

RECENTLY ACQUIRED HIV INFECTION IN MEN WHO HAVE SEX WITH MEN (MSM) IN FRANCE, 2003-2008

Caroline Semaille (c.semaille@invs.sante.fr)¹, F Cazein¹, F Lot¹, J Pillonel¹, S Le Vu¹, Y Le Strat¹, V Bousquet¹, A Velter¹, F Barin²

1. Institut de Veille Sanitaire (InVS, French Institute for Public Health Surveillance), Saint Maurice, France

2. Université François Rabelais, Inserm ERI 19, Centre National de Référence du VIH, Tours, France

This article was published on 9 December 2009.

Citation style for this article: Semaille C, Cazein F, Lot F, Pillonel J, Le Vu S, Le Strat Y, Bousquet V, Velter A, Barin F. Recently acquired HIV infection in men who have sex with men (MSM) in France, 2003-2008. *Euro Surveill.* 2009;14(48):pii=19425. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19425>

An increase in the number of new HIV diagnoses among men who have sex with men (MSM) was observed in several countries in the early 2000s. In this article, we explore the trends among MSM in France between 2003 and 2008. To estimate the number of MSM newly diagnosed with HIV, we take into account the reporting delay, underreporting and missing data for HIV case notification. To identify recent infections (RI) (acquired an average of six months before diagnosis), we used an enzyme immunoassay for recent HIV-1 infections (EIA-RI) which has been performed routinely for new HIV diagnoses since 2003. Multivariate analysis was used to identify factors associated with RI. We estimate that between 1,900 and 2,400 MSM have been newly diagnosed with HIV every year: the proportion of MSM among all newly diagnosed with HIV cases has increased from 25.2% (95% confidence interval (CI): 23.3-27.1) in 2003 to 37.0% (95% CI: 35.2-38.7) in 2008 and was stable during the period 2006-2008. In 2008, the rate of newly diagnosed HIV cases per 10,000 MSM living in France was 72.5. The proportion of non-B subtypes of HIV-1 among cases diagnosed in MSM was 11.7% (2003-2008). The assessment of RI was performed for 4,819 MSM newly diagnosed with HIV in 2003-2008. Of these, 47.6% (95%CI = 46.2-49.0) (2,295 cases) were shown to have been recently infected. The risk of RI was greater for those of French nationality (adjusted odds ratio (aOR) =1.6 [95% CI: 1.4-1.9]), those with high economic status (aOR =1.4 [95% CI: 1.2-1.8]), those tested after a risk exposure (aOR =1.6 [95% CI: 1.3-1.8]) or after presenting with clinical symptoms or abnormal biological markers (aOR =1.8 [95% CI: 1.5-2.0]), those who had tested for HIV three or more times during their lifetime (aOR =4.2 [95% CI: 3.4-5.2]) and those living in the Paris area (aOR =1.2 [95% CI: 1.0-1.3]). The risk of RI decreased with age. The HIV situation among MSM living in France is a cause of concern, despite the prevention campaigns dedicated to this highly educated sub-population.

Introduction

Men who have sex with men (MSM) were one of the largest groups of reported AIDS cases until 1999 in France. In the early 1990s, MSM in most countries adopted strategies for reducing the risk of HIV transmission. But since 1996, an increase in sexual risk practices has been observed in North America, Australia and most Western European countries [1-4]. An increase in frequency of unprotected anal intercourse (UAI) was observed for the first time in France in 2000, through the "Enquête Presse Gay" (EPG survey), a behavioural survey that has been conducted since 1985

among readers of the gay press in France (increase of UAI in the last 12 months with a casual partner from 19% to 26% between 1997 and 2000) [5]. The increase of sexual risk practices among MSM may have an impact on the incidence of sexually transmitted infections (STI), including HIV.

In this article, we analyse trends and characteristics of MSM newly diagnosed with HIV from 2003 to the end of 2008 in France and describe factors associated with recent infection (RI) defined as HIV transmission in the last six months preceding diagnosis [6].

