

# The global epidemic of HIV infection among men who have sex with men

Frits van Griensven<sup>a,b</sup>, Jan Willem de Lind van Wijngaarden<sup>c</sup>, Stefan Baral<sup>d</sup> and Andrew Grulich<sup>e</sup>

<sup>a</sup>Thailand Ministry of Public Health–US Centers for Disease Control and Prevention Collaboration, Nonthaburi, Thailand, <sup>b</sup>Division of HIV/AIDS Prevention, Atlanta, Georgia, USA, <sup>c</sup>UNESCO, Bangkok, Thailand, <sup>d</sup>Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland, USA and <sup>e</sup>National Centre in HIV Epidemiology and Clinical Research, University of New South Wales, Sydney, New South Wales, Australia

Correspondence to Dr Frits van Griensven, Thailand Ministry of Public Health–US Centers for Disease Control and Prevention Collaboration, DDC7 Building, Ministry of Public Health, 11000 Nonthaburi, Thailand E-mail: fav1@cdc.gov

**Current Opinion in HIV and AIDS** 2009, 4:300–307

## Purpose of review

In the last few years, there have been reports of new, newly identified and resurging epidemics of HIV infection among men who have sex with men (MSM). This article reviews and summarizes the global epidemic of HIV infection among MSM.

## Recent findings

In the Western world, the increase in notifications of new HIV infections among MSM is continuing. Steep increases in reports of new HIV diagnoses among MSM were also seen in the developed economies of East Asia. In the developing world, epidemiologic studies have now established the presence of MSM populations in Africa, China and Russia and a high HIV prevalence among them. High and increasing HIV prevalence was also reported from South and Southeast Asia, and Latin America and the Caribbean.

## Summary

HIV continues to spread among MSM on a global level. Current prevention efforts have been unable to contain or reduce HIV transmission in this population. Additional behavioral and biomedical interventions are urgently needed.

## Keywords

epidemiology, HIV infection, homosexuality, men who have sex with men

Curr Opin HIV AIDS 4:300–307  
© 2009 Wolters Kluwer Health | Lippincott Williams & Wilkins  
1746-630X

## Introduction

In the last few years, there has been increased concern about resurgence in HIV infection among men who have sex with men (MSM) in the Western world [1–3]. At the same time, there have been reports of new or newly identified epidemics of HIV infection among MSM in Asia, Africa and Latin America [4,5,6]. Against the background of low or declining HIV prevalence in the general population, MSM continue to be disproportionately affected by HIV infection [7]. Recent articles reviewing the epidemiology of HIV infection among MSM were limited to the Western world [2], Europe [3], Southeast Asia [4] or lower and middle-income countries [6,7,8]. In this article, we review the global epidemic of HIV infection among MSM in Europe, North America, the Pacific, Asia, Latin America and Africa and the Middle East.

## Europe

According to The Joint United Nations Programme on HIV/AIDS (UNAIDS) [9,10], the adult HIV prevalence in Western and Central Europe was 0.3% in 2007. It was generally lower in Northern countries such as Sweden

and Finland (0.1%) than in Southern countries such as Italy (0.4%) and Spain (0.5%). In Eastern Europe and the former Soviet Union states, the adult HIV prevalence was 0.8%, ranging from 0.1% in Georgia to 1.1% in the Russian Federation and 1.6% in Ukraine.

In their most recent account, the European surveillance network, EuroHIV, reported that in 13 Western European countries with data available, the number of new HIV diagnoses in MSM increased almost 100%, from 2538 to 5016 during 1999–2006 [11,12]. In all 23 countries, after discounting the number of heterosexually acquired infections in immigrants from countries with generalized epidemics [at least 4420 out of 10 722 cases (origin of heterosexually acquired infection was available for 16 countries contributing 10 199 cases)], MSM constituted the largest group of new infections for which the route of transmission was known in 2006 [11,12]. In Central Europe, the number of reported new cases was smaller but it also increased, from 130 in 1999 to 295 in 2006, an increase of more than 100% [12]. In several Central European countries, such as Hungary, the Czech Republic, Slovakia and Slovenia, the total number of new reported HIV cases in MSM constituted more than 50% of all new reported cases [12]. In Eastern Europe, less

than 1% of newly reported HIV cases were in MSM, and no increase was observed over time [12].

Only one recent cohort study [13<sup>•</sup>] measuring HIV incidence among European MSM could be identified. In Amsterdam, the Netherlands, the annual HIV incidence rate was stable at 1.2% during 1999–2005. A number of studies reported significant increases in HIV incidence among MSM who underwent repeat testing at sexually transmitted disease (STD) clinics in Rome (from 2.8 to 5.0 per 100 person-years during 1996–2003) [14] and in Valencia (from 1.9 to 3.3 per 100 person-years during 2002–2003) [15]. In Amsterdam, the HIV incidence among MSM attending STD clinics was estimated to vary from 1.8% in 1998 to 3.8% during 1999–2005, using the Serologic Testing Algorithm for Recent HIV Seroconversion (STARHS) assay [13<sup>•</sup>]. In the UK, HIV incidence among MSM attending STD clinics did not change significantly (ranging from 1.5 to 3.3% during 1999–2004, using the STARHS assay) [16]. In recent cross-sectional studies [3<sup>•</sup>,17,18] among MSM, the HIV prevalence ranged from 5.3% in Ireland to 18.3% in Spain in Western Europe, from 0% in Lithuania to 2.5% in Slovenia in Central Europe and from 0.0% in Kazakhstan to 6.0% in Moscow in Eastern Europe and the former Soviet Union states.

