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SUBSTANTIVE REVIEW

# A Systematic Review of HIV and STI Behavior Change Interventions for Female Sex Workers in the United States

**Neetu Abad · Brittney N. Baack · Ann O'Leary · Yuko Mizuno · Jeffrey H. Herbst · Cynthia M. Lyles**

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**Abstract** The lives of female sex workers (FSW) in the US are typically marked by substance abuse, violence, trauma, and poverty. These factors place FSW at risk for acquiring and transmitting HIV and other sexually transmitted infections (STIs). The purpose of this systematic review is to examine HIV/STI interventions conducted in the US that aim to reduce sexual- or drug-related risk behavior among FSW. Eighteen studies describing 19 unique interventions met our selection criteria: five exclusively targeted FSW, two reported stratified data for FSW, and 12 included at least 50 % FSW. Results indicate that 15 interventions provided HIV/STI information, 13 provided substance abuse prevention information, and few included content tailored to specific needs of FSW. Our findings suggest that current HIV/STI prevention efforts in the US do not adequately address the needs of FSW. Interventions are needed to address issues facing FSW in order to reduce HIV/STI transmission in this high-risk group.

**Resumen** Las vidas de las trabajadoras sexuales (TS) en los EE.UU. típicamente están marcadas por el abuso de sustancias, violencia, trauma y pobreza. Estos factores ponen las TS en riesgo de contraer y transmitir el VIH y otras infecciones de transmisión sexual (ITS). El propósito de esta revisión sistemática es examinar las intervenciones de VIH/ITS llevó a cabo en los EE.UU. que tienen como objetivo reducir comportamiento arriesgado entre las TS relacionado a drogas o relaciones sexuales. Dieciocho estudios que describen 19 intervenciones únicas cumplieron con los criterios de selección: 5 enfocaron exclusivamente en las TS, 2 reportaron datos estratificadas para las TS, y en 12 por lo menos el 50 % de los participantes eran TS. Los resultados indican que 15 intervenciones proporcionaron información sobre el VIH/ITS, 13 proporcionaron información sobre la prevención del abuso de sustancias, y pocas incluyeron contenidos adaptados a las necesidades específicas de las TS. Nuestros resultados sugieren que los esfuerzos actuales de prevención del VIH/ITS en los EE.UU. no abordan adecuadamente las necesidades de las TS. Se requieren intervenciones para abordar los problemas que enfrentan las TS con el fin de reducir la transmisión de VIH/ITS en este grupo de alto riesgo.

**Keywords** HIV/STI prevention · Female sex workers · Behavioral interventions · Systematic review

N. Abad (✉)
Division of STD Prevention, NCHHSTP, Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop E-44, Atlanta, GA 30333, USA
e-mail: vjx3@cdc.gov

B. N. Baack · A. O'Leary · Y. Mizuno · C. M. Lyles
Division of HIV/AIDS Prevention, NCHHSTP, Centers for Disease Control and Prevention, Atlanta, GA, USA

J. H. Herbst
Division of Violence Prevention, NCIPC, Centers for Disease Control and Prevention, Atlanta, GA, USA

## Introduction

In the United States, an estimated 20–40 % of women at high risk of HIV infection reported having sex in exchange for money or drugs within the past year [1–3]. Female sex workers (FSW) in the US have been identified as a high-risk 'bridge' population who can acquire and transmit HIV and other STIs via engagement in multiple risk behaviors that often occur simultaneously: inconsistent condom use, sex with partners of

unknown HIV status, concurrent sexual partnerships with risky sexual partners, and engagement in poly-drug use including injection drugs and crack [4, 5]. However, the criminalized nature of sex work in the US makes this population particularly difficult to identify and reach. As a result, FSW may be less likely to receive HIV/STI services and to access programs that enable long-term behavior change [6].

The stigmatization and marginalization of FSW in the US also makes it difficult to reliably quantify HIV-risk in this population. Conservative estimates suggest that women who exchange sex for money or drugs have a higher risk of HIV/STI infection than not only the general population, but also other similarly high-risk women who do not engage in sex work [7–10]. According to 2010 national surveillance estimates for high-risk heterosexuals, HIV prevalence among men and women who reported ≥1 one exchange partner in the past year was 3.7 %, compared with 2.1 % among individuals with no exchange partners [7, 11]. Findings from smaller, single-location studies that used similar venue-based sampling methods suggest that FSW are likewise at increased risk of HIV infection when compared to their non-sex-working counterparts [1, 8].

However, it is likely that population-based studies underestimate the true risk among FSW. Incarcerated FSW, who are typically excluded from larger studies, appear to be at higher risk for HIV/STI. Among newly incarcerated FSW in New York City, more than 10 % tested positive for HIV and 14 % tested positive for STIs [12]. Moreover, HIV/STI risk appears to be variable among FSW, and is greater among FSW who have high numbers of exchange partners [1]. In additional samples of high-risk FSW, studies have documented HIV prevalence above 20 % [13, 14].

