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Sexually transmitted infections in sex workers

A systematic review

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Executive summary

Introduction

Sex work spans a wide range of activities, and is defined in this review as the provision of sexual services in exchange of money and goods.

Objective

The objective of this review is : to investigate whether sex workers (SWs) have an increased risk to be affected by sexually transmitted infections (STIs).

Sex workers are a priority population for public health and may experience vulnerability for a number of health issues, including those related to mental health, sexual health, substance use and interpersonal violence. Therefore, it should be realized that STIs are not the sole health issue sex workers are confronted with.

Methodology

We used the results from the systematic review by Acke et al (2022) for the period from January 1, 2009 until December 8, 2020 and a PubMed search was done using (prevalence STI+) AND (sex worker+) for the period December 9, 2020-March 1st 2023 . Together they yielded 33 articles on prevalence of STIs in high income countries . The prevalence in SW was compared with that of the general population (UNAIDS data for infections by HIV and WHO prevalence estimates for infections by *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Trichomonas vaginalis* and *Treponema pallidum*) .

Results

The results are given for female sex workers (FSWs) Table 3), male sex workers (MSWs) (Table 4) and transgender sex workers (TGSWs) (Table 5).

Comparison of STI prevalence in FSWs with that in the general population

Infections by HIV

In 9 of 15 studies retrieved, the prevalence of infections by HIV was at least 4 times higher in FSWs than in the general population. As for the other 6 studies, in 4 studies the prevalence was between 2 and 3,5 times higher than in the general population. In 1 study(Melbourne) the prevalence was lower in FSWs than in the general population, the authors explain that FSWs in legalized brothels (in Australia), generally have a low STI prevalence; in 1 study (Lausanne) the seropositivity was 0.

Infections by *N.gonorrhoeae* and *C.trachomatis*

Comparing with the WHO data, in 8/12 studies, the prevalence of infections by *N.gonorrhoeae* is more than 4 times higher than in the general population, in 2 studies it was 2 times higher and in 2 studies (Lausanne and Melbourne) the prevalence was lower. As for infections by *C.trachomatis*, in 1/12 studies, the prevalence in FSWs was 4 times that in the general population; in 10/12 other studies the prevalence in FSWs was higher than in the general population (up to 6 times) except in Catalunia.

Syphilis (*T.Pallidum*)

in 7/11 studies, the prevalence of *T.pallidum* infections was at least 4 times higher in FSWs than in the general population (WHO data). In the other studies: In Melbourne, the same explanation as for infections by HIV is valid. In Amsterdam, the authors did not discuss the results of *T.pallidum* infections specifically, but the place of the study was the Prostitution & Health Center

(P&G292) where SWs are offered STI consultations regularly, the same applies to GUM (genitourinary medicine) clinics in UK. In Rome, the authors mention the young age and the short period the women had been in prostitution as an explanation.

Hepatitis B and C

In 2 of 4 studies on infections by HBV, the prevalence of HBV-infections is more than 4 fold higher than in the general population and in 2 other the prevalence of HBV-infections was somewhat higher that in the general population. Two studies on infections by HCV indicate that it is not an important problem in the locations studied

Infections by HPV

The results of all 4 studies show a 2 to 4 fold increase in prevalence in FSWs, compared to the general population.

Infections by *T.vaginalis*

In 3/4 studies retrieved, the prevalence in FSWs -was more than 4 times higher than in the general population (WHO data), except in England, where it was only slightly higher.

Infections by *Mycoplasma genitalium* and genital herpes

The number of studies is low and the results are inconsistent.

Comparison of STI prevalence in MSWs with that in the general population

The number of studies comparing STIs in male sex workers (MSWs) to the general population of men having sex with men (MSM) is limited ; in this review 3 studies on infections by HIV, 4 studies on *T.Pallidum* infections , 3 studies on *N.gonorrhoeae* infections and infections by C.trachomatis, 2 studies on infections by HBV and one study on infections by HSV2 . The results show consistently a higher prevalence compared with the general population with one exception : a study on *T.pallidum* infections in Tel Aviv. The prevalence of infections by HIV was more than 4 fold higher in 2/3 studies, that of *T.pallidum* and *N.gonorrhoeae* infections in 1 study, that of infections by HBV in 2 studies; the prevalence of infections by *C.trachomatis* was increased but not 4 times. Actually the risks of most STIs are not as large as in FSW, probably due to a higher prevalence in the comparison group of MSM.

Comparing STI prevalence in TGSWs with that in other populations

The number of studies in TGSWs is limited; in this review 3 studies on infections by HIV, 2 on *N.gonorrhoeae* and *C.trachomatis* infections and 1 on infections by *T.Palladum* and 1 on *T.vaginalis* infections. Using the UNAIDS data on infections by HIV and WHO data for selected STIs for both men and women, it appears that the prevalence of infections by HIV, *T.pallidum* , *N.gonorrhoeae*, infections by *C.trachomatis* and *T.vaginalis* in TGSWs is comparable in transgender SWs and NSWs, but is much higher (more than 4 times) than in the general population. One possible explanation is that 24-75% of trans women reported to have participated in sex work in their life time.

Prevention of STIs in sex workers

Behavioural and biomedical interventions for prevention are only moderately successful in reducing STIs at population level.

Suboptimal access to health and STI prevention services remains concerning. **Better access to health and STI prevention services** can lead to lower rates of STIs in SW

Vaccination against infections by HPV and by HBV is clearly an option, confirmed in a recent WHO position paper.

Meningococcal serogroup B vaccines for the prevention of gonorrhoea (effectiveness 32-42%) have been advised by the Joint Committee on Vaccination and Immunisation (JCVI) in the United Kingdom.

In an overview in the *Lancet*, the **decriminalization of sex work** has now been demonstrated to have the largest potential to reduce HIV infections in sex work, estimated to avert 33-46 % of new HIV infections among SWs over the next decade.

Conclusions

From this review it appears that SWs -female as well as male and transgender- have a higher prevalence for a number of well-known STIs i.c. infections by HIV, *N.gonorrhoeae*, infections by *C. trachomatis*, *T.vaginalis* and infections by HBV. Studies in FSWs also show an increased risk for infections by HPV.
Studies in MSWs show a clearly increased risk for Infections by *T.pallidum* as do most studies in FSWs; in the studies not showing an increased risk, this was probably due to good health care. The risks for most STIs in TG-assigned male at birth(AMAB) SWs (infections by HIV, N.gonorrhoeae, infections by *C.trachomatis*, *T.pallidum*) was much higher than in the general male or female population.
For a few STIs conclusions are difficult , because the number of studies is limited : infections by HCV, infections by *Mycoplasma genitalium* and herpes.
A number of preventive strategies are available: behavioural and biomedical interventions, optimal access to health and STI prevention services, vaccination and decriminalization of sex work.

Introduction

Sex work spans a wide range of activities, but is defined in this review as the provision of sexual services in exchange of money and goods. Sex workers are a heterogeneous population: there is extensive variability in the structural, economic social and legal context in which they work and in their health and social needs (Johnson et al; 2023).

Sexually transmitted infections (STIs)

Sexually transmitted diseases (STDs), also known as sexually transmitted infections (STIs), are very common.
STIs pass from one person to another through vaginal, oral, and anal sex. They also can spread through intimate physical contact like heavy petting, though this is not very common.
STIs don't always cause symptoms or may only cause mild symptoms. Therefore, it is possible to have an infection and not know it. All STIs are treatable with medicine and some are curable entirely (CDC;2023).

According to a World Health Organization (WHO) publication dating from 2013 , more than 30 bacterial, viral and parasitic pathogens are transmissible sexually and constitute a group referred to as sexually transmitted infections (STIs). Although some of the pathogens can be acquired through routes other than sexual transmission, epidemiologically, sexual contact is more important for their transmission from one person to another. The list of main sexually transmitted pathogens is given in Table 1 (Unemo; 2013).

In recent publications of the WHO , there is no list of STIs as such but a number of STIs are mentioned in the text. In the "Guidelines for the management of symptomatic sexually transmitted infections" dating from 2021 , 11 sexually transmitted infections are mentioned (WHO;2021); in a publication dating from 2022, different hepatitis infections (A,B,C,D) are added and also cervical cancer as a complication of HPV infection (WHO;2022)

In a recent review on diagnosis and treatment of STIs the following STIs were mentioned : gonorrhoea, chlamydia (including lymphogranuloma venereum), syphilis, *Mycoplasma genitalium*, trichomoniasis and herpes simplex virus type 1 & 2 (Tuddenham et al;2022).

