Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis

Stefan Baral, Chris Beyrer, Kathryn Muessig, Tonia Poteat, Andrea L Wirtz, Michele R Decker, Susan G Sherman, Deanna Kerrigan

Summary
Background Female sex workers are a population who are at heightened risk of HIV infection secondary to biological, behavioural, and structural risk factors. However, three decades into the HIV pandemic, understanding of the burden of HIV among these women remains limited. We aimed to assess the burden of HIV in this population compared with that of other women of reproductive age.

Methods We searched PubMed, Embase, Global Health, SCOPUS, PsycINFO, Sociological Abstracts, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Web of Science, and POPLine for studies of female sex workers in low-income and middle-income countries published between Jan 1, 2007, and June 25, 2011. Studies of any design that measured the prevalence or incidence of HIV among female sex workers, even if sex workers were not the main focus of the study, were included. Meta-analyses were done with the Mantel-Haenszel method with a random-effects model characterising an odds ratio for the prevalence of HIV among female sex workers compared with that for all women of reproductive age.

Findings Of 434 selected articles and surveillance reports, 102 were included in the analyses, representing 99 878 female sex workers in 50 countries. The overall HIV prevalence was 11·8% (95% CI 11·6–12·0) with a pooled odds ratio for HIV infection of 13·5 (95% CI 10·0–18·1) with wide intraregional ranges in the pooled HIV prevalence and odds ratios for HIV infection. In 26 countries with medium and high background HIV prevalence, 30·7% (95% CI 30·2–31·3; 8 627 of 28 075) of sex workers were HIV-positive and the odds ratio for infection was 11·6 (95% CI 9·1–14·8).

Interpretation Although data characterising HIV risk among female sex workers is scarce, the burden of disease is disproportionately high. These data suggest an urgent need to scale up access to quality HIV prevention programmes. Considerations of the legal and policy environments in which sex workers operate and actions to address the important role of stigma, discrimination, and violence targeting female sex workers is needed.

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Introduction Epidemiological surveillance data have shown declines in the rate of spread of HIV from an estimated 3·1 million (95% CI 3·0–3·3) new infections in 2002 to 2·7 million (95% CI 2·4–2·9) new infections in 2010.1 UNAIDS estimates that over the past decade, 33 countries—including 22 sub-Saharan African countries—have achieved declines in HIV incidence of more than 25%.2 These decreases highlight overall advances in the fight against HIV, but might mask sustained or expanding spread among populations who are at most risk including sex workers, men who have sex with men (MSM), and people who use drugs.3 In much of the world, HIV epidemics are most concentrated in populations who are at most risk,3 and where HIV epidemics occur in general populations, largely in sub-Saharan Africa, these populations might still have very high disease burdens relative to others.4,5 Unfortunately, our understanding of the burden of HIV in populations who are at most risk is poor, largely because these populations are poorly represented in national HIV surveillance systems and are hidden and stigmatised in many settings. Female sex workers have been reported to be at high risk for HIV infection in nearly every setting where they have been studied, yet in 2012 we still have limited understanding of the relative burden of HIV in these women.

Sex work—defined here as the exchange of sex for money—and the structure of sex work vary substantially around the world. Those who sell sex might work with or without a controller (eg, pimp, manager) through establishments such as bars, brothels, or saunas, or in more public spaces such as parks, streets, or festivals. Additionally, a growing portion of sex work is arranged through the internet.6,7 Most sex workers worldwide are women; however, substantial populations of male and transgender sex workers exist in many countries.8 The dynamics of HIV transmission among male and transgender sex workers could be further complicated by the heightened biological risks of anal intercourse, high prevalence of HIV in some subgroups of MSM, and the large proportion of male and transgender sex workers who report bisexual practices.9
HIV infection in female sex workers varies by geographical epidemic typology, structure of sex work, and overlapping nature of HIV-risk behaviours such as injection drug use. Yet the heightened risk for HIV acquisition and transmission among sex workers operates through a similar variety of behavioural, biological or biomedical, and structural risks. Behavioural risk factors act at the level of the individual, with sex workers experiencing high-risk sexual exposures through high numbers of sexual partners and high concurrency of these partners. Biologically, the high prevalence of bacterial sexually transmitted infections (STIs) in sex workers and the synergistic relation between HIV and STIs compounds their risks and could lead to complications around reproductive health and childbearing. In some settings, protective sexual practices including consistent condom use and HIV testing are higher among sex workers than among women in the general population, although these rates remain low in many areas. HIV transmission among sex workers might also be driven, or exacerbated, by the intersection of injection drug use and sex work through increased parenteral exposures from shared injection equipment, sex with more HIV-positive partners, low condom use, and increased risk of other STIs such as syphilis and hepatitis C.

