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Elevated Risk for HIV Infection among Men Who Have Low- and Middle-Income Countries 2000–2006: A Sys

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Abstract

Background

Recent reports of high HIV infection rates among men who have sex with men (MSM) from Asia, Africa, Latin Ame high levels of HIV transmission among MSM in low- and middle-income countries. To investigate the global epidem outbreaks to general populations, we conducted a comprehensive review of HIV studies among MSM in low- and meta-analysis of reported MSM and reproductive-age adult HIV prevalence data.

Methods and Findings

A comprehensive review of the literature was conducted using systematic methodology. Data regarding HIV preva each of the studies that met inclusion criteria and aggregate values for each country were calculated. Pooled odds including HIV prevalence of the country, Joint United Nations Programme on HIV/AIDS (UNAIDS)–classified level o not injection drug users (IDUs) played a significant role in given epidemic. Pooled ORs were stratified by prevalen overall MSM OR of 58.4 (95% CI 56.3–60.6); low-prevalence countries, 14.4 (95% CI 13.8–14.9); and medium- t 9.0–10.2). Significant differences in ORs for HIV infection among MSM in were seen when comparing low- and mi an OR of 7.8 (95% CI 7.2–8.4), whereas middle-income countries had an OR of 23.4 (95% CI 22.8–24.0). Stratif substantial component of IDU spread resulted in an OR of 12.8 (95% CI 12.3–13.4) in countries where IDU transn 23.7–25.2) where it was not. By region, the OR for MSM in the Americas was 33.3 (95% CI 32.3–34.2); 18.7 (95 for Africa; and 1.3 (95% CI 1.1–1.6) for the low- and middle-income countries of Europe.

Conclusions

MSM have a markedly greater risk of being infected with HIV compared with general population samples from low Asia, and Africa. ORs for HIV infection in MSM are elevated across prevalence levels by country and decrease as remain 9-fold higher in medium–high prevalence settings. MSM from low- and middle-income countries are in urge both understudied and underserved.

Figures

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Abbreviations: CI, confidence interval; FSU, former Soviet Union; IDU, injection drug user; MESH, medical sul men; OR, odds ratio

Editors' Summary

Background.
AIDS (acquired immunodeficiency syndrome) first emerged in the early 1980s among gay men living in New Yo spread around the world, it became clear that AIDS also affected heterosexual men and women. Now, a quart infected with human immunodeficiency virus (HIV), the organism that causes AIDS. HIV is most often spread b partner and in sub-Saharan Africa, the region most badly hit by HIV/AIDS, heterosexual transmission predomin infections are thought to be in men who have sex with men (MSM, a term that encompasses gay, bisexual, trar sometimes have sex with men), and in several high-income countries, including the US, male-to-male sexual co transmission route.

Why Was This Study Done?
In the US, the MSM population is visible and there is considerable awareness about the risks of HIV transmissi other countries, MSM are much less visible. They remain invisible because they fear discrimination, stigmatizat arrest—sex between men is illegal in 85 countries. Consequently, MSM are often under-represented in HIV sur programs. If the AIDS epidemic is going to be halted, much more needs to be known about HIV prevalence (th among MSM. In this study, the researchers have done a systematic review (a type of research where the resu published reports of HIV prevalence among MSM in low- and middle-income countries to get a better picture o

What Did the Researchers Do and Find?
The researchers found 83 published studies that reported HIV prevalence in 38 low- and middle-income countri Europe. When the results were pooled—in what statisticians call a meta-analysis—MSM were found to have a with HIV than the general population. This is described as a pooled odds ratio (OR) of 19.3. The researchers a asked whether factors such as injection drug use (another risk factor for HIV transmission), per capita income, the general population were associated with differential risk (increase in odds) of HIV infection compared to the that in countries where the prevalence of HIV in the general population was very low (less than 1 adult in 1,000 to the general population was 58.4; where it was high (more than 1 adult in 20 infected), the pooled OR for MS

What Do These Findings Mean?
These findings indicate that MSM living in low- to middle-income countries have a greater risk of HIV infection t The subgroup analyses indicate that the high HIV prevalence among MSM is not limited to any one region or in prevalence or injection drug use level. Although the small number and design of the studies included in the meta these findings, the clear trend toward a higher HIV prevalence of among MSM suggests that HIV surveillance e those countries where they are currently ignored. Efforts should also be made to include MSM in HIV preventic these programs by investigating the cultural, behavioral, social, and public policy factors that underlie the high H surveillance, research, and prevention among MSM in low- to middle-income countries, it should be possible to population and reduce the global burden of HIV.