Sciensano mentions on its website " the most diagnosed STIs : chlamydia, gonorrhoea, syphilis, chancroid (*Haemophilus ducreyi*), *Mycoplasma genitalium*, genital herpes (HSV), human papillomavirus (HPV), HIV, hepatitis B virus (HBV), hepatitis C virus (HCV) and trichomoniasis" (www.sciensano.be/nl/gezondheidsonderwerpen/seksueel-overdraagbare -infectie-soi#de-meest-gediagnosticeerde-soa) (Sciensano;2023).

In conclusion, there seems to be some confusion in the international literature as to the list of STIs. For the purpose of this review, we propose to include those infections on which there is a consensus i.c. *Chlamydia trachomatis* (chlamydia) , *Neisseria gonorrhoeae* (gonorrhoea), *Treponema pallidum* (syphilis), *Haemophilus ducrey* (chancroid), *Mycoplasma genitalium*, herpes simplex (genital herpes), human papillomavirus (HPV), human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and *Trichomonas vaginalis* (trichomoniasis). These are also mentioned by the Minister of Social Affairs In his request for this review and Fedris, which is responsible for this review.

Research question

The research question of this review has been formulated by the Minister of Social Affairs and Health in his request to Fedris : to investigate whether sex workers have an increased risk to be infected by sexually transmitted infections, which have already been recognized as occupational diseases for health care workers in the Royal Decree of 28-03-1969, establishing the list of occupational diseases which can be compensated and establishing the criteria of exposure to the occupational risk (1.404.02 ; viral hepatitis and 1.404.03 other infections in health care workers).

Sex workers and health

Sex workers include female (FSWs), male (MSWs), trans and gender diverse (TGSW) adults (18 years of age and above) who receive money or goods in exchange for sexual services, either regularly or occasionally. Sex work is consensual sex between adults, can take many forms, and varies between and within countries and communities. Sex work also varies in the degree to which it is more or less ”formal”, or organized . Increasingly, sex workers are meeting and staying in contact with their clients online (WHO; 2022).

In a recent systematic review, health outcomes in sex workers were reviewed (McCann et al;2021). Sex workers are a priority population for public health and there is growing support for occupational health and safety approaches to support sex worker health. Sex workers may experience vulnerability for a number of health issues, including those related to mental health, sexual health, substance use and interpersonal violence. A recent study found higher rates of alcohol use, illicit drug use, and experiences of violence amongst sex workers compared to the general population. Similar outcomes have been noted in other research, with concerns raised for the human rights of sex workers in response to increasing rates of violence, alcohol and drug use. Health issues in this population are exacerbated by the experience of discrimination and stigma, leading to reduced health service seeking behaviour. Therefore, it should be realized that STIs are not the sole health issue sex workers are confronted with (McCann et al; 2021).

Stigma, discrimination and punitive legal and social environments are key elements of increased HIV vulnerability and therefore it is not surprising that the global burden of HIV among female sex workers (FSWs) is an estimated 30 times higher than among all women, according to UNAIDS estimates. For sex workers who also inject drugs, a lack of non-stigmatising needle and syringe exchange and treatment programmes also adds to the burden of common HIV comorbidities such as HBV and HCV. Sex workers are also at greater risk for poor mental health, social exclusion, and violence-including homicide, a too common cause of death for sex workers. Faced with these health risks, there is a need to protect and support the health and lives of sex workers (Lancet Editorial; 2023)

Sex workers face an increased burden of STIs and blood-borne infections (STBBIs). The average reported prevalence of active syphilis among sex workers (gender not defined) according to WHO is 10.8% (range 5.8% to 30.3%) While less is known about the prevalence or incidence of other STIs (including hepatitis infections) among sex workers, increased rates have been documented in different contexts around the globe (Argento et al;2019, WHO, GHO, 2020).
Sex workers face high levels of stigma and criminalization almost everywhere. Modelling studies indicate that decriminalizing sex work could lead to a 46% reduction in new HIV infections in sex workers over 10 years, while eliminating sexual violence against sex workers could lead to a 20% reduction in new HIV infections (WHO; 2023).

Prevalence of STIs in sex workers

As already pointed out, there are indications that the prevalence of STIs in sex workers is higher than in the general population, but within the Belgian framework of specific work-related risks and social protection, including possible compensation and prevention, there is a need for detailed and concrete data on prevalence of STIs in sex workers compared to the general population in Belgium and/or comparable high -income countries. This topic has already been explored in two relatively recent systematic reviews, one on factors mediating HIV risk among FSWs in Europe (Platt et al;2013) and one, more recent, of infectious disease risk associated with occupational exposure among non-healthcare workers by Acke et al (Acke et al; 2022). As the first systematic review was published already 10 years ago, we used the results only as background for our present review.

In the first systematic review, the authors systematically-searched MEDLINE, EMBASE, Global Health, Social Science Citation Index, Popline and CINAHL for studies published from 2005 to 20 October 2011. They included reports written in English, Spanish, French and Russian published from 2000 to 2011 based on studies reporting rates on HIV prevalence or incidence; syphilis, chlamydia and gonorrhoea. Following full-text review, 73 peer-reviewed and grey literature documents were identified as meeting the selection criteria of which 63 papers provided unique estimates of HIV and STI prevalence and nine papers report multivariate or univariate risk factors for HIV/STI among FSWs.

The results of this systematic review showed a relatively low prevalence of HIV in Europe among FSWs who do not inject drugs (<1 %), but the prevalence of other STIs was high, particularly syphilis in Eastern Europe (up to 35% in Kyrgyzstan) and gonorrhoea (up to 18% in Georgia). FSWs experienced high levels of violence and structural risk factors associated with HIV, including lack of access to services and working on the street. Linear regression models showed HIV among FSWs to link with injecting drug use and imprisonment (Platt et al; 2013).

Methods and materials

Search strategy

We used the results from the systematic review by Acke et al; here the authors performed an extensive electronic search strategy in Medline, Ovid, Embase.com and Cochrane CENTRAL for the period from January 1, 2009 until December 8, 2020. The search yielded 270 full-text articles of which 43 concerned sex workers (Acke et al; 2022).Of these, 13 reported studies done in high-income countries and these studies were included in this review.

In order to cover the literature gap since December 8, 2020, we performed a PubMed search using (prevalence STI+) AND (sex worker+) for the period December 9, 2020-March 1st 2023: this search resulted in 114 articles; after application of inclusion criteria (high income country, prevalence data reported), 17 articles were retained of which 1 was a systematic review where evidence on HIV/STI prevalence, access to HIV/STD/SRH -services and condom use among immigrant sex workers was reviewed globally. This review identified 13 studies reporting on HIV and/or STI prevalence of which 7 were in high-income countries, 4 of these 7 had not been identified through our search and were included in our review (McBride et al; 2021).
In total, prevalence data were extracted out of 33 (13+16+4) articles covering the period January 1st 2009 until March 1st 2023.

Studies were retrieved for FSWs, MSWs and TGSWs. In the studies on HIV , we used UNAIDS data on HIV prevalence in the general population (male/female) as a comparison group. UNAIDS data were not available for Canada, Russia and UK, but for both Russia and UK comparison data

were available in the publications (UNAIDS;2022). For chlamydia, gonorrhoea, trichomoniasis and syphilis, we used the global WHO prevalence estimates for high income countries as a comparison group (see Table 2) (Rowley et al;2019). We also used the data from the general population in the respective publications, when given.

The heterogeneity of studies with regard to definitions of sex work, sampling strategy and geographical diversity precluded statistical meta-analysis. We therefore undertook a narrative synthesis and described prevalence of HIV and STIs (Checkoway et al;2004)

Results

The results are given for FSWs (Table 3), MSWs (Table 4) and transgender sex workers (TGSWs) (Table 5) . The results in the tables include the STIs studied, place of the study, methods used to diagnose STIs, the number of subjects studied, number and % positive and comparison with the general population, when given.

Description of the retrieved studies

Female sex workers (FSWs)(table 3)

In a study in Moscow, Russia, of 385 FSWs, the STIs studied were HIV, syphilis, gonorrhoea, chlamydia, trichomoniasis and *Mycoplasma genitalium*. The results are given in Table 3 and show a clearly higher prevalence for all STIs studied compared with the general population(Bernier et al; 2010).