Structural risk factors indirectly heighten risk for HIV infection among sex workers by restricting access to preventive health and HIV and STI services and treatment. Structural factors also include the limiting influences of poverty, discrimination, and gender inequality as well as the damaging effects of physical and sexual violence, stigma, and social exclusion. Finally, structural factors such as the organisation and power dynamics of sex work and legal and regulatory policies regarding sex work have also been shown to contribute to sex workers’ increased risk of HIV infection by limiting their ability to negotiate safer sex.

Health enabling environments, including safer work spaces, structural support for condom promotion and distribution, and community empowerment for sex workers have been shown to reduce structural risks for HIV infection.

Interventions targeting behavioural and structural-level risk factors for HIV among sex workers have proven successful for increasing protective behaviours and decreasing HIV and STI transmission. In fact, 44 of 87 countries with available data report that over 80% of sex workers used condoms with their last client. Despite these promising results and increasing number of initiatives, UNAIDS estimates that less than 50% of sex workers worldwide are covered by ongoing HIV prevention programmes. In view of this urgent need for HIV prevention and treatment among sex workers, there is still a lack of crucial information to guide global resource investment because most meta-analyses are limited to a single country or area. Systematic reviews and meta-analyses have been undertaken in other populations who are most at risk, including MSM and people who use drugs, to better characterise the relative burden of HIV to background rates. To date, however, such a review has not been completed for female sex workers, which is needed to better characterise the relative level of HIV risk among these women and to guide the allocation of resources and content of HIV prevention programmes and policies. The aim of this study is to characterise current burdens of HIV in female sex workers.

Methods

Search strategy and selection criteria

We searched PubMed, EMBASE, Global Health, SCOPUS, PsycINFO, Sociological Abstracts, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Web of Science, and POPLine for studies published between Jan 1, 2007, and June 25, 2011. Articles and citations were downloaded, organised, and reviewed using the QUOSA information management software package (version 8.05) and EndNote (version X4). The search included MeSH terms for HIV or AIDS, and terms associated with sex work (prostitute [MeSH] or “sex work” or “sex work*” or “female sex worker” or “commercial sex worker”).

Other data sources included national surveillance system data reports, including AIDS indicator surveys, demographic health surveys, and integrated biobehavioral surveillance studies done by large international non-governmental organisations. Governmental surveillance reports were searched, including those from EuroHIV surveillance, US Centers for Disease Control and Prevention, Australian Surveillance Reports, Public Health Agency of Canada, Pan American Health Organization, and structured government-sponsored surveillance assessments from Asia. Expert researchers were contacted to identify unpublished or in-press data not identified through other search methods, although data were only included if the studies met all inclusion criteria.

Studies of any design were included that measured the prevalence or incidence of HIV among female sex workers, even if sex workers were not the main focus of the study. Studies were accepted if clear descriptions of HIV testing methods were included such as laboratory-derived HIV status with biological samples from blood, urine, or oral specimens. Only studies from countries defined as low income or middle income on the basis of The World Bank Atlas Method including all countries with a gross national income of US$12,275 per head or less were included. To be included, clear descriptions of the sampling, HIV testing, and analytical methods were required with sources including peer-reviewed journals and non-peer-reviewed publications meeting other criteria with online availability in the public domain. Studies published in English, French, Spanish, or Portuguese were included.
Studies were excluded if the sample size of female sex workers was less than 50 in a study including other populations or if the total sample size was less than 50 in studies that only included female sex workers. Additionally, studies that only included self-reported HIV status rather than biological testing were excluded from the analysis.