Additional Information.
Please access these Web sites via the online version of this summary at http://dx.doi.org/10.1371/journal.pmed

The International Lesbian and Gay Association provides a world legal map on legislation affecting lesbia

The International Gay and Lesbian Human Rights Commission provides a page called Off the Map: How Practicing People in Africa
The American Foundation for AIDS Research (amfAR) has launched their MSM initiative, which is focuse groups working on providing services and doing research focused on HIV among MSM in lower income-s
Information is available from the US National Institute of Allergy and Infectious Diseases on HIV infection
HIV InSite has comprehensive information on all aspects of HIV/AIDS, including a list of organizations tha
Information is available from Avert, an international AIDS charity, on HIV, AIDS, and men who have sex v
The US Centers for Disease Control and Prevention provides information on HIV/AIDS and on HIV/AIDS and Spanish)

Introduction

Male-to-male sexual contact has been an important route of HIV-1 spread since HIV/AIDS was first identified som diversely identified men who have sex with men (MSM) remains a significant or predominant component of HIV ep including the United States, Australia, and much of Western Europe [1]. In the United States and European contex minority MSM have been seen by many as evidence of resurgent HIV spread [2,3]. Recent reports of high HIV pre America, and the states of the former Soviet Union (FSU) indicate that high levels of HIV infection among MSM are income countries [4–8]. Reports from Thailand, Cambodia, and Senegal, countries characterized by relatively low populations, but which have greater than 20% prevalence in MSM in recent samples, suggest an unlinked epidemi and those in MSM [6,9–12].

MSM is a term coined in 1994 to reduce stigma against gay, bisexual, transgendered, and self-identified heterosex describing behaviors rather than social or cultural identities [13]. While the term is sensitive to defining a common b specificity across the many subsets it contains [14,15]. Multiple reports have described significant differences in H transgenders and male sex workers, and among MSM practicing receptive versus insertive anal intercourse—nuan Nevertheless, MSM is now widely used in the literature, and we have used it here for standardization and compara

A review of the epidemiologic literature suggests that MSM are inadequately studied in many countries, and that d and transmission, MSM continue to be under-represented in national HIV surveillance systems, in targeted prevent have published a recent estimate of the number of MSM in low- and middle-income countries, and Johnson et al. [MSM, but there has been no meta-analysis of MSM HIV epidemics in low- and middle-income countries. MSM pop in many African, Asian, and FSU countries due to criminalization in many states, stigma (often referred to as homo consenting adult men is criminalized in 85 countries as of 2007, and in more than half of African states [18]. Where America, many reports do not include biologic measures, or do so among highly selected samples of MSM whose where HIV levels have been measured, nearly all reports suggest significantly higher HIV prevalence rates among [16].

The highest rates of HIV infection overall have been seen in sub-Saharan Africa, where heterosexual transmission epidemics of the FSU, the principal mode of transmission of HIV is through needle sharing among injection drug us million IDUs, with 25 countries having documented an HIV seroprevalence of more than 20% among this group [27 settings, and include men of all sexual orientations. MSMs who are also IDUs, though likely a minority compared w the risk group with the highest burden of HIV, making interpretation of MSM rates in these contexts complex. In ID rates among MSM and heterosexual populations where many, or most, infections are due to IDU exposure. To add analyses of MSM epidemics in countries with substantial IDU epidemics. The Joint United Nations Programme on H Aceijas et al., which details those countries where at least one cohort of IDUs has been found with more than 20% identifying these countries [27].

To investigate the global epidemic of HIV among MSM and the relationship of outbreaks among MSM to spread in systematic review of HIV studies among MSM in low- and middle-income countries, and performed a meta-analys among adults of reproductive age in reviewed countries [28].