---

### North America

In 2008, the US Centers for Disease Control and Prevention (CDC) estimated that at the end of 2006, approximately 1.1 million persons (prevalence rate 447.8 per 100 000 or 0.45%) were living with HIV in the United States. Of these, nearly half (48.1%) were MSM [19]. In 2008, CDC also reported on trends in new HIV/AIDS cases among MSM from 33 states with name-based case reporting from 2001 to 2006 [20]. Overall, the number of new HIV/AIDS cases in MSM increased 8.6% during 2001–2006, and of the estimated 214 379 persons that had HIV/AIDS diagnosed, 46% were MSM and 4% were MSM who also injected drugs [20]. In black MSM, from 2001 to 2006, a 12.4% increase in the number of new HIV/AIDS cases was observed, and among black MSM aged 13–24 years, this increase was 93.1% [20]. Even though blacks constitute only 13% of the US population, the number of HIV/AIDS cases diagnosed in black MSM aged 13–24 years (7658) was more than double the number diagnosed in whites (3221) [20]. In a third report in the same year, CDC reported the results of an elaborate analysis of multiple source data to estimate the number of new HIV infections in the United States in 2006 ('stratified extrapolation approach') and during the period 1977–2006 ('extended back calculation approach') [21<sup>••</sup>,22<sup>••</sup>,23]. In the first approach, characteristics of the HIV-tested population were generalized to the population at large to estimate the overall HIV incidence,

and in the second approach, the distribution of time from infection to new HIV diagnosis was used to estimate the underlying total number of new HIV infections [22<sup>••</sup>]. It was estimated that in 2006, 56 300 new adult HIV infections occurred, of which 53% were in MSM. Of new HIV infections in men, 72% were in MSM [23], and of new infections in MSM, 46% were in whites, 35% were in blacks and 19% were in Hispanics. Overall, the estimated HIV incidence among black MSM was 5.9 times higher than among white MSM [23]. The CDC analysis also reported that MSM had the largest estimated HIV incidence throughout most of the epidemic, except in the early 1990s. During the period 2003–2006, MSM accounted for more than half of the persons with estimated HIV incident infection [22<sup>••</sup>].

In Canada, it was estimated that by the end of 2005, 58 000 people were living with HIV infection (adult prevalence 0.4%) [11], of which more than half (51%) were in MSM [24]. In 2007, a total of 2432 positive HIV tests in adults were reported to the Public Health Agency of Canada, of which 41.3% were in MSM. From 1998 to 2007, the number of positive test reports among MSM increased by 24.8%. The number peaked in 2004 and remained relatively constant through 2007 [24].

Two studies [25,26] reporting HIV incidence in clinical trial participants were identified from the United States. During 1998–2003, among 4295 MSM enrolled in the EXPLORE study [25], a controlled trial of a behavioral intervention to reduce HIV infection, the HIV incidence density was 2.1 per 100 person-years, and among 5095 MSM enrolled in a clinical trial of AIDSVAX B/B [26], an experimental preventive candidate HIV vaccine, the annual HIV incidence was 2.7%. In a community-based study [27] among MSM in Baltimore during 1996–2000, using the STARHS assay, HIV incidence was 4.2% per year, ranging from zero in Hispanics to 11.0% among non-Hispanic blacks. A study [28] among MSM attending STD clinics in San Francisco estimated an HIV incidence of approximately 4% per year during 1998–2004, also using the STARHS assay. A recent review article [29<sup>•</sup>] concluded that HIV infection in San Francisco is 'hyperendemic', meaning that the HIV prevalence among MSM has stabilized at approximately 25%, which in the absence of new and effective prevention strategies will persist in the future.

---

### Pacific

Australia's National Center in HIV Epidemiology and Clinical Research estimated that by the end of 2007, 16 692 persons were living with HIV infection (prevalence rate 74.5 per 100 000 or 0.07%). In Australia, during 2003–2007, MSM accounted for 64% of newly diagnosed HIV infections and for 82% of newly acquired

HIV infections [30]. Overall, the number of newly diagnosed HIV infections among MSM increased by 13.6% during 2003–2007 [30]. There were substantial increases in the states of Victoria and Queensland but stable rates in the largest jurisdiction, New South Wales [31]. New Zealand's Ministry of Health estimated the HIV prevalence among MSM to be 0.9% in 2007 [11], and 54.9% of the 2872 reported HIV cases during 1985–2007 were in MSM. However, of recently diagnosed HIV infections, MSM comprised about 40% of the total [32]. Papua New Guinea, which has an estimated 1.5% HIV prevalence in the general population, reported 0.1% of the total number of reported HIV infections to be in MSM [11].

In a community-based cohort study [33] of MSM in Sydney, the HIV incidence density was 0.87 per 100 person-years during 2002–2006 and did not change significantly over time.

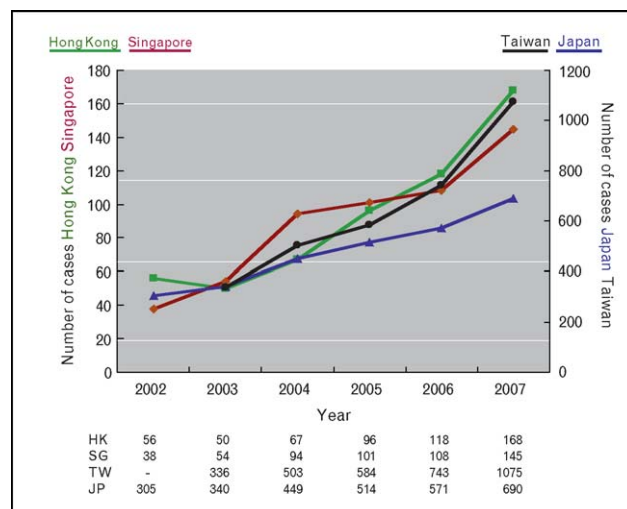
In a study [34] among MSM attending STD clinics in New Zealand in 2005–2006, the prevalence of existing and previously undiagnosed HIV infection were 44.1 and 20.1 per 1000, respectively, an increase compared with 1996–1997, when the existing and previously undiagnosed prevalence of HIV infection were 11.4 and 18.8 per 1000, respectively.

