

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Behavioural intervention versus control for reducing HIV transmission among sex workers and their clients in high-income countries.						
Patient or population: Sex workers and their clients Settings: High-income countries Intervention: Behavioural intervention versus control						
Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Comparison intervention versus control				
STI incidence for sex workers	Study population		RR 0.46 (0.11 to 1.98)	627 (2 studies)	⊕○○○ very low ^{1,2,3,4}	
	302 per 1000	139 per 1000 (33 to 598)				
	Moderate					
	268 per 1000	123 per 1000 (29 to 531)				
STI prevalence for clients of sex workers	Study population		RR 0.09 (0.01 to 0.72)	288 (1 study)	⊕⊕⊕⊕ high ^{3,5}	
	75 per 1000	7 per 1000 (1 to 54)				
	Moderate					
	75 per 1000	7 per 1000 (1 to 54)				
Condom use for sex workers	Study population		RR 1.04 (0.99 to 1.09)	1133 (3 studies)	⊕○○○ very low ^{3,6}	

	825 per 1000	858 per 1000 (817 to 900)			
	Moderate				
	729 per 1000	758 per 1000 (722 to 795)			
Condom use for clients of sex workers	Study population		RR 1.1 (0.69 to 1.75)	26 (1 study)	⊕⊕⊕○ moderate ³
	706 per 1000	776 per 1000 (487 to 1000)			
	Moderate				
	706 per 1000	777 per 1000 (487 to 1000)			

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio;

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

¹ Not randomised studies.

² Heterogeneity is significantly different.

³ Small sample size.

⁴ RR is 0.46.

⁵ RR is 0.09.

⁶ Including non randomised studies.

BACKGROUND

Description of the condition

The HIV/AIDS epidemic continues to expand worldwide. Globally, there were an estimated 33.3 million people (range 31.4 million to 35.3 million) living with HIV in 2009, and the annual number of new HIV infections declined from 3.0 million (range 2.6 million to 3.5 million) in 2001 to 2.6 million (2.3 million to 2.8 million) in 2009 (UNAIDS 2010). Overall, 1.8 million people (range 1.6 million to 2.1 million) died from AIDS in 2009 (UNAIDS 2010).

Some of the most worrisome increases in new infections are now occurring in various high-income countries, such as those in Western Europe (UNAIDS 2010, UNAIDS 2009). The rate of newly reported HIV infections in Europe nearly doubled between 2000 and 2007 (van de Laar 2008). In the United States, the Centers for Disease Control and Prevention estimated that the annual HIV incidence has remained relatively stable since the early 1990s, although the annual number of new HIV infections in 2006 (56,300) was approximately 40% greater than previously estimated (Hall 2008). In Canada, official epidemiological estimates suggest that the annual HIV incidence may have increased between 2002 and 2005 (Public Health Agency of Canada 2007).

Sex workers are defined as female, male and transgender, whether adults or young people including adolescents, who receive money, goods or protection directly or indirectly in exchange for indoor or outdoor sexual services, such as in a brothel, street or home, either regularly or occasionally, and who may or may not consciously define those activities as income-generating. The World Health Organization (WHO) regards sex workers as one of the four key populations globally for HIV/AIDS health initiatives (WHO 2006). Sex workers are at high risk for infection with HIV, and their clients may serve as a "bridging population" by spreading HIV to the general population (Ghys 2001A). Talbott argued that the number of HIV-infected sex workers in an individual country is highly significant for explaining the HIV prevalence levels across countries in globally (Talbott 2007). National estimates of the median HIV prevalence among sex workers averaged 0.4% (range 0.1% to 1.4%) in Western Europe in 2000 (Vandepitte 2006). It has been estimated that there are around 80,000 female sex workers (FSWs) in Britain (Scambler 2007) and that less than 2% of London's FSWs are HIV-positive (Day 2006a; Day 2006b), notwithstanding reports that almost half (43%) of new diagnoses of HIV in the United Kingdom in 2005 occurred in London (UNAIDS/WHO 2006).

In general, the living and working conditions of sex workers could result in a variety of interrelated risk factors for HIV infection as follows: a large number of different sexual partners, and hence exposure to many other sexually transmitted infections (STIs) that could increase the probability of acquiring or transmitting HIV; unprotected sexual activity, often because clients or private partners refuse to use condoms; and drug injection by either the sex

workers or her sexual partners (Estebanez 1993). Violence against sex workers mediated by partners, family or the community was reported to have a relationship with an increased risk of STIs in San Francisco (Cohan 2006).

Migrant sex workers have become a bridging population in the global spread of HIV/AIDS in various high-income countries (Parrado 2004A, O'Connor 1996), and their mobility causes problems for the establishment of support networks and ongoing medical care (Mardh 1999, Church 2001, Wolffers 2002). An Australian study showed a higher risk of STIs and lower rates of condom use for international sex workers than for local sex workers (O'Connor 1996). Higher HIV rates were also found in foreign transsexual sex workers in Rome (Spizzichino 2001). Migrant sex workers face cultural, social, legal and linguistic obstacles to accessing services and information (WHO 2005).

Description of the interventions

Many clients of sex workers refuse to use condoms during sexual relations (Estebanez 1993). Condoms comprise one of the most efficacious methods for reducing the risk of transmission of agents of STIs, including HIV infection (Sarkar 2008). Female condoms are accepted by sex workers (Denlaud 1997, Michael 2005), but are associated with major difficulties including cost and poor availability. Continued use of female condoms has not been easy, because some populations have not been receptive to these condoms owing to concerns about the unfamiliar appearance, reported discomfort from the inner ring, high cost and prejudice against their use by providers (Mantell 2005). In Amsterdam, a survey of men recruited from an STI clinic who had had relations with sex workers in the preceding 4 months found that less than half of these men always used condoms during vaginal intercourse with sex workers, and only 7% used condoms with their private sexual partners (Hooykaas 1989).

Injecting drug use is the major risk factor associated with HIV infection among sex workers in Western countries (Estebanez 1993). In most cases, infection among injecting drug users probably results from sharing contaminated syringes or needles, although some women may have acquired HIV through sexual contact with a drug-using partner. Furthermore, non-injected recreational drugs may also cause people to fail to practice safer sex, thereby contributing to HIV transmission. A number of investigators have reported that the disinhibiting effects of alcohol and other drugs decrease the likelihood of using condoms, and may increase the tendency to engage in higher-risk forms of sexual activity (Robertson 1988, Harcourt 1990, Plant 1990). Among 118 sex workers studied in New York from 1985 to 1987, 31% of those who injected drugs versus only 7% of those who did not were HIV-positive (Wallace 1987). A European survey of 866 sex workers from nine European centres (Amsterdam, Antwerp, Athens, Copenhagen, Lisbon, London, Paris, Vienna and eight cities in Spain) carried out from 1990 to 1991 found that the HIV

seroprevalence was 32% among women who were injecting drug users and <2% among women who did not inject drugs (European Working Group 1992). Similarly, a survey of 208 street-based sex workers in Glasgow found that 59% injected drugs (McKeganey 1990).

In regions where HIV infection is rare among FSWs, surveillance of risk behaviour and STIs will indicate the potential for spread of HIV infection (UNAIDS/WHO 2006). Surveillance of behaviour, STIs and HIV among sex workers is important, because the results may indicate the success or failure of the national response to the epidemic, including targeted programs to encourage safe sex between sex workers and clients (Ghys 2001). Interventions to change behaviour among sex workers and their clients have been identified as a strategy to reduce HIV transmission. Fisher et al (Fisher 2006a, Fisher 2006b) concluded that critical components of interventions included not only information but also motivation and skills. Vaginal use of topical microbicides by women helps to reduce the transmission of HIV (Poynten 2009) and other STIs (Behets 2008). Interventions for management of STIs were based on clinical diagnosis and serologic tests for herpes simplex virus type 2 (HSV-2) with a monoclonal blocking enzyme immunoassay (Kamali 2003).

Many sex workers experience violence and fear of arrest under illegal conditions, and may give lower priority to their health needs and behaviour changes, compared with more immediate concerns for their safety and survival (WHO 2005, Alexander 1998).

How the interventions might work

A previously conducted meta-analysis in developing countries showed that behaviour change interventions effectively reduce HIV transmission for sex workers (Merson 2000). Voluntary counselling and testing (VCT) for HIV has been associated with increased condom use, reduced number of partners, and decreased HIV in sex workers and clients (Merson 2000). These effects result from behaviour changes following education, support and knowledge of one's HIV status. Care programmes and participation in research can have similar effects (Michael 2005).

