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).

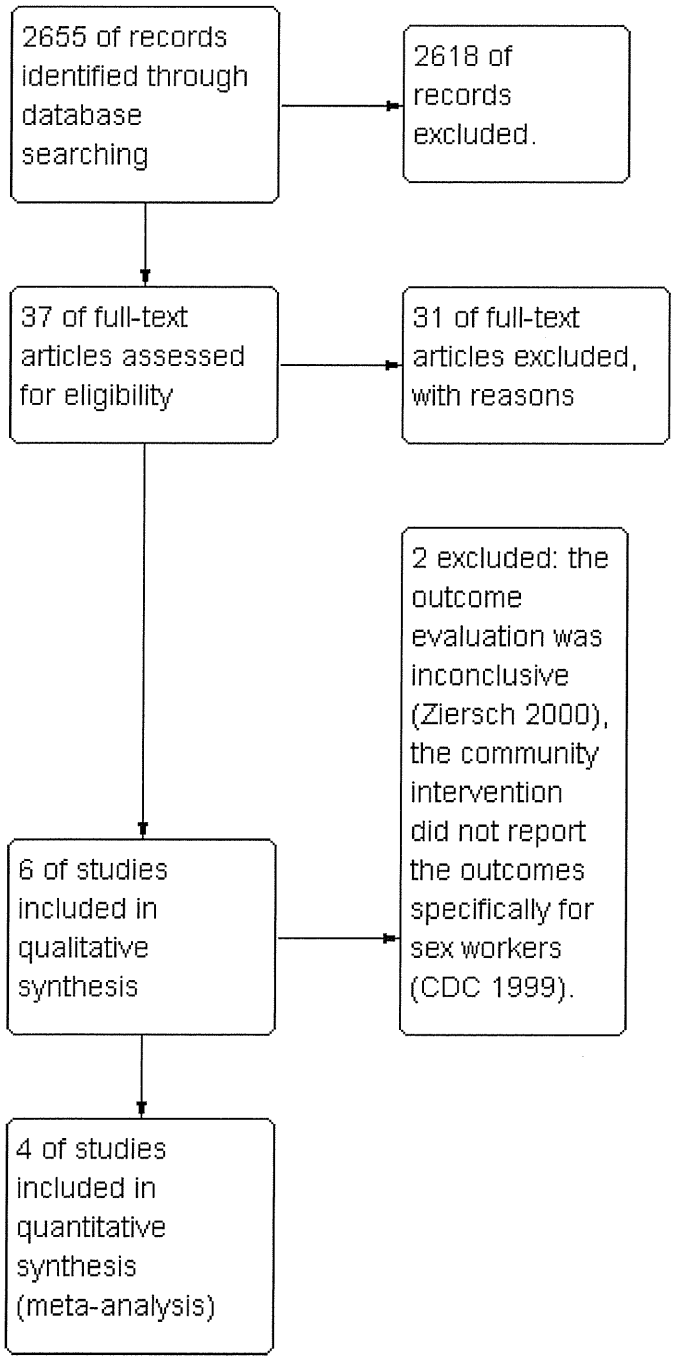
RESULTS

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 $\geq$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.