Methods

Search Protocol

We searched both electronic databases and conference proceedings for this review. The databases used included Database of Systematic Reviews on October 3, 2006. All the databases were included to ensure sensitivity, thoug analysis found in other databases that was not also found on PubMed. Inclusion criteria for studies were determin data among MSM populations (including homosexual, bisexual, male sex workers, transgender, and other country- peer-reviewed journal; an abstract at a conference with peer-reviewed blinded abstract selection process; listed d collection started since January 1, 2000; studies in low- and middle-income countries; and studies taking place in c population prevalence for 2006. If the studies were not published in a peer-reviewed journal, though commissioned monitoring agencies such as European Centre for the Epidemiological Monitoring of AIDS (EuroHIV) or the US Ce the studies were also included. The following medical subject heading (MESH) terms were used for PubMed, while other databases: "Homosexual, Men" *OR* "Homosexual" which were cross-referenced with the key word *(AND)* "H term "Human Immunodeficiency Virus" (107 articles, four reviews) and limited to reports in the English language, p present date, and pertaining to individuals 15 y of age and older (Figure 1). The exclusion criteria were studies wit status rather than serologic testing, and if the sample was a subset of another population used in another study. If not further exclude studies demonstrating 0% prevalence of HIV among MSM. On further review, the 107 articles r subset of the collection retrieved using HIV as a keyword. Based on abstract and title alone, 1,280 articles were r were retrieved for further analysis. Of these 115 full texts, 22 contained data from at least one study that fulfilled t abstract volumes were searched from the International AIDS conference; The Conference on HIV Pathogenesis, T Retroviruses and Opportunistic Infections with similar restrictions using Boolean logic with search terms including " "MSM" (265 abstracts), "homosexual" (214 abstracts), "bisexual" (46 abstracts), *OR* "transgender" (37 abstracts) were unique and 49 met all the inclusion and exclusion criteria, though six were later excluded due to the inability to clarification, or an inability to retrieve background prevalence of HIV in that country. An additional 16 studies were EuroHIV [5]. The 2004 US Census Bureau database of HIV/AIDS is a thorough compilation of global HIV prevalen the methodology used in their collection [29]. This database was used to assess the sensitivity of the literature and unique conference abstracts being retrieved that met inclusion and exclusion criteria (Figure 1). Significant attentio HIV among MSM among the same population published in two different reports. Bibliographies of articles were als retrieved by this method. In all, 83 studies from 58 unique reports were used in the meta-analysis describing MSM was done by one of the authors (SB), and abstraction methods and data extraction were independently validated b abstractors were settled by contacting the authors of the study in question for further clarification. This resulted in were unable to be reached. Abstractors were not blinded to the purpose of the study.