Male condoms reduce HIV and STI transmission in sex workers (Hananberg 1994, Holmes 1994, Donovan 2004) and prevent STI complications, such as pelvic inflammatory disease (Ness 2004). A reliable and accessible supply of good quality condoms is essential (UNAIDS 2002, Merson 2000, Michael 2005). Condom promotion, distribution and social marketing result in increased condom use and reduced STI and HIV infection rates, especially in FSWs (Merson 2000). Local culture, language and traditions should also be considered (Gerofi 1995). Female condoms have successfully prevented pregnancy and reduced STI transmission in analytical studies (Denlaud 1997, Fontanet 1998, French 2003), and there is *in vitro* evidence and biological plausibility for HIV prevention (Denlaud 1997).

Education for sex workers may improve healthy behaviour by delivering the basic facts about disease, dispelling myths, and offering healthy lifestyle and work options (Michael 2005). Education may effectively reduce drug use, disease, violence, debt and exploitation (O'Connor 1996, Merson 2000, Vanwesenbeeck 2001, UNAIDS 2002). Peer education has resulted in substantial increases in STI and HIV knowledge, condom use and safer sex practices, and reduced the incidence of HIV and STIs (Vanwesenbeeck 2001, UNAIDS 2002, Michael 2005).

Community development has been successful in the promotion of safe sex, identification of injustice, support for HIV-infected workers, enhancement of self-esteem, cooperation with police and controllers, provision of legal and financial training, initiation of alternative income-generation schemes, and support for migrants and human rights (UNAIDS 1999, UNAIDS 2002, Michael 2005). Successful initiatives have resulted in enhanced self-esteem, improved negotiating skills, ability to refuse clients, access and use of condoms, training to recognize, avoid and escape violence, STI and HIV preventive services, safe houses, drop-in centres and STI treatment through pharmacies (UNAIDS 1999, Vanwesenbeeck 2001, Williamson 2001, UNAIDS 2002).

Why it is important to do this overview

The settings in which sex workers work, as well as the behavioural characteristics of these sex workers and their clients, may differ between the high-income developed world and low- and middle-income developing world. Hence, the intervention strategies may also be different.

Behavioural interventions are being undertaken in various regions of high-income countries (Dorfman 1992). However, there has been no systematic review that has examined and summarized their effects. Therefore, this systematic review was undertaken to assess the available evidence regarding behavioural interventions to prevent HIV transmission among sex workers in high-income countries.

OBJECTIVES

- To identify the studies performed on behavioural interventions to reduce the transmission of HIV infection among sex workers and their clients in high-income countries.
- To evaluate the effects of behavioural interventions on reducing the transmission of HIV infection among sex workers and their clients in high-income countries.

METHODS

Criteria for considering studies for this review

Types of studies

Studies that evaluated the effects of behavioural interventions on any one of the outcome measures, specified below, and that met the criteria for methodological rigour on the basis of the study design (randomised controlled trials and certain quasi-experimental designs) in high-income countries were included. Randomised controlled trials in which the units of randomisation were individuals and clusters (groups or communities) were included. Cross-over trials were also included. From non-randomised studies, specified quasi-experimental prospective designs with a control group were considered eligible only if they included independent comparison groups where assignment to treatment status was not based on need or volition, and where separate baseline measurements were also taken, as in the Untreated Control Group Design with Pretest and Posttest (Cook 1979).

Examples of studies that were not eligible were those that compared:

- People who chose to participate in an intervention with those who did not.
- Baseline and follow-up measures with no separate comparison condition.
- Only follow-up measures without baseline measures when either individuals or groups were assigned to the treatment condition by a non-random process.

High-income countries are those that are technologically advanced and enjoy a relatively high standard of living. For the purposes of this review, we considered these to be the 66 countries identified by the World Bank as having “high-income economies” (World Bank).

Types of participants

1. Sex workers were defined as female, male and transgender, whether adults or young people including adolescents, who receive money, goods or protection directly or indirectly in exchange for indoor or outdoor sexual services, such as in a brothel, street or home, either regularly or occasionally, and who may or may not consciously define those activities as income-generating.

2. Clients of sex workers (male, female and transgender) were defined as female, male and transgender adults or young people who give money, goods or protection in exchange for sexual services to sex workers (defined above), either regularly or occasionally.

Types of interventions

Behavioural or social interventions designed to promote sexual risk reduction and thereby to reduce transmission of HIV or other

STIs. These interventions may be delivered to individuals, groups or communities.

Types of outcome measures

Primary outcomes:

- Changes in biological variables for prevention among FSWs and their male clients, including HIV incidence, HIV prevalence, STI incidence and STI prevalence.

Secondary outcomes:

- Changes in self-reported behaviour or changes in observed behaviour (e.g. knowledge, attitudes, intentions, self-reported sexual behaviour and biological outcomes).

These outcome measures included:

1. Condom use (male/female).
2. Needle changes.
3. Increasing self-efficacy for protective behaviour.
4. Improving communication with partners (male clients and private partners) regarding safer sexual practices.
5. Use of microbicides (post-exposure and pre-exposure).
6. Treatment of STIs and reproductive tract infections.
7. Violence (physical, psychological or sexual victimisation).

Search methods for identification of studies

See the Cochrane HIV/AIDS Group search strategy.

See Appendix 1 for our strategies in searching PubMed, Cochrane CENTRAL and EMBASE.

Intervention strategies for behavioural changes may be heterogeneous and influenced by social, demographic and cultural factors, according to local situations. Reporting strategies for the effects of these interventions might not be uniform and there may be considerable grey literature and local publications dealing with this issue. Hence, relevant studies were identified by the following procedures:

Electronic searches

An extensive search strategy string was developed in consultation with the Trial Search Coordinator of the HIV/AIDS Review Group and contained trials identified from January 1980 to July 2010:

The Cochrane Central Register for Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews, PubMed, PsycInfo, ERIC, Web of Science, National Research Register, CINAHL, Dissertation Abstract International (DAI), EMBASE and Cochrane HIV/AIDS Group specialized register were searched. The publication sites of the World Health Organization, US Centers for Disease Control and Prevention, and other international research sites were also searched.

All possible keywords were included in the string to get an exhaustive electronic literature search. Journals in all languages were included in the search. Articles from other languages were translated into English with the help of experts, and the data were extracted.

Searching other resources

Personal communication: Key personnel and organisations working in HIV/AIDS interventions in high-income countries, including members of the various networks of sex work researchers and activists in high-income countries including the United Kingdom, Canada and the United States, were contacted for published and unpublished references and data.

Conference proceedings of national and international conferences related to HIV/AIDS were searched using AEGiS until 2008, and with the respective conference websites for more recent years, such as the International AIDS Conference (IAC), International AIDS Society (IAS) and Conference on Retroviruses and Opportunistic Infections (CROI).

The search strategy was iterative in that references in the included studies were searched for additional references.

Data collection and analysis

The methodology for the data collection and analysis was based on the Cochrane Handbook of Systematic Reviews of Interventions (Higgins 2011).

Selection of studies

All studies that addressed behavioural interventions in high-income countries were identified. High-income countries included all high-income countries in the World Bank. A high-income country was one with an annual gross national income per capita equivalent to USD \$11,906 or greater in 2009 (World Bank). The abstracts of all the identified studies underwent initial screening in an inclusive manner, based on the objectives of the study, and were short-listed. The full articles of the short-listed studies were obtained and scrutinized independently by two reviewers (EO, WW) for possible inclusion. The scrutiny for inclusion was based on the type of study, type of participants, type of interventions, and outcome measures. A standard proforma was developed and used for documenting the decision process. Each reviewer independently documented the determination of the study's inclusion or exclusion and the reasons. A third reviewer (RM) served as an arbitrator. Subsequently, the agreed-upon studies were included in the review. In the case of the excluded studies, a summary statement was made about the reasons for each exclusion.

Data extraction and management

The data from the selected studies were independently extracted by two review authors (EO, WW), using a pre-designed data extraction sheet. The data extraction sheet contained details of the key entries, namely the trial's identification, methods, type of participants, intervention and outcomes.