In Portugal , the prevalence of HIV among non-documented immigrant FSWs (IFSWs) was 13.6% against 2.3 % in documented IFSWs and 8 % in non-immigrant FSWs, compared to 0.1-0.3 in the general female population (Dias et al;2017, UNAIDS;2022).

In a study in Alicante, Spain, the prevalence of HIV and HPV in 549 FSWs was 2.9 and 30.8 %, compared to 0.3 and 10.1% respectively in women in the general population (Gonzalez et al;2011). In a study in 400 FSWs in Catalonia, Spain, the prevalence of HIV, chlamydia and gonorrhoea was 3.0, 1.8 and 0.5% respectively(Lopez-Corbeto et al;2022).

In a study in London, the prevalence of STIs (n=268) was 1.1, 2.2, 4.3 and 2.2% for HIV, syphilis, chlamydia and gonorrhoea respectively. This prevalence of these STIs was considered low relative to other surveys of non-sex selling women recruited from GUM and antenatal clinics (Platt et al; 2011). In a study of the effect of police enforcement on women selling sex in London, the prevalence of HIV , chlamydia and gonorrhoea, was 0, 11.3 and 10.4 % respectively (n=97); according to the authors similar to the study by Platt and al (Elmes et a;2022).

The study of Mc Grath-Lone et al in England (n=2704) showed that FSWs were twice as likely as other female attendees of genitourinary medicine (GUM) clinics to be diagnosed with chlamydia and almost three times more likely to be diagnosed with gonorrhoea, but there was no significant difference in the period prevalence of HIV or syphilis. The calculated odds of infection for FSWs by comparison with other females may be lower than in those reported elsewhere, as the comparative population of GUM clinics attendees is likely to be at higher risk for STIs than the General Household Survey (GHS) population. In this study, the methods used to diagnose the STIs are not explicitly given. but the authors mentioned that they used the results from STI testing currently used in GUM clinics in England (Mc Grath-Lone et al;2014)

In the study by Park et al in Baltimore, USA, the authors report that the prevalence of gonorrhoea and trichomoniasis in FSWs were double national statistics recorded among women by the CDC; they also report an incidence rate of chlamydia , gonorrhoea and trichomonas of respectively 14.3, 19.3 and 69.1 per 100 person-year or a cumulative incidence of respectively 13.9, 18,2 and 54.2 % (Park et al; 2019)

In a community-based HIV prevention intervention study in cisgender FSWs in Baltimore, USA the baseline data report a prevalence for HIV, chlamydia and gonorrhoea of respectively 5.2, 18.2 and 15.8%, combined STI prevalence was 28% (Silberzahn et al;2021). In an adjusted multivariate logistic model, prevalent STI was associated with having financial dependent(s) (p=0.04), food insecurity last week (p=0.01), entering sex work in the past year (p=0.002), having more than 6 clients in the past week (p=0.01) and being less than 40 years of age (p=0.02) (Sherman et al;2021b). In another article based on this study, it was shown that having a prevalent STI was associated with having police as clients (adjusted odds ratio for having a positive test for chlamydia/gonorrhoea infection was 2.43 (95% CI 1.46-4.04) (Sherman et al; 2021a). In this study a community-level empowerment intervention was done resulting in a slightly lower but not significant cumulative STI prevalence found at follow-up visits (31.5 vs 22.4 % p = 0.07)(Sherman et al;2023)

In Vancouver, Canada, the prevalence of HIV in FSWs was 10.5 % and of acute STIs (gonorrhoea, chlamydia or syphilis) 11.%; lower in immigrant sex workers (ISWs). (Goldenberg et al;2015).

In a community-based cohort study in FSWs in Vancouver, Canada from 2010 to 2019, community participation was independently associated with lower odds of STI seropositivity (adjusted OR 0.66, 95%CI 0.45-0.96), but actual prevalence of STIs studied (syphilis, chlamydia or gonorrhoea) was not given in the paper(Pearson et al;2022).

In a study in Sofia, Bulgaria the prevalence of HPV in FSWs was 43.4%, compared to 23% in the general population (Shikova et al;2011).

In a study from Antwerp, Belgium, the prevalence of HPV in FSW was 41.7%, compared to 19.8 % in a control group consisting of women from the general population (Vorsters et al;2016).

In a study on papillomavirus in Amsterdam, the prevalence of vaginal HPV and anal HPV was 46.1 and 54.6% respectively, compared to 19% in the general population. All participants were also tested for gonorrhoea, chlamydia, HBV, HIV and syphilis. The prevalence was 0.7, 8.9, 0, 0.7 and 0 % respectively with no new cases of HIV, HBV and syphilis. The authors conclude that the relative low prevalence of most STIs (chlamydia, gonorrhoea, HIV) indicates that the presence of specific medical services i.c. the Prostitution & Health Center(P&G292) can result in low prevalence of curable STIs in SWs (Marra et al;2018).

In a somewhat older study in 3 cities in the Netherlands (Amsterdam, Rotterdam and The Hague, 2002-2005), the authors compared the prevalence of HIV seropositivity in 3 groups of sex workers : FSWs, drug-using FSWs and male-to-female TGSWs. The overall prevalence of HIV was 5.7%, but HIV was more prevalent among TGSWs (18.8%) and drug-using FSWs (13.6 %) than in non-drug-using FSWs (3.8 %)(Van Veen et al;2010).

In another study in South Limburg, The Netherlands, the prevalence of STIs in both MSWs and FSWs was compared to men having sex with men (MSM). In this study the prevalence in FSWs of HIV, chlamydia, gonorrhoea, syphilis and HBV was 0.4, 5.7, 2.9, 0.5 and 0.1 % respectively.(Verhaegh-Haasnoot et al; 2015).

In a study in 97 exclusively Nigerian FSWs in Rome, Italy, the prevalence of HIV , HBsAg , anti HCV and syphilis was 1.2, 2.4, 0 and 0 % respectively. The authors explain that these women were young, were only in sex work for 3-6 months and that there was no drug addiction among the screened population. (Marone et al; 2023).

In a study in Verona, Italy, in a group of 345 foreign (83% from Africa and 17% from Eastern Europe) FSWs, the prevalence of HIV (4.6%) and HBsAg (3.5%) was higher in the whole cohort compared to the general population. The prevalence of syphilis was 2% and significantly higher in FSWs from Eastern Europe than in FSW from Africa. HCV prevalence (0.9%) was lower than in the general population in Italy, reflecting the low prevalence of drug addiction in this cohort (Zermiani et al; 2012).

In a study in Melbourne, Australia, STI prevalence was compared in immigrant FSWs (IFSWs) from high prevalence countries (HPC) with non-migrant FSWs and nonFSW women. The prevalence of STI in HPC IFSWs was 4.2% for chlamydia, 0.24% for gonorrhoea and 0.65 % for trichomoniasis, with respectively 7.9, 0.57 and 0.38% in nonFSW women attending the Melbourne Sexual health Clinic (MSHC), so it was lower in FSWs than in nonFSW women. Studies have shown that the prevalence of chlamydia among nonFSW women attending MSHC is similar to that in the general Australian community. Prevalence of early syphilis and HIV in the entire FSWs group was 0.07 and 0.02%. ISWs had a statistically significant (but clinically insignificantly) higher prevalence of chlamydia (AOR 1.35 95%CI 1.09-1.66) and gonorrhoea (AOR 2.30, 95%CI 1.31-4.05) relative to non-immigrant FSWs (Tang et al:2013).

In a systematic review and meta-analysis on the global prevalence of *Trichomonas vaginalis* in FSWs, the pooled prevalence was estimated at 22 % (95CI 10-37%) in FSWs in high income countries (14 studies) compared to 5% in the general population; in a specific study the prevalence of trichomoniasis in the general female population in Flanders was 0.37 % (Mirzadeh et al; 2021, De Puydt et al;2010) .

In a local, exploratory, cross-sectional study in Lausanne, Switzerland in 96 FSWs the prevalence of HIV, latent syphilis, chlamydia, gonorrhoea, HBV and HCV was 0, 0.5, 5.2, 6.3, 0, 4.2 and 0 % respectively; the prevalence of chlamydia was comparable to that in a survey of the general population aged < 30 years in the canton of Vaud, the prevalence of latent syphilis and HBV were clearly higher than in the general population. The authors suggest that their study sample was maybe not that representative of the population of FSWs in Lausanne (Vu et al; 2020).