**Screening and data extraction**

All publications were originally screened by two independent reviewers (KM and TP) to include those that potentially included data about HIV prevalence, were not included in duplicate, and originated from low-income or middle-income countries. If either author classed a publication as relevant, the abstract was reviewed. Two independent reviewers (KM and TP) examined the abstracts of the remaining articles and retained those that either clearly met the inclusion criteria or for whom the full text of the article had to be reviewed before a final decision about inclusion could be made. If either author classed an article as relevant, a full-text copy was obtained. Review of these full-text articles was done by two independent reviewers (KM and TP). Subsequently, data were extracted by two trained coders with standardised data extraction forms that included details about study design, methods of recruitment, location, sample size, period of study, and middle-income countries. If either author classed a population as relevant, the abstract was reviewed. Two independent reviewers (KM and TP) to include those that either clearly met the inclusion criteria or for whom the full text of the article had to be reviewed before a final decision about inclusion could be made. If either author classed an article as relevant, a full-text copy was obtained. Review of these full-text articles was done by two independent reviewers (KM and TP). Subsequently, data were extracted by two trained coders with standardised data extraction forms that included details about study design, methods of recruitment, location, sample size, period of study.

**Statistical analysis**

The prevalence for all reproductive age women in the general population was calculated using 2009 data from the UNAIDS report to assess the number of women, aged 15 years or older, living with HIV in each country as the numerator. The denominator used to measure HIV prevalence among women in the general population was assessed in two ways: data from the US Census Bureau International Division was used to assess the total number of women who were aged 15 years or older and also the total number of women of reproductive age, or those between the ages of 15 and 49 years. The meta-analysis represents the increased odds of being HIV seropositive for female sex workers compared with all women; it was completed with the Mantel-Haenszel method with a random-effects model with the assumption that the HIV prevalence in one country was independent of the HIV prevalence in other countries. A standard correction of 0·5 was added to all zero cells with STATA (version 11). Heterogeneity testing was done with the DerSimonian and Laird’s Q test. The data are presented in the form of forest plots including the odds ratio, its 95% CI, and the relative weight of any particular study in estimating the summary odds ratio for all countries.

Meta-analyses of subgroups of countries by prevalence level and region were also done. The following categorisation scheme classed the HIV prevalence among women of reproductive age or those aged 15–49 years as very low prevalence (<0·5% living with HIV), low prevalence (0·5–1·0%), medium prevalence (1·1–5·0%), and high prevalence (>5%). A similar approach was used for systematic review of MSM in low-income and middle-income countries. As a sensitivity analysis, we used the two different aforementioned calculated background rates. No significant difference was detected between estimates calculated with these two methods. However, since women older than 49 years of age contribute relatively few infections in most low-income and middle-income countries, use of the background rate calculated with the numerator for women older than 15 years of age and the denominator for those aged between 15 and 49 years was deemed to be a more conservative approach. As of 2009, UNAIDS did not produce estimates of the number of people living with HIV in Afghanistan, Laos, and Albania and thus these countries were excluded from the meta-analysis.

**Figure 1: Flow chart of included studies**

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19180 potentially relevant studies

18765 excluded

18682 duplicates excluded

1783 study titles did not relate to sex work or HIV

415 retrieved for review

118 potentially relevant surveillance reports

99 excluded

99 did not have quantitative data, geographical context, sample size, and self-reported HIV status

19 retrieved for further analysis

183 excluded

183 did not have quantitative data or HIV status among sex workers in low-income and middle-income countries

232 retrieved for further analysis

141 excluded

141 had small sample size (<50 participants), paucity of information on sampling, or absence of biological confirmation of HIV status

8 excluded

8 did not have HIV prevalence data and country population HIV prevalence could not be calculated

102 included in the analysis
To quantify the number of infections among women of reproductive age attributable to infections among female sex workers, estimates of HIV prevalence among female sex workers by country and region characterised primarily by Vandepitte and colleagues were used unless more recent data were available. When an estimate of the total number of female sex workers by country was available this estimate was used; otherwise a regional estimate was used. In each case, the lowest estimate in the range provided was used to be conservative. To complete the meta-analysis, we used estimates of the proportion of HIV cases among women attributable to female sex workers, by country.