We used the data collection forms to extract the data for the study design. For the eligible studies, two review authors (EO, WW) extracted the data using the agreed-upon form. We resolved any discrepancies through discussion or, if required, we consulted an additional review author (RM). We entered the data into Review Manager software (RevMan 2011) and checked for accuracy. When information regarding any of the above was unclear, we contacted the authors of the original reports to provide further details.

Assessment of risk of bias in the included studies

Two review authors (EO, WW) independently assessed the risk of bias for each study using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2011). We resolved any disagreements by discussion or by involving an additional assessor (RM). The following risks of bias were evaluated:

1. Sequence generation (checking for possible selection bias).
2. Allocation concealment (checking for possible selection bias).
3. Blinding (checking for possible performance bias).
4. Incomplete outcome data (checking for possible attrition bias through withdrawals, dropouts or protocol deviations).
5. Selective reporting bias.
6. Other sources of bias.
7. Overall risk of bias.

Measures of treatment effects

- Dichotomous data: We have presented the results as the summary risk ratio with the 95% confidence interval (CI).
- Continuous data: We have used the mean difference if outcomes were measured in the same way between trials. We have used the standardised mean difference to combine trials that measured the same outcome but used different methods.

Unit of analysis issues

Individually randomised trials, cluster-randomised trials and cross-over trials were included.

Dealing with missing data

For the included trials, we noted the levels of attrition. For all outcomes, we carried out the analysis on an intention-to-treat basis. The denominator for each outcome in each trial was the number randomised minus any participants whose outcomes were known to be missing.

Assessment of heterogeneity

We used the I^2 statistic to measure the heterogeneity among the trials in each analysis. If we identified substantial heterogeneity ($I^2 > 50\%$), we explored it by a prespecified subgroup analysis.

Assessment of reporting biases

Where we suspected reporting bias, we attempted to contact the study authors, asking them to provide missing outcome data. Where this was not possible, and the missing data were thought to introduce serious bias, we explored the impact of including such trials in the overall assessment of the results by a sensitivity analysis.

Data synthesis and investigation of heterogeneity

Cochrane Review Manager software RevMan 5.1.4 was used for all data syntheses and analyses (RevMan 2011). All participants were analysed in the groups to which they were randomised, and the heterogeneity between study results was assessed using the chi-square test of homogeneity, with significance defined at the 10% level. The study results were expressed as the risk ratio (RR) for dichotomous data, with the 95% CI, and combined using the random-effects method because of the significant heterogeneity between the study results. We used the criteria of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) to evaluate the quality of the evidence by outcome (Guyatt 2008).

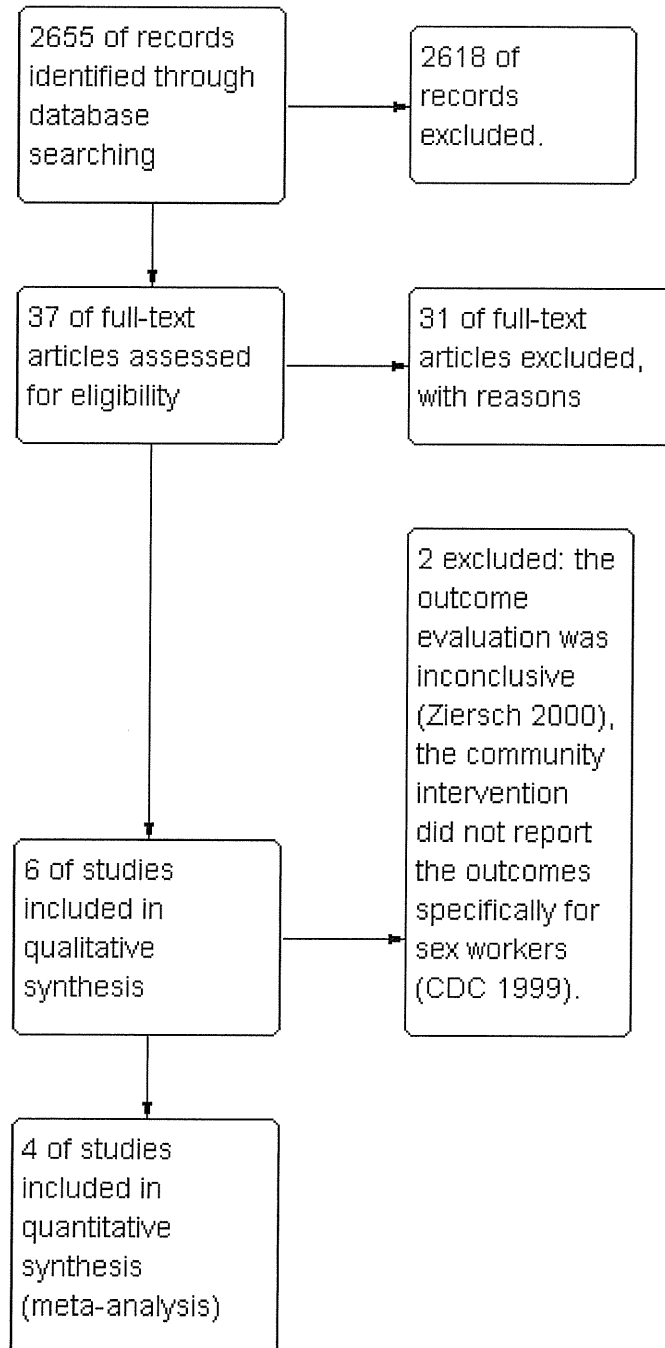
RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

After screening 2655 citations, we identified 34 potentially relevant studies. After reviewing the 34 complete articles for the studies, we determined that four (two randomised controlled trials and two quasi-experimental pretest-posttest trials with control groups) met our inclusion criteria (Archibald 1994, Wong 1998, Lau 2010, Surratt 2010) (Figure 1) out of six eligible studies (Archibald 1994, Wong 1998, CDC 1999, Ziersch 2000, Lau 2010, Surratt 2010). The other two studies were excluded because the outcome evaluation was inconclusive (Ziersch 2000) and the community intervention did not report the outcomes specifically for sex workers (CDC 1999).

Figure 1. Study flow diagram.



The details of each study are given in the table "Characteristics of included studies" and are noted below.

Randomised control trials

Surratt 2010 conducted a randomised intervention study in Miami, Florida, USA. The primary objective of the study was to test the relative effectiveness of two alternative HIV and hepatitis B and C prevention protocols, the National Institute on Drug Abuse (NIDA) Standard Intervention and a Sex Worker Focused (SWF) Intervention that was developed specifically to reduce risky drug use and sexual behaviours of street-based FSWs. Eligible participants were women aged 18 to 50 years who had (a) traded sex for money or drugs at least three times in the past 30 days, and (b) used heroin and/or cocaine three or more times a week in the past 30 days. A total of 806 drug-using FSWs were recruited using targeted sampling strategies and randomly assigned to the NIDA Standard Intervention (n=396) or the innovative SWF Intervention (n=410). Similar to the standard intervention, the SWF Intervention was designed as a brief protocol consisting of two 60-minute sessions delivered 2 weeks apart. At the 3-month follow-up, 272 FSWs assigned to the NIDA Intervention (66.3%) and 274 FSWs assigned to the SWF Intervention (69.2%) were included in the analysis. At the 6-month follow-up, 254 (62.0%) and 252 (63.6%) were included, respectively.

The trial conducted by Lau 2010 investigated the relative efficacy of using the VCT plus information dissemination (VCT-ID) approach versus the information dissemination (ID) approach in promoting condom use among male clients of FSWs in Hong Kong. The inclusion criteria were male Hong Kong Chinese cross-border truck drivers (aged ≥ 18 years), who reported having had sex with either an FSW or a female non-regular sex partner (NRP) in mainland China in the last 12 months (NRP was operationally defined as female sex partners who were not commercial sex partners, spouses or girlfriends) and were willing to provide their mobile phone number. A total of 301 participants were randomly allocated to intervention group (n=147) or control group (n=154) by opening a randomisation envelope. At baseline, anonymous structured questionnaires, administered through a computer-assisted method, were used to collect data. The intervention group received the voluntary counselling and testing service (30-45 minutes to complete) and the control group was given three educational pamphlets with very brief counselling (2-4 minutes). At the first follow-up (1 month from baseline), 141 (95.9%) for the intervention group and 148 (96.1%) for the control group completed the follow-up. At the second follow-up (2 months from

baseline), 141 (95.9%) and 147 (95.5%) completed the follow-up, respectively.