Further, there are a number of behavioral and structural risk factors that place FSW at increased risk of acquiring HIV and other STIs [9, 15–23]. FSW are more likely to engage in unprotected sex, have multiple, high-risk sex partners, and inject drugs than other at-risk women [1]. They are likely to abuse other substances, including alcohol, marijuana, crack/cocaine, and prescription drugs, which increase their risk of contracting HIV via lowered inhibitions, reduced ability to negotiate condom use, and a higher likelihood of continued engagement in transactional sex as a method of obtaining drugs or money [4, 24, 25]. Violence, including intimate partner violence, is a common experience of many FSW and has been associated with HIV/STI risky sexual behaviors, including inconsistent condom use, multiple partners, and an earlier sexual debut [21, 26, 27]. Structural gender inequality may prevent FSW from feeling in control of condom use during transactional sex [14]. A confluence of other structural vulnerabilities—e.g., homelessness or unstable housing, incarceration, poverty, unemployment—acting synergistically increases FSW's likelihood of engaging in HIV-related sex- and drug-risk behaviors [28–30].

### Purpose of Review

Despite the risk of HIV/STI acquisition & transmission among FSW and their vulnerability to multiple risk factors, studies of risk-reduction efforts among FSW have been missing from the US-based HIV prevention literature. There is a critical need to develop efficacious interventions to reduce sex and drug injection risk behaviors among this marginalized population. To our knowledge, this is the first systematic review to identify and discuss HIV/STI prevention interventions conducted in the US, though many have been conducted internationally [31–37].

## Methods

Since 1996, the Centers for Disease Control and Prevention (CDC) has supported the Prevention Research Synthesis (PRS) Project to systematically review the HIV/STI intervention research literature to understand the state of the science, identify evidence-based HIV prevention interventions, and make evidence-based recommendations [38]. Additional information about the PRS risk-reduction efficacy review methods is available via the PRS website (http://www.cdc.gov/hiv/dhap/prb/prs/efficacy/rr/criteria/review_methods.html).

Although the primary purpose of the PRS project is to evaluate intervention efficacy, the purpose of this review was to characterize all interventions for FSW described in the published literature, regardless of whether they were evaluated for intervention efficacy. The PRS database was used to identify eligible studies.

### Database and Search Strategy

As part of the PRS project, a cumulative database of the HIV/STI prevention literature was developed using a systematic search procedure, including both automated and manual search strategies [38]. Briefly, the automated component uses combinations of keywords and MESH terms and searches multiple electronic databases—AIDSLINE (1988 to discontinuation in December 2000), EMBASE (OVID), MEDLINE (OVID), PsycINFO (OVID), and Sociological Abstracts (PROQUEST)—to identify relevant literature published between 1988 and 2012. The full search strategy is available from the authors. The automated search component is repeated annually to update the PRS database and the last update prior to this review was completed in January 2013. A manual search component consists of quarterly hand searches of 38 pertinent HIV/AIDS journals and review of reference lists of relevant articles and conference abstracts. The last quarterly hand search prior to this review was completed in February 2013.

The PRS database was searched in May 2013 to identify all eligible HIV/STI prevention intervention studies for this review, using variations of keywords related to female sex work (e.g., commercial sex, sex trade, prostitution, paying partners). The applicable Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed in this review (Moher et al. 2009). A protocol for this review is not available.

### Study Selection

A study was eligible for this review if it described or evaluated an HIV/STI behavioral intervention, was conducted in the United States, was an English-language study published in a peer-reviewed journal, was published between 1988 and May 2013, and met one of the following three criteria: (1) focused on or targeted FSW, (2) stratified data by FSW if other groups were also targeted, or (3) included a study sample that consisted of more than 50 % (a majority) FSW. As there is not a substantial literature documenting or quantifying the various types of difference between FSW, this review utilizes the definition of a sex worker as a woman or a girl who trades sex for money, drugs or goods [39, 40]. Studies were eligible for this review whether or not they contained evaluation data, and all study outcomes were abstracted, particularly sex and drug-relevant outcomes.

### Data Abstraction

Data were coded for study information and study methodology (e.g., location, allocation method), target population characteristics (i.e., whether the study specifically targeted FSW, stratified results by FSW, or contained greater than 50 % FSW), participant demographics (e.g., age, race/ethnicity, education, housing, and income), risk behavior at baseline (e.g., substance abuse and sexual behavior), and intervention content and characteristics (e.g., HIV prevention, substance abuse prevention, mental health, and economic resources) by two independent reviewers. For one-group designs, within-group outcomes were considered, but for studies with a comparison group, only significant between-group outcomes were considered.

Due to the limited number and heterogeneous nature of the outcomes reported, we were unable to perform a meta-analysis on abstracted data. We summarized the results by stratifying studies in three categories: those that exclusively focused on FSW ("targeted"), those that stratified baseline or outcome data by FSW ("stratified"), and those in which FSW comprised greater than 50 % of the sample ("majority").

## Results

Two thousand and six hundred and eighty four citations were identified through a search of the PRS database and 53 citations were identified through ad hoc searches for inclusion in this review (Fig. 1). Among those citations, 2,737 citations were screened at title and abstract, and 149 were assessed at full report for eligibility. After linking citations that describe the same study, 18 unique studies that either described or evaluated 19 unique interventions met the inclusion criteria and were included in this review. One study, reported by Sterk et al. [41] evaluated two different interventions: the motivation intervention and the negotiation intervention. Another intervention, the female condom study [42], was implemented and evaluated in two cities, St. Louis, MO and San Antonio, TX. Though this intervention was counted as one unique intervention and coded once for content, the baseline and outcome data from each city are reported separately in Tables 1 and 2. Reasons for excluding citations are provided in Fig. 1.

The final set of 19 interventions [number of studies (k) = 18] included five that exclusively targeted FSW, two that stratified data by FSW, and 12 that included greater than 50 % FSW.