## Asia

Most countries in Asia have very low (<0.5) or low (0.5–1.0%) adult HIV prevalence, except Thailand (1.4%) [11]. In Asia, HIV/AIDS case report data are available for some countries, but most nations rely on epidemiological studies and sentinel surveillance for information about MSM HIV prevalence.

In Hong Kong, the reported number of new HIV infections in MSM increased from 56 to 168 during 2002–2007, an increase of 200% (Fig. 1) [35]. In 2007, MSM constituted 41% of all reported HIV cases (414), more than any other group at risk [35]. Statistics provided by the Taiwan Centers for Disease Control show that the number of HIV infections reported in MSM increased from 336 to 1075 during 2003–2007, an increase of more than 200% (Fig. 1) [36]. Of all infections reported in 2007, 38.5% were in MSM [36]. In 2007 in Singapore, 145 MSM were newly reported with HIV infection, almost four times the 38 cases reported in 2002 (Fig. 1). MSM accounted for 34.3% of the total number of new HIV cases (423) [37]. In Japan, the number of newly reported HIV cases in MSM more than doubled from 305 in 2002 to 690 in 2007 (Fig. 1) [38]. Of all 1082 new HIV cases reported in 2007, 67.4% were in MSM [38]. The South Korean CDC reported that of the 797 new HIV cases notified in 2008, 93.2% were in men, and 33.2% were in MSM. Of the cumulative number of reported cases

**Figure 1** Number of reported newly diagnosed HIV infections in men who have sex with men, Hong Kong, Singapore, Taiwan and Japan, 2002–2007



through 2007, 23.0% were in MSM, indication of an increase in more recent years [39].

In cross-sectional studies from Southeast Asia, HIV prevalence in MSM ranged from 0.7 to 8.7% in Cambodia [40], from zero to 7.8% in Vietnam [41,42] and from 17.3 to 30.8% in Thailand [43,44] and was 5.6% in Lao PDR [45]. In Myanmar, 29.3% of MSM were found to be HIV-infected in two study sites in 2007 [46]. In mainland China, several recent cross-sectional studies [47–53] among MSM show HIV prevalence ranging from 0.5% in Jinan to 8.5% in Chongqing and 9.1% in Chengdu (Fig. 2). Increasing prevalence has been observed among MSM in Harbin, from 1.3 to 2.2% during 2002–2006 [54], in Beijing, from 0.4 to 5.8% during 2004–2006 [55\*,56], in Shenzhen, from 1.7 to 3.8% during 2005–2007 [57] and in Jiangsu from zero to 5.8% during 2003–2007 (Fig. 2) [58].

In a cross-sectional study [59] among MSM in Chinese Taipei in 2004, the HIV prevalence was 8.5%, in Singapore in 2007, 4.2% [60] and in Hong Kong in 2006–2007, 4.1% [61]. In the Philippines, zero percent prevalence was found among over 500 MSM sampled from Manila and Baguio [62]. In South Asia, recent data from Indonesia show that 2.0, 5.6 and 8.1% of MSM were HIV-infected in cross-sectional studies in Bandung, Surabaya and Jakarta, respectively [63].

Some information on HIV incidence is available from Thailand, where the HIV incidence density was 5.7 per 100 person-years in a cohort of MSM in Bangkok [64] and 2.7 per 100 person-years among MSM attending an HIV testing clinic using nucleic acid testing to detect acute infection [65\*]. In a study using the STARHS assay

**Figure 2 HIV prevalence among men who have sex with men in China**

among MSM attending STD clinics in Beijing, the estimated HIV incidence was 2.9% in 2005 and 3.6% in 2006 [66].

In Bangladesh, Pakistan and Nepal, recent biobehavioral surveillance among MSM found 0.2, 2.8 and 3.3%, respectively, to be HIV-infected [11,67,68]. Sentinel biobehavioral surveillance in 40 districts in India showed the HIV prevalence to be greater than 5% in 21 and greater than 15% in nine districts [69]. Several cross-sectional and clinic-based studies [70,71] found HIV prevalence among MSM ranging from 4.8 to 24.7% across sites.

### Latin America

For Latin America and the Caribbean, systematic HIV/AIDS case reporting data are not available. With notable exceptions, the countries of Latin America and the Caribbean have very low (<0.5%) or low level (0.5–1.0%) adult HIV prevalence [72]. These epidemics are

becoming increasingly recognized as being concentrated predominantly among MSM [8].

Most HIV prevalence data among MSM in Latin America have come from Peru, Mexico, Argentina, Brazil and Colombia [73]. In Peru, where MSM are included in the national biobehavioral HIV surveillance program, the HIV prevalence ranged from 9.8 to 22.3% between sites, and was highest in Lima [74,75]. High prevalence has been observed in cross-sectional studies [76,76,77] among MSM in Bolivia (21.2%), Ecuador (15.1%), Colombia (19.4%), Brazil (7.0–9.8%) and Paraguay (13%). In Mexico, biobehavioral HIV surveillance among MSM showed HIV prevalence of 25.6% across urban centers [76]. The average HIV prevalence among MSM across El Salvador, Guatemala, Honduras, Nicaragua and Panama was 11.7%; the lowest prevalence was observed in Nicaragua (7.6%) and the highest in El Salvador (15.3%) [78]. There is a paucity of epidemiologic data on HIV among MSM in the Caribbean, but where

data exist, rates have been high; in Trinidad and Tobago, a 2006 study [7\*\*] found 20.4% of MSM infected; a recent study [79] in Jamaica found an HIV prevalence of 31.8%.

Using the STARHS assay, HIV incidence in MSM in Central American countries was 5.1 per 100 person-years, lowest in Guatemala, 2.1 and highest in Nicaragua, 14.4 [78\*].