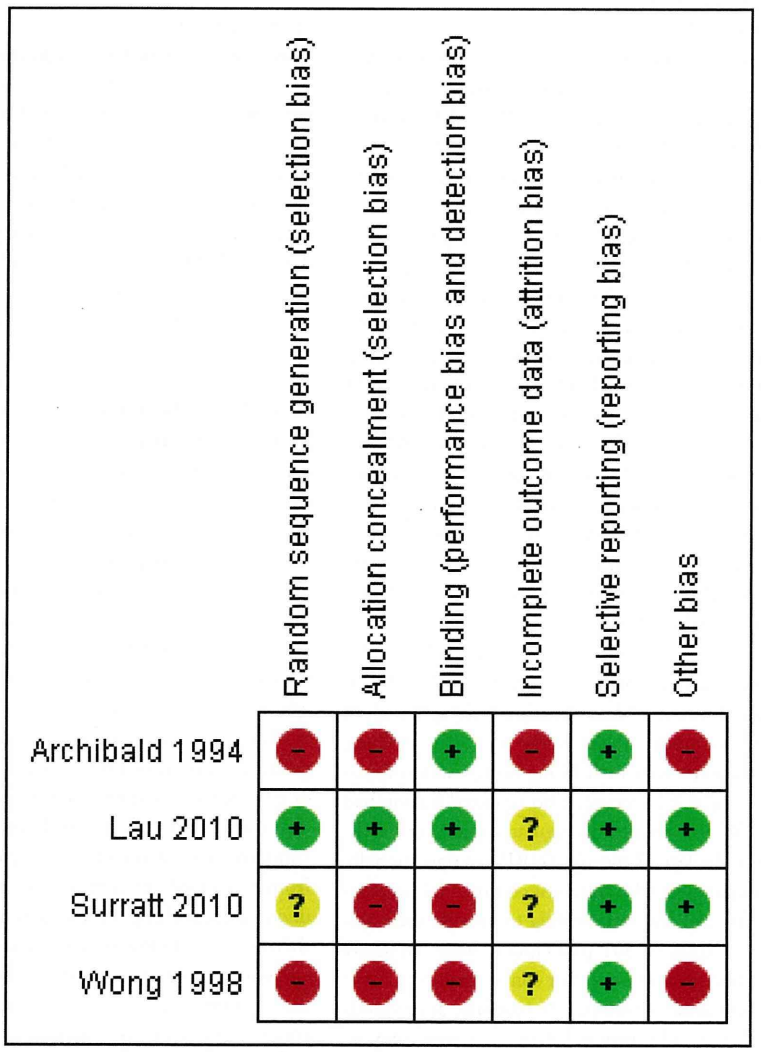
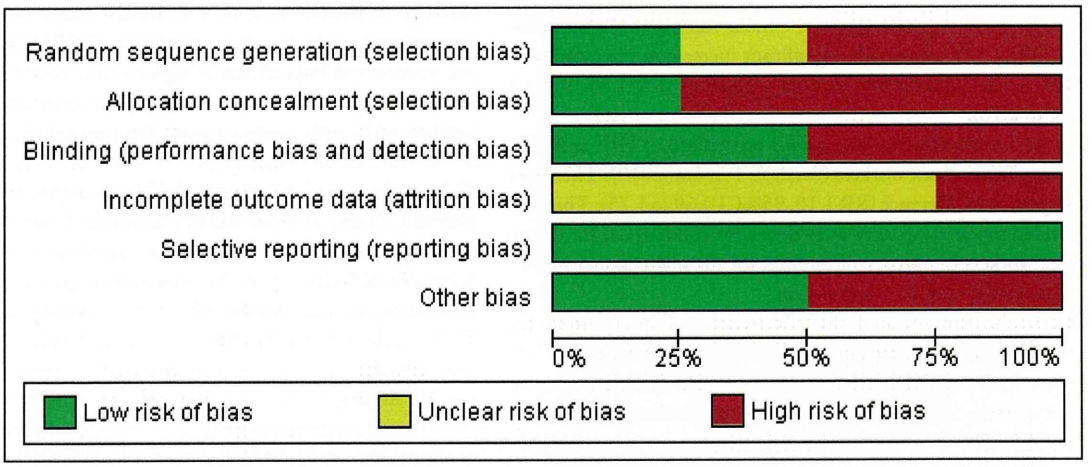


Figure 3. Risk of bias graph: the review authors' judgements about each risk of bias item presented as percentages across all the included studies.



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, I^2=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, I^2=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.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by year of study]*

Archibald 1994

Methods	*Quasiexperimental pretest-posttest with control group.* 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	
Risk of bias		
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

Risk of bias

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.

Wong 1998 *(Continued)*

Other bias	High risk	Not randomised study and baseline imbalance between experimental group and control

Lau 2010

Methods	RCT.An experienced HIV prevention worker of a NGO briefed prospective participants about the study in the rest area of checkpoint in Hong Kong while the drivers were waiting for custom clearance
Participants	Male Hong Kong Chinese cross-border truck drivers (age 18 years old or above), who reported having had sex with either a FSW or a female non-regular sex partner (NRP) in mainland China in the last 12 months (NRP is operationally defined as female sex partners who were not commercial sex partners, nor spouse, nor girlfriends) and were willing to provide us with their mobile phone number
Interventions	Members of the intervention group received the VCT service (30_45 minutes to complete). The baseline risk level of these VCT participants was assessed (e.g., STD history, number of sex partners, sexual risk behaviours, and relevant risk perceptions) by a well-trained fieldworker. Discussion was made (e.g., other relevant HIV-related perceptions and planning prior to the testing) before the administration of the rapid test. Other topics were then discussed in the post-test counselling procedure (e.g., under what circumstances condoms should be used, window period for HIV detection, meaning/implications associated with a positive or negative testing result, and action plans). The three aforementioned education pamphlets and a letter written by a person living with HIV/AIDS (about meaning and issues concerning HIV positive status) were presented to the participants, who were further encouraged to ask questions. The Abbott Determine HIV-1/2 test kit was used. During the study period, the same fieldworker contacted all the participants of both groups via mobile phone biweekly to establish rapport and to conduct the two follow-up surveys
Outcomes	Condom use, Penetrated before putting on condoms when having sex with FSW(%), Drank alcohol frequently before having sex with FSW in mainland China(%), Used psychoactive substances before having sex with FSW in mainland China(%), Self-reported having contracted STD (%)
Notes	Baseline, first follow up (1 month), second follow up (2 months)