### Demographics

Baseline study population characteristics of the 18 intervention studies are presented in Table 1, organized by type of intervention. Not all studies reported all demographic variables coded. In total, more than 4,000 participants were included across the 18 studies. Most studies included women who were, on average, in their mid to late thirties (k = 9). The vast majority of included study samples were predominately black/African American (k = 10) or Hispanic/Latino (k = 3); none of the studies were majority white. Women included in these studies tended to have low levels of education (k = 6 had a majority of participants with less than a high school degree), were largely unemployed (k = 6 reported over 75 % unemployed), were often reliant on public assistance (k = 6), friends and family (k = 3), or illegal sources (k = 4) for income, and were frequently homeless or unstably housed (k = 5 reported over 20 % homeless).

### HIV/STI Risk Behaviors

Women in the included studies reported high levels of current and past drug use, though the type of drug use varied from study to study. In general, IDU tended to range between 35 and 65 %, while reported crack use was frequently very high (k = 5 studies reported over 75 % crack

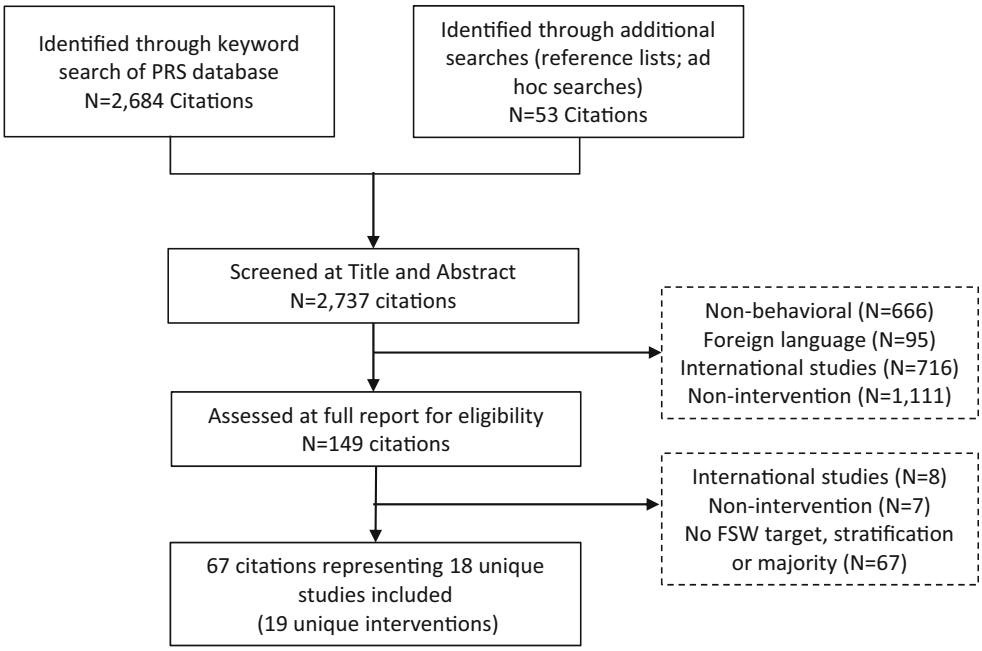


**Fig. 1** Study flow

use). In more than 60 % of the included studies, over 75 % of participants reported trading sex for money, drugs, or another reason. Among the few studies that specifically reported reasons for trading sex, women most frequently reported trading sex for money, followed by trading sex for drugs; only one study reported that women had traded sex for any other reason (Torres et al. [43] counted food as one potential reason). Among studies that tested for HIV, the prevalence of HIV ranged from 0 to 46 % (k = 13).

## Childhood Abuse and Adult Interpersonal Violence

Few studies provided information on rates of childhood abuse and adult interpersonal violence among FSW. Wechsberg et al. [44] reported that 30 % of their sample had experienced childhood sexual abuse and 30 % had experienced childhood physical abuse. Similarly, Grella et al. [45] reported that 38 % of their sample had experienced childhood sexual abuse, 40 % childhood physical abuse, and 57 % childhood emotional abuse. Vigalante et al. [46] reported that 31 % of their sample had experienced abuse by an intimate partner, and 50 % had a history of rape. Gollub et al. [47] and Torres et al. [43] reported that 25 and 24 %, respectively, of their sample reported that their first sexual experienced was forced. Surratt and Inciardi [48] reported that 23 % of their sample had been physically victimized, and 18 % had been sexually victimized in the past 90 days.

Very few studies reported rates of depression, anxiety, anger, stress, post-traumatic stress disorder (PTSD), or any other mental health indicator at baseline. Grella et al. [45] stated that 66 % of their sample reported depression, 61 % reported suicidal ideation, 43 % were taking psychiatric medication, 39 % had previously attempted suicide, and 21 % had been hospitalized for a psychiatric problem. Wechsberg et al. [44] reported moderate rates of depression [mean 12.9; standard deviation (SD) 4.9] and anxiety (mean 11.2; SD 6.2) on the Drug Abuse Treatment Assessment and Research scale (range 0–28), and trauma (mean 18.2; SD 10.4) on the Global Appraisal of Individual Needs scale (range 0–48).