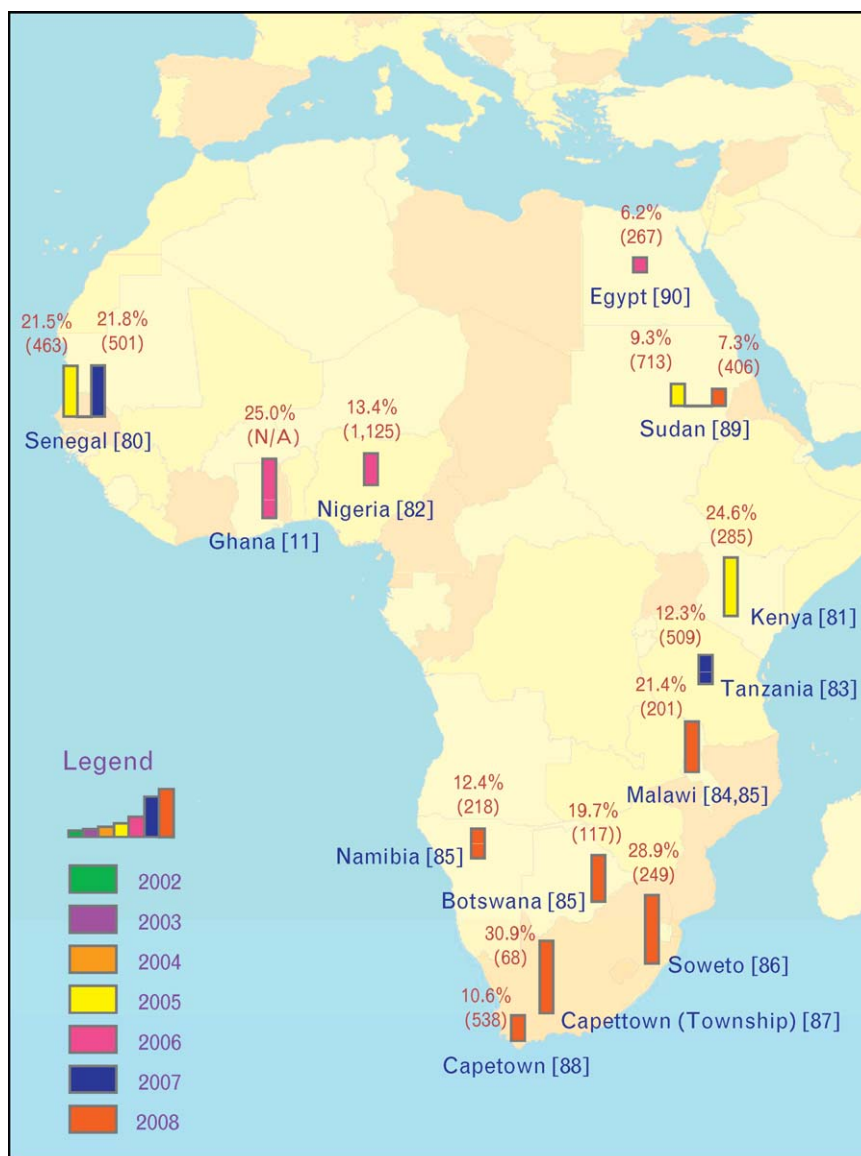
### Africa and the Middle East

No systematic HIV/AIDS case reporting data are available for Africa and the Middle East. UNAIDS estimates the 2007 adult HIV prevalence in Sub-Saharan Africa at 5%, but prevalence rates differ considerably between countries, ranging from 0.5% in Somalia to 26.1% in

Swaziland [11]. In North Africa and the Middle East, the adult HIV prevalence ranges from 0.1% in Morocco to 1.4% in Sudan [11].

Recently, a number of epidemiological studies have been completed among MSM in Africa. In Senegal in 2004 and 2007, 21.5 and 21.8% of MSM enrolled in two similar cross-sectional studies were HIV-infected (Fig. 3) [80\*]. At entry into a cohort study [81] in Kenya, the HIV prevalence among MSM was 24.6% in 2005. Other cross-sectional studies [11,82–84,85\*,86–88] among MSM have shown HIV prevalence to vary from 12.3% in Tanzania to 30.9% in a Cape Town township. The HIV prevalence among city-dwelling MSM in Cape Town was 10.6% in 2008 (Fig. 3). In a study [89] among ‘receptive’ MSM in Khartoum State in Sudan in 2005, the HIV prevalence was 9.3%, whereas in a complementary study

**Figure 3 HIV prevalence among men who have sex with men in Africa and the Middle East**



among 'insertive' MSM in 2007, it was 7.8% (Fig. 3). HIV surveillance in Egypt found 6.3% of MSM infected in 2006 [90]. During follow-up through 2007 in the Kenya cohort study [81], the HIV incidence was 8.8 per 100 person-years.

## Conclusion

Our review shows that the trend of increasing HIV diagnoses among MSM in the Western world is continuing. In addition, steep increases in diagnoses of new HIV infections among MSM were seen in the developed economies of East Asia. In countries where traditional surveillance systems are available, MSM contributed the largest number of new HIV cases, and in some countries, they contributed the majority. A large number of epidemiologic studies have recently established the presence of populations of MSM throughout Sub-Saharan Africa, as well as high HIV prevalence among them. Similarly, populations of MSM with high and increasing HIV prevalence have been identified in Russia, China and in other parts of Asia. High MSM HIV prevalence rates were also seen throughout Latin America and the Caribbean. Globally, only a handful of HIV incidence studies among MSM could be identified, but where available, showed the spread of HIV among MSM to be continuing. Current HIV prevention efforts have been unable to contain or reduce the spread of HIV infection among MSM. Additional behavioral and biomedical interventions are urgently needed.

## Acknowledgements

The authors like to acknowledge the helpful assistance of Tim Brown, Philippe Girault, Darwin Mak, Samart Kurachit and Patnaree Oungprartgul.

The findings and views presented in this article are those of the authors and do not necessarily represent those of the US Centers for Disease Control and Prevention.