In a study to evaluate target groups for STI screening in the whole of Switzerland, the prevalence of 8 STIs (HIV, syphilis, gonorrhoea, chlamydia, trichomoniasis, *M.genitalium*, HBV and HCV) was studied in 490 FSWs and compared with 92 multipartner women not paid for sex. The prevalence is given in Table 2 and the authors conclude that HIV (0.4%) and HBV (1.4%) do not seem to pose a major problem among FSWs in Switzerland. Non-viral STIs, particularly syphilis (5.9%) and gonorrhoea (4.9%) appear to have a major impact in this population and were clearly higher than in the comparison group (Vernazza et al; 2020).

In a study in Japan, the odds ratio of having syphilis was 3.40(95% CI 1.96-5.90) for female patients working in the sex industry (Shimano et al,2021).

Male sex workers (MSWs)

In a study in Tel Aviv, Israel, the prevalence in MSWs of gonorrhoea, chlamydia, syphilis, HIV, HSV2 and HBV was 9.4, 3.8 1.9, 5.7, 11.3 and 1.9 % respectively(Mor&Dan;2012).

In a study in South-Limburg, the prevalence in MSWs of HIV, chlamydia, gonorrhoea, syphilis and HBV was 7.6, 18.4, 8.5 16.5 and 5.2 % respectively. It was higher in MSWs than in both FSWs ($p< 0.01$) and MSM ($p< 0.05$). MSWs tested 6.5 (95% CI 4.5 -9.4) times more positive for a new STI, including HIV, than FSWs and 4 times more often (95% CI 3.0-5.3) than MSM. The authors concluded from this study that MSWs form a hidden key population that impacts the transmission of STI within the MSM population and, possibly, to the heterosexual population. They require specific targeted interventions (Verhaegh-Haasnoot et al;2015).

In a European-wide study(31 European countries) on the social and behavioural determinants of syphilis, repeated cross-sectional surveys were done in 2010 and 2017 among 278 256 MSM. In this study syphilis was self-reported (last 12 months) and in 2010 6.3 % (494) of 7867 men selling sex previous 12 months reported a syphilis diagnosis; in 2017 9.9 % (468) of 4752 men selling sex previous 12 months reported a syphilis diagnosis. Incidence of syphilis in the total cohort was 2.3 and 4.5% respectively (Mendez-Lopez et al; 2022).

In a study in MSWs in Melbourne, Australia from 2010 to 2018, the prevalence of HIV, infectious syphilis, chlamydia and gonorrhoea, was 1.7, 6.1, 9.6 and 9.4% respectively. In Table 3 the prevalence of gonorrhoea has been split up, because of a change in diagnostic methods (from culture to nucleic acid amplication test), and 9.4% is the mean of both prevalences. Actually the positivity of any HIV/STI was 0% in MSWs who exclusively had sex with women compared to 15.7% in MSWs who reported having sex with men only (Turek et al; 2021).

Transgender sex workers (TGSW)

As already mentioned, in a study in 3 cities in the Netherlands (Amsterdam, Rotterdam and The Hague, 2002-2005), the prevalence of HIV among male to female TGSWs was 18.8% compared with 3.8 % in FSWs (Van Veen et al; 2010).

In a study from The Hague & Amsterdam STI clinics, the prevalence of STIs in transgender people (TGP) was studied. In this study, a significant proportion (53.5%) of the TGP-AMAB (assigned male at birth) visiting STI clinics engaged in sex work, which mirrors the reported 44% of TGP engaging in sex work in the USA (Schulden et al; 2008). In TGP-AFAB (assigned female at birth), the proportion of SWs was 6.1% and therefore, no data on prevalence of STIs were available for TGP-AFAB SWs.

In this Dutch study the prevalence STIs was studied in TGP-AMAB SWs. It was 14.6, 0.7, 8.0 and 5.1% for HIV, syphilis, chlamydia and gonorrhoea (Drückler et al;2022).

In a study among TG FSWs in Baltimore, USA, the prevalence of STIs was-high: HIV 40.3%, chlamydia 17.7 %, gonorrhoea 9.7, trichomoniasis 14.5 % . This study was longitudinal over 12 months and the prevalence at 3,6,9 and 12 months remained high ; in multivariate analyses, recent arrest was the only structural factor that remained significantly associated with positive STI results, both baseline STIs and STIs over the course of the study (Poteat et al; 2022).

Comparison of STI prevalence in FSWs with that in the general population

HIV

All retrieved studies of HIV among FSWs comparing prevalence in FSWs with that in the general population are given in Table 6. In total 15 studies in 9 countries and on 14 locations were retrieved. The prevalence of HIV was between 0 and 8.0%. In 9 studies (Alicante, A'dam-R'dam-The Hague, Baltimore (2 studies), Catalunia, Moscow, Portugal, Rome, Verona), the prevalence of HIV was at least 4 times higher in the FSWs than in the general population. As for the other 6 studies, in Amsterdam alone, the prevalence was 3.5 times that in the UNAIDS population; the study was done at the STI consultation at Prostitution & Health Center (P&G292), in a population with high condom use according to the authors (Marra et al; 2018). In the UK, the prevalence of HIV was low (0.2 %), but higher than in a comparative population of GUM attendees (0.1%). Actually, as the authors point out, the calculated odds for FSWs by comparison with other females may be lower than in those reported elsewhere , as the comparative population of GUM clinics attendees is likely to be at higher risk than in the General Household Survey (GHS) population. (McGrath-Lone et al; 2014). In South Limburg, the prevalence in FSWs was twice that in the general population. In Melbourne, the prevalence was lower in FSWs than in the general population. In Switzerland the prevalence was double of that in the UNAIDS data on the general population, while in a control group the prevalence was 0. In Lausanne, the seropositivity in FSWs was 0. The authors explain that the low prevalence is probably due to low frequency of intravenous drug use and imprisonment, which according to a European study, are the main factors statistically associated with HIV seropositivity among FSWs in Europe (Platt et al; 2013); this is also clear from the Dutch study by Van Veen et al (1.5% in non drug using FSWs, , 13.6 % in drug-using FSWs (Van Veen et al;2010).

Gonorrhoea and chlamydia

For both gonorrhoea and chlamydia in FSWs, 12 studies were retrieved; the number of studies on prevalence in the general population is limited to 4 for gonorrhoea and 5 for chlamydia (see Table 7). In those studies the prevalence of both STIs is 2 to 3 times higher than in the general population , except in the Melbourne study. When we compared the prevalence in all 12 studies with the WHO data, the prevalence of gonorrhoea is clearly higher than in the general population (up to 40 times), except in Lausanne and Melbourne; as for chlamydia, the prevalence in FSWs was higher than in the general population in all studies (up to 6 times) except in Catalunia, but the difference with the general population was smaller than for gonorrhoea, also due to the fact that the prevalence of chlamydia was higher in the general population (3.0% versus 0.4% for gonorrhoea).

Syphilis

For syphilis, 11 studies were retrieved, of which 5 compared prevalence in FSWs with the general population (see Table 8). The prevalence in FSWs was clearly higher in 4 studies, but not in England. Comparing the prevalence with WHO data in the general population, 7 studies showed an increased prevalence in the FSWs ; in England, the prevalence in the general population was about the same as in FSWs; in Melbourne, Amsterdam and Rome the prevalence in FSWs was lower than in the general population, in 2 studies (Amsterdam and Rome), the prevalence in FSWs was even 0.

Hepatitis B and C

The number of studies on HBV and HCV is limited (see Table 9): 4 studies on HBV and 2 studies on HCV . In Lausanne and England, the prevalence of HBV is more than 4 fold higher than in the general population, in Verona and Switzerland, the prevalence in FSWs is somewhat higher than in the

general population. The results of the two studies on HCV probably indicate that it is not an important problem in the locations studied, possibly due to low frequency of intravenous drug use and imprisonment.

HPV

Although the number of studies is limited to 4, the results are very consistent showing an 2 to 4 fold increase in prevalence in FSWs, compared to the general population (see Table 10).