## Intervention Characteristics & Study Methods

A summary of intervention characteristics and study methods are presented in Table 2, organized by type of intervention. Study locations included 14 states and Puerto Rico; Miami, FL and cities in Southern California were the most common study locations. Study participants were primarily recruited from street strolls or other street-based locations where FSW were known to solicit clients (e.g. back alleys, and empty lots). Some studies also recruited participants from non-profit and health care organizations, correctional facilities, HIV/AIDS clinics, and via fliers and word of mouth. Fifteen studies targeted women who used drugs at recruitment.

Eight interventions (2 target and 5 majority) reported conducting formative research prior to implementing the interventions. Two interventions asked FSW for input in designing the intervention, typically in the form of focus group. The median number of intervention sessions was 4, with a range of 1–6. The median total time per intervention

**Table 1** Baseline study population characteristics of female sex workers

| Author, year intervention title, location & study years | Target population | Demographic characteristics[a] | Education, housing, income source | Sex trading | Substance abuse | HIV/STD status |
|---|---|---|---|---|---|---|
| Targeted FSW (k = 5) | | | | | | |
| Bellis, 1993<br>Free methadone maintenance<br>5 cities in Southern California<br>1988–1989 | Targeted drug-using (heroin) FSW<br>Included 100 % FSW | N = 41<br>Mean age 31.8<br>R/E: 13 % Black, 50 % Hispanic, 33 % White, 2 % Native American | Income sources: 12 % legal sources | 100 % engaged in sex exchange | IDU: 100 % used heroin; average length of heroin use: 10 years | 7 % HIV+;<br>17 % syphilis; 10 % chlamydia; 5 % gonorrhea |
| CDC, 1992<br>CDC street outreach<br>Colorado Springs, CO<br>1987–1991 | Targeted FSW<br>Included 100 % FSW | NR | NR | NR | NR | NR |
| Yahne, 2002<br>Magdalena project.<br>Albuquerque, NM<br>study dates n/a | Targeted drug-using FSW<br>Included 100 % FSW | N = 27<br>Mean age 37.8 (8.10), [22–53]<br>R/E: 3 % Black, 52 % Hispanic, 30 % White, 15 % Native American | NR | Participants exchanged sex on average 18.10 (11.10) days out of past 30 days | IDU: 59 % used heroin<br>Non-IDU: 33 % used crack; 48 % used illicit drugs every day; sample used drugs on average 25 out of past 30 days | NR |
| Sherman, 2006<br>JEWEL project<br>Baltimore, MD<br>2002–2003 | Targeted drug-using (heroin and cocaine) FSW<br>Included 100 % FSW | N = 55<br>Median age 39 [34–45]<br>R/E: 62 % Black, 38 % Other | Housing: 27 % homeless<br>Employment: 5 % employed<br>Income sources: 55 % friends/relatives; 43 % state/federal benefits; 35 % selling drugs; 31 % touting drugs; 24 % full/part-time job; 14 % theft; 13 % street security | 100 % exchanged sex for money or drugs in past 3 months | IDU: 56 % injected drugs<br>Non-IDU: 27 % used crack; 76 % used some drugs in past 3 months | 9 % HIV+ |
| Surratt, 2010<br>Sex-worker focused intervention<br>Miami, FL<br>2001–2005 | Targeted drug-using (heroin and cocaine) FSW<br>Included 100 % FSW | N = 806<br>Mean age: 36.80 (8.20); [18–50]<br>R/E: 64 % Black, 15 % White, 3 % Other | Education: 53 % <HS; 30 % HS; 17 % >HS<br>Housing: 42 % homeless | 100 % exchanged sex for money or drugs | IDU & non-IDU: participants used crack, alcohol, heroin, marijuana, or powder cocaine on average 26.0 (7.60) days in past 30 days | 21 % HIV+<br>50 % HBV; 26 % HCV |

**Table 1** continued

| Author, year intervention title, location & study years | Target population | Demographic characteristics[a] | Education, housing, income source | Sex trading | Substance abuse | HIV/STD status |
|---|---|---|---|---|---|---|
| Stratified FSW (k = 2) | | | | | | |
| Fehrs, 1998<br>Anonymous versus confidential testing<br>Oregon<br>1986–1987 | Targeted FSW<br>Included 3 % FSW | N = 51 | NR | NR | NR | NR |
| Weeks, 1998<br>Project cope II<br>Hartford, CT<br>1992–1997 | Targeted active, out of tx PWID and crack-cocaine users<br>Included 46 % FSW | NR | Income: 51 % earned <$500 in past 30 days | 100 % ever engaged in sex exchange | IDU: 57 % injected drugs in past 30 days<br>Non-IDU: 62 % used crack | 46 % HIV+ |
| Sample >50 % FSW (k = 11) | | | | | | |
| Corby, 1996<br>AIDS community demonstration project<br>"Community promise"<br>Long Beach, CA<br>1991–1994 | Targeted female PWID or female sex partner of PWID<br>Included: 62 % FSW | N = 373<br>Mean age 32.90<br>R/E: 60 % Black, 14 % Hispanic, 22 % White, 4 % Other | NR | 68.3 % ever exchanged sex for money; 50 % ever exchanged sex for drugs; 46 % exchanged sex for money in past 30 days; 27 % exchanged sex for drugs in past 30 days | IDU: 35 % injected drugs in past 30 days | 30 % gonorrhea; 35 % syphilis; 3 % genital warts; 2 % chlamydia; 2 % herpes |
| Metsch, 1995<br>Miami CARES<br>Miami, FL<br>1992–1994 | Targeted out of treatment chronic drug abusers (cocaine and heroin injectors, cocaine snorters, crack smokers) who are members of hard to reach population<br>Included: 68.3 % | N = 541<br>R/E: 95 % Black, 1 % Hispanic, 3 % White, 1 % Other | Education: 55 % <HS; 30 % HS; 15 % >HS<br>Employment: 72 % unemployed<br>Income sources: 63 % family/friends; 41 % welfare/public assistance; 17 % illegal activities; 9 % social security; 9 % sell/trade goods; 3 % alimony/child support | 78 % traded sex for money or drugs | IDU: 89 % ever used non-injection drugs; 10 % injected drugs in past 30 days<br>Non-IDU: *82* % ever used cocaine; 97 % ever used crack; 30 % ever used heroin; participants used cocaine on average 8.6 days; used crack on average 25.60 days; used heroin on average 13.6 days out of past 30 days | 10 % HIV+ |