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Participants were randomly allocated to Group I or Group C by opening a randomisation envelope (block randomisation with block size of eight)

Lau 2010 *(Continued)*

Allocation concealment (selection bias)	Low risk	The fieldworker was concealed of the allocation sequence.
Blinding (performance bias and detection bias) All outcomes	Low risk	Allocation was evident, although the outcomes would not have been affected by a lack of blinding
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No description.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	Ransomisation has essentially balanced the characteristics of the intervention and control groups

Surratt 2010

Methods	Parallel RCT.	
Participants	Eligible participants were women aged 18 to 50 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	
Interventions	Similar to the Standard intervention, the SWF intervention was also designed as a brief protocol consisting of two 60-minute sessions delivered 2 weeks apart. It provides parallel coverage of many of the topics covered in the Standard intervention, yet it discusses them in language suggested by the target population as more relevant and meaningful to female sex workers. In addition, as indicated earlier, the intervention addresses issues of special relevance to sex workers, including common misconceptions about HIV risk, techniques for avoiding violent situations, risks associated with unprotected oral sex, and common barriers to safer sex	
Outcomes	Risk behaviours: Days of substance use in past 30 days, Times unprotected vaginal sex in past 30 days, Times unprotected oral sex in past 30 days, Times sex work while high in past 30 days, Physical victimization in past 90 days, Sexual victimization in past 90 days,	
Notes	3 month follow up, 6 month follow up	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not described

Surratt 2010 *(Continued)*

Allocation concealment (selection bias)	High risk	Not described
Blinding (performance bias and detection bias) All outcomes	High risk	Not blinding
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No description on this.
Selective reporting (reporting bias)	Low risk	All study outcomes reported
Other bias	Low risk	Randomisation has essentially balanced the characteristics of the SWF intervention and standard intervention control groups

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Albert 1995	Not intervention study.
Burgos 2010	Study was not conducted in high income country.
Cameron 2002	Not intervention study.
CDC 1999	Community intervention, not only sex workers also other targeted included, outcome could not only measure sex workers
Chan 1997	No control group.
Corby 1998	*Conference proceeding only. Only the abstract was available as this study has never been published. Authors of the study did not reply our e-mail and could not contacted, and no further information was obtained.*
de Graaf 1997	Not intervention study.
Etcheverry 2010	Not intervention study.
Feldblum 2007	Study was not conducted in high income country.
Ghys 2001	Study was not conducted in high income country.
Greenberg 1998	Participants are not only sex workers (10-36%), results are not specified on sex workers
Hoffman-Goetz 2005	Not intervention study.
Johnson 2002	Not intervention study focused on sex workers.

(*Continued*)

Kwiatkowski 1999	Participants are injection drug users.
Lau 2002	Not intervention study.
Lau 2003	Not intervention study.
Mantell 2008	Not intervention study.
Miller 1998	No control group.
Morse 1992	Not intervention study.
National 2002	Not only sex workers also other targeted included, outcome could not only measure sex workers
Paone 1999	Not intervention study.
Parrado 2004	Not intervention study.
Reisner 2008	Qualitative research.
Richardson 2001	Study was not conducted in high income country.
Sankary 1998	Conference proceeding only. Only the abstract was available as this study has never been published. First author who knows further detail could not contacted for missing contact information per the suggestion of the other co-author who could contacted, and no further information was obtained
Schroeder 2006	Focused on drug user not sex worker.
Stary 1991	Not intervention study.
Van Damme 2000	Study was not conducted in high income country.
Vickerman 2010	Study was not conducted in high income country.
Ward 1996	Study was not conducted in high income country.
Weir 1999	Study was not conducted in high income country.
Yahne 2002	No control group.
Ziersch 2000	The failure of the quasi-experimental design. The outcome evaluation was inconclusive