**Role of the funding source**
The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

**Results**
Our search criteria identified 19 180 citations, of which

<table>
<thead>
<tr>
<th>Country</th>
<th>Sample size</th>
<th>HIV prevalence among female sex workers (95% CI)</th>
<th>HIV prevalence among female population</th>
<th>Odds ratio (95% CI)</th>
<th>Prevalence level*</th>
<th>% HIV infections among female sex workers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afghanistan</td>
<td>544</td>
<td>0·2% (0·0–0·5)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>9383</td>
<td>0·2% (0·1–0·3)</td>
<td>0·00%</td>
<td>47·8 (30·8–74·3)</td>
<td>Very low</td>
<td>9·5%</td>
</tr>
<tr>
<td>Cambodia</td>
<td>160</td>
<td>23·1% (16·6–29·7)</td>
<td>0·86%</td>
<td>34·8 (24·1–50·3)</td>
<td>Low</td>
<td>8·1%</td>
</tr>
<tr>
<td>China</td>
<td>18 773</td>
<td>3·0% (2·8–3·3)</td>
<td>0·06%</td>
<td>50·0 (46·0–54·4)</td>
<td>Very low</td>
<td>48·6%</td>
</tr>
<tr>
<td>India</td>
<td>13 386</td>
<td>13·7% (13·3–14·3)</td>
<td>0·29%</td>
<td>54·3 (51·7–57·0)</td>
<td>Very low</td>
<td>23·5%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>7482</td>
<td>4·9% (4·4–5·4)</td>
<td>0·14%</td>
<td>38·0 (34·2–42·2)</td>
<td>Very low</td>
<td>14·5%</td>
</tr>
<tr>
<td>Laos</td>
<td>1422</td>
<td>0·5% (0·1–0·9)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Malaysia</td>
<td>552</td>
<td>10·7% (8·1–13·3)</td>
<td>0·15%</td>
<td>81·2 (62·0–106·5)</td>
<td>Very low</td>
<td>65·4%</td>
</tr>
<tr>
<td>Mongolia</td>
<td>931</td>
<td>0·0% (0·0–0·0)</td>
<td>0·02%</td>
<td>2·4 (0·2–39·1)</td>
<td>Very low</td>
<td>0·0%</td>
</tr>
<tr>
<td>Nepal</td>
<td>1687</td>
<td>8·3% (7·0–9·6)</td>
<td>0·26%</td>
<td>35·0 (29·4–41·6)</td>
<td>Very low</td>
<td>64·4%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>5999</td>
<td>0·1% (0·0–0·1)</td>
<td>0·06%</td>
<td>0·8 (0·3–2·5)</td>
<td>Very low</td>
<td>0·3%</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>205</td>
<td>16·6% (11·5–21·7)</td>
<td>1·20%</td>
<td>16·1 (10·1–25·7)</td>
<td>Medium</td>
<td>5·6%</td>
</tr>
<tr>
<td>Thailand</td>
<td>319</td>
<td>11·9% (8·4–15·5)</td>
<td>1·15%</td>
<td>11·6 (8·3–16·3)</td>
<td>Medium</td>
<td>2·1%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>3381</td>
<td>6·5% (5·7–7·3)</td>
<td>0·32%</td>
<td>22·0 (19·2–25·2)</td>
<td>Very low</td>
<td>4·1%</td>
</tr>
<tr>
<td><strong>Eastern Europe</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albania</td>
<td>92</td>
<td>1·1% (0·0–3·2)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Estonia</td>
<td>433</td>
<td>8·1% (5·5–10·7)</td>
<td>0·95%</td>
<td>9·1 (6·5–12·9)</td>
<td>Low</td>
<td>9·3%</td>