Trichomoniasis

There were 4 studies on trichomoniasis (see Table 11) all of which showed a higher prevalence of FSWs compared with the general population. The large meta-analysis study showed clearly a higher prevalence of trichomoniasis in FSWs compared with the general female population (22% to 5%). When comparing the prevalences in Table 11 with the WHO data, the prevalence in FSWs -was clearly higher than in the general population, except in England, where it was only slightly higher.

***Mycoplasma genitalium* and genital herpes**

The number of studies is low and the results are inconsistent. The prevalence of *Mycoplasma genitalium* is increased in Moscow but not in Switzerland, the prevalence of genital herpes in England is higher in FSWs than in the general population

Comparing STI prevalence in MSWs with that in the general population

The number of studies comparing STIs in male sex workers (MSWs) to the general population of MSM is limited ; in this review 2 studies on HIV, 4 studies on syphilis, 3 studies on gonorrhoea and chlamydia, 2 studies on HBV and one study on HSV2 (see Table 12). The results show consistently an elevated risk compared with the general population with one exception : the study on syphilis in Tel Aviv. Actually the risks are not as large as in FSWs, but this could be due to a higher prevalence in the comparison group of MSM , as MSM are known to have higher incidence of STIs than the general male population (De Schryver & Meheus; 1990).

When the prevalence is compared with WHO data for men, all prevalences are clearly much higher than in the general population

Comparing STI prevalence in TGSWs with that in other populations

In the Dutch study by Drückler et al, the prevalence of HIV in SWs and NSWs was comparable (14.6 vs 15.1%) , and the prevalence of chlamydia, gonorrhoea and infectious syphilis was slightly lower in the SWs, although not statistically significant. An explanation given by the authors is that it might be that SWs are more aware of the risk and have taken safety precautions to reduce the risk of acquiring STIs (Drückler et al;2022).

Using the UNAIDS data on HIV and WHO data for selected STIs for both men and women , it appears that the prevalence of HIV, syphilis, gonorrhoea, chlamydia and trichomoniasis in TGSWs is much higher than in the general population.

Discussion

Female sex workers (FSWs)

HIV

Most studies (13/15) comparing the prevalence of HIV in FSWs with that in the general population, showed an increased prevalence, up to 10 times more than in the general population. In only 2 studies the prevalence in FSWs was lower than that in the general population. In Melbourne, the authors explain that FSWs in legalized brothels (in Australia) generally have a low STI prevalence. The finding of a prevalence of 0.02% is consistent with this (Tang et al;2013). The same is true for other STIs. As for the low prevalence in Lausanne, the authors suggest that their study sample was maybe not that representative of the population of FSWs in Lausanne (Vu et al; 2020).

Other studies have estimated the prevalence of HIV in FSWs in high-income countries to be 1.8%, compared to a prevalence of 233/100 000 in the general population(Argento et al; 2019)

The prevalence seems to be highest in criminalized places (Baltimore, Vancouver) and in southern Europe. The prevalence is remarkedly lower in western Europe (Netherlands, United Kingdom), but it is still clearly higher than in the general population.

Gonorrhoea and chlamydia

In the studies where the prevalence in the general population was studied (Bernier et al; 2020, McGrath-Lone et al; 2014, Tang et al;2023, Vernazza et al; 2020, Vu et al; 2020), the prevalence of both STIs was 2 to 3 times higher than in the general population, except in the Melbourne study, where the comment on HIV (cfr supra) is valid. Compared with the WHO data, the differences were even larger.

Intriguing data on London: in one study studying the effect of police enforcement, the prevalence of both gonorrhoea and chlamydia is around 10% while in another study in London both prevalences are only 2.2 and 4.3 %; the conclusion might be that police enforcement leads to higher prevalence of STIs in FSWs, a conclusion also suggested in studies from North America (Argento et al;2019, Elmes et al; 2022, Platt et al;2011, Silberzahn et al;2021).

Syphilis

For syphilis, the prevalence was higher in FSWs in 4 of 5 studies, not in England. The prevalence in FSWs in England was extremely low (0,1%) and could be explained by the fact that FSWs have access to high-quality sexual health care through the GUM clinics network including sexual health screen (e.g. a syphilis serological test) while consulting for signs and symptoms caused by another STI (McGrath-Lone et al; 2014). The same remark can be made on the prevalence of syphilis in the Amsterdam study (0%) and the role of the Prostitution&Health Clinic there.

When the prevalence is compared with the WHO data, in 7/11 studies, the prevalence of syphilis was higher in FSWs than in the general population. In Melbourne, the same explanation as for HIV is valid. In Amsterdam, the authors did not discuss the syphilis results specifically, but the place of the study was the Prostitution & Health Center (P&G292)where SWs are offered STI consultations regularly. In Rome, the authors mention the young age and the short period the women had been in prostitution as explanation.

Hepatitis B and C

The number of studies on HBV and HCV is limited (see Table 8). In Lausanne and England, the prevalence of HBV is more than 4 fold higher than in the general population, in Verona, Rome and Switzerland, the prevalence in FSWs is somewhat higher than in the general population. The studies on HCV are difficult to interpret, mainly due to the lack of data in the general population, but

probably indicate that it is not an important problem in the locations studied, possibly due to low frequency of intravenous drug use and imprisonment.

HPV

Although the number of studies is limited to 4, the results are very consistent showing an 2 to 4 fold increase in prevalence in FSWs, compared to the general population (see Table 9).

Trichomoniasis

The large meta-analysis study showed clearly a higher prevalence of trichomoniasis in FSWs compared with the general female population.

***Mycoplasma genitalium* and genital herpes**

For these STIs the results are more difficult to interpret because the number of studies is limited and the results are inconsistent.

Male sex workers (MSWs)

The number of studies on STIs in male sex workers (MSWs) is limited ; in this review 3 studies on HIV, 5 studies on syphilis, 3 studies on gonorrhoea and chlamydia, 2 studies on HBV and one study on HSV2 (see Table 12) . compared with 2.4, 1.7, 3.4, 4.7, 5.1 and 0.4 in MSM. In the study in Tel Aviv, the prevalence of STIs was comparable with high-risk MSM, but significantly higher than in low-risk MSM (Mor&Dan;2012).

The results show consistently an elevated risk of STI compared with the general population with one exception : the study on syphilis in Tel Aviv. Actually the risks are not as large as in FSWs, but this could be due to a higher prevalence in the comparison group of MSM , as MSM are known to have a higher incidence of STIs than the general male population (De Schryver & Meheus; 1990).

Transgender sex workers (TGSW)

Data are sparse among trans men: therefore available data among trans SW are limited to trans women (Argento et al;2019). The number of studies in TGSW is low, but they all show a high prevalence of STIs. As a significant proportion (53.5%) of the TGP-AMAB (assigned male at birth) visiting STI clinics engaged in sex work, this mirrors the high prevalence of sex work among trans women in the USA : 24-75% of trans women reported to have participated in sex work in their lifetime, other studies reported 44% of TGW engaging in sex work in the USA (Argento et al; 2019, Schulden et al; 2008). The prevalence of STIs (HIV, chlamydia, gonorrhoea and infectious syphilis) was comparable in transgender SWs and NSWs, but was clearly higher than the WHO data in both men and women.

Limitations

One of the main limitations of this review is the heterogeneity of studies with regard to definition of sex work, sampling strategy and geographical diversity, which precluded statistical meta-analysis. The complexity and dynamic nature of the legal sex working context is likely to be an explanatory factor for study heterogeneity.
Due to the nature of recruiting a marginalised population, all studies presented limitations in sampling strategy and most used either convenience or snowball sampling (Johnson et al; 2023).

The paucity of data on a number of STIs (e.g. HBV, *Mycoplasma genitalium* and herpes) made the interpretation of these data extra difficult

Another limitation is that most studies were on female sex workers and the number of studies of male and transgender sex workers was limited.

Prevention of STIs in sex workers

Behavioural and biomedical interventions

As most studies show that sex workers -female as well as male and transgender have a higher prevalence for a number of well-known STIs, the question of prevention is paramount. Evidence suggests that behavioural and biomedical interventions for prevention are only moderately successful in reducing STIs at population level, but research has demonstrated consistent evidence of direct and indirect impacts of structural factors on increasing risk for STIs among sex workers, further compounded by individual and interpersonal factors (e.g. mental health, substance use, unprotected sex) (Argento et al; 2019).