Materials and methods

New HIV diagnoses

Case reporting of HIV infection became mandatory in France in early 2003 [7]. All laboratories must notify all new HIV diagnoses anonymously, and practitioners must provide clinical information. The following variables are collected and entered into the national database: sex, age, country of birth, current nationality, region of residence, mode of transmission, socio-professional category, clinical stage at the time of HIV diagnosis (primary infection, asymptomatic stage, symptomatic non-AIDS stage, AIDS stage), number of previous HIV tests and reasons for HIV screening (such as exposure to HIV, clinical symptoms or abnormal biological markers, routine testing). Information on 'primary infection' is reported by clinicians independently of the test result of recent infection. The data presented here are for diagnoses made between 1 January 2003 and 31 December 2008. The MSM category is compared with male heterosexuals when we describe characteristics in terms of age, clinical stage, socio-professional category, region of residence, reason for screening and testing frequency.

The estimated proportion of cases not reported per estimated total number of newly diagnosed HIV cases varied from 44% in 2003 to 29% in 2008, depending on the year of diagnosis. The methodology is described in details in previous published articles [8,9]. In this article, the underreporting rate and the reporting delay are taken into account when presenting the trends in MSM and the estimated numbers of new HIV diagnoses. Moreover, some crucial data (such as unknown mode of transmission or unknown current nationality) were missing for some cases. We used a multiple imputation method (ICE-STATA 9) to estimate missing data when we presented trends over time among MSM [10,11].

To estimate the rate of new HIV diagnoses per 10,000 MSM, we used an estimated number of MSM living in France in the denominator. This estimate is based on the results from a national survey on sexual practices conducted in 2005 (the definition used for MSM was “reported sexual intercourse with a man in the last 12 months”)[12]. Based on this survey, the estimated number of MSM is 330,000 men, representing 1.6% of the male population in France.

Virological surveillance

Virological surveillance (VS) based on voluntary participation by both microbiologists and patients (the patient’s consent is obtained by the reporting clinician through the HIV notification form) was implemented at the same time as the HIV case reporting system and described in detail in a previous publication [7]. For each case, the laboratories were asked to take a dried serum spot (DSS) from the stored serum sample and send it to the National Reference Center (NRC), to determine the type, group and subtype of HIV by serotyping and to perform a test for RI (EIA-RI) [6,13,14]. The RI assessment was done by an EIA-RI assay able to identify infections acquired less than six months before obtaining the sample. Similar to the various avidity assays, in the initial design of the EIA-RI, the cut-off for recently acquired infection was at 180 days and the biomarkers’ threshold was estimated retrospectively [14]. Results from the NRC were linked to the epidemiological data in the HIV national database. Individuals diagnosed during the first half of 2003 were excluded because the virological surveillance was implemented progressively in early 2003.

Statistical analyses

Percentages were compared with the chi-squared test for raw data and by confidence interval for the data which have been corrected by multiple imputation. The threshold of significance was set at 5%. To identify factors associated with RI, we used multiple logistic regression (using backward procedure) including all variables that were significant in a univariate analysis; the Wald test was used for categorical variables. The goodness of fit of the resulting model was tested according to the Hosmer–Lemeshow test. SAS software version 9.1 was used for all analyses.

Results

Trends in newly diagnosed HIV cases among MSM

The proportion of new HIV diagnoses with missing information on mode of transmission was 31.2% for the study period 2003-2008. When the multiple imputation method is applied and underreporting is taken into account, MSM account for 32.0% and male heterosexuals for 28.3% of all new HIV diagnoses reported between 2003 and 2008. Sex between men was reported for more than 50% of male cases newly diagnosed with HIV every year and we estimate that between 1,900 and 2,400 MSM were diagnosed every year (1,858 in 2003; 2,059 in 2004; 2,288 in 2005; 2,409 in 2006; 2,340 in 2007 and 2,393 in 2008).

Sex between men represented the only risk category for which an increase was observed during the study period: the proportion of MSM among all newly diagnosed HIV cases has increased from 25.2% (95% CI: 23.3-27.1) in 2003 to 37.0% (95% CI: 35.2-38.7) in 2008, and the estimated number of MSM newly diagnosed with HIV increased from 1,858 (95% CI : 1604-2145) in 2003 to 2,409 (95% CI : 2175-2668) in 2006 and remained stable in 2007 and 2008 (Figure). The proportion of male heterosexuals was stable, at around 28%.

The estimated rate of new HIV diagnoses among MSM was 72.5 per 10,000 MSM population in 2008 (2,393 cases per estimated 330,000 MSM population living in France).