## References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 339–340).

- 1 Jaffe HW, Valdiserri RO, De Cock KM. The reemerging HIV/AIDS epidemic in men who have sex with men. *JAMA* 2007; 298:2412–2414. This article signals the reemerging HIV epidemic among MSM and discusses possible reasons and solutions.
- 2 Grulich AE, Kaldor JM. Trends in HIV incidence in homosexual men in developed countries. *Sex Health* 2008; 5:113–118. This study describes trends in HIV notifications, HIV prevalence and incidence among MSM in developed countries.
- 3 Likatavičius G, Klavs I, Deveaux I, *et al.* An increase in newly diagnosed HIV cases reported among men who have sex with men in Europe, 2000–6: implications for a European public health strategy. *Sex Transm Infect* 2008; 84:499–505. This study collates and analyzes HIV/AIDS case reporting and HIV prevalence data from 27 European Union member states and Norway, Iceland and Switzerland.

- 4 de Lind van Wijngaarden JW, Brown T, Girault P, *et al.* The epidemiology of human immunodeficiency virus infection, sexually transmitted infections, and associated risk behaviors among men who have sex with men in the Mekong subregion and China: implications for policy and programming. *Sex Transm Dis* 2009. [Epub ahead of print]
- A comprehensive review of HIV and STD epidemiological data among MSM in the Mekong subregion and China.
- 5 van Griensven F. Men who have sex with men and their HIV epidemics in Africa. *AIDS* 2007; 21:1361–1362.
- 6 Cáceres C, Konda K, Segura E, Lyerla R. Epidemiology of male same-sex behaviour and associated sexual health indicators in low- and middle-income countries: 2003–2007 estimates. *Sex Transm Infect* 2008; 84 (Suppl 1):i49–i56.
- A systematic review of the prevalence of male-to-male sex, bisexuality, condom use and HIV and STD prevalence in low and middle-income countries.
- 7 Baral S, Sifakis F, Cleghorn F, *et al.* Elevated risk for HIV infection among men who have sex with men in low and middle income countries 2000–2006: results of meta-analysis. *PLOS* 2007; 4:e339.
- A comprehensive and systematic review of HIV prevalence estimates and summarized increased risk associated with MSM in low and middle-income countries.
- 8 Beyrer C. Hidden yet happening: the epidemics of sexually transmitted infections and HIV among men who have sex with men in developing countries. *Sex Transm Infect* 2008; 84:410–412.
- 9 UNAIDS 2008 Report on the global AIDS epidemic. Annex 1. HIV and AIDS estimates and data [Internet]. Geneva: Switzerland; December 2008. [http://data.unaids.org/pub/GlobalReport/2008/jc1510\\_2008\\_global\\_report\\_pp211\\_234\\_en.pdf](http://data.unaids.org/pub/GlobalReport/2008/jc1510_2008_global_report_pp211_234_en.pdf). [Accessed 25 February 2009].
- 10 Ghys P, Walker N, McFarland W, *et al.* Improved data, methods and tools for the 2007 HIV and AIDS estimates and projections. *Sex Transm Infect* 2008; 84 (Suppl 1):i1–i4.
- 11 Herida M, Alix J, Devaux K, *et al.* HIV/AIDS in Europe: epidemiological situation in 2006 and a new framework for surveillance. *Euro Surveill* 2007; 12:E071122.1.
- 12 European Centre for the Epidemiological Monitoring of AIDS. HIV/AIDS surveillance in Europe. End-year report 2006 [no. 75]. Saint-Maurice: Institut de veille sanitaire; 2007. [http://www.eurohiv.org/reports/report\\_75/pdf/report\\_eurohiv\\_75.pdf](http://www.eurohiv.org/reports/report_75/pdf/report_eurohiv_75.pdf). [Accessed 5 February 2009]
- 13 Dukers N, Fennema H, van der Snoek E, *et al.* HIV incidence and HIV testing behavior in men who have sex with men: using three incidence sources, The Netherlands, 1984–2005. *AIDS* 2007; 21:491–499.
- An examination of calendar trends in HIV incidence among MSM from two cohort studies and an STD clinic.
- 14 Guiliani M, Di Carlo A, Palamara G, *et al.* Increased HIV incidence among men who have sex with men in Rome. *AIDS* 2005; 19:1429–1431.
- 15 Hurtado I, Alastrue I, Ferreros I, *et al.* Trends in HIV testing, serial HIV prevalence and HIV incidence among men who have sex with men attending a Center for AIDS Prevention from 1988 to 2003. *Sex Transm Infect* 2007; 83:23–28.
- 16 Dougan S, Eiford J, Chadborn TR, *et al.* Does the recent increase in HIV diagnoses among men who have sex with men in the UK reflect a rise in HIV incidence or increased uptake of HIV testing? *Sex Transm Infect* 2007; 83:120–126.
- 17 Sifakis F, Peryskina A, Sergeev B, *et al.* Rapid assessment of HIV infection and associated risk behaviors among men who have sex with men in Russia [abstract #MOPE0396]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 18 EuroHIV. European Centre for the epidemiological monitoring of AIDS. HIV prevalence database. <http://eurohiv-database.invs.sante.fr/eng/connexion/default.asp>. [Accessed 5 February 2009]
- 19 Centers for Disease Control and Prevention. HIV prevalence estimates: United States, 2006. *MMWR* 2008; 57:1073–1076.
- 20 Centers for Disease Control and Prevention. Trends in HIV/AIDS diagnoses among men who have sex with men 33 states, 2001–2006. *JAMA* 2008; 300:497–499.
- 21 Hall H, Song R, Rhodes P, *et al.* Estimation of HIV incidence in the United States. *JAMA* 2008; 300:520–529. An elaborative analysis by CDC to more accurately estimate the HIV incidence in the United States during 1977–2006.
- 22 Karon J, Song R, Brookmeyer R, *et al.* Estimating HIV incidence in the United States from HIV/AIDS surveillance data and biomarker HIV test results. *Statist Med* 2008; 27:4617–4633. Scientific account by CDC regarding the statistical procedures used to estimate the HIV incidence in the United States.
- 23 Centers for Disease Control and Prevention. Subpopulation estimates from the HIV incidence surveillance system: United States, 2006. *MMWR* 2008; 57:985–989.