</tr>
<tr>
<td>Georgia</td>
<td>234</td>
<td>0·4% (0·0–1·3)</td>
<td>0·13%</td>
<td>3·3 (0·5–23·8)</td>
<td>Very low</td>
<td>2·3%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>2278</td>
<td>12·9% (11·5–14·3)</td>
<td>1·46%</td>
<td>10·0 (8·9–11·3)</td>
<td>Medium</td>
<td>3·6%</td>
</tr>
<tr>
<td><strong>Latin America and the Caribbean</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>625</td>
<td>3·2% (1·8–4·6)</td>
<td>0·34%</td>
<td>9·6 (6·1–15·0)</td>
<td>Very low</td>
<td>1·9%</td>
</tr>
<tr>
<td>Brazil</td>
<td>90</td>
<td>6·7% (5·1–11·8)</td>
<td>0·47%</td>
<td>15·3 (6·7–34·9)</td>
<td>Very low</td>
<td>10·0%</td>
</tr>
<tr>
<td>Chile</td>
<td>626</td>
<td>0·0% (0·0–0·0)</td>
<td>0·27%</td>
<td>0·3 (0·0–4·6)</td>
<td>Very low</td>
<td>0·0%</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1110</td>
<td>4·4% (3·2–5·6)</td>
<td>0·58%</td>
<td>7·9 (5·9–10·5)</td>
<td>Low</td>
<td>4·6%</td>
</tr>
<tr>
<td>El Salvador</td>
<td>484</td>
<td>3·3% (1·7–4·9)</td>
<td>0·67%</td>
<td>5·1 (3·1–8·3)</td>
<td>Low</td>
<td>3·0%</td>
</tr>
<tr>
<td>Guyana</td>
<td>450</td>
<td>27·6% (23·4–31·7)</td>
<td>1·48%</td>
<td>25·3 (20·5–31·2)</td>
<td>Medium</td>
<td>11·2%</td>
</tr>
<tr>
<td>Honduras</td>
<td>493</td>
<td>9·7% (7·1–12·4)</td>
<td>0·59%</td>
<td>18·1 (13·5–24·5)</td>
<td>Low</td>
<td>9·9%</td>
</tr>
<tr>
<td>Jamaica</td>
<td>433</td>
<td>8·8% (6·1–11·4)</td>
<td>1·31%</td>
<td>7·3 (5·2–10·1)</td>
<td>Medium</td>
<td>4·0%</td>
</tr>
<tr>
<td>Mexico</td>
<td>4742</td>
<td>6·2% (5·6–6·9)</td>
<td>0·19%</td>
<td>35·0 (31·1–39·4)</td>
<td>Very low</td>
<td>19·8%</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>460</td>
<td>2·2% (0·8–3·5)</td>
<td>0·13%</td>
<td>16·8 (8·9–31·4)</td>
<td>Very low</td>
<td>9·9%</td>
</tr>
<tr>
<td>Paraguay</td>
<td>723</td>
<td>2·8% (1·6–4·0)</td>
<td>0·22%</td>
<td>12·8 (8·2–19·9)</td>
<td>Very low</td>
<td>7·5%</td>
</tr>
<tr>
<td><strong>Middle East and North Africa</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>118</td>
<td>0·8% (0·0–2·5)</td>
<td>0·01%</td>
<td>73·2 (10·2–524·1)</td>
<td>Very low</td>
<td>36·3%</td>
</tr>
<tr>
<td>Lebanon</td>
<td>95</td>
<td>0·0% (0·0–0·0)</td>
<td>0·10%</td>
<td>5·4 (0·3–87·5)</td>
<td>Very low</td>
<td>0·0%</td>
</tr>
<tr>
<td>Somalia</td>
<td>237</td>
<td>5·5% (2·6–8·4)</td>
<td>0·67%</td>
<td>8·6 (4·9–15·0)</td>
<td>Low</td>
<td>29·4%</td>
</tr>
<tr>
<td>Sudan</td>
<td>321</td>
<td>0·9% (0·0–2·0)</td>
<td>1·32%</td>
<td>0·7 (0·2–2·2)</td>
<td>Medium</td>
<td>2·6%</td>
</tr>
<tr>
<td>Tunisia</td>
<td>188</td>
<td>0·0% (0·0–0·0)</td>
<td>0·03%</td>
<td>8·0 (0·5–128·7)</td>
<td>Very low</td>
<td>0·0%</td>
</tr>
</tbody>
</table>