Characteristics of MSM newly diagnosed with HIV

Between 2003 and 2008, 6,213 cases of new HIV diagnoses in MSM were notified in France. The average age of MSM at diagnosis was 37 years and MSM aged under 30 years represented 24% of all cases. The majority of MSM (82%) were of French nationality, while 3.3 % were from the Americas, mainly Brazil and Peru, and 2.6% were from Western Europe, mainly from Italy and Portugal. Nearly one in five MSM (18.7%) discovered their infection at the time of primary infection (‘PI’ as reported by clinicians independently of the test result) whereas male heterosexuals rarely discovered their seropositivity at the PI stage (5.4%). Nevertheless, 11.5% of MSM were diagnosed at a very late stage of the disease (AIDS-defining illness) and this proportion was highest among MSM aged over 50 years (27.5%). However, the proportion of MSM presenting with an AIDS-defining illness at the time of diagnosis declined from 19.5% in 2003 to 8.8% in 2008. An exposure to HIV (whatever the type of exposure) was the reason for HIV testing for one in three MSM (31.5%) (compared to 18.5% for male heterosexuals). Among MSM aged below 40 years, the main reason for testing (37.4%) was a possible exposure to HIV, whereas among older MSM (> 40 years old) biological or clinical symptoms represented the principal reason for performing an HIV test (38.7%). Of the MSM newly diagnosed with HIV in 2003-2008, 42% had a high level of education, 24% were employees and 10.4% were blue collar workers.

Nearly one in three MSM newly diagnosed with HIV (29.8%) had been tested twice or more for HIV prior to their diagnosis (compared to 16% for male heterosexuals).

Recent infections among new HIV diagnoses

The results of the test for RI were available for 4,819 MSM (77.5% of MSM newly diagnosed with HIV). Nearly half of these patients (47.6%, 95% CI 46.2 to 49.0) had been recently infected.

The proportion of RI among all MSM newly diagnosed with HIV remained stable between 2003 and 2008. It was higher in young MSM (57% [CI 95% = 53.7-59.4] in the 15-29 age group) than among the oldest age group (30% [CI 95% = 26.3-34.2] in the > 50 age group) and higher in MSM with French nationality (49%, [CI 95% =47.6-50.7]) than in those with another nationality (40% [CI 95% = 37.2-43.8]). The proportion of RI varied according to socio-professional categories: RI was less frequent in blue-collar workers (37%) than in employees or other professions. The proportion of RI was also higher in the Paris area (51%) than in the rest of France (45%).

Results of the multivariate analysis

The year of diagnosis was not associated with recent infection in the univariate analysis and was not included in the multivariate analysis. MSM of French nationality (aOR=1.6), those who had undergone HIV testing because of clinical/biological manifestations (aOR=1.7), those who were tested after an exposure to HIV (aOR=1.6), those with high socio-economic status, residence in the Paris region, notification by a community physician and those who had undergone three or more tests were all independently associated with an increased risk of RI in multiple logistic regression analysis (Table). The risk of RI also decreased with age (>50 years

aOR= 1, <30 years, aOR=2.6). The risk of RI increased with the lifetime number of tests performed aOR=1 (one HIV test), aOR=2.0 (two HIV tests), aOR=4.2 (three or more tests).

HIV type, group and subtype

The results for the HIV type, group and subtype were available for 4,369 MSM newly diagnosed with HIV in 2003-2008. For the remaining individuals, the DSS was not sent by the biologist (811 cases) or the virus was not typeable by the serotyping method (710 cases). There were four cases of HIV-2 infection, one involving a French national, one from Peru, one from Colombia and one from the Ivory Coast. Most MSM were infected with HIV-1 subtype B (76.5%), non-B subtype was found in 11.7% and the M group HIV was detected in 11.8% of MSM.

Discussion

MSM account for more than 50% of new HIV diagnoses in men each year, while it is estimated that in 2005 they represented only 1.6% of the male population in France [15]. The rate of newly diagnosed HIV infection among MSM is therefore very high (72/10,000 MSM for the year 2008). Moreover, MSM are the only transmission group in which the number of new HIV diagnoses increased between 2003 and 2006 in France. Screening pattern trends in MSM can not fully explain this increase: in every year of the EPG survey, we observed a substantial and stable proportion of MSM who had never been tested for HIV (14.5% in 1997, 13.0% in 2000, 13.3% in 2004, $p=0.16$) [16].