Quasi-experimental pretest-posttest trials with a control group

Archibald 1994 evaluated the effects of a brief intervention programme on sexually transmitted disease (STD) knowledge, condom use and gonorrhoea incidence among brothel-based sex workers in Singapore. All brothel-based sex workers (n=1226) were invited to attend a 3-hour safe sex intervention session, which consisted of educational lectures, video presentations and role-playing. A controlled before-and-after study was performed whereby the experimental group (n=221) was interviewed, immediately given the intervention and then interviewed again 3 months later. The control group (n=221) was interviewed at the same times, but their intervention was not given until the second interview was complete. At the 3-month follow-up, 182 participants (82.4%) in the experimental group and 199 participants (90.0%) in the control group completed the follow-up.

The other quasi-experimental pretest-posttest trial with a control group was conducted in a cohort of 253 female brothel-based sex workers in Singapore by Wong 1998. One intervention site (n=124) and a comparable control site (n=122) were maintained for 5 months, followed by a time series design to follow up the intervention group for 2 years. Two 2-hour small-group sessions were conducted in a public STD clinic. The instructional methods used included video presentations with actresses as local sex workers to demonstrate negotiation skills, role-playing and peer group discussion of problems arising from their self-monitoring of condom use. Experienced peers gave practical tips on how to deal with difficult clients, and how to reduce problems specific to condom use such as condom slippage, condom breakage and pain from prolonged condom use. All gonorrhoea cases were given individual counselling. Peer leaders were selected by the sex workers themselves to follow up on the sessions and to act on problems encountered. After 3 months, a booster session was held with the distribution of free condoms and pamphlets, and dissemination of congratulatory messages to all compliant and non-infected participants. The control group did not receive any new intervention. A total of 246 subjects were followed up at 5 months with 122 subjects in the control group and 124 in the intervention group. Of these, 96 (77.4%) intervention subjects completed the 1-year follow-up and 74 (59.7%) completed the 2-year follow-up.

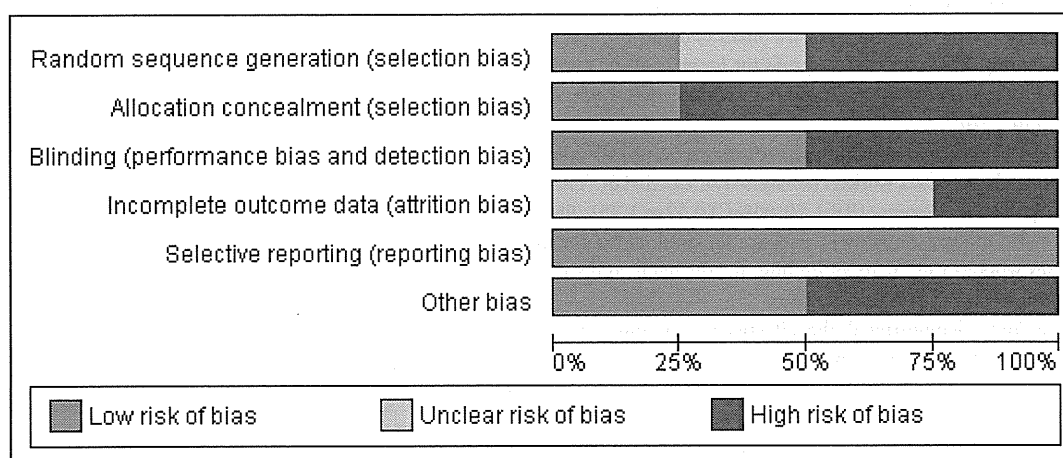
Risk of bias in included studies

See Figure 2 and Figure 3.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding (performance bias and detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Archibald 1994	⊖	⊖	⊕	⊖	⊕	⊖
Lau 2010	⊕	⊕	⊕	?	⊕	⊕
Surratt 2010	?	⊖	⊖	?	⊕	⊕
Wong 1998	⊖	⊖	⊖	?	⊕	⊖

Figure 3. Risk of bias graph: the review authors' judgements about each risk of bias item presented as percentages across all the included studies.



Surratt 2010: The study was randomised between the NIDA Standard Intervention and the SWF Intervention, although adequate sequence generation was not described. The randomisation essentially balanced the characteristics of the SWF Intervention group and the NIDA Standard Intervention control group. The study was unmasked and all study outcomes were reported.

Lau 2010: The study was block randomised. The fieldworker was concealed from the allocation sequence. The randomisation essentially balanced the characteristics of the intervention group and the control group.

Archibald 1994: The study was not randomised and there was a baseline imbalance between the experimental group and the control group. Missing outcome data for C1 (Time 1, n=221 to Time 2, n=199) and E1 (Time 1, n=221 to Time 2, n=182) were not reported.

Wong 1998: The study was not randomised and there was a baseline imbalance between the experimental group and the control group.

Effects of interventions

See: **Summary of findings for the main comparison** Behavioural intervention vs. control for reducing HIV transmission among sex workers and their clients in high-income countries.

Behavioural interventions versus controls: four studies with 1802 sex workers and their clients

The four studies contributing data to the review focused on different outcomes. One study included clients of FSWs (Lau 2010), while the participants of the other three studies were FSWs (Archibald 1994, Surratt 2010, Wong 1998).

Primary outcomes

No trials reported the HIV prevalence/incidence as outcomes.

1. STI incidence and STI prevalence

Data were collected for two of the reviews' primary outcomes: STI incidence for FSWs (Analysis 1.1, Archibald 1994, Wong 1998) and STI prevalence for clients of FSWs (Analysis 1.2, Lau 2010). There was significant heterogeneity in the included studies in the STI incidence (two trials, n=627, heterogeneity P=0.02, I²=82%). Overall, the effects of behavioural interventions for sex workers in high-income countries on STI incidence were not significant between groups with random effects models (RR 0.46, 95% CI 0.11 to 1.98). Both studies examined gonorrhoea with biological tests, and no data were available by randomisation for the STI incidence. These trials provided very low quality evidence of no effect of behavioural interventions on STI incidence (Summary of findings for the main comparison). Only one study reported that STI prevalence based on self-reports of clients of FSWs was statistically significant (RR 0.09, 95%CI 0.01 to 0.72). This trial provided high quality of evidence for a benefit of behaviour intervention on lower STI prevalence (Summary of findings for the main comparison).

Secondary outcomes

2. Condom use

Three trials evaluated condom use for prevention of HIV and STIs among sex workers (Analysis 1.3, Surratt 2010, Archibald 1994, Wong 1998). The heterogeneity was not statistically significant among the included trials for condom use (three trials, n=1133, heterogeneity P=0.07, I²=63%). Moreover, there was no significant difference between the behavioural intervention group and the control group for condom use (RR 1.04, 95%CI 0.99 to 1.09). Sub-group analysis was conducted among randomised control trial group (Surratt 2010; RR 1.0, 95%CI 0.96 to 1.03) and quasi-experimental pretest-posttest with control group (Archibald

1994; Wong 1998; RR 1.08, 95%CI 0.99 to 1.18). The three trials (Archibald 1994; Surratt 2010; Wong 1998) provided very low quality evidence for condom use for prevention of HIV and STI (Summary of findings for the main comparison). Nevertheless, Wong 1998 observed a significant increase in the number of FSWs always refusing sex without a condom (RR 1.85, 95%CI 1.25 to 2.76).

One trial evaluated condom use for prevention of HIV and STIs among clients of sex workers (Analysis 1.4, Lau 2010). There was no significant difference (RR 1.10, 95%CI 0.69 to 1.75). This trial provided moderate quality of evidence for condom use for clients of sex workers (Summary of findings for the main comparison).

3. Knowledge of HIV transmission

One study demonstrated the effectiveness of intervention for knowledge of HIV transmission for sex workers (Analysis 1.5, Archibald 1994). In Archibald 1994, a brief intervention programme on STD knowledge for FSWs appeared to have an effect (RR1.82, 95%CI 1.55 to 2.14), although the study was not randomised and there were differences in the educational levels.

One study showed the effectiveness of intervention for knowledge of HIV transmission for clients of sex workers (Analysis 1.6, Lau 2010). In Lau 2010 (randomisation study), 30–45 minutes of VCT service for clients of FSWs also had a significant effect for knowledge of HIV transmission (RR 1.93, 95%CI 1.46 to 2.55).