Optimal access to health and STI prevention services

Suboptimal access to health and STI prevention services remains concerning. Full decriminalization of sex work has been shown to have the largest potential to avert new infections in sex work , through reducing workplace violence and increasing access to safer workplaces.

There are indications, from this review and the global literature, that better access to health and STI prevention services lead to lower rates of STIs in sex workers. The studies from Amsterdam, done at the Prostitution & Health Center (P&G292) and the extremely low prevalence of syphilis in England show that, when sex workers have access to high-quality sexual health care, the prevalence of a number of STIs (i.c. syphilis & HIV) is drastically reduced. (Marra et al;2018, McGrath-Lone et al;2014).

Vaccination

Another preventive intervention is vaccination. As this review corroborates the increased risk for HPV and HBV in sex workers, vaccination against both these agents, in the framework of high quality sexual care is certainly an option, confirmed in a recent WHO position paper (WHO;2022). Studies on vaccination in SWs are scarce,only one vaccination study against HBV is mentioned in the review of interventions by Johnson et al (Johnson et al;2023). In this study in The Netherlands on 259 SWs, 74 SWs received all three vaccinations(28.6 %), so the best strategy to implement these vaccination programmes must still be determined (Ranjan et al; 2019, Schim van der Loeff;2019).

Recently, the Joint Committtee on Vaccination and Immunisation (JCVI) in the United Kingdom has published an advice on the use of meningococcal serogroup B vaccines for the prevention of gonorrhoea. Real world studies have estimated that the 4CMenC vaccine (Bexsero) has between 32.7 to 42% effectiveness against gonorrhoea.
Evidence of protection from meningococcal serogroup B vaccines has only been observed in outer membrane vesicles (OMV) containing vaccines such as 4CMenB.
The JCVI has recommended to offer this vaccination to those who are at increased risk of infection with bacterial STIs, including sex workers (JCVI;2023).

Decriminalization of sex work

In a overview in the *Lancet*, the decriminalization of sex work (i.e., removal of all laws targeting the sex industry including sex workers, clients, and third parties) has now been demonstrated to have the largest potential to reduce HIV infections in sex work, estimated to avert 33-46 % of new HIV infections among sex workers in Canada, India and Kenya over the next decade (Shannon et al;2015). A number of regions, most notably New Zealand and in some states in Australia, have decriminalized all aspects of sex work, and research by government and academics have shown increased access to occupational health and safety standards, and better coverage of health services, (Abel et al; 2009), with no evidence of unintended harms. In this review too, the prevalence of a number of STIs in FSWs in Melbourne, Australia, were lower than in the general population, according to the authors due to the legalization of sex work (Tang et al;2013). Importantly, WHO/UNAIDS international guidelines, alongside the Global Commission on HIV and the Law and Amnesty International, all call for evidence-based decriminalization of sex work as necessary to prevent and treat HIV (Argento et al;2019).

WHO supports countries in their efforts to: address these structural barriers, ensure human rights for sex workers, and to implement a comprehensive package of HIV and other STI services through community-led approaches.

A number of priority health interventions can target prevention of HIV and other STIs among sex workers (see Table 13)(WHO;2022).

Although these interventions to prevent HIV and other STIs in sex workers are important, it should not be forgotten that STIs are only one of the health inequities that SWs are suffering from: other ones include harm due to alcohol and drug use, high rates of physical, verbal and sexual violence from intimate partners , perpetrators posing as clients, and the police. They frequently have poor mental health, with increased rates of anxiety, depression, lonelineness , posttraumatic stress disorder, self harm and suicide (McCann et al;2021, Lancet Editorial;2023).

Conclusions

From this review it appears that sex workers -female as well as male and transgender have a higher prevalence for a number of well-known STIs i.c. HIV, gonorrhoea, chlamydia, trichomoniasis and HBV. Studies in FSWs also show an increased risk for HPV.
Studies in MSWs show a clearly increased risk for syphilis as do most studies in FSWs; in the studies not showing an increased risk, this was probably due to good health care including regular screening for syphilis when being treated for another STI. The risks for most STIs in TG-AMAB SWs (HIV, gonorrhoea, chlamydia , syphilis) was comparable with TG NSWs but much higher than in the general male or female population.
For a few STIs conclusions are difficult , because the number of studies is limited : HCV, *Mycoplasma genitalium* and herpes

Table 1 Main sexually transmitted pathogens (Unemo; 2013)

Bacterial infections

Neisseria gonorrhoeae
Chlamydia trachomatis
Chlamydia trachomatis (serovars L1-L3)
Treponema pallidum
Haemophilus ducreyi
Klebsiella (Calymmatobacterium granulomatis)
Mycoplasma genitalium

Viral infections

Human immunodeficiency virus (HIV)
Herpes simplex virus type 2
Herpes simplex virus type 1
Human Papilloma virus (HPV)
Hepatitis B virus (HBV)
Cytomegalovirus
Molluscum contagiosum virus
Kaposi sarcoma associated herpesvirus (human herpesvirus type 8)

Protozoal infections

Trichomonas vaginalis

Fungal infections

Candida albicans

Parasitic infestations

Phthirus pubis
Sarcoptes scabiei

Table 2. 2016 WHO prevalence estimates in % of chlamydia, gonorrhoea, trichomoniasis and syphilis in high income countries in the general population aged 15-49 yrs
(Romley et al;2019)

	Women	Men
Chlamydia	3.0	2.0
Gonorrhoea	0.4	0.3
Trichomoniasis	2.3	0.7
Syphilis	0.1	0.1

Table 3 Prevalence of Sexually transmitted infections in female sex workers in high income countries

Reference =	STI	Place	Method	Number Studied	Number positive (%)	% in general population+	RR
Bernier et al; 2020	HIV	Moscow	Serology SD BIOLINE HIV	385	15 (3.9)	0.996	3.9
Bernier et al; 2020	Syphilis (Lifetime contact)	Moscow	Serology SD BIOLINE Syphilis Duo Rapid Diagnostic Test	385	54 (14.0)	0.2 -1.1	70 -12.7
Bernier et al; 2020	Gonorrhoea	Moscow	PCR AmpliSens MULTIPRIME -FL	385	13 (3.4)	0.5 – 2.2	6.8 – 1.6
Bernier et al; 2020	Chlamydia	Moscow	PCR AmpliSens MULTIPRIME -FL	385	37 (9.6)	3 – 6.6	3.2 -1.5
Bernier et al; 2020	Trichomoniasis	Moscow	PCR AmpliSens MULTIPRIME -FL	385	46 (12.0)	0.8 -1.7	15 – 7.1
Bernier et al; 2020	*Mycoplasma genitalium*	Moscow	PCR AmpliSens MULTIPRIME -FL	385	54 (14.0)	1 – 3.3	14 -4.2
Dias et al; 2017	HIV	Portugal	Rapid HIV test	176	14 (8.0)	< 0.1 -0.3	
Elmes et al; 2022 (190 cis/7 other)	HIV	London	OraSure Rapid Oral Test	53	0 (0.0)		
Elmes et al; 2022(190 cis/7 other)	Chlamydia	London	Self-administered Chlamydia screening	97	11(11.3)		

Table 3 (continued)

Elmes et al; 2022(190 cis/7 other)	Gonorrhoea	London	Self-administered Gonorrhoea screening	97	7(10.4)		
Goldenberg et al; 2015	HIV	Vancouver	Rapid point-of-care tests. confirmed by Western Blot	650	75 (11.5)		
Goldenberg et al; 2015	Acute STI	Vancouver	Urine for NG &CT, serology for syphilis	650	72 (11.1)		
Gonzalez et al; 2011	HIV	Alicante	« HIV test »	549	16 (2.9)	0.3	9.7
Gonzalez et al; 2011	Human papilloma virus(16,18,31,33,35, 39,45,51,52,56,58,59,68)	Alicante	HC2 HR HPV DNA test	549	168(30.8)	10.1	3.05
Lopez-Corbeto et al; 2022	HIV	Catalonia		400	(3.0)		
Lopez-Corbeto et al; 2022	Chlamydia	Catalonia		400	(1.8)		
Lopez-Corbeto et al; 2022	Gonorrhoea	Catalonia		400	(0.5)		
Marra et al;; 2018	Gonorrhoea	Amsterdam	Tested within STI consultation	304	2 (0.7)		
Marra et al; 2018	Chlamydia	Amsterdam	Tested within STI consultation	304	27 (8.9)		