**Table 1** continued

| Author, year intervention title, location & study years | Target population | Demographic characteristics[a] | Education, housing, income source | Sex trading | Substance abuse | HIV/STD status |
|---|---|---|---|---|---|---|
| Grella, 1995<br>Enhanced methadone maintenance<br>Los Angeles, CA<br>1990–1995 | Targeted PWID who are HIV+ or gay/bisexual men, are sex partners of IDU gay/bisexual men, or are female sex worker<br>Included: 78 % | N = 239<br>Mean age 38.70, [20–56]<br>R/E: 50 % Black, 24 % Hispanic, 26 % White | Education: 41 % <HS<br>Housing: 21 % live in hotel or homeless<br>Employment: 11 % unemployed<br>Income sources: 75 % public assistance; 46 % petty theft; 39 % drug dealing; 26 % job; | 78 % traded sex for money or drugs | Non-IDU:60 % used cocaine; 39 % used crack; 96 % used cocaine; 15 % used alcohol; 27 % used marijuana; 37 % used benzodiazepines; 92 % used cigarettes | 10 % HIV+ |
| Vigilante, 1999<br>Women's HIV/ Prison prevention program<br>Rhode Island<br>1992–1996 | Targeted incarcerated women who are either PWID and/ or crack cocaine users, (2) engage in commercial sex work, or (3) have a history of recidivism and poor future employment/ educational prospects<br>Included: 56 % FSW | N = 430<br>Mean age: 37.20 (7.20), [18–59]<br>R/E: 25 % Black, 18 % Hispanic, 45 % White, 12 % Other | Education: 60 % <HS; 11 % HS; 19 % >HS | 61.3 % ever exchanged sex for money or drugs | IDU: 47 % injected drugs<br>Non-IDU: 88 % used cocaine; 37 % used crack; 58 % used heroin; 48 % used a combination of heroin and cocaine in the year before incarceration | 1 % HIV+ |
| Surratt, 1998<br>Female condom study<br>St. Louis, MO site<br>1996 | Targeted out of tx crack/cocaine and/ or ID-using women<br>Included: 61 % FSW | N = 106<br>Median age 36.0<br>R/E: 98 % Black, 1 % White, 1 % Other | Education: 47 % <HS; 53 % HS | 64 % ever exchanged sex for money or drugs | IDU: 18 % injected drugs in past 30 days<br>Non-IDU: primary drug of choice in past 30 days: 87 % crack; 13 % heroin; 0.0 % cocaine | 3 % HIV+ |
| Surratt, 1998<br>Female condom study<br>San Antonio, TX site<br>1996 | Targeted out of tx crack/cocaine and/ or ID-using women<br>Included: 64 % FSW | N = 115<br>Median age 34.0<br>R/E: 52 % Black, % Hispanic, 11 % White, 2 % Other | Education: 52 % <HS; 48 % HS | 64 % exchanged sex for money or drugs in past 30 days | IDU: 64 % injected drugs in past 30 days<br>Non-IDU: primary drug of choice in past 30 days: 40 % crack; 60 % heroin; 0 % cocaine | NR |