- 24 Health Canada. HIV/AIDS in Canada. Surveillance report to 31 December 2007. [www.hc-sc.gc.ca/ahc-asc/intactiv/conf/info07-eng.php](http://www.hc-sc.gc.ca/ahc-asc/intactiv/conf/info07-eng.php). [Accessed 5 February 2009]
- 25 The Explore Study Team. Effects of a behavioural intervention to reduce acquisition of HIV infection among men who have sex with men: the EXPLORE randomised controlled study. *Lancet* 2004; 364:41–50.
- 26 The rgp120 HIV Vaccine Study Group. Placebo-controlled phase 3 trial of a recombinant glycoprotein 120 vaccine to prevent HIV-1 infection. *J Infect Dis* 2005; 191:654–665.
- 27 Sifakis F, Hylton JB, Flynn C, *et al*. Racial disparities in HIV incidence among young men who have sex with men: the Baltimore Young Men's Survey. *J Acquir Immune Defic Syndr* 2007; 46:343–348.
- 28 Truong H, Kellogg T, Klausner J, *et al*. Increases in sexually transmitted infections and sexual risk behaviour without a concurrent increase in HIV incidence among men who have sex with men in San Francisco: a suggestion of HIV serosorting? *Sex Transm Infect* 2006; 82:461–466.
- 29 Scheer S, Kellogg T, Klausner JD, *et al*. HIV is hyperendemic among men who have sex with men in San Francisco: 10 year trends in HIV incidence, HIV prevalence, sexually transmitted infections and sexual risk behavior. *Sex Transm Infect* 2008; 84:493–498.
- This article applies an ecological approach to describe temporal trends in risk behavior and HIV and STD prevalence and incidence among MSM in San Francisco between 1998 and 2007.
- 30 HIV/AIDS, viral hepatitis, and sexually transmissible infections in Australia. Annual surveillance report. Sydney: National Center for HIV Epidemiology and Clinical Research; 2008. <http://www.nchechr.unsw.edu.au/NCHECRweb.nsf/page/Annual+Surveillance+Reports>. [Accessed 5 February 2009]
- 31 Guy RJ, McDonal AM, Bartlett MJ, *et al*. HIV/AIDS diagnoses in Australia: diverging epidemics in a low prevalence country. *Med J Aust* 2007; 187:1–4.
- 32 Public Health Surveillance. New Zealand: Ministry of Health; 2007. [http://surv.esr.cri.nz/surveillance/annual\\_sti.phpdf](http://surv.esr.cri.nz/surveillance/annual_sti.phpdf). [Accessed 25 February 2009].
- 33 Jin F, Prestage G, McDonald A, *et al*. Trend in HIV incidence in a cohort of homosexual men in Sydney: data from the health in men study. *Sex Health* 2008; 5:109–112.
- 34 McAllister SM, Dickson NP, Sharples K, *et al*. Unlinked anonymous HIV prevalence among New Zealand sexual health clinic attenders: 2005–2006. *Int J STD AIDS* 2008; 19:752–757.
- 35 Center for Health Protection, Department of Health. Hong Kong: AIDS Office. Virtual AIDS Office of Hong Kong. [http://www.info.gov.hk/aids/english/surveillance/off\\_surreport.htm](http://www.info.gov.hk/aids/english/surveillance/off_surreport.htm). [Accessed 5 February 2009]
- 36 Centers for Disease Control. Taipei: Ministry of Health, R.O.C. (Taiwan, China); 2008. <http://www.cdc.gov.tw/jp.asp?ctNode=2237&ctUnit=1263&BaseDSD=7&mp=5>. [Accessed 5 February 2009].
- 37 Ministry of Health Singapore, Republic of Singapore; September 2008. [http://www.moh.gov.sg/mohcorp/diseases.aspx?id=420#\\_ftn1](http://www.moh.gov.sg/mohcorp/diseases.aspx?id=420#_ftn1). [Accessed 5 February 2009].
- 38 National Institute of Infectious Diseases. Tokyo: Ministry of Health, Labour and Welfare (Japan); June 2008. <http://idsc.nih.go.jp/iasr/29/340/tpc340.html>. [Accessed 5 February 2009].
- 39 Centers for Disease Control and Prevention. HIV/AIDS surveillance report, 2008. Seoul: Ministry of Health (South Korea); 2008.
- 40 Neal JJ, Morineau G, Phalkun M, *et al*. NCHADS BSS 2005: HIV, sexually transmitted infections and related risk behavior among Cambodian men who have sex with men [abstract #MOOPB02-02]. Presented at the 8th International Congress on AIDS in Asia and the Pacific; Colombo, Sri Lanka; 19–23 August 2007; 2007.
- 41 Colby D, Minh TT, Toan TT. Down on the farm: homosexual behaviour, HIV risk and HIV prevalence in rural communities in Khanh Hoa province, Vietnam. *Sex Transm Infect* 2008; 84:439–443.
- 42 Nguyen TA, Nguyen HT, Le GT, Detels R. Prevalence and risk factors associated with HIV infection among men having sex with men in Ho Chi Minh City, Vietnam. *AIDS Behav* 2008; 12:476–482.
- 43 Li A, Varangrat A, Wimonasate W, *et al*. Sexual behaviors and risk factors for HIV infection among homosexual and bisexual men in Thailand. *AIDS Behav* 2009; 13:318–327.
- 44 Chemnasiri T, Kladsawad K, Varangrat A, *et al*. Trends in HIV prevalence, estimated HIV incidence and risk behavior among men who have sex with men in Bangkok, Thailand, 2003 to 2007 [abstract CD0235]. Presented at the XVII International AIDS Conference, 3–8 August 2008; Mexico City, Mexico, 2008.