4. Others

In Lau 2010, the outcome of male clients who visited FSWs in Hong Kong decreased in the intervention group (10.9% to 6.4%), while it increased in the control group (6.5% to 11.7%) at the second follow-up survey (2 months after baseline), but the RR was not significant (RR 0.54, 95%CI 0.25 to 1.18) (Analysis 1.7). Moreover, VCT intervention increased the number of participants who perceived the use of condoms as highly efficacious in preventing HIV (15.8% to 27.7%), while the number decreased in the control group (22.1% to 20.5%), although the difference between the groups was not significant (RR 1.35, 95% CI 0.89 to 2.04) (Analysis 1.8).

Violent victimisation outcomes were examined for the intervention group effect in the Surratt 2010 parallel intervention study. The SWF Intervention was significantly more effective in reducing sexual violence at the 6-month follow-up, with the participants in this group nearly twice as likely compared with those in the Standard Intervention group to report a decrease in sexual abuse/victimisation. Although both groups reported lower physical abuse/victimisation after exposure to their respective intervention protocols, no differential impact was apparent at either the 3- or 6-month follow-ups (Analysis 1.9, physical victimisation RR 0.99, 95%CI 0.63 to 1.56) (Analysis 1.10, sexual victimisation RR 0.99, 95%CI 0.53 to 1.86).

DISCUSSION

Summary of main results

This review demonstrates that there is limited evidence from randomised controlled trials on the effectiveness of behavioural interventions in reducing the transmission of HIV infection among sex workers and their clients in high-income countries. Only two randomised controlled trials and two quasi-experimental pretest-posttest trials with control groups were included in this review. Indeed, of the four studies that we identified, only two reported STI incidence and one reported STI prevalence as an outcome measure. In one of these, the STI incidence (rates of gonorrhoea based on biological testing) was not significantly different after 5 months of follow-up in the intervention group of FSWs. STI prevalence was also significantly reduced among male clients of FSWs, although the outcome was self-reported. There were no outcomes for HIV incidence or prevalence among the included studies. Although there was no significant difference between the behavioural intervention group and the control group for overall condom use, Wong 1998 observed a significant increase in the number of FSWs always refusing sex without a condom in the intervention group at the 5-month follow-up, which may be related to the favourable outcome of STI incidence above. Interventions that include condom negotiation techniques with role-playing and peer group discussions may be effective strategies for FSWs. Moreover, findings from the two studies (Archibald 1994; Lau 2010) demonstrated the effectiveness of interventions that increase knowledge of HIV transmission for sex workers and their clients.

This review provides information that such potential approaches to contract sex workers make them more conscious of and responsible for their health status. Where sex workers are vulnerable in the transmission of HIV and STIs, protection strategies to reduce the vulnerability should be a priority on the policy agenda. Therefore, the meta-analysis in this review provides designs and implementations for future priority studies, particularly in high-income settings, that should be taken into account by policymakers in the design of future interventions.

Overall completeness and applicability of evidence

Only four studies contributed data to this review, of which only two were randomised controlled trials. The data are limited and the results of the review should thus be interpreted with caution. No data were available for some of the review's prespecified outcomes (e.g. HIV incidence or prevalence, needle changes, use of microbicides, less risky types of sex) or participants (e.g. male and transgender sex workers, female clients for sex workers). Therefore, the results of this review can only be applied to FSWs and their clients. Despite these limitations, the results of the review suggest that targeted HIV prevention programs may play an important role in reducing STI incidence and prevalence among FSWs and their male clients.

Quality of the evidence

The evidence from the four studies included in the review is likely to be at some risk of bias, as the two quasi-experimental pretest-posttest trials with a control group design had baseline differences (Archibald 1994, Wong 1998). Only one study from Lau 2010 made efforts to reduce bias introduced by certain aspects of the study design with the use of sequence generation, allocation concealment and blinding for fieldworkers. Another randomised controlled trial from Surratt 2010 randomised the FSWs, but did not report the use of sequence generation, allocation concealment or blinding.

Missing data are a particular problem in studies where a population of highly marginalized FSWs with high levels of unstable housing and transience, combined with heavy drug use and limited social connections, impeded efforts to maintain contact with a significant proportion of the participants. Thus, there is no direct evidence to suggest that attrition biased the analyses of the key outcomes.

One of the eligible, but excluded, STI prevention studies on the male sex industry in London by Ziersch illustrated some of the difficulties associated with conducting these studies (Ziersch 2000). The outcome evaluation was inconclusive owing to loss of follow-up.

Potential biases in the review process

There were a number of potential biases in the review process. We attempted to minimise bias in several ways: two review authors independently assessed the eligibility for inclusion and exclusion, carried out data extraction and assessed the risk of bias. However, carrying out reviews is not an exact science and may require a certain amount of subjective judgment. Therefore, it is possible that a different review team may have reached different decisions regarding assessments of eligibility and risk of bias.

Agreements and disagreements with other studies or reviews

Two of the included studies were peer-driven interventions that used both quantitative and qualitative methods to identify sex workers' needs (Surratt 2010; Wong 1998). One of the studies (Wong 1998) was consistent with the result that HIV prevention education among injecting drug users in the United States is more effective for peer-driven intervention than for intervention by outreach workers (Broadhead 1998). Wong 1998 used social and behavioural theories to develop multiple interventions aimed at motivating sex workers to use condoms by relating safe sex to their values, developing their negotiation skills and increasing their self-efficacy to always refuse sex without a condom if the negotiation fails, and providing support by getting brothel keepers to display posters and talk to clients on condom use. Prior to the study, Surratt 2010 conducted a series of focus groups with

53 active and former sex workers to better understand the issues most relevant to HIV prevention among this population, including drug use and sexual activity. The role of violent victimisation in exacerbating women's risk for HIV was derived from important content obtained from these focus groups. In addition, the intervention was more effectively tailored to sex workers by using language suggested by the target population as being more relevant and meaningful to FSWs. These sex workers specified that peer intervention programs may have positive effects on the results of the studies.

AUTHORS' CONCLUSIONS

Implications for practice

To date, four interventions have been identified that assess the effectiveness of behavioural interventions in reducing the transmission of HIV infection among sex workers and their clients in high-income countries. The behavioural interventions were effective at reducing STI prevalence and improving the knowledge of HIV transmission, but not significant for overall STI incidence or condom use in individual-level interventions for FSWs and their clients. The results of these interventions were positive, but more randomized controlled trials are needed before the evidence can be considered conclusive.

Implications for research

Very little research has been carried out on the use of behavioural interventions to prevent HIV transmission among sex workers and their clients in high-income settings. This may be a result of the difficulties associated with follow-up tracking of highly marginalized sex workers and their clients. Further randomised controlled trials are very likely to have an important impact on our confidence in the estimates of the effects. Rigorous interventions with outcomes of HIV incidence or prevalence, conducted among sex workers and their clients (e.g. female, male, transgender) in a variety of different settings are urgently needed. Studies on the nature and types of violence against sex workers are also necessary to provide evidence on how sex workers experience physical, psychosocial and sexual violence from the community or partners.

ACKNOWLEDGEMENTS

We thank the Thai Cochrane Network for providing the Cochrane workshop.

REFERENCES

References to studies included in this review

Archibald 1994 *{published data only}*

Archibald C P, Chan R K, Wong M L, Goh A, Goh C L. Evaluation of a safe-sex intervention programme among sex workers in Singapore. *Int J STD AIDS*. 1994; Vol. 5, issue 4:268–72.

Lau 2010 *{published data only}*

Lau J T F, Tsui H Y, Cheng S, Pang M. A randomized controlled trial to evaluate the relative efficacy of adding voluntary counseling and testing (VCT) to information dissemination in reducing HIV-related risk behaviors among Hong Kong male cross-border truck drivers. *AIDS Care*. 2010;22(1):17–28.

Surratt 2010 *{published data only}*

Surratt H L, Inciardi J A. An effective HIV risk-reduction protocol for drug-using female sex workers. *Journal of Prevention & Intervention in the Community*. 2010;38(2): 118–31.

Wong 1998 *{published data only}*

Wong M L, Chan K W, Koh D. A sustainable behavioral intervention to increase condom use and reduce gonorrhoea among sex workers in Singapore: 2-year follow-up. *Prev Med*. 1998;27(6):891–900.