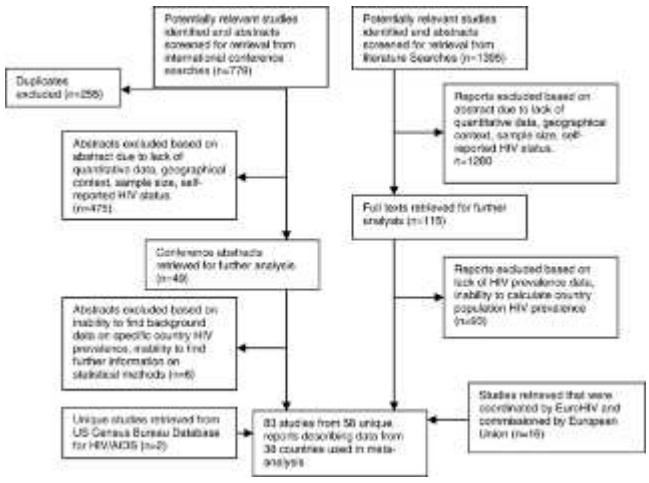

Figure 1. Search Protocol and Results
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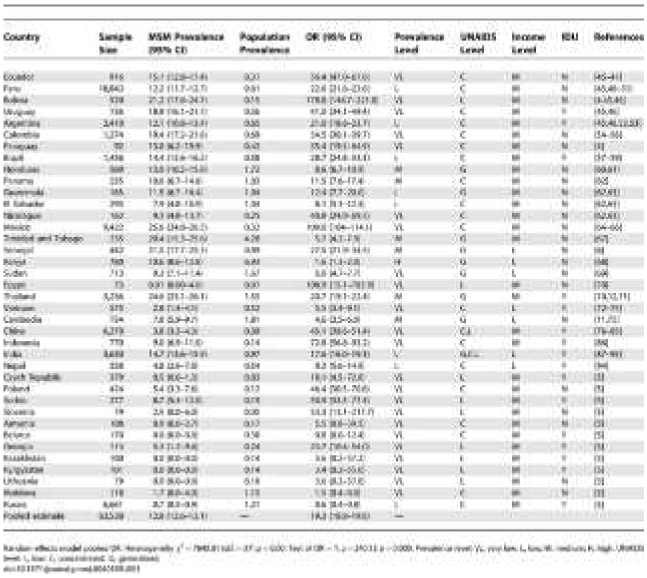
Low- and Middle-Income Country Definition

Economies are divided according to 2005 gross national yearly income per capita, calculated using the World Ban US$875 or less; lower middle income, US$876–3,465; upper middle income, US$3,466–10,725; and high income, countries with a gross national income per capita of less than US$10,725 [30].

Statistical Methods

This meta-analysis calculates the measure of association between being MSM, the independent variable, and HIV
this relationship in the form of an odds ratio (OR). In addition, individual country prevalence estimates were calcula



Country	Sample Size	MSM Prevalence (95% CI)	Population Prevalence	OR (95% CI)	Prevalence Level	UNAIDS Level	Income Level	IDU	References
Ecuador	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Peru	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bolivia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Uruguay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Argentina	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colombia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Paraguay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brazil	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Honduras	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Panama	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Guatemala	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
El Salvador	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nicaragua	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mexico	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Trinidad and Tobago	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Senegal	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kenya	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sudan	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Egypt	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Thailand	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vietnam	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cambodia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
China	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indonesia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
India	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nepal	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Czech Republic	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 1.

Meta-Analyses of Aggregate Country Data Comparing HIV Prevalence among MSM and Adults of Reproductiv
with Data on MSM HIV Prevalence, 2000–2006
doi:10.1371/journal.pmed.0040339.t001

HIV Epidemic Categories

HIV epidemics have been characterized by prevalence levels and/or epidemic stages. In defining categories of pre
proposed by Stover et al., which defines HIV epidemics among adults of reproductive age (those aged 15–49 y) a
prevalence, 0.5%–1.0%; medium prevalence 1.1%–5%; and high prevalence, >5% of adults [31]. The extent to wl
these national estimates affects both their overall validity and our ability to compare MSM infection rates to genera

Background Population Estimates

General population prevalence was estimated by using reported absolute number of HIV infected adults of reprodu
2006 and, using as the denominator the population estimates of people aged 15–49 y in the respective countries a
Division International Database [1,32]. The data were then grouped into two categories: the absolute number of th
those who were uninfected.

The population estimates calculated by UNAIDS are based on statistical models rather than actual survey data. Si
computed individually, based on the specific dynamics of the HIV epidemic in that country, there is potential for bia
countries. For very populous and diverse countries such as China and India, different regions of these nations have
epidemic (Table 1). Specifically, India has been classified as having low-level, concentrated, and generalized epide
concentrated epidemics. For China and India, the data were included in the meta-analysis in each of the strata for

UNAIDS defines what is a country according to the criteria used by the United Nations; thus, separate analyses fo
meta-analysis, data from Taiwan were coupled with that of mainland China; similarly, data from Puerto Rico would
high-income country.

MSM Prevalence Estimates

Data regarding prevalence and total sample size were obtained from each of the studies that met inclusion criteria

country by combining the absolute number of MSM with HIV and without HIV. As only raw data were collected fror MSM were determined for each country with 95% confidence intervals (CIs). A combined prevalence estimate wa prevalence among MSM for each country. The pooled estimate was weighted according to the sample size of MS