Table 3 (continued)

Marra et al; 2018	Syphilis	Amsterdam	Serology	304	0 (0.0)		
Marra et al; 2018	HIV	Amsterdam	Serology	304	2 (0.7)		
Marra et al; 2018	Hepatitis B virus	Amsterdam	Serology	304	0 (0.0)		
Marra et al; 2018	Vaginal human papilloma virus (6,11,16,18,31,33,35 39,45,51,52,56,58,59)	Amsterdam	HPV DNA Amplification	304	140 (46.1)	19 *	2.43
Marra et al; 2018	Anal human papilloma virus (6,11,16,18,31,33,35 39,45,51,52,56,58,59)	Amsterdam	HPV DNA Amplification	304	166 (54.6)		
Marra et al; 2018	HR HPV L1 seropositivity (11,16,18,31,33,45,52,58)	Amsterdam	Multiplex assays	304	111 (37.0)		
Marone et al; 2023	HIV	Rome	ELISA + WB for confirmation	82	1 (1.2)		
Marone et al; 2023	Hepatitis B	Rome	HBsAg (ECLIA)	82	2 (2.4)		
Marone et al; 2023	Hepatitis C	Rome	Anti-HCV (ECLIA)	82	0 (0.0)		
Marone et al; 2023	Syphilis	Rome	TPA/RPR	82	0 (0.0))		

Table 3 (continued)

Mc Grath-Lone et al; 2014	Chlamydia	England	See text	2534	257 (10.1)	8.5	1.93(adjusted)
Mc Grath-Lone et al; 2014	Gonorrhoea	England	See text	2534	68 (2.7)	1.0	2.75(adjusted)
Mc Grath-Lone et al; 2014	Syphilis	England	See text	2380	3 (0.1)	0.1	2.55(adjusted)
Mc Grath-Lone et al; 2014	HIV	England	See text	2405	5 (0.2)	0.1	0.74(adjusted)
Mc Grath-Lone et al; 2014	Herpes	England	See text	2704	62 (2.3)	2.8	0.91(adjusted)
Mc Grath-Lone et al; 2014	Genital warts	England	See text	2704	76(2.8)	5.0	1.07(adjusted)
Mc Grath-Lone et al; 2014	Hepatitis B	England	See text	2704	16(0.6)	0.1	1.63(adjusted)
Mc Grath-Lone et al; 2014	Hepatitis C	England	See text	2704	6(0.2)	0.04	1.68(adjusted)
Mc Grath-Lone et al; 2014	Trichomoniasis	England	See text	2704	24(0.9)	0.8	1.64(adjusted)
Park et al;2019	Chlamydia	Baltimore	Nucleic amplification Test for CT	239	25 (10.5)		

Table 3 (continued)

Park et al;2019	Gonorrhoea	Baltimore	Nucleic amplification Test for NG	239	30 (12.6)	
Park et al;2019	HIV	Baltimore	OraQuick Advanced Rapid HIV-1/2 test kit	239	12 (5.0)	
Park et al;2019	Trichomoniasis	Baltimore	Nucleic amplification Test for TV	239	116 (48.5)	
Platt et al;2011	HIV	London	Abbott/Murex GACELISA HIV 1+2 enzyme immunoassay	268	3 (1.1)	
Platt et al; 2011	Syphilis	London	Murex ICE syphilis assay	268	6 (2.2)	
Platt et al;2011	Chlamydia	London	Self-administered diagnostic tests collected through vaginal or vulval swabs	232	10(4.3)	
Platt et al; 2011	Gonorrhoea	London	Self-administered diagnostic tests collected through vaginal or vulval swabs	232	5(2.2)	
Shikova at al; 2011	Human papillomavirus	Sofia	PCR	106	46(43.4)	23
Silberzahn et al; 2021	HIV	Baltimore	OraQuick ADVANCE Rapid HIV-1-2 Antibody test	385	20 (5.2)	
Silberzahn et al; 2021	Chlamydia	Baltimore	Aptima vaginal swab Nucleic acid amplification	373	68 (18.2)	
Silberzahn et al; 2021	Gonorrhoea	Baltimore	Aptima vaginal swab Nucleic acid amplification	374	59 (15.8)	

Table 3 (continued)

Tang et al;2013	Chlamydia (any sites)	Melbourne	Nucleic acid amplification	1702	71 (4.2)	7.9
Tang et al;2013	Gonorrhoea (any sites)	Melbourne	Culture	1702	4 (0.24)	0.57
Tang et al ;2013	Trichomoniasis	Melbourne	Culture	1702	11 (0.65)	0.38
Tang et al ;2013	HIV	Melbourne	Serology	4296	1 (0.02)	0.1
Tang et al ;2013	Syphilis	Melbourne	Serology	4296	3 (0.07)	
Van Veen et al; 2010	HIV	A'dam, R'dam, Den Haag	ELISA	547	31(5.7)	
Van Veen et al; 2010	HIV	A'dam, R'dam, Den Haag	ELISA	390	6(1.5)	Non-drug using
Van Veen et al; 2010	HIV	A'dam, R'dam, Den Haag	ELISA	88	12(13.6)	Drug using
Verhaegh-Haasnoot et al; 2015	HIV	South Limburg, Netherlands	Serology+ Western Blot	801	3 (0.4)	
Verhaegh-Haasnoot et al; 2015	Chlamydia	South Limburg, Netherlands	Nucleic amplification+ PCR	801	46 (5.7)	

Table 3 (continued)$

Verhaegh-Haasnoot et al; 2015	Gonorrhoea	South Limburg, Netherlands	Nucleic amplification+ PCR	801	23 (2.9)	
Verhaegh-Haasnoot et al; 2015	Syphilis	South Limburg, Netherlands	Serology	801	4 (0.5)	

Table 3 (continued)

Verhaegh-Haasnoot et al; 2015	Hepatitis B	South Limburg, Netherlands	Serology	801	1 (0.1)		
Vernazza et al; 2020	HIV infection	Switzerland	Serology	490	2 (0.4)	0.0	
Vernazza et al; 2020	Syphilis	Switzerland	IgG/M TP antibodies	490	29 (5.9)	0.0	
Vernazza et al; 2020	Chlamydia	Switzerland	Anyplex II STI-7 multiplex PCR	490	31 (6.3)	5.4	
Vernazza et al; 2020	Gonorrhoea	Switzerland	Anyplex II STI-7 multiplex PCR	490	24 (4.9)	0.0	
Vernazza et al; 2020	Trichomoniasis	Switzerland	Anyplex II STI-7 multiplex PCR	490	51 (10.4)	0.0	
Vernazza et al; 2020	*M.genitalium* infection	Switzerland	Anyplex II STI-7 multiplex PCR	490	33 (6.7)	6.5	
Vernazza et al; 2020	Hepatitis B infection	Switzerland	Anti-HBc II ECLIA	490	7 (1.4)	0.0	
Vernazza et al; 2020	Hepatitis C infection	Switzerland	Anti-HCV II ECLIA	490	2 (0.4)		
Vorsters et al; 2016	HPV (6,11,16, 31,33,35,39,45,51,52,53,56 58,59,66,67,68)	Antwerp	HPV DNA Amplification	1334	556 (41.7)	19.8	2.8 (2.3-3.4)

Table 3 (continued)

Vu et al; 2020	HIV infection	Lausanne	INSTI	96	0 (0.0)	0.4
Vu et al; 2020	Latent syphilis	Lausanne	On Site Rapid Test	96	5 (5.2)	<0.02
Vu et al; 2020	Chlamydia	Lausanne	Specific quantitative duplex PCR	96	6 (6.3)	6.0
Vu et al; 2020	Gonorrhoea	Lausanne	Specific quantitative duplex PCR	96	0 (0.0)	
Vu et al; 2020	Hepatitis B infection	Lausanne	VIKIA HBsAg	96	4 (4.2)	0.3
Vu et al; 2020	Hepatitis C infection	Lausanne	OraQuick HCV	96	0 (0.0)	
Zemiani et al; 2012	HIV	Verona	ELISA/Immunoblot	345	16 (4.6)	0.4
Zemiani et al; 2012	Syphilis	Verona	VDRL/TPHA	345	7 (2.0)	
Zemiani et al; 2012	Hepatitis B	Verona	HBsAg	345	12 (3.5)	< 2%
Zemiani et al; 2012	Hepatitis C	Verona	Anti-HCV	345	3 (0.9)	4.0