**Table 1** continued

| Author, year intervention title, location & study years | Target population | Demographic characteristics[a] | Education, housing, income source | Sex trading | Substance abuse | HIV/STD status |
|---|---|---|---|---|---|---|
| Sterk, 2003<br>Health intervention project (HIP)<br>Atlanta, GA<br>1998–2001 | Targeted HIV-, heterosexual, out of tx African-American drug-using (crack/cocaine) women<br>Included: 71 % FSW | N = 265<br>Mean age: 37.20 (7.20), [18–59]<br>R/E: 100.0 % Black | Education: 55 % <HS; 31 % HS; 13 % >HS<br>Housing: 5 % homeless<br>Employment: 86 % unemployed<br>Income sources: 37 % hustling/dealing; 30 %: family/friends; 12 % wages; 6 % social security/ | 56 % exchanged sex for money; 33 % exchanged sex for drugs in the year before incarceration; | *Non-IDU:* 7 % used cocaine; 100 % used crack; 4 % used heroin; 2 % used speedball in past 30 days; participants used crack on average 249.40 (510.60) times in past 30 days | 0 % HIV+ |
| Wechsberg, 2004<br>Women's Co-Op<br>Wake and Durham Counties, NC<br>1999–2002 | Targeted out of tx, crack-using African-American women<br>Included: 67 % FSW | N = 762<br>Mean age: 36.70 (6.90)<br>R/E: 100.0 % Black | Housing: 30 % homeless<br>Employment: 11 % employed<br>Income Sources: 45 % received public assistance | 71 % ever exchanged sex for money; 43 % exchanged sex for money or drugs in past 30 days; 5 % exchanged sex for drugs besides crack in past 30 days | IDU: 10.7 % ever used injection drugs<br>Non-IDU: participants used crack on average 17.10 (10.0) days; used alcohol on average 14.8 (12.10) days in past 30 days | 0 % HIV+ |
| Gollub, 2012<br>Body empowerment<br>Philadelphia, PA<br>2001–2004 | Targeted drug-using (heroin and cocaine) women<br>Included 80 % FSW | N = 198<br>Mean age: 39.6 (7.30), [18–65]<br>R/E: 66 % Black, 7 % Hispanic, 27 % White, 7 % other | Employment: 93 % unemployed<br>Income sources: 65 % received food stamps; 52 % received welfare | 80 % ever exchanged sex for money; 68 % ever exchanged sex for drugs | *IDU:* 42 % ever injected drugs<br>*Non-IDU:* 43 % used cocaine; 88 % used crack; 35 % used heroin; 82 % used alcohol; 62 % used marijuana in past 6 months | 0 % HIV+<br>0 % current STI; 38.9 % previous STI |
| Bowser, 2008<br>California prevention and education project<br>(CAL-PEP)<br>Oakland, CA; San Francisco, CA<br>2001–2007 | Targeted drug-using FSW of color most likely to fail in regular drug tx<br>Included 100 % FSW | Mean age: 41.3<br>R/E: 86.0 % Black, 7.0 % White, 7.0 % other | Housing: 20 % homeless or living in a shelter<br>Employment: 93 % unemployed<br>Income: Mean $640/month | 77 % exchanged sex for money, food, or drugs | IDU: participants used heroin 5.70 days in past 30 days.<br>Non-IDU: Participants used crack on average 8.4 days in past 30 days; used marijuana 2.6 days in past 30 days; used multiple unspecified drugs 17.90 days in past 30 days; used multiple drugs and | NR |

**Table 1** continued

| Author, year intervention title, location & study years | Target population | Demographic characteristics[a] | Education, housing, income source | Sex trading | Substance abuse | HIV/STD status |
|---|---|---|---|---|---|---|
| Torres, 2008<br>Risk reduction counseling-puerto rico (RReduc-PR)<br>Puerto Rico | Targeted female crack-users and sexual partners of PWID visiting STI and family planning clinics<br>Included 77 % FSW | N = 51<br>Mean age 37, [21–56]<br>R/E: 96.0 % Hispanic, 4 % Other | Education: 47 % <HS; 41 % HS; 12 % >HS<br>Employment: 10 % employed<br>Income: 96 % below poverty | 67 % ever exchanged sex for money or drugs; 43 % exchanged sex for money or drugs in past 30 days | Non-IDU: 63 % used alcohol; 84 % used cigarettes | 6 % HIV+ |
| Koblin, 2010<br>UNITY study<br>South Bronx, NYC<br>2005–2007 | Targeted non-injection heroin and/or crack-cocaine users<br>Included 86 % | N = 311<br>Mean age 42.30<br>R/E: 66 % Black, 24 % Hispanic, 10 % other | Education: 67 % <HS; 24 % HS; 9 % >HS<br>Housing: 27 % homeless<br>Employment: 94 % unemployed<br>Income: 86 % <$12,000/year | 86 % exchanged sex for money in last three months | IDU: 0 % injected drugs<br>Non-IDU: 66 % used cocaine, 86 % used crack; 37 % used heroin; 0 % injected drugs; 78 % used alcohol in past three months | 0 % HIV+ |

[a] Age reported as mean/median (std. dev) [range]

was 145 min, with a range of 30–900 min. Nine interventions were individual-level, seven were group-level, and two were community-level.

Seven of the included interventions utilized a randomized control trial (RCT) design, four utilized a non-RCT two-group design, seven were tested with a one-group post-design only, and one intervention did not report study design or evaluation information.

## Intervention Content

Table 3 describes intervention content for "target" and "majority" studies, including guiding behavioral theories, content addressing issues facing FSW, HIV prevention information, HIV services, substance abuse, and skills building techniques. The two stratified studies [49, 50] did not report sufficient information to make meaningful comparisons with other interventions.

Two target interventions tailored content for issues facing FSW and few reported using behavioral theory to guide intervention development. At least half of the target HIV/STI prevention interventions for FSW included general HIV/STI and substance abuse prevention information. Nearly all target interventions referred participants to social service programs while few offered general health care, mental health, psychosocial, or victimization-relevant services within the intervention.

Similar to target interventions, less than half of the majority interventions included content that specifically addressed issues faced by FSW and few reported using behavioral theory to guide intervention development. Nearly all of the majority interventions included general HIV/STI and substance abuse prevention information, and several offered HIV counseling and testing services. Few interventions offered HIV/STI-related medical care or substance abuse treatment services. Majority interventions were more likely to focus on skill building within the intervention, particularly proper syringe/needle cleaning techniques and male/female condom demonstrations than target interventions. More majority than target interventions included psychosocial content, including gender norms, empowerment, motivation to reduce risk behavior, risk-reduction attitudes, and self-esteem, although less than half of the interventions included these components. Fewer majority interventions referred participants to social service programs than target interventions, while a greater number of majority than target interventions created individualized risk-reduction plans, typically centered on substance use reduction.