Meta-Analyses

Meta-analyses were completed using the comprehensive statistical software package Stata 9.1 [33]. The Mantel- used, which automatically adds 0.5 to any 0% prevalence levels seen in Table 1 for the purpose of meta-analysis. effects model, as the prevalence estimates are assumed to be random variables representative of the prevalence testing was completed using the DerSimonian and Laird *Q* test [34]. The data are presented both in the form of fo relative weight of any particular study in estimating the summary OR for all countries. With the Mantel-Haenszel m country will increase the precision of the OR (reflected by a narrow CI) and lend more weight to final pooled OR e

Stratified Meta-Analysis

Countries were stratified by epidemic level and by the presence or absence of IDU predominance to determine wh odds of having HIV among MSM. Background prevalence estimates were categorized as very low (<0.1% prevale (0.1%–0.5%), and medium–high (>0.5%). Pooled estimates were also stratified by whether or not injection drug u HIV in that country [27,31]. A summary OR was also stratified by geographical location, into the Americas, Europe by whether UNAIDS has classified the HIV epidemic level within the country as low level (consistently <5% prevale (consistently >5% in any high risk subset, but less than 1% in antenatal clinics), or generalized (>1% in antenatal c

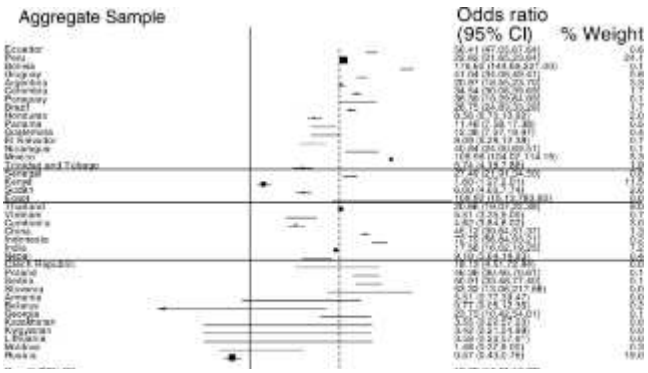
Results

Individual Country Summary Statistics

Summary statistics, including ORs, aggregate sample sizes, average prevalence of HIV among MSM, and backgr 38 countries used in the meta-analysis as well as the their respective prevalence level and UNAIDS HIV epidemic l

Meta-Analyses

Using studies from all countries, MSM had a 19.3 (95% CI 18.8–19.8) times higher odds of having HIV compared pooled OR was stratified by prevalence levels of countries, very low-prevalence countries had the highest OR of ir population: in very low-prevalence countries the OR was 58.4 (95% CI 56.3–60.6); in low-prevalence countries it v high-prevalence settings it was 9.6 (95% CI 8.9–10.2) (Table 2). The OR of infection was higher where IDU transr epidemic: 24.4 (95% CI 23.7–25.2) compared with 12.8 (95% CI 12.3–13.4) where IDUs are a substantial driver classified low level and generalized epidemics had similar ORs for HIV infection among MSM, and both ratios were epidemics: 24.5 (95% CI 22.8–26.3) for low-level epidemic countries; 23.5 (95% CI 22.9–24.1) for concentrated e for generalized epidemic countries (Table 2). Significant differences in ORs for HIV infection among MSM in were s countries; low-income countries had an OR of 7.8 (95% CI 7.2–8.4), whereas middle-income countries had an OR stratifying by region, an OR for HIV among MSM in the Americas was 33.3 (95% CI 32.3–34.2), 18.7 (95% CI 17 Europe, and 3.8 (95% CI 3.3–4.3) for Africa (Table 2).



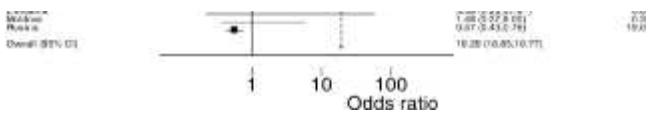


Figure 2. Forest Plot Showing Meta-Analysis of Risk of HIV Infection among MSM Compared with Adult Income Countries, 2000–2006
doi:10.1371/journal.pmed.0040339.g002