References to studies excluded from this review

Albert 1995 *{published data only}*

Albert AE, Warner DL, Hatcher RA, Trussell J, Bennett C. Condom Use among Female Commercial Sex Workers in Nevada's Legal Brothels. *American Journal of Public Health* 1995; Vol. 85, issue 11:1514–20. [0090–0036]

Burgos 2010 *{published data only}*

Burgos JL, Gaebler JA, Strathdee SA, Lozada R, Staines H, Patterson TL. Cost-effectiveness of an intervention to reduce HIV/STI incidence and promote condom use among female sex workers in the Mexico-US border region. *PloS one*. 2010/07/10 2010; Vol. 5, issue 6:e11413. [1932–6203: (Electronic)]

Cameron 2002 *{published data only}*

Cameron DW. Targeted HIV treatment to sex workers to promote HIV prevention. *Journal of the International Association of Physicians in AIDS Care*. 2003/08/29 2002; Vol. 1, issue 2:51–2. [1545–1097: (Print)]

CDC 1999 *{published data only}*

CDC. Community-level HIV intervention in 5 cities: final outcome data from the CDC AIDS Community Demonstration Projects. *American journal of public health* 1999, issue 3:336–45.

Chan 1997 *{published data only}*

Chan R, Goh CL. STD/AIDS knowledge and risk behaviour among masseuses and bar hostesses in Singapore. *International journal of STD & AIDS*. 1997/06/01 1997; Vol. 8, issue 6:373–7. [0956–4624: (Print)]

Corby 1998 *{unpublished data only}*

Corby NH, Rhodes F. Influence of role-model stories and condom availability on condom use by female sex workers. *Int Conf AIDS*. Geneva, Switzerland, 1998; Vol. 12:233.

de Graaf 1997 *{published data only}*

de Graaf R, van Zessen G, Vanwesenbeeck I, Straver CJ, Visser JH. Condom use by Dutch men with commercial heterosexual contacts: determinants and considerations. *AIDS education and prevention : official publication of the International Society for AIDS Education*. 1997/12/10 1997; Vol. 9, issue 5:411–23. [0899–9546: (Print)]

Etcheverry 2010 *{published data only}*

Etcheverry MF, de Lazzari E, Fuchs JD, Merono M, Sierra E, Del Romero J, et al. Pilot Study Assessing HIV Vaccine Trial Readiness Among Female Sex Workers, Injection and Non-injection Drug Users, and Men Who Have Sex with Men in Spain. *AIDS and Behavior* 2010; Vol. 14, issue 3: 607–17. [1090–7165]

Feldblum 2007 *{published data only}*

Feldblum PJ, Nasution MD, Hoke TH, Van Damme K, Turner AN, Gmach R, et al. Pregnancy among sex workers participating in a condom intervention trial highlights the need for dual protection. *Contraception*. 2007/07/28 2007; Vol. 76, issue 2:105–10. [0010–7824: (Print)]

Ghys 2001 *{published data only}*

Ghys PD, Diallo MO, Etiegne-Traore V, Satten GA, Anoma CK, Maurice C, et al. Effect of interventions to control sexually transmitted disease on the incidence of HIV infection in female sex workers. *Aids* 2001, issue 11: 1421–31.

Greenberg 1998 *{published data only}*

Greenberg J, Lifshay J, Van Devanter N, Gonzales V, Celentano D. Preventing HIV infection: the effects of community linkages, time, and money on recruiting and retaining women in intervention groups. *Journal of women's health / the official publication of the Society for the Advancement of Women's Health Research*. 1998/07/03 1998; Vol. 7, issue 5:587–96. [1059–7115: (Print)]

Hoffman-Goetz 2005 *{published data only}*

Hoffman-Goetz L, Friedman DB, Clarke JN. HIV/AIDS risk factors as portrayed in mass media targeting First Nations, Métis, and Inuit peoples of Canada. *Journal of health communication* 2005, issue 2:145–62.

Johnson 2002 *{published data only}*

Johnson AM, Fenton KA, Mercer C. Phase specific strategies for the prevention, control, and elimination of sexually transmitted diseases: background country profile, England and Wales. *Sexually Transmitted Infections* 2002; Vol. 78: 1125–32. [1368–4973]

Kwiatkowski 1999 *{published data only}*

Kwiatkowski CF, Stober DR, Booth RE, Zhang Y. Predictors of increased condom use following HIV intervention with heterosexually active drug users. *Drug and alcohol dependence* 1999, issue 1:57–62.

- Lau 2002** *{published data only}*
Lau JTF, Siah PC, Tsui HY. Behavioral surveillance and factors associated with condom use and STD incidences among the male commercial sex client population in Hong Kong -- results of two surveys. *AIDS Education & Prevention* 2002; Vol. 14, issue 4:306–17. [0899–9546]
- Lau 2003** *{published data only}*
Lau JT, Tsui HY, Wang QS. Effects of two telephone survey methods on the level of reported risk behaviours. *Sexually transmitted infections* 2003, issue 4:325–31.
- Mantell 2008** *{published data only}*
Mantell JE, Stein ZA, Susser I. Women in the time of AIDS: Barriers, bargains, and benefits. *Aids Education and Prevention* 2008; Vol. 20, issue 2:91–106. [0899–9546]
- Miller 1998** *{published data only}*
Miller RL, Klotz D, Eckholdt HM. HIV prevention with male prostitutes and patrons of hustler bars: replication of an HIV preventive intervention. *American Journal Of Community Psychology* 1998, issue 1:97–131.
- Morse 1992** *{published data only}*
Morse EV, Simon PM, Balson PM, Osofsky HJ. Sexual behavior patterns of customers of male street prostitutes. *Archives of sexual behavior*. 1992/08/01 1992; Vol. 21, issue 4:347–57. [0004–0002: (Print)]
- National 2002** *{published data only}*
National Institute of Mental Health Multisite HIVPTG. Predictors of sexual behavior patterns over one year among persons at high risk for HIV. *Archives of sexual behavior* 2002, issue 2:165–76.
- Paone 1999** *{published data only}*
Paone D, Cooper H, Alperen J, Shi Q, Des Jarlais DC. HIV risk behaviours of current sex workers attending syringe exchange: the experiences of women in five US cities. *AIDS care*. 1999/09/04 1999; Vol. 11, issue 3:269–80. [0954–0121: (Print)]
- Parrado 2004** *{published data only}*
Parrado EA, Flippen CA, McQuiston C. Use of commercial sex workers among Hispanic migrants in North Carolina: implications for the spread of HIV. *Perspectives on Sexual & Reproductive Health* 2004; Vol. 36, issue 4:150–6. [1538–6341]
- Reisner 2008** *{published data only}*
Reisner SL, Mimiaga MJ, Mayer KH, Tinsley JP, Safren SA. Tricks of the trade: sexual health behaviors, the context of HIV risk, and potential prevention intervention strategies for male sex workers. *Journal of LGBT health research*. 2008/01/01 2008; Vol. 4, issue 4:195–209. [1557–4091: (Print)]
- Richardson 2001** *{published data only}*
Richardson BA, Lavreys L, Martin HL, Stevens CE, Ngugi E, Mandalia K, et al. Evaluation of a low-dose nonoxynol-9 gel for the prevention of sexually transmitted diseases: a randomized clinical trial. *Sexually transmitted diseases* 2001, issue 7:394–400.
- Sankary 1998** *{unpublished data only}*
Sankary T, Frerichs R, Kihara M, Miyao M, Nakajima K, Tadokoro K. HIV risk behavior intervention trial in foreign female prostitutes (FFPs) in Japan.. *Int Conf AIDS*. 1998; Vol. 12:900. [: AEGiS]
- Schroeder 2006** *{published data only}*
Schroeder JR, Epstein DH, Umbricht A, Preston KL. Changes in HIV risk behaviors among patients receiving combined pharmacological and behavioral interventions for heroin and cocaine dependence. *Addictive behaviors* 2006, issue 5:868–79.
- Stary 1991** *{published data only}*
Stary A, Kopp W, Soltz-Szots J. Medical health care for Viennese prostitutes. *Sexually transmitted diseases*. 1991/07/01 1991; Vol. 18, issue 3:159–65. [0148–5717: (Print)]
- Van Damme 2000** *{published data only}*
Van Damme L, Chandeying V, Ramjee G, Rees H, Sirivongrangson P, Laga M, et al. Safety of multiple daily applications of COL-1492, a nonoxynol-9 vaginal gel, among female sex workers. *COL-1492 Phase II Study Group*. *AIDS*. 2000/03/14 2000; Vol. 14, issue 1:85–8. [0269–9370: (Print)]
- Vickerman 2010** *{published data only}*
Vickerman P, Ndowa F, O'Farrell N, Steen R, Alary M, Delany-Moretwe S. Using mathematical modelling to estimate the impact of periodic presumptive treatment on the transmission of sexually transmitted infections and HIV among female sex workers. *Sexually transmitted infections*. 2009/10/27 2010; Vol. 86, issue 3:163–8. [1472–3263: (Electronic)]
- Ward 1996** *{published data only}*
Ward H, De La Court A, Kitchen V. Nonoxynol-9 in lubricated condoms. Results of a study in female prostitutes. *Sexually transmitted diseases*. 1996/09/01 1996; Vol. 23, issue 5:413–4. [0148–5717: (Print)]
- Weir 1999** *{published data only}*
Weir SS, Roddy RE, Zekeng L, Ryan KA. Association between condom use and HIV infection: a randomised study of self reported condom use measures. *Journal of epidemiology and community health*. 1999/09/24 1999; Vol. 53, issue 7:417–22. [0143–005X: (Print)]
- Yahne 2002** *{published data only}*
Yahne CE, Miller WR, Irvin-Vitela L, Tonigan JS. Magdalena Pilot Project: motivational outreach to substance abusing women street sex workers. *Journal of substance abuse treatment*. 2002/07/20 2002; Vol. 23, issue 1:49–53. [0740–5472: (Print)]
- Ziersch 2000** *{published data only}*
Ziersch A, Gaffney J, Tomlinson DR. STI prevention and the male sex industry in London: evaluating a pilot peer education programme. *Sexually transmitted infections*. 2001/02/28 2000; Vol. 76, issue 6:447–53. [1368–4973: (Print)]