The results of virological surveillance are worrying: 47.6% of MSM were infected within the six months preceding HIV diagnosis. This high proportion reflects, to a certain extent, the incidence of HIV infection in the MSM community. However, it also depends on other factors, particularly screening practices. We know that French MSM are more frequently tested for HIV than the rest of the population: 12% of MSM newly diagnosed with HIV reported more than three tests before their HIV diagnosis, compared with 2.5% of male heterosexuals. Moreover, among readers of the gay press based on a survey conducted regularly since 1985, 31% had had at least one test in the previous 12 months compared to 11% in the general male population [16,17]. A French study estimating the national incidence rate of HIV infection using the EIA-RI test and testing patterns will be published next year.

The probability of being diagnosed soon after the infection is also higher when the test is motivated by a high-risk event. This is confirmed by the high proportion of diagnoses made shortly after high-risk events of any type among MSM newly diagnosed with HIV (31.5%). However, this is not the case for MSM aged over 50 years, of whom nearly one in three discover their seropositivity at a late stage of the disease (AIDS-defining illness) and wait for clinical or biological manifestations to perform a HIV screening.

We also found that residence in Paris was independently associated with a diagnosis of RI and the Paris region was the area most affected by HIV (the Paris region accounted for 20% of all new HIV diagnoses between 2003 and 2008). Behavioural surveys showed no difference in risk behaviours between MSM living in Paris and other regions [18,19]. It therefore seems that the rate of HIV test per population is higher in the Paris area than in other regions [9]. In addition, seronegative and seropositive MSM may mix more frequently in Paris because of the many commercial gay-venues available in the city.

In addition to the test of RI, virological surveillance showed a high proportion of non-B subtype HIV-1 infection in France among MSM (12% in 2003-2008). In France, the HIV-1 epidemic has historically been dominated by strains of subtype B. The presence of non-B subtypes in MSM was detected as early as 1996-1998, but the proportion was only 2% [20]. The high proportion of non-B subtypes among MSM suggests an increasing genetic diversity of HIV strains that are transmitted within the homosexual community in France. In a pilot survey conducted in Berlin among 114 MSM newly diagnosed with HIV, the authors identified no strains of non-B subtypes [21]. The increase in non-B subtypes in France suggests also a closer interplay between the HIV epidemics in MSM and in the African population living in France.

The increase in the number of newly diagnosed HIV cases in MSM occurred in France during the same time period as the re-emergence of syphilis in the late 2000s [5,22], and the emergence of rectal lymphogranuloma venereum (LGV) in 2003 [23]. Half of MSM who had syphilis were HIV-seropositive and rectal LGV in France has been diagnosed exclusively in HIV positive MSM [24]. The recent outbreaks of syphilis in MSM have probably had a minor impact on HIV incidence because for many years now in France, most MSM with a new diagnosis of syphilis have already been infected by HIV and this is also true for some other countries [25].

The epidemiological situation regarding HIV and other STI in MSM in France is not very different from that in the neighbouring European countries. In the early 2000s, epidemics of syphilis and then of LGV occurred in all Western European countries, mainly among HIV-infected MSM [26-31]. The number of new HIV diagnoses among MSM and bisexual men increased by 86% between 2000 and 2006 in 23 European countries [32]. The rate of HIV notifications among MSM in eight countries with concentrated HIV epidemics (Australia, Canada, France, Germany, Netherlands, Spain, United Kingdom and the United States) increased by 3.3% per year from 2000 to 2005 and this increase is not wholly explained by changes in HIV patterns [33].

Prevention campaigns remain crucial, but they do not seem sufficient to contain sexual risk behaviours among MSM in France, despite the wide availability of screening, condoms and information and the fact that MSM represent a highly educated sub-population. Moreover, in view of the large proportion of HIV-seropositive MSM who are affected by STI, counselling of seropositive MSM during medical follow-up must be reinforced. Regarding the high proportion of MSM aged over 50 years who have been diagnosed with HIV at the AIDS stage and who have been screened for HIV only when they have presented with clinical manifestations, HIV screening should be encouraged among this specific sub-population of MSM. The HIV epidemic situation in MSM in France remains a serious issue and more research into the underlying causes may be necessary to adopt appropriate prevention and control measures.