Category	Subcategory	Number of Countries	OR (95% CI)
Level of epidemic	Low level	11	31.5 (23.8–39.3)
	Concentrated	21	24.3 (19.3–29.4)
	Generalized	9	10.3 (7.3–13.4)
Region	Americas	15	33.5 (32.5–34.5)
	Asia	7	14.7 (13.7–15.7)
	Europe	12	1.3 (1.28–1.4)
	ROW	4	3.8 (3.3–4.3)
Prevalence	Very low prevalence countries	23	55.4 (54.3–56.6)
	Low prevalence countries	6	34.4 (33.9–34.9)
	Medium- to high-prevalence countries	7	9.6 (9.0–10.2)
IDU	IDU epidemic	16	12.0 (11.4–12.6)
	Non-IDU epidemic	22	24.4 (23.7–25.2)
Income level	Low-income countries	7	7.8 (7.2–8.4)
	Middle-income countries	31	23.4 (22.8–24.0)

doi:10.1371/journal.pmed.0040339.t002

Table 2.
Stratification of Pooled OR for HIV Infection among MSM by Epidemic Level, Region, Prevalence, and IDU Co
doi:10.1371/journal.pmed.0040339.t002

Discussion

This is to our knowledge the first meta-analysis of HIV survey data collected from MSM participants in low- to mid HIV infection are markedly and consistently higher among MSM than among the general population of adults of rep and the FSU.

There are a number of limitations to this study. MSM in many developing countries are often difficult to access and behavior, the social stigma associated with their behaviors and identities, participant safety concerns in some setti MSM. These barriers likely limited both the number and quality of studies in the literature—only a few lower-incom Peru, have systematically surveyed MSM. The majority of studies cited in this analysis are convenience samples a representative of MSM. To determine a corollary of risk for HIV infection among MSM in low- and middle-income c prevalence estimates for each country as the unexposed population to compute ORs. Because of the lack of contr formally controlled for in our study. MSM tend to congregate in urban areas, at least partially explaining why the m may limit generalizability. In very populous countries such as China and India, there may be even more marked diff prevalence and in reporting of MSM behaviors. Publication bias tends to affect the results of meta-analyses, both and could be partly responsible for the magnitude of associations seen in this study [35]. To minimize the effect of database and the EuroHIV surveillance report were searched to validate the sensitivity of the journal and conferen study was that it was limited to English-language publications, which could serve as a source of language bias in th non-English databases, the authors found no sources of primary data that had not also been reported in English jo factors for HIV infection are assessed in this study, and these may be subject to ecologic fallacy, meaning that the at the individual level. Although individual drivers of HIV acquisition and transmission among MSM have been well c cannot be said for the majority of countries included in this study [36,37]. Only with prospective observational and risk factors for HIV acquisition and transmission apply to MSM in low- and middle-income settings. Finally, a portio may be explained by a ceiling effect. That is, a bias where the magnitude of a relative association, such as an OR

MSM were likely included in some samples of men in the general reproductive-age population. This is likely the ca hidden. We conducted a sensitivity analysis to assess the importance of this misclassification of MSM. Such an ap assumptions made for statistical calculations in meta-analyses [38]. Using the prevalence of MSM behavior in eac sensitivity analysis was conducted by removing the total (estimated) population of MSM from the population estim

countries. We then recalculated the odds of HIV infection among MSM for a hypothetical population where MSM d prevalence. This modified the overall magnitude of the OR modestly, from 1.5% to 7.5%, depending on the country the meta-analyses. Data and methodological quality of these studies was deemed sufficient for the purposes of th underwent peer review or were published as government reports, with high methodological standards such as that

Despite these limitations, this meta-analysis draws its precision strength from the combined estimates of the OR a 63,538). By calculating a measure of association, such as an OR, one can see that two regions with identical abso MSM, may be in very different stages of the HIV epidemic affecting the overall risk status of MSM in that region. D of the ORs of HIV infection among MSM from differing countries, one pooled OR describing the HIV risk of MSM g of risk. Rather, the value of these analyses is in the overall trends of the results. These trends of high HIV prevalen concentrated HIV epidemics speak to the urgent need for increased targeted prevention strategies to this at-risk p