- 45 Sheridan S, Phimphachanh C, Chanlivong N, *et al*. HIV prevalence and risk behaviour among men who have sex with men in Vientiane Capital, Lao People's Democratic Republic, 2007. *AIDS* 2008; 23:409–414.
- 46 National AIDS Programme. Report of the HIV Sentinel Sero-surveillance Survey 2007, Myanmar. Yangon, Myanmar, Department of Health, Ministry of Health, 2009.
- 47 Ruan S, Yang H, Zhu Y, *et al*. HIV prevalence and correlates of unprotected anal intercourse among men who have sex with men, Jinan, China. *AIDS Behav* 2008; 12:469–475.
- 48 Zhang X, Wang C, Hengwei W, *et al*. Risk factors of HIV infection and prevalence of co-infections among men who have sex with men in Beijing, China. *AIDS* 2007; 21 (Suppl 8):S53–S57.
- 49 Zhu WM, Lin HJ, Zhang YF, *et al*. Human immunodeficiency virus/sexually transmitted infection, risk behavior and sexual networks among men who have sex with men in Taizhou city, Zhejiang province (in Chinese). *Zhonghua Liu Xing Bing Xue Za Zhi* 2008; 29:994–998.
- 50 Zou H, Yu J, Li M, *et al*. Sexual risk behaviors and HIV infection among men who have sex with men who use the internet [abstract #CDC0101]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 51 Guo W, Song AJ, Meng HD, *et al*. Survey on AIDS/STD risk behaviors and prevalence among men who have sex with men in Langfang, Hebei (in Chinese). *Zhonghua Liu Xing Bing Xue Za Zhi* 2008; 29:545–547.
- 52 Feng LG, Ding XB, Lu RR, *et al*. HIV prevalence and its associated factors among men who have sex with men in Chongqing (in Chinese). *Zhonghua Yu Fang Yi Xue Za Zhi* 2008; 42:870–874.
- 53 Feng Y, Wu Z, Detels R. HIV/STD prevalence among MSM in Chengdu, China and associated risk factors for HIV infection [abstract #CDC088]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 54 Zhang D, Bi P, Lv F, *et al*. Changes in HIV prevalence and sexual behavior among men who have sex with men in a northern Chinese city: 2002–2006. *J Infect* 2007; 55:456–463.
- 55 Ma X, Zhang Q, He X, *et al*. Trends in prevalence of HIV, Syphilis, Hepatitis C, Hepatitis B, and sexual risk behavior among men who have sex with men: results of 3 consecutive respondent-driven sampling surveys in Beijing, 2004 through 2006. *J Acquir Immune Defic Syndr* 2007; 45:581–587.
- This first study to systematically track trends in HIV prevalence among MSM in China.
- 56 Ruan Y, Shi W, Li D, *et al*. Changes of HIV and syphilis infection among men who have sex with men in Beijing China [abstract #CDC0153]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008
- 57 Feng TJ, Lui XL, Cai YM, *et al*. Prevalence of syphilis and human immunodeficiency virus infections among men who have sex with men in Shenzhen, China: 2005 to 2007. *Sex Transm Dis* 2008; 35:1022–1024.
- 58 Guo H, Wei JF, Yang H, *et al*. Rapidly increasing prevalence of HIV and syphilis and HIV-1 subtype characterization among men who have sex with men in Jiangsu, China. *Sex Transm Dis* 2009; 36:120–125.
- 59 Ko NY, Lee HC, Chang JL, *et al*. Prevalence of human immunodeficiency virus and sexually transmitted infections and risky sexual behaviors among men visiting gay bathhouses in Taiwan. *Sex Transm Dis* 2006; 33:467–473.
- 60 Toh P, Lim S, Chio M, *et al*. Men having sex with men HIV sero-prevalence study in Singapore, a community based project to protect the MSM community [abstract #THPE0354]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 61 Mak D, Ho K, Mak K. The first integrated seroprevalence and behavioral survey for men who have sex with men (MSM) in Hong Kong: prism [abstract #MOPE0407]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 62 Hernandez LI, Imperial RH. Sexually transmitted and blood-borne infections assessment in a high-risk population: males who have sex with males (MSM) in the Philippines. Manila: Center for Multidisciplinary Study on Health and Development, Family Health International and Department of Health, Philippines; 2006.
- 63 Department of Health (DepKes). IBBS integrated biological-behavioral surveillance among most at risk groups (MARG) in Indonesia. Surveillance highlights: MSM. Jakarta: Department of Health; 2008. [Accessed 25 February 2009]
- 64 van Griensven F, Wimonasate W, McNicholl J, *et al*. Continuing high HIV incidence in a cohort of men who have sex with men in Bangkok, Thailand [abstract #1037b]. Presented at the 16th Conference on Retroviruses and Opportunistic Infections; 8–11 February 2009; Montreal; 2009.
- 65 Ananworanich J, Phanuphak N, de Souza M, *et al*. Incidence and characterization of acute HIV-1 infection in a high-risk Thai population. *J Acquir Immune Defic Syndr* 2008; 49:151–155.
- This study used nucleic acid testing of fourth-generation enzyme immunoassay (EIA)-negative samples and first-generation EIA testing of fourth-generation EIA-positive samples to detect acute HIV infection in a large sample of HIV-negative men attending an anonymous testing clinic.