Acknowledgements

We thank everyone who participates in HIV surveillance, in particular microbiologists, physicians and public health doctors. We also thank Marlène Leclerc, Lotfi Benyelles, H el ene Haguy, Sophie Couturier, Fr ed erique Biton, Sylvie Brunet, Damien Thierry, and Alain Moreau for their technical support.

Financial support

The InVS is funded by the French Ministry of Health. The National Reference Centres are funded by a grant from the InVS.

References

1. Chen SY, Gibson S, Katz MH, Klausner JD, Dille JW, Schwarcz SK, et al. Continuing increases in sexual risk behavior and sexually transmitted diseases among men who have sex with men: San Francisco, Calif, 1999-2001, USA. *Am J Public Health*. 2002;92(9):1387-8.
2. Strathdee SA, Martindale SL, Cornelisse PG, Miller ML, Craib KJ, Schechter MT, et al. HIV infection and risk behaviours among young gay and bisexual men in Vancouver. *CMAJ*. 2000;162(1):21-5.
3. Van de Ven P, Prestage G, Crawford J, Grulich A, Kippax S. Sexual risk behaviour increases and is associated with HIV optimism among HIV-negative and HIV-positive gay men in Sydney over the 4 years period to February 2000. *AIDS*. 2000;14(18):2951-3.
4. Elford J. Changing patterns of sexual behaviour in the era of highly active antiretroviral therapy. *Curr Opin Infect Dis*. 2006;19(1):26-32.
5. Adam P, Hauet E. [Preliminary results of the 2000 Gay Press Survey on the risk-taking and STDs among gays]. Saint-Maurice: Institut de Veille Sanitaire, 2001. French.
6. Barin F, Meyer L, Lancar R, Deveau C, Gharib M, Laporte A, et al. Development and validation of an immunoassay for identification of recent human immunodeficiency virus type 1 infections and its use on dried serum spots. *J Clin Microbiol*. 2005;43(9):4441-7.
7. Semaille C, Barin F, Cazein F, Pillonel J, Lot F, Brand D, et al. Monitoring the Dynamics of the HIV Epidemic Using Assays for Recent Infection and Serotyping among New HIV Diagnoses: Experience after 2 Years in France. *J Infect Dis*. 2007;196(3):377-83.
8. Cazein F, Pillonel J, Le Strat Y, Lot F, Pinget R, David D, et al. [HIV and AIDS surveillance in France, 2006]. *Bull Epidemiol Hebd*. 2008;46-47:434-43. French.
9. Cazein F, Pillonel J, Imounga L, Le Strat Y, Bousquet V, Spaccaverri G, et al. Surveillance du dépistage et du diagnostic de l'infection VIH et du sida, France, 2008. *BEHWeb*. 2009;(2). Available from: <http://www.invs.sante.fr/display/?doc=behweb/index.html>
10. Royston P. Multiple imputation of missing values. *Stata J*. 2004;4(3):227-41.
11. Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ*. 2009;338:b2393.
12. Bajos N, Bozon M. [Survey on sexuality in France. Practices, gender and health]. Paris: Editions La Découverte, 2008. French.
13. Barin F, Plantier JC, Brand D, Brunet S, Moreau A, Liandier B, et al. Human immunodeficiency virus serotyping on dried serum spots as a screening tool for the surveillance of the AIDS epidemic. *J Med Virol*. 2006;78 Suppl 1:S13-8.
14. Le Vu S, Meyer L, Cazein F, Pillonel J, Semaille C, Barin F, et al. Performance of an immunoassay at detecting recent infection among reported HIV diagnoses. *AIDS*. 2009;23(13):1773-9.
15. ANRS-Inserm-Ined. First results of the CSF survey Context of sexuality in France. ANRS. 2007. [cited 2007 Aug 30]. Available from: <http://gazette.kb.inserm.fr/csf/Premiers-resultats-CSF-noData.html>
16. Institut de Veille Sanitaire. [Press Survey Report Gay 2004]. Saint-Maurice: Institut de Veille Sanitaire, 2007. French. Available from: http://www.invs.sante.fr/publications/2007/epg_2004/epg_2004.pdf
17. Moreau C, Lydié N, Warszawski J, Bajos N. [Sexual activity, STIs, contraception: a stable situation]. In: Beck F, Guilbert P, Gautier A. *Health Barometer 2005*, Saint-Denis: Éditions INPES. 2005:329-54. French.