Additional references

Alexander 1998

Alexander P. Sex work and health: a question of safety in the workplace. *Journal of the American Women's Medical Association* 1998;53(2):77–82.

Behets 2008

Behets FM, Turner AN, Damme KV, Rabenja NL, Ravelomanana N, Swezey TA, et al. Vaginal microbicide and diaphragm use for sexually transmitted infection prevention: a randomized acceptability and feasibility study among high-risk women in Madagascar. *Sexually Transmitted Diseases* 2008;35(9):818–826.

Broadhead 1998

Broadhead RS, Heckathorn DD, Weakliem DL, Anthony DL, Madray H, Mills RJ, et al. Harnessing peer networks as an instrument for AIDS prevention: results from a peer-driven intervention. *Public health reports (Washington, D.C. : 1974)* 1998;113 Suppl 1:42–57. [PubMed: 9722809]

Church 2001

Church S, Henderson M, Barnard M, Hart G. Violence by clients toward female prostitutes in different work settings: questionnaire survey. *BMJ* 2001;322:524–25.

Cohan 2006

Cohan D, Lutnick A, Davidson P, Cloniger C, Herlyn A, Breyer J, et al. Sex worker health: San Francisco style. *Sexually transmitted infections* 2006;82(5):418–22.

Cook 1979

Cook TD, Campbell DT. Chapter 3: Quasi-Experiments: Nonequivalent Control Group Designs. *Quasi-Experimentation: Design & Analysis Issues for Field Settings*. Boston: Houghton Mifflin Company, 1979:103–118.

Day 2006a

Day S, Ward H. Sex Work, morbidity and health in Europe. London. *Sex work, morbidity and health in Europe*. London: Kegan Paul, 2006a.

Day 2006b

Day, S, & Ward, H. Approaching health through the prism of stigma: research in seven European countries. *Sex work, morbidity and health in Europe*. London: Kegan Paul, 2006b.

Deniaud 1997

Deniaud F. Current status of the female condom in Africa. *Sante* 1997;7:405–15.

Donovan 2004

Donovan B. Sexually transmissible infections other than HIV. *Lancet* 2004;363:545–56.

Dorfman 1992

Dorfman LE, Derish PE, Cohen JB. Hey girl friend: an evaluation of AIDS prevention among women in the sex industry. *Health Education Quarterly* 1992;19:25–40.

Estebanez 1993

Estebanez P, Fitch K, Najera R. HIV and female sex workers. *Bulletin of the World Health Organization* 1993;71(3-4):397–412.

European Working Group 1992

European Working Group on HIV Infection in Female Prostitutes. HIV infection in European female sex workers:

epidemiological link with use of petroleum based lubricants. Abstracts of the 8th international conference on AIDS. Amsterdam. 1992:C274.

Fisher 2006a

Fisher JD, Fisher WA, Amico KR, Harman JJ. An information-motivation-behavioral skills model of adherence to antiretroviral therapy. *Health Psychology* 2006;25(4):462–73.

Fisher 2006b

Fisher JD, Fisher WA, Cornman DH, et al. Clinician-delivered intervention during routine clinical care reduces unprotected sexual behavior among HIV-infected patients. *J Acquir Immune Defic Syndr* 2006;41:44–52.

Fontanet 1998

Fontanet AL, Saba J, Chandelying V, Sakondhavit C, Bhiraueus P, Rugpao S, Chongsomchai C, Kiriwat O, Tovananutra S, Dally L, Lange JM, Rojanapithayakorn W. Protection against sexually transmitted diseases by granting sex workers in Thailand the choice of using the male or female condom: results from a randomized controlled trial. *AIDS* 1998;12:1851–59.

French 2003

French PP, Latka M, Gollub EL, Rogers C, Hoover DR, Stein ZA. Use-effectiveness of the female versus male condom in preventing sexually transmitted disease in women. *Sex Transm Dis* 2003;30:433–39.

Gerofi 1995

Gerofi J, Deniaud F, Friel P. Interaction of condom design and user techniques and condom acceptability. *Contraception* 1995;52:223–28.

Ghys 2001A

Ghys PD, Jenkins C, Pisani E. HIV surveillance among female sex workers. *AIDS* 2001;15(3):s33–40.

Guyatt 2008

Guyatt GH, Oxman AD, Vist G, Kunz R, Falck-Ytter Y, Alonso-Coello P, Schünemann HJ, for the GRADE Working Group. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008;336:924–926.

Hall 2008

Hall HI, Song R, Rhodes P, Prejean J, An Q, Lee LM, Karon J, Brookmeyer R, Kaplan EH, McKenna MT, Janssen RS. Estimation of HIV incidence in the United States. *JAMA* 2008 Aug 6;300(5):520–9.

Hanenberg 1994

Hanenberg RS, Rojanapithayakorn W, Kunasol P, Sokal DC. Impact of Thailand's HIV-control programme as indicated by the decline of sexually transmitted diseases. *Lancet* 1994;344:243–45.

Harcourt 1990

Harcourt C, Philpot R. Female prostitutes, AIDS, drugs, and alcohol in New South Wales. *Plant, M., ed. AIDS, drugs and prostitution*. London: Tavistock/Routledge, 1990: 132–157.