## Outcome Findings

One target intervention reported a significant reduction in STI incidence among FSW [51]. Six out of the ten

**Table 2** Intervention characteristics

| Author, year & study years | Study design | Theoretic framework | Goal of intervention (sessions; duration; time span) | Unit of delivery; deliverer | Assessments; greatest retention[a] | Outcomes reported |
|---|---|---|---|---|---|---|
| Targeted FSW (k = 5) | | | | | | |
| Bellis, 1993<br>1988–1989 | 1 group | NR | *Free methadone maintenance:* free methadone maintenance to reduce drug use and prostitution (ongoing; 12 months) | Individual, group; health care provider, outreach worker | 12 months; 61 % retained | *NS outcomes:* non-prescribed drug use; income—street prostitution, legal sources |
| CDC, 1992<br>1987–1991 | 1 group | NR | *CDC street outreach*: HIV risk reduction counseling and condom distribution (1 session; 20 min; 1 day) | Individual; health educator | | *Other outcomes*: prostitutes tested for STIs ≥5 times sig. less likely to be infected with gonorrhea or trachomatis than those tested less frequently<br>*NS outcomes*: Gonorrhea incidence; trachomatis incidence |
| Yahne, 2002<br>study dates n/a | 1 group | Motivational interviewing | *Magdalena project:* motivational interviewing to reduce HIV risk and drug use (1 session; 30 min; 1 day) | Individual; research staff, interviewer | 4 months; 93 % retained | *Sex outcomes:* decreased proportion of days engaged in sex work of last 30 (59 vs. 17 %; $p < 0.01$)<br>*Drug outcomes:* increased # of drug/alcohol abstinent days [$t(24) = 3.95$, $p < 0.01$]<br>*Other outcomes:* increased days of lawful employment |
| Sherman, 2006<br>2002–2003 | 1 group | Social cognitive theory | *JEWEL project:* economic empowerment and HIV prevention intervention, which taught women how to make, market and sell jewelry (6 sessions; 720 min; 3 weeks) | Group; facilitator | 3 months; 91 % retained | *Sex outcomes:* increased 100 % CU during vaginal sex w/sex work partner in past 3 months (53 vs. 75 %, $p = 0.03$); decreased # of sex work partners/month [median (SD) = 9.0 (23.6) vs. 3.0 (42.4), $p = 0.02$] and # of sexual contacts/month [median (SD) = 10.0 (29.9) vs. 3.0 (22.4), $p = 0.01$]<br>*Drug outcomes:* decreased IDU (56 vs. 36 %, $p = 0.01$), daily drug use (76 vs. 55 %, $p < 0.01$), daily crack use (27 vs. 13 %, $p = 0.01$) and US$/day spent on drugs [median (SD) = $53 (58) vs. $17 (65), $p < 0.01$)<br>*Other outcomes:* decreased income from sex trading and income from selling drugs; increased job self-efficacy<br>*NS outcomes:* CU—steady, casual male partners during vaginal sex; income—family/friends, licit jobs, other illegal activity |

**Table 2** continued

| Author, year & study years | Study design | Theoretic framework | Goal of intervention (sessions; duration; time span) | Unit of delivery; deliverer | Assessments; greatest retention[a] | Outcomes reported |
|---|---|---|---|---|---|---|
| Surratt, 2010<br>2001–2005 | RCT: 1 intervention group | NR | *Sex worker focused (SWF) intervention:* Peer-led sex and drug risk reduction structured around engagement, education, action, testing and referral (2 sessions; 120 min; 2 weeks) | Not specified; sex worker<br>peer | 3 and 6 months; 67 % retained at 3 months | *Sex outcomes*: decreased oral UPS in past 30 days at 6 months [OR 1.60 (1.12,2.30)]<br>*Other outcomes:* decreased sexual victimization in past 90 days at 6 months<br>*NS outcomes:* vaginal UPS, non-IDU, sex work while high, physical victimization |
| Stratified FSW (k = 2) | | | | | | |
| Fehrs, 1998<br>1986–1987 | Cohort | NR | *Anonymous HIV testing:* introduced anonymous HIV testing alongside confidential testing in public clinics<br>(1 session) | Individual; health care provider | N/A | *NS outcomes:* demand for HIV testing; testing behavior |
| Weeks, 1998<br>1992–1997 | RCT: 1 intervention group | NR | *Project cope II:* community-based, culturally and gender- tailored HIV risk reduction intervention, in addition to HIV counseling and testing (4 sessions; 435 min; 3 weeks) | NR | NR | NR |
| Sample >50 % FSW (k = 11) | | | | | | |
| Corby, 1996<br>1991–1994 | Non-RCT (matched): 1 intervention community | Social cognitive theory; theory of reasoned action; health belief model; transtheoretical model; | *AIDS community demonstration project* ("*community promise*"): publication of HIV prevention media featuring role model stories, distribution of stories by peer volunteers, and environmental facilitation through distribution of condoms and bleach (ongoing) | Community; peer volunteer, small business owner, printed material | Repeated cross-sectional samples in 10 waves | *Sex outcomes:* higher CU stage of change w/main partners (condition main effect $F = 7.85$, $p < 0.01$); increased CU stage of change w/non-main partners (condition × time interaction effect $F = 41.32$, $p < 0.01$)<br>*NS outcomes:* CU stage of change w/main partners (condition × time interaction) |
| Metsch, 1995<br>Miami CARES<br>Miami, FL<br>1992–1994 | Non-RCT (conv): 1 intervention group | Theory of reasoned action; social learning theory; health belief model; self-efficacy | *Miami CARES:* used themes of domestic responsibility and supportive behaviors to assist women in reducing HIV risk and maintaining behavior change, in addition to standard HIV counseling and testing (n/a: # sessions) | Group; interventionist | 6–18 months; 80 % retained | *Sex outcomes:* Increased >95 % CU during oral/anal sex in last 30 days over the study period [OR 1.59 (1.06,2.38)]; increased proportion with >50 % CU and <15 days drug use in last 30 days over the study period [OR 1.05 (1.05,2.19)]<br>*Drug outcomes:* increased proportion who used drugs <10 days of past 30 days over study period [OR 1.59 (1.06,2.38)];<br>*NS outcomes:* using drugs <30 times during sex in past 30 days |