Table 4 Prevalence of Sexually transmitted infections in male sex workers in high income countries

Reference =	STI	Place	Method	Number Studied	Number positive (%)	% in general population+	RR
Mendez-Lopez et al; 2022	Syphilis (2010 cohort)	31 European countries	Self-reporting	7867	494 (6.3)	2.3	
Mendez-Lopez et al; 2022	Syphilis (2017 cohort)	31 European countries	Self-reporting	4752	468 (9.9)	4.5	
Mor& Dan;2012	Gonorrhoea	Tel Aviv	PCR+culture	53	5 (9.4)	2.4	
	Syphilis	Tel Aviv	Serology	53	1 (1.9)	3.4	
	Chlamydia	Tel Aviv	PCR	53	2 (3.8)	1.7	
	HSV2	Tel Aviv	?	53	6 (11.3)	5.1	
	Hepatitis B virus	Tel Aviv	?	53	1 (1.9)	0.4	
	HIV	Tel Aviv	Serology	53	3 (5.7)	4.7	
Turek et al;2021	HIV	Melbourne	see text	174	3 (1.7)		
Turek et al;2021	Syphilis	Melbourne	Serology	158	9 (6.1)		
Turek et al;2021	Chlamydia	Melbourne	Nucleic acid Amplification test	177	17 (9.6)		

Table 4 (continued)

Turek et al;2021	Gonorrhoea	Melbourne	Culture	116	10 (8.6)	
Turek et al;2021	Gonorrhoea	Melbourne	Nucleic acid Amplification test	65	7 (10.8)	
Verhaegh-Haasnoot et al; 2015	HIV	South Limburg, Netherlands	Serology+ Western Blot	212	16 (7.6)	1.0
Verhaegh-Haasnoot et al; 2015	Chlamydia	South Limburg, Netherlands	Nucleic amplification+ PCR	212	39 (18.4)	8.0
Verhaegh-Haasnoot et al; 2015	Gonorrhoea	South Limburg, Netherlands	Nucleic amplification+ PCR	801	18 (8.5)	5.0
Verhaegh-Haasnoot et al; 2015	Syphilis	South Limburg, Netherlands	Serology	212	35 (16.5)	1.0
Verhaegh-Haasnoot et al; 2015	Hepatitis B	South Limburg, Netherlands	Serology	212	11 (5.2)	0.0

Table 5 Prevalence of sexually transmitted infections in transgender male-to-female sex workers (AMAB = assessed male at birth) in high income countries

Reference =	STI	Place	Method	Number Studied	Number positive (%)	%+ in general TGP population	RR
Drückler et al; 2022	HIV	A'dam, The Hague	Serology	137	20 (14.6)	13.4	
Drückler et al; 2022	Syphilis	A'dam, The Hague	Serology	136	1 (0.7)	2.6	
Drückler et al; 2022	Chlamydia	A'dam, The Hague	Aptima Combo2 Assay	137	11 (8.0)	10.1	
Drückler et al; 2022	Gonorrhoea	A'dam, The Hague	Aptima Combo2 Assay	137	7 (5.1)	7.6	
Poteat et al; 2022	HIV	Baltimore	Advanced Rapid HIV ½ test kit	62	25 (40.3)		
Poteat et al; 2022	Chlamydia	Baltimore	NAAT	62	11 (17.7)		
Poteat et al; 2022	Gonorrhoea	Baltimore	NAAT	62	6 (9.7)		
Poteat et al; 2022	Trichomoniasis	Baltimore	NAAT	62	9 (14.5)		
Van Veen et al;	HIV	A'dam, R'dam, Den Haag	ELISA	69	13 (18.8)		

Table 6. Prevalence of HIV in female sex workers, compared to the general population

Location	Prevalence (in %)	Prevalence in general population	Prevalence UNAIDS data
Portugal	8.0	0.1	0.5
Baltimore (USA)	5.2	NA	0.5
Baltimore (USA)	5.0	NA	0.5
Verona (Italy)	4.6	0.4	0.2
Moscow (Russia)	3.9	1	NA
A'dam, R'dam, The Hague (Netherlands)	3.8	NA	0.2
Catalunia (Spain)	3.0	NA	0.4
Alicante (Spain)	2.9	0.3	0.4
Rome (Italy)	1.2		0.2
A'dam (Netherlands)	0.7	NA	0.2
South Limburg (Netherlands)	0.4	NA	0.2
Switzerland	0.4	0.0	0.2
England (UK)	0.2	0.1	NA
Melbourne (Australia)	0.02	NA	0.1
Lausanne (Switzerland)	0.0	0.4	0.2

Table 7. Prevalence of gonorrhoea and chlamydia in female sex workers, compared to the general population (where available)

Location	Gonorrhoea (%)		Chlamydia (%)	
	In FSWs	In general population	In FSWs	In general population
Amsterdam	0.7		8.9	
Baltimore	15.8		18.2	
Baltimore	12.6		10.5	
Catalunia	0.5		1.8	
England	2.7	1.0	10.4	8.5
Lausanne (Switzerland)	0.0		6.3	6.0
London	10.4		11.3	
London	2.2		4.3	
Melbourne (Australia)	0.24	0.57	4.2	7.9
Moscow (Russia)	3.4	0.5- 2.2	9.6	3.0-6.6
South Limburg	2.9		5.7	
Switzerland	4.9	0.0	6.3	5.4

Table 8. Prevalence of syphilis in female sex workers, compared to the general population (where available)

Location	Prevalence (in %)	Prevalence in general population	OR
Moscow	14.0	0.2-1.1	
Switzerland	5.9	0.0	
Lausanne	5.2	< 0.02	
London	2.2		
Verona	2.0		
South Limburg	0.5		
England	0.1	0.1	
Melbourne	0.07		
Amsterdam	0.0		
Rome	0.0		
Japan			3.4 (2.0-5.9)

Table 9. Prevalence of HBV and HCV in female sex workers, compared to the general population

Location	Hepatitis B virus (%)		Hepatitis C virus (%)	
	In FSWs	In general population	In FSWs	In general population
England	0.6	0.1	0.2	0.04
Lausanne	4.2	0.3	0.0	NA
Switzerland	1.4	0.0	0.4	NA
Verona	3.5	< 2	0.9	4.0

Table 10. Prevalence of HPV in female sex workers, compared to the general population

Location	Prevalence (in %)	Prevalence in general population
Amsterdam	54.6	19
Sofia	43.4	23
Antwerpen	41.7	19.8
Alicante	30.8	10.1

Table 11. Prevalence of trichomoniasis in female sex workers, compared with the general population (where available)

Location	Prevalence in %	Prevalence in general population
Baltimore	48.5	
England	0.9	0.8
Moscow	12.0	0.8 – 1.7
Switzerland	10.4	0.0

Table 12. Prevalence of selected STIs in male sex workers (MSWs) , compared to the general population (where available)

Location	HIV (%)		Syphilis(%)		Gonorrhoea (%)		Chlamydia (%)		Hepatitis B		Herpes simplex	
	MSWs	General population	MSW	General population	MSWs	General population	MSWs	General population	MSW	General population	MSW	General population
Melbourne	1.7	0.1	6.1	NA	10.8	NA	9.6	NA	ND	ND	ND	ND
Tel Aviv	5.7	4.7	1.9	3.4	9.4	2.4	3.8	1.7	1.9	0.4	11.3	5.1.
South Limburg	7.6	0.2	16.5	1.0	8.5	5.0	18.4	8.0	5.2	0.0		
31 European countries (1)			9.9	4.5								
31 European countries (2)			6.3	2.3								

Table 13 List of priority health and structural interventions targetting HIV and other STIs among sex workers (WHO;2022)

- Prevention (condom, pre-exposure prophylaxis, etc.)
- Harm reduction interventions (needle and syringe programmes, opioid substitution therapy, naloxone)
- Behavioural interventions
- HIV testing services
- HIV treatment and care
- Prevention and management of tuberculosis, hepatitis and mental health
- Sexual and reproductive health interventions
-

Structural interventions

-
- Supportive legislation, policy and funding including decriminalization of behaviours (e.g. drug use and possession, sex work, same-gender sex)
- Addressing stigma and discrimination
- Available, accessible and acceptable health services
- Community empowerment
- Addressing violence

(WHO;2022)

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