(Continues on next page)
2240 were unique records (figure 1). Of 434 selected articles and surveillance reports, data from 102 met inclusion criteria. These studies included 91 articles and 11 surveillance reports representing 99,878 female sex workers in 50 countries: 14 countries in Asia, four in the eastern Europe, 11 in Latin America and the Caribbean, five in the Middle East and north Africa, and 16 countries in sub-Saharan Africa (figure 1, table 1).

The overall HIV prevalence among female sex workers in all regions was 11·8% (95% CI 11·6–12·0; table 1) with notable variation by region, reflective of background rates of HIV. The highest prevalence of HIV was in sub-Saharan Africa, followed by eastern Europe, Latin America and the Caribbean, and Asia; the lowest rate was in the Middle East and north Africa (table 2).

The overall estimate for the odds ratio for a female sex worker to be living with HIV compared with all women of reproductive age in low-income and middle-income countries was 13·5 (95% CI 10·0–18·1; table 1) with high heterogeneity (I²=99·3%; test of odds ratio=1, Z=17·27, p=0·0001).

### Table 1: Meta-analyses of aggregate country data comparing HIV prevalence among female sex workers and women of reproductive age in low-income and middle-income countries, 2007–11

<table>
<thead>
<tr>
<th>Region</th>
<th>Prevalence level</th>
<th>Number of countries</th>
<th>Sample size of sex workers with HIV (95% CI)</th>
<th>Sample size of sex workers (95% CI)</th>
<th>Pooled HIV prevalence (95% CI)</th>
<th>Background prevalence</th>
<th>Pooled odds ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>Very low or low*</td>
<td>14</td>
<td>3323 (3197–3449)</td>
<td>64,224</td>
<td>5·2% (5·0–5·3)</td>
<td>0·38%</td>
<td>29·2 (22·2–38·4)</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td></td>
<td>4</td>
<td>331 (330–333)</td>
<td>3037</td>
<td>10·9% (9·8–12·0)</td>
<td>0·20%</td>
<td>NA</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td></td>
<td>11</td>
<td>627 (624–630)</td>
<td>10,337</td>
<td>6·1% (5·7–6·6)</td>
<td>0·38%</td>
<td>12·0 (7·3–19·7)</td>
</tr>
<tr>
<td>Middle East and north Africa</td>
<td></td>
<td>5</td>
<td>17 (17–17)</td>
<td>959</td>
<td>1·7% (0·9–2·6)</td>
<td>0·43%</td>
<td>NA</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td></td>
<td>16</td>
<td>7899 (7899–7899)</td>
<td>21,421</td>
<td>36·9% (36·2–37·5)</td>
<td>7·42%</td>
<td>12·4 (8·9–17·2)</td>
</tr>
</tbody>
</table>

### Table 2: Subgroup meta-analysis of pooled odds ratios for HIV infection among female sex workers, by region and prevalence level

<table>
<thead>
<tr>
<th>Region</th>
<th>Prevalence level</th>
<th>Number of countries</th>
<th>Sample size of sex workers with HIV (95% CI)</th>
<th>Sample size of sex workers (95% CI)</th>
<th>Pooled HIV prevalence (95% CI)</th>
<th>Background prevalence</th>
<th>Pooled odds ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>Very low or low*</td>
<td>21</td>
<td>3561 (3427–3708)</td>
<td>69,729</td>
<td>5·1% (4·9–5·3)</td>
<td>0·17%</td>
<td>24·5 (19·1–31·3)</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td></td>
<td>26</td>
<td>8627 (8516–8739)</td>
<td>28,075</td>
<td>30·7% (30·2–31·3)</td>
<td>5·47%</td>
<td>11·6 (9·1–14·8)</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td></td>
<td>50</td>
<td>12,197 (12,100–12,297)</td>
<td>99,878</td>
<td>11·8% (11·6–12·0)</td>
<td></td>
<td>13·5 (10·0–18·1)</td>
</tr>
</tbody>
</table>

*Very low (<0·5%), low (0·5–1·0%). †Medium (1·1–5·0%), high (>5·0%). ‡Meta-analysis of prevalence does not include Afghanistan, Laos, and Albania.
countries was 13·5 (95% CI 10·0–18·1; table 2). The highest pooled odds ratio for HIV infection among sex workers was seen in Asia, followed by sub-Saharan Africa. The lowest odds ratio was seen in Latin America and the Caribbean (table 2). Sex workers from countries with very low or low HIV prevalence had higher odds of infection than did sex workers from countries with medium or high HIV prevalence among all women (figures 2, 3).

Sensitivity analyses compared whether there would be a difference in odds ratio when comparing the HIV prevalence rates among female sex workers with that of all women, including sex workers, or comparing them with women who do not sell sex. Globally, no substantially different magnitude in the relation between these two scenarios was seen. However, in China, India, Malaysia, Egypt, and Rwanda a substantial increase was reported in the odds ratio of HIV infection among female sex workers when compared with women who do not sell sex rather than all women of reproductive age. In each of these countries, more than 20% of prevalent HIV infections among women were attributable to female sex workers (table 1). To be conservative, the odds ratios we report refer to the comparison of female sex workers with that of all women of reproductive age, including female sex workers.

