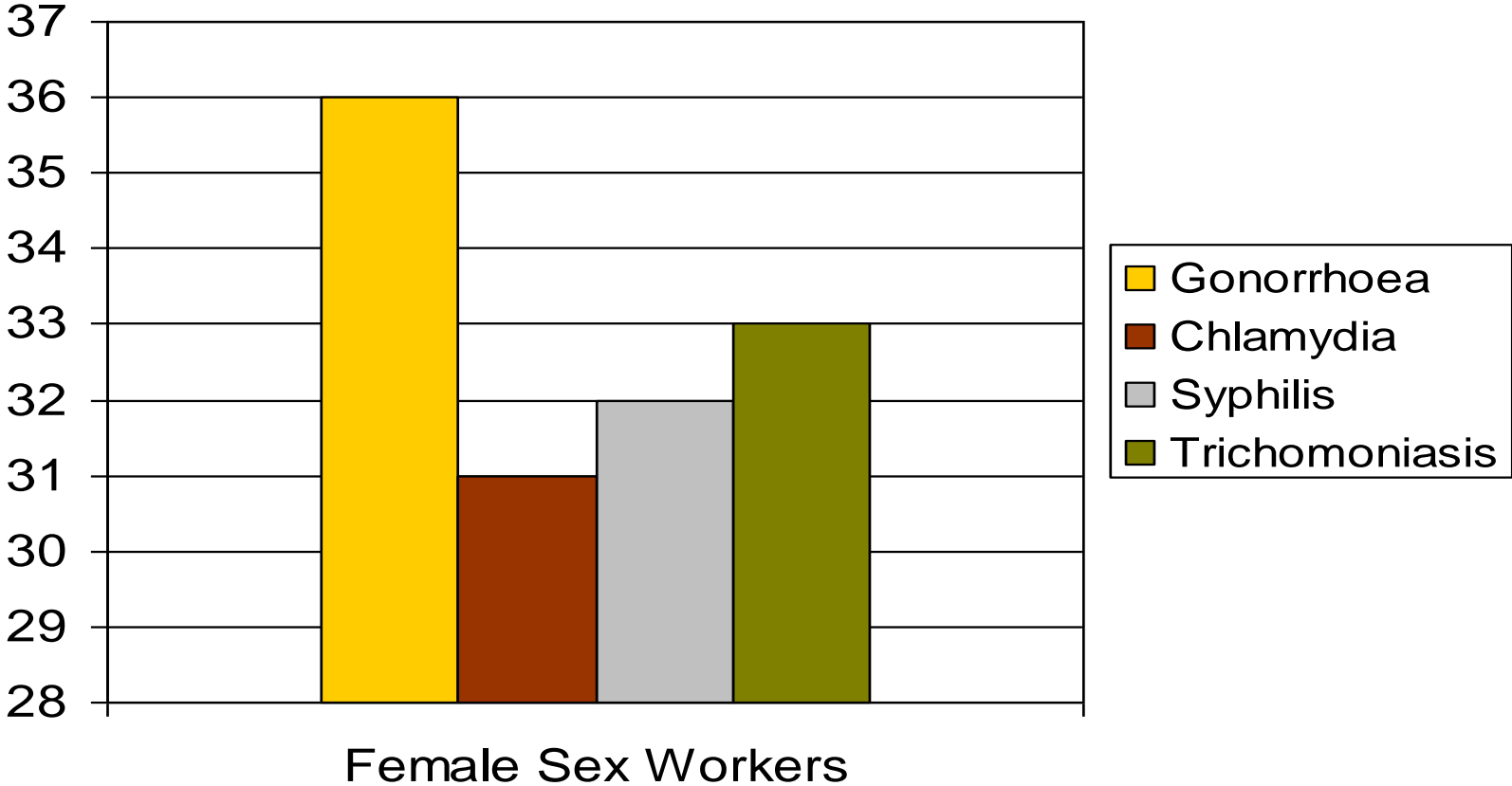
# National level prevalence assessment studies: Cambodia, 2002\*



\*Adapted from: Low prevalence of STIs in Cambodia supports recent behavioral and HIV prevalence trends, 2002



# Cross-sectional prevalence assessment studies: Papua New Guinea, 2000\*



\*Source: Adapted from Consensus Report on STI, HIV and AIDS Epidemiology, 2000

# Peru's Ministry of Health HIV and STD Control Programme: Community Randomized Trial, 2002.

- ❑ Objective: To assess the prevalence of STD among young adults of mid-sized Peruvian cities.
- ❑ Methods: Cross-sectional survey. Household random sample of 18 to 29 year old resident of 24 Peruvian cities.
- ❑ Demographic and risk behaviour questionnaires
- ❑ STI assessed: Syphilis, HIV, Gonorrhoea and Chlamydia infection in men and women and *T. vaginalis* infection in women.
- ❑ Results:

	Chlamydia (%)		Gonorrhoea (%)		Trichomonas (%)	Syphilis (%)
	<i>Urine</i>	<i>Swabs</i>	<i>Urine</i>	<i>Swabs</i>	<i>Swabs</i>	<i>Blood</i>
Female	2.7	6.8	0.2	0.8	5.2	0-3.8
Male	4		0.3			0-3.4

# STI trends and risks in Eastern Mediterranean and North Africa, 2003

- 74 000 STIS reported in 2002 from 5 countries of the Region
- Most reported STIs are Trichomoniasis, gonorrhoea and syphilis
- Observed increased rate of syphilis among pregnant women in Bahrain from 0.25% in 2001 to 0.35% in 2002
- In Pakistan 78% of women are reported to have vaginal pathogenic discharge, 29.4% had pelvic tenderness, 17% had cervical ulcers, 4.5% had abdominal tenderness and 2.9% had vesicles on the genitalia

Source: Abu Dhabi Meeting, July 2003

# Never ending story?

**The past started**

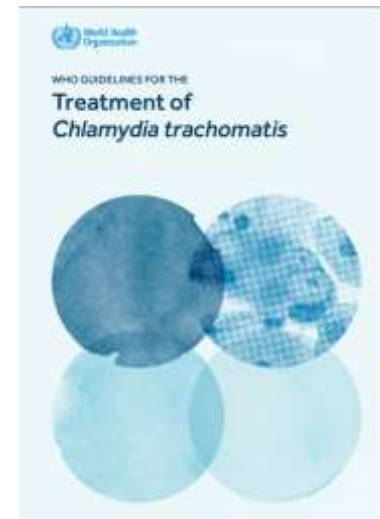
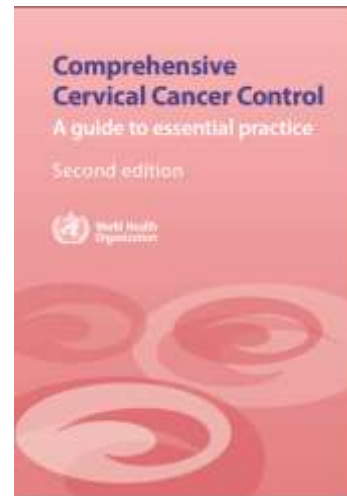
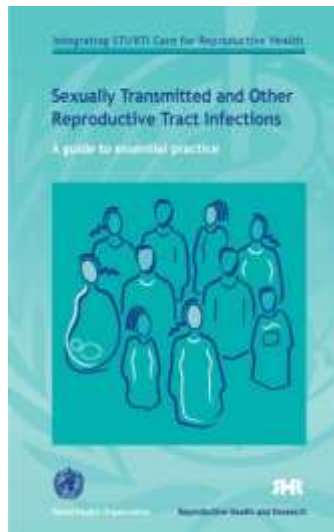
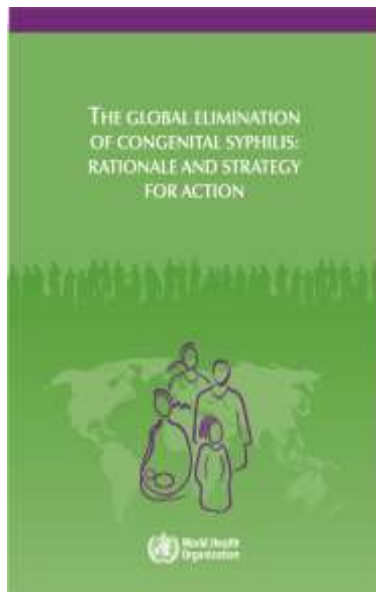
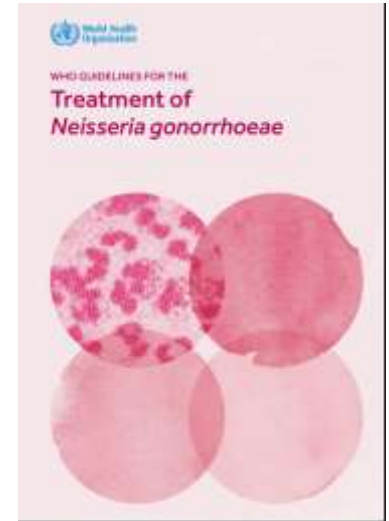


**The present is working**





# Progress is made



## **Acknowledgements:**

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