To determine if there is a differential risk status of MSM depending on the level of the HIV epidemic in given countr level of the epidemic (very low, low, and medium–high; Table 2). There was a trend of decreasing OR with increas 58.4 in very low-prevalence countries, 14.4 in low-prevalence countries, and 9.6 in medium- to high-prevalence cou OR by income level showed an OR for HIV infection of 23.4 for middle-income countries and 7.8 for low-income co study had generally higher general population prevalence rates, these results may represent a consistent increase given the potential of a ceiling effect. As more data become available, it will be important to determine to what ext of HIV among MSM. The marked differences in OR by prevalence or income level may be a function of epidemic s adults of reproductive age, HIV transmission may be linked through sexual networks between high-prevalence gen low prevalence in general populations, HIV transmission among MSM may be isolated and propagated within this g

To control for the assumption that prevalence level categories are more relevant than epidemic levels in assessing pooled estimates were stratified using both criteria. Stratification by UNAIDS-defined epidemic level showed that t among MSM in countries with generalized epidemics (OR 10.8), and was even higher in countries with low-level ep (OR 23.5) (Table 2). The UNAIDS classification of HIV epidemics was designed, in part, to provide guidance on th a country. However, the absence of a difference in the odds of HIV infection among MSM between concentrated a classification system is currently not ideal for measuring the increased risk of specific subsets of the population. Th improved as more comprehensive prevalence data of specific vulnerable populations such as MSM become availa

The direction of the measure of association among MSM appears to be quite consistent between individual countri highlighting the external validity of the individual studies. Eastern Europe appears to be an exception: MSM data ar primarily driven by IDU exposure. No peer-reviewed published report or abstract meeting our inclusion criteria was EuroHIV surveillance report served as the primary source for these data. Since an unknown but potentially significa IDUs, estimating the attributable risk fraction for these differing behaviors is difficult. What is clear is the need for r this region.

The stratification of the pooled OR estimate revealed some general differences in risk status between MSM globa the Americas, at 33.3. It was lower, but still extremely high, in Asia at 18.7, lower still in Africa at 3.8, and lowest i result from Eastern Europe is likely due, as we have argued, to comparing MSM with populations where IDUs are Americas and Asia were by far the best evidenced, suggesting that these epidemics among MSM are real, and th than heterosexuals in these settings. Data regarding MSM in Africa were the sparsest, but are beginning to emerg MSM were found from Uganda, Zambia, Sudan, and Nigeria, though not all met inclusion criteria for this analysis [4 part, by marked stigma and homophobia in these settings and by a lack of specific prevention strategies. Although are in desperate need of targeted prevention campaigns, social intolerance currently limits prevention efforts. UNA MSM globally had access to appropriate HIV prevention services [1].

These results constitute a clear call to action on three fronts: surveillance, research, and prevention [39]. The varic may not necessarily explain complex differences in global HIV epidemic dynamics, but they do demonstrate that hi limited to any one epidemic level, prevalence category, region, or income level. HIV surveillance efforts should take and expand surveillance to include them in countries where they are not now included. Social science, epidemiolog population-based sampling methods and standardized data collection tools to assess prevalence of HIV risk behav network interactions, and the roles individual and partner circumcision status may play in male-to-male HIV transm assessments could further describe the cultural and behavioral nuances of MSM globally and refine data collection cessation of discrimination against MSM could afford greater access to HIV prevention and education services and Male-to-male sexual contact is not inherently dangerous; only in the context of an advanced stage of the epidemic high-risk behavior for HIV infection. Notably, there exists a risk that demonstrating high HIV prevalence rates amon prevention expenditures are generally allocated based on need; thus, the risk of increasing stigma must be balanc

advocating for dedicated funding resources for MSM. In Asia, prevention expenditures targeting MSM range from Thailand [43]. This lack of governmental expenditures is notable given that two recent meta-analyses have demons strategies targeting MSM are successful in decreasing high-risk behaviors [17,44]. MSM have been largely ignore many countries for too long, given their highly disproportionate burden of HIV. Surveillance, research, and preventi HIV transmission in this marginalized population.

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Author Contributions

SB designed the initial search strategies and was one of the authors responsible for abstraction and data analysis draft of the manuscript. CB is SB's supervisor and was the source of the original ideas for this research study. CB significant role in the writing of this manuscript. FS contributed critical thought, aided in data analysis, and also wa manuscript. FC helped direct the research, provided extensive critical review of the writing and data analysis meth

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