18. Michel A, Velter A, Couturier E, Couturier C, Semaille C. [Gay Barometer 2002: Survey among men attending gay venues in France]. *Bull Epidemiol Hebd*. 2004;(43):227-8. French.
19. Velter A. [Sexual behaviour at risk for HIV and STIs and strategies for reducing sex-related risks. Gay Press Survey Report]. Saint Maurice: Institut de Veille Sanitaire, 2007:15-32. French.
20. Couturier E, Damond F, Roques P, Fleury H, Barin F, Brunet JB, et al. HIV-1 diversity in France, 1996-1998. The AC 11 laboratory network. *AIDS*. 2000;14(3):289-96.
21. Batzing-Feigenbaum J, Loschen S, Gohlke-Micknis S, Hintsche B, Rausch M, Hillenbrand H, et al. Implications of and perspectives on HIV surveillance using a serological method to measure recent HIV infections in newly diagnosed individuals: results from a pilot study in Berlin, Germany, in 2005-2007. *HIV Med*. 2009;10(4):209-18.
22. Couturier E, Michel A, Janier M, Dupin N, Semaille C, the syphilis surveillance network. Syphilis surveillance in France, 2000-2003. *Euro Surveill*. 2004;9(12):pii=493. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=493>
23. Herida M, de Barbeyrac B, Sednaoui P, Scieux C, Lemarchand N, Kreplak G, et al. Rectal lymphogranuloma venereum surveillance in France 2004-2005. *Euro Surveill*. 2006;11(9):pii=647. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=647>
24. Gally A, Bouyssou A, Fischer A, Dupin N, Lassau F, Lemarchand N, et al. HIV infection among patients with sexually transmitted infections in the RésIST surveillance network in France between 2000 and 2007. *Bull Epidemiol Hebd*. 2008;45-46:453-7. French
25. Buchacz K, Greenberg A, Onorato I, Janssen R. Syphilis epidemics and human immunodeficiency virus (HIV) incidence among men who have sex with men in the United States: implications for HIV prevention. *Sex Transm Dis*. 2005;32(10 Suppl):S73-9.
26. Bremer V, Meyer T, Marcus U, Hamouda O. Lymphogranuloma venereum emerging in men who have sex with men in Germany. *Euro Surveill*. 2006;11(9):pii=643. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=643>
27. Simms I, Fenton KA, Ashton M, Turner KM, Crawley-Boevey EE, Gorton R, et al. The re-emergence of syphilis in the United Kingdom: the new epidemic phases. *Sex Transm Dis*. 2005;32(4):220-6.
28. Sasse A, Defraye A, Ducoffre G. Recent syphilis trends in Belgium and enhancement of STI surveillance systems. *Euro Surveill*. 2004;9(12):pii=492. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=492>
29. op de Coul EL, de Boer IM, Koedijk FD, van de Laar MJ, Stichting HIV Monitoring (HIV Monitoring Foundation), SOA Peilstation (STI sentinel surveillance network), et al. HIV and STIs increasing in the Netherlands according to latest surveillance data. *Euro Surveill*. 2006;11(7):pii=2901. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=2901>
30. Dougan S, Evans BG, Elford J. Sexually transmitted infections in Western Europe among HIV-positive men who have sex with men. *Sex Transm Dis*. 2007;34(10):783-90.
31. Marcus U, Bremer V, Hamouda O, Kramer MH, Freiwald M, Jessen H, et al. Understanding recent increases in the incidence of sexually transmitted infections in men having sex with men: changes in risk behavior from risk avoidance to risk reduction. *Sex Transm Dis*. 2006;33(1):11-7.
32. Likatavicius G, Klavs I, Devaux I, Altix J, Nardone A. 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(6):499-505.
33. Sullivan PS, Hamouda O, Delpech V, Geduld JE, Prejean J, Semaille C, et al. Reemergence of the HIV epidemic among men who have sex with men in North America, Western Europe, and Australia, 1996-2005. *Ann Epidemiol*. 2009;19(6):423-31.