Discussion

We identified consistent evidence of substantially higher levels of HIV among female sex workers compared with all women of reproductive age in low-income and middle-income countries in all regions with data. Although female sex workers have long been understood to be a key affected population, the scope and breadth of their disproportionate risk for HIV infection had to date not been systematically documented.

The largest sample size was available from Asia (table 1), where we reported the highest relative burden of disease (table 2). While some countries such as Thailand showed a trend towards higher prevalence in the 1990s, surveillance data have shown an increasingly concentrated HIV epidemic in populations who are most at risk.\textsuperscript{143} Responses such as the 100% condom campaign have been heralded as successes, though HIV prevalence is a lagging indicator of prevention success, time is needed to reveal the benefit of these programmes in terms of the absolute burden of HIV among female sex workers in India. Nonetheless, the disproportionate burden of HIV among these sex workers, even in settings where progressive

![Figure 2: Forest plot showing meta-analysis of risk of HIV infection among female sex workers compared with women aged 15–49 years in low-income and middle-income countries, 2007-11](http://www.thelancet.com/infection)
programmes exist, emphasises the need to increase coverage by increasing scale of prevention programmes and decreasing barriers to access.

HIV in Latin America and the Caribbean has remained a disease mostly concentrated among populations who are most at risk since the beginning of the epidemic. With low background prevalence and early recognition of the high risk among sex workers in Latin America and the Caribbean, HIV prevalence has a limited magnitude among sex workers in the region. Brazil famously declined USAID funding over the need to sign the “Prostitution Pledge”, which was mandated as part of the President’s Emergency Plan for AIDS Relief (PEPFAR) in 2003, and would have limited the ability to do comprehensive surveillance and service provision for sex workers. Consequently, Brazil has continued to invest in HIV prevention for sex workers throughout the country. In these analyses, Guyana was an anomaly in that female sex workers had more than 25-times increased odds of HIV infection. These analyses show that the HIV epidemic among female sex workers in Latin American and the Caribbean is not over, because these women have more than ten-times increased odds of having HIV than other women.

Sufficient data were not available to warrant meta-analyses of HIV prevalence among female sex workers in eastern Europe and the Middle East and north Africa. Most data in eastern Europe was derived from Ukraine, and in the Middle East and north Africa the combined data from the studies represented less than a thousand sex workers. The studies that have been done in these regions show that sex workers exist and that prevalence of HIV, although low in these settings, is concentrated among these women. In view of the importance of parenteral transmission of HIV through injection drug use in eastern Europe, characterisation of the synergies between epidemics of injection drug use and injection drug use among female sex workers in this region is important to guide prevention.

While wide variation in the prevalence of HIV exists across western, eastern, and southern Africa, the prevalence of HIV among female sex workers is high in each of these regions (table 1). Variation in the relative odds of infection among these women seems to be largely attributable to high background rates of HIV prevalence among all adults in hyperendemic zones, especially in southern regions of Africa. According to UNAIDS criteria, these countries have generalised epidemics because the HIV prevalence among women of reproductive age (as measured in antenatal clinics) is higher than 1%. Application of the system used by Stover and colleagues showed that these prevalence levels correspond to medium-prevalence and high-prevalence HIV epidemics. Overall, even in generalised epidemics in sub-Saharan Africa, female sex workers have more than 12-times increased odds of living with HIV as compared with all women. Similarly, in other medium and high HIV-prevalence settings, or generalised HIV epidemics, the odds ratio for HIV infection was high. These findings counter the notion that female sex workers play a less relevant part in the transmission of HIV in generalised epidemics.

The largest body of data about HIV prevalence among female sex workers in Africa was available from Kenya where in 2010, the Kenyan National AIDS and STI Control Program (NASCOP) developed a set of National Guidelines for HIV and STI Programmes for sex workers. These guidelines were developed in response to the Kenya National HIV Strategic Plan (KNASP III) 2009–13, which identified that female sex workers were a population who are most at risk and that barriers existed that limited their access to health and social services.