- 66 Li SW, Zhang XY, Li XX, *et al.* Detection of recent HIV-1 infections among men who have sex with men in Beijing during 2005–2006. *Chin Med J* 2008; 121:1105–1108.
- 67 Rafiq M, Lal K, Abbas, Q *et al.* Surveillance of STDs and HIV among MSMs and implementation of interventions [abstract #CDC0825]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 68 National Centre for AIDS and STD Control. Integrated biological and behavioural survey (IBBS) among men who have sex with men (MSM) population in Kathmandu Valley round 2. Kathmandu: National Centre for AIDS and STD Control; 2007.
- 69 National AIDS Control Organization. HIV sentinel surveillance and HIV estimation in India, 2007. A technical brief. New Delhi: Ministry of Health and Family Welfare; 2007. [http://www.nacoonline.org/upload/Publication/M&E%20Surveillance,%20Research/HIV%20Sentinel%20Surveillance%20and%20HIV%20Estimation%202007\\_A%20Technical%20Brief.pdf](http://www.nacoonline.org/upload/Publication/M&E%20Surveillance,%20Research/HIV%20Sentinel%20Surveillance%20and%20HIV%20Estimation%202007_A%20Technical%20Brief.pdf). [Accessed 25 February 2009]
- 70 Ramakrishnan L, Kallam S, Kohli A, *et al.* High HIV/STI prevalence among self-identified men who have sex with men in South Asia [abstract #CDC0264]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 71 Brahman GN, Kodavalla V, Rajkumar H, *et al.* Sexual practices, HIV and sexually transmitted infections among self-identified men who have sex with men in four high HIV prevalence states of India. *AIDS* 2008; 22 (Suppl 5): S545–S557.
- 72 Bastos FI, Caceres C, Galvao J, *et al.* AIDS in Latin America: assessing the current status of the epidemic and the ongoing response. *Int J Epidemiol* 2008; 37:729–737.
- 73 Caceres CF, Konda K, Segura ER, Lyerla R. Epidemiology of male same-sex behaviour and associated sexual health indicators in low- and middle-income countries: 2003–2007 estimates. *Sex Transm Infect* 2008; 84 (Suppl 1): i49–i56.
- 74 Sanchez J, Lama JR, Kusunoki L, *et al.* HIV-1, sexually transmitted infections, and sexual behavior trends among men who have sex with men in Lima, Peru. *J Acquir Immune Defic Syndr* 2007; 44:578–585.
- 75 Salvatierra Flores HJ, Segura ER, Konda K, *et al.* HIV/STD risk behaviors and social discrimination in MSM gay, MSM no gay and travestis in Lima, Peru [abstract #MOPE0411]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 76 Mello MB, Pinho AA, Tun W, *et al.* Risky sexual behavior and HIV seroprevalence among MSM in Campinas, SP, Brazil [abstract #TUPE0313]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 77 Aguayo N, Laguna-Torres VA, Villafane M, *et al.* Epidemiological and molecular characteristics of HIV-1 infection among female commercial sex workers, men who have sex with men and people living with AIDS in Paraguay. *Rev Soc Bras Med Trop* 2008; 41:225–231.
- 78 Soto RJ, Ghee AE, Nunez CA, *et al.* Sentinel surveillance of sexually transmitted infections/HIV and risk behaviors in vulnerable populations in 5 Central American countries. *J Acquir Immune Defic Syndr* 2007; 46:101–111.
- This study provided the first published estimates of HIV prevalence and sero-incidence among MSM in Central America.
- 79 Figueroa C, Weir SS, Jones-Cooper C, *et al.* High HIV prevalence among hard to reach gay men in Jamaica is associated with high social vulnerability [abstract #MOPE0400]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 80 Wade A, Larmarange J, Diop A, *et al.* Reduction of risk behaviors among MSM in Senegal after targeted prevention interventions [abstract #THPE0349]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- The first study to assess HIV prevalence among MSM in an African country.
- 81 Sanders E, Graham S, Okuku H, *et al.* HIV-1 infection in high risk men who have sex with men in Mombasa, Kenya. *AIDS* 2007; 21:2513–2520.
- 82 Adebajo S, Myers T, Allman D, *et al.* HIV/STIs and heterosexual bridging among men who have sex with men in Nigeria [abstract #705/SOC06]. Presented at the 15th International Conference on AIDS in Sub Saharan Africa; 3–7 December 2008; Dakar, Senegal; 2008.
- 83 Johnston L, Dahoma M, Holman A, *et al.* HIV infection and risk factors among men who have sex with men in Zanzibar (Ugungu), Tanzania [abstract #WEPE742]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 84 Trapence G, Chibwezo W, Nyadani D, *et al.* A cross-sectional evaluation of the HIV prevalence and HIV-related risk factors of men who have sex with men (MSM) in Malawi [abstract #708/SOC06]. Presented at the 15th International Conference on AIDS in Sub Saharan Africa; 3–7 December 2008; Dakar, Senegal; 2008.
- 85 Baral S, Trapence G, Motimedi F, *et al.* HIV prevalence, risks for HIV Infection, and human rights among men who have sex with men (MSM) in Malawi, Namibia, and Botswana. *PLoS ONE* 2009; 4:e4997.
- This study evaluated the prevalence of bisexual concurrency and its association with HIV risk status among MSM in Africa.
- 86 Lane T, Raymond H, Dladia S, *et al.* High HIV prevalence among men who have sex with men in a South African township community: preliminary results from the Soweto Men's Study [abstract #704/SOC06]. Presented at the 15th International Conference on AIDS in Sub Saharan Africa; 3–7 December 2008; Dakar, Senegal; 2008.
- 87 Burrell E, Baral S, Wood R, Bekker G. Exploratory study to determine rights violations and HIV prevalence among township men who have sex with men (MSM) in Cape Town, South Africa [abstract #LBPE1195]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 88 Burrell E, Mark D, Grant R, *et al.* High-risk sexual behavior and HIV-1 prevalence correlation among men who have sex with men (MSM) in Cape Town, South Africa [abstract #706/SOC06]. Presented at the 15th International Conference on AIDS in Sub Saharan Africa; 3–7 December 2008; Dakar, Senegal; 2008.
- 89 Elrashid S. HIV sero-prevalence and related risky sexual behaviours among insertive men having sex with men (IMSM) in Khartoum state, Sudan, 2007 [abstract #WEPE750]. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City, Mexico; 2008.
- 90 Impact. Egypt final report, April 1999–September 2007. Arlington: Family Health International; 2007.