- Higgins 2011**
Higgins JPT, Green S, editor. *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 (updated 2011)*. The Cochrane Collaboration, 2011.
- Holmes 1994**
Holmes KK. Human ecology and behavior and sexually transmitted bacterial infections. *Proc Natl Acad Sci USA* 1994;**91**:2448–55.
- Hooykaas 1989**
Hooykaas C, van der Pligt J, van Doornum GJ, van der Linden MM, Coutinho RA. Heterosexuals at risk for HIV: differences between private and commercial partners in sexual behaviour and condom use. *AIDS* 1989;**3**:525–32.
- Kamali 2003**
Kamali A, Quigley M, Nakiyingi J, et al. Syndromic management of sexually-transmitted infections and behaviour change interventions on transmission of HIV-1 in rural Uganda: a community randomized trial. *Lancet* 2003;**361**:645–652.
- Mantell 2005**
Mantell JE, Myer L, Carballo-Díéguez A, Stein Z, Ramjee G, Morar NS, Harrison PF. Microbicide acceptability research: current approaches and future directions. *Social Science & Medicine* 2005;**60**(2):319–30.
- Mardh 1999**
Mardh PA, Shoubnikova M, Genc M, Chaplinkas S, Unzeitig V. Health care of female commercial sex workers. *Eur J Contracep Repr Health Care* 1999;**4**:165–80.
- McKeganey 1990**
McKeganey N, Barnard M, Bloor M, Leyland A. Injecting drug use and female street-working prostitution in Glasgow. *AIDS* 1990;**4**:1153–1155.
- Merson 2000**
Merson MH, Dayton JM, O'Reilly K. Effectiveness of HIV prevention interventions in developing countries. *AIDS* 2000;**14**(2):s68–84.
- Michael 2005**
Michael LR. Sex-work harm reduction. *Lancet* 2005;**366** (9503):2123–34.
- Ness 2004**
Ness RB, Randall H, Richter HE, Peipert JF, Montagno A, Soper DE, Sweet RL, Nelson DB, Schubeck D, Hendrix SL, Bass DC, Kip KE. Condom use and the risk of recurrent pelvic inflammatory disease, chronic pelvic pain, or infertility following an episode of pelvic inflammatory disease. *Am J Public Health* 2004;**94**:1327–29.
- O'Connor 1996**
O'Connor CC, Berry G, Rohrsheim R, Donovan B. Sexual health status and use of condoms among local and international sex workers in Sydney. *Genitourin Med* 1996;**72**:47–51.
- Parrado 2004A**
Parrado EA, Flippen CA, McQuiston C. Use of commercial sex workers among Hispanic migrants in North Carolina: implications for the spread of HIV. *Perspect Sex Repr Health* 2004;**36**(4):150–6.
- Plant 1990**
Plant M. Sex work, alcohol, drugs, and AIDS. *AIDS, drugs and prostitution*. London: Tavistock/Routledge, 1990:1–17.
- Poynten 2009**
Poynten IM, Millwood IY, Falster MO, Law MG, Andresen DN, Van Damme L, Kaldor JM. The safety of candidate vaginal microbicides since nonoxynol-9: a systematic review of published studies. *AIDS* 2009;**23**(10):1245–54.
- Public Health Agency of Canada 2007**
Public Health Agency of Canada. HIV/AIDS epi updates. Public Health Agency of Canada November 2007.
- RevMan 2011**
The Cochrane Collaboration. Review Manager (RevMan) 5.1.4. Copenhagen: The Nordic Cochrane Centre, 2011.
- Robertson 1988**
Robertson JA, Plant MA. Alcohol, sex and risks of HIV infection. *Drug and alcohol dependence* 1988;**22**:75–78.
- Sarkar 2008**
Sarkar NN. Barriers to condom use. *The European Journal of Contraception and Reproductive Health Care* 2008;**13**(2): 114–22.
- Scambler 2007**
Scambler, G. Sex work stigma: opportunist migrants in London. *Sociology* 2007;**41**:1079–1096.
- Spizzichino 2001**
Spizzichino L, Zaccarelli M, Rezza G, Ippolito G, Antinori A, Gattari P. HIV infection among foreign transsexual sex workers in Rome: prevalence, behavior patterns, and seroconversion rates. *Sex Transm Dis* 2001;**28**(7):405–11.
- Talbott 2007**
Talbott JR. Size matters: the number of prostitutes and the global HIV/AIDS pandemic. *PLoS One* 2007;**2**(6):e543.
- UNAIDS 1999**
UNAIDS. *Summary booklet of best practices*. Geneva: Joint United Nations Programme on HIV/AIDS, 1999.
- UNAIDS 2002**
UNAIDS. *Sex work and HIV/AIDS*. Geneva: Joint United Nations Programme on HIV/AIDS, 2002.
- UNAIDS 2009**
UNAIDS. AIDS epidemic update. <http://data.unaids.org/pub/Report/2009/JC1700'Epi'Update'2009'en.pdf> 2009.
- UNAIDS 2010**
UNAIDS. Report on the global AIDS epidemic. http://www.unaids.org/globalreport/Global_report.htm. UNAIDS, 2010.
- UNAIDS/WHO 2006**
UNAIDS, WHO. AIDS epidemic update. <http://data.unaids.org/pub/EpiReport/2006/2006'EpiUpdate'en.pdf> 2006.
- van de Laar 2008**
van de Laar MJ, G Likatavicius, A R Stengaard, M C Donoghoe. HIV/AIDS surveillance in Europe: update 2007. *Eurosurveillance* 2008;**13**(50):1–3.

Vandepitte 2006

Vandepitte J, Lyerla R, Dallabetta G, Crabb F, Alary M, Buy A. Estimates of the number of female sex workers in different regions of the world. *Sex Transm Infect* 2006;**82**(3):iii18–25.

Vanwesenbeeck 2001

Vanwesenbeeck I. Another decade of social scientific work on sex work: a review of research 1990–2000. *Ann Rev Sex Res* 2001;**12**:242–89.

Wallace 1987

Wallace JI, et al. HIV exposure in New York City street walkers (prostitutes). Abstracts of the 3rd international conference on AIDS. Washington DC, 1987; Vol. 55:172.

WHO 2005

World Health Organization. Violence against women and HIV/AIDS: Critical intersections Violence against sex workers and HIV prevention. Information Bulletin Series, Number 3 2005:1–6.

WHO 2006

World Health Organization. 2006 Report on the global AIDS epidemic. Geneva. WHO 2006.

Williamson 2001

Williamson C, Folaron G. Violence, risk, and survival strategies of street prostitution. *West J Nurs Res* 2001;**23**:463–75.

Wolffers 2002

Wolffers I, Fernandez I, Verghis S, Vink M. Sexual behaviour and vulnerability of migrant workers for HIV infection. *Cult Health Sexuality* 2002;**4**:459–73.

World Bank

World Bank 2009. List of economies. siteresources.worldbank.org/DATASTATISTICS/Resources/CLASS.XLS.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by year of study]

Archibald 1994

Methods	<i>Quasiexperimental pretest-posttest with control group.</i> All brothel-based sex workers (n=1226) were invited to attend a 3-h safe sex intervention session. Each group of sex workers was chosen from a different area of the city to reduce the possibility of contamination of the control group	
Participants	Brothel-based sex workers in Singapore.	
Interventions	3-h safe sex intervention session which consisted of educational lectures, video presentations and role-playing	
Outcomes	STD knowledge, condom use, gonorrhoea rates	
Notes	Baseline, 3 month	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomised.
Allocation concealment (selection bias)	High risk	Not randomised.
Blinding (performance bias and detection bias) All outcomes	Low risk	The outcomes would not have affected by a lack of blinding.
Incomplete outcome data (attrition bias) All outcomes	High risk	Missing outcome data of C1 (Time 1, n=221 to Time 2, n=199) and E1 (Time1, n=221 to Time 2=182) was not reported
Selective reporting (reporting bias)	Low risk	All study outcomes reported.
Other bias	High risk	Not randomised study and baseline imbalance between experimental group and control

Wong 1998

Methods	Quasiexperimental pretest-posttest with control group. All 128 sex workers from a central locality in Singapore were assigned to an intervention programme. In the selection of a control group from the six localities, we used available socio-demographic data of the sex workers from our earlier studies, clinical records of gonorrhoea from the Department of STD Control, and findings from our pilot studies on their sexual behaviour and negotiation skills	
Participants	Brothel-based sex workers in Singapore	
Interventions	It consisted of two 2-h small group sessions conducted by trained health advisers and the principal investigator (M.L.W.) in the public STD clinic. Groups of about 16 sex workers were organized to provide a heterogeneous mix of sex workers with differing attitudes and skills in condom negotiation so as to get them to share their individual views and experiences, and provide support to each other under the guidance of a health facilitator. Instructional methods used include video presentations with local sex workers as actresses to demonstrate negotiation skills, role-plays and peer group discussion of problems arising from their self-monitoring of condom use. The experienced peers gave practical tips on how to deal with difficult clients, and how to reduce problems specific to condom use such as condom slippage, breakage and pain from prolonged use of condoms. All gonorrhoea cases were given individual counselling. Peer leaders were selected by the sex workers themselves to follow up on the sessions and to act on problems encountered. Three months later, a booster session was held with the distribution of free condoms, pamphlets and dissemination of congratulatory messages to all compliant and non-infected participants. The control group did not receive any new intervention	
Outcomes	Average success rate in persuading clients to use condoms(%), No(%) always refusing sex without condom, No(%) with gonorrhoea	
Notes	Baseline, 5 months, 1 year, 2 years	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomised.
Allocation concealment (selection bias)	High risk	Not randomised.
Blinding (performance bias and detection bias) All outcomes	High risk	Not blinding.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No description.
Selective reporting (reporting bias)	Low risk	All study outcomes reported.