![Figure 3: Map of HIV prevalence among female sex workers in low-income and middle-income countries including data from 2007–11, categorised by HIV prevalence and pooled HIV prevalence estimates by region](image-url)
because some of their work is both criminalised and stigmatised by society. Encouragingly, incidence rates of HIV have been decreasing among some groups of female sex workers in Kenya, signalling decreasing HIV incidence in the general population.

In Pakistan, Chile, and Sudan the odds ratio for HIV associated with sex work suggested a trend towards this practice being protective, though this trend was not significant in any of these countries. Moreover, in Mongolia and Madagascar, the odds ratio for HIV among female sex workers was also not significantly increased. These results are likely to have some combination of truth and artefact. Non-probability samples of female sex workers could have underestimated the actual HIV prevalence in the population. However, in each of these countries except for Sudan, most prevalent HIV infections in 2009 were among men with risk factors including same-sex practices and injecting drug use. In Sudan, competing risk factors exist for HIV including migration and rape, which might, in part, account for these results.

Our study had several limitations. The focus on data from the past 5 years with an inclusion criterion of January, 2007, excluded data from many countries. While this exclusion represents a limitation, the aim of this study was to characterise current burdens of HIV in female sex workers. Any pooling of data comes at the risk of masking intracountry and intercountry variations in the risk status, including practices and HIV prevalence, and variations in the social contexts of female sex workers. Such masking in the variation of risk status is relevant in India and China, which have wide geographical variations in HIV prevalence and risk factors for HIV infection. Furthermore, these estimates are of limited generalisability since most studies were done in urban settings; female sex workers working in more rural settings, border areas, and truck stops were under-represented. The pooled estimates also mask differences between various contexts in which sex work is practised including establishment-based versus non-establishment-based sex work or additional risk factors among sex workers including injecting drug use and migration. There was significant heterogeneity of the HIV-prevalence results included in the meta-analysis, because these studies were from different populations of female sex workers in different countries. To account for this difference, a random-effects model was used for the meta-analysis.

The comparison of HIV prevalence rates among female sex workers and all women was conservative since HIV infections were included in the estimates provided by UNAIDS for all women of reproductive age. To address this issue, a sensitivity analysis was done to account for prevalent infections among women of reproductive age attributable to female sex workers, after which we undertook the meta-analysis. The size of the global pooled estimate did not change though it did change in certain countries where a high proportion of HIV in women is attributable to sex work. While the pooled analysis is limited in relation to the heterogeneity estimates by country, it does show the continued disease burden among female sex workers, and their continued need for services. A recent report on the investment framework for the global response to HIV/AIDS suggested that current allocation of resources for sex workers was adequate. This analysis, contextualised by evidence that female sex workers living with HIV have more sexual partners than other women of reproductive age living with HIV and have higher rates of STIs facilitating HIV transmission, suggests that more resources are needed to address these subepidemics.

This report shows that 50 of 145 low-income and middle-income countries have published data for the past 5 years that include biological assessments of HIV prevalence among female sex workers (figure 3). In other words, about two-thirds of low-income and middle-income countries do not have a current estimate of the burden of HIV in this population. Possible explanations for these gaps in the data include social stigma, criminalisation of sex work, and the “Prostitution Pledge”, which conflated the issue of sex work and human trafficking and substantially reduced research funding and investigator interest in this area.

These findings suggest an urgent need to scale up access to quality HIV-prevention programming and services among female sex workers because of their heightened burden of disease and likelihood of onward transmission through high numbers of sexual partners as clients. In view of the high burden of HIV among female sex workers and recent biomedical advances related to treatment as prevention, improvement of linkages to antiretroviral treatment, and retention in care, ongoing prevention for sex workers already living with HIV is crucial. The substantially increased odds of living with HIV among sex workers merits continued research regarding the role of not only behavioural but also structural factors associated with HIV in this population. Considerations of the legal and policy environments in which sex workers operate, and the important role of stigma, discrimination, and violence targeting female sex workers globally will be required to reduce the disproportionate disease burden among these women.

Contributors
SB, DK, and CB designed the study. SB and TP developed and implemented the search protocol. KM, AW, and TP abstracted data with SB acting as a tiebreaker at all stages. ALW developed the global prevalence map. MRD and SGS provided technical support at all stages. All authors wrote the report.

Conflicts of interests
We declare that we have no conflicts of interest.

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References


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