**Table 2** continued

| Author, year & study years | Study design | Theoretic framework | Goal of intervention (sessions; duration; time span) | Unit of delivery; deliverer | Assessments; greatest retention[a] | Outcomes reported |
|---|---|---|---|---|---|---|
| Grella, 1995<br>Enhanced methadone maintenance<br>Los Angeles, CA<br>1990–1995 | RCT: 1 intervention group | NR | *Enhanced methadone maintenance:* methadone maintenance with enhancements, such as case management, contingency contracting, supplemental services and rewards, to retain clients in treatment and promote HIV risk reduction (ongoing) | Individual, group; counselor; case manager; psychiatrist; peer/ person in recovery | 18–24 months; 87 % retained | *NS outcomes:* CU; # of sex partners; IDU; non-IDU; sex work income; HIV knowledge; mental health |
| Vigilante, 1999<br>1992–1996 | Non-RCT (conv): 1 intervention group | NR | *Women's HIV/prison prevention program (WHPPP):* Discharge planning to help remove women from situations that predispose them to drug use and HIV risk paired with ongoing interaction with established therapeutic contacts to implement the plan and prevent relapse (ongoing) | Individual; health care provider, social worker, peer counselor | 3 and 12 months | *Other outcomes:* decreased recidivism at 3 and 12 months compared to historic controls; kept prior recidivists out of prison longer at 3 months |
| Surratt, 1998<br>1996<br>San Antonio, TX | 1 group | NR | *Female condom study:* female condom education, in addition to standard HIV counseling and testing (2 sessions; 1–3 weeks) | Individual; interventionist | 3 months; 46 % retained | *NS outcomes:* female CU—vaginal sex; condom satisfaction |
| St. Louis, MO | 1 group | NR | Same intervention as given to participants in San Antonio | Individual; interventionist | 3 mo; 65 % retained | *NS outcomes:* female CU—vaginal sex; condom satisfaction |
| Sterk, 2003<br>1998–2001 | RCT: 2 intervention groups | Stages of change, theory of gender and power, social cognitive theory, theory of planned behavior, theory of reasoned action | *HIP, motivation intervention:* emphasized self-motivation to change behaviors that may or may not be linked to HIV (4 sessions; 120–140 min; 4 weeks) | Individual; female health interventionist | 6 months; 96 % retained | *Sex outcomes:* increased mean # of paying oral sex partners in past 30 days (17.6 vs. 7.0, RES = 151 %; $p < 0.05$)<br>*NS outcomes:* CU; # of paying sex partners—vaginal; # of paid sex acts—vaginal/anal/oral; crack use; crack use during sex |
| | | | *HIP, negotiation intervention:* sought to reduce HIV risk by improving technical and communication skills (4 sessions; 120–140 min; 4 weeks) | Individual; female health interventionist | 6 months; 94 % retained | *Sex outcomes:* decreased mean # of vaginal/oral/anal sex acts w/paying partners in past 30 days (3.0 vs. 5.6, RES = −46.4 %; $p < 0.01$); Increased mean frequency of CU (0 = never to 4 = always) during vaginal sex w/steady partners (1.7 vs. 0.9, RES = 88.9 %; $p < 0.01$)<br>*NS outcomes:* # of sex partners—vaginal/oral; crack use; crack use during sex |

**Table 2** continued

| Author, year & study years | Study design | Theoretic framework | Goal of intervention (sessions; duration; time span) | Unit of delivery; deliverer | Assessments; greatest retention[a] | Outcomes reported |
|---|---|---|---|---|---|---|
| Wechsberg, 2004<br>1999–2002 | RCT: 2 intervention groups | Empowerment, African American feminism | *Women's Co-Op:* gender- and culture-tailored HIV prevention intervention to reduce HIV risk and drug use[b]<br>(4 sessions; 180–260 min; 8 weeks) | Individual, group; AA women from the community | 3 and 6 months; 75 % retained at 6 months | *Sex outcomes:* decreased UPS in past 30 days at 6 months [OR 0.62 (0.41,0.96)] and sex trading in past 30 days at 3 months [OR 0.58 (0.34,1.00)]<br>*Drug outcomes:* decreased # of days used crack in past 30 at 3 months [B = −3.69 (−5.65, −1.74)]<br>*Other outcomes:* decreased homelessness and increased full-time employment at 3 months<br>*NS outcomes:* Sex trading, crack smoking, homelessness and employment at 6 months; UPS at 3 months |
| Gollub, 2012<br>2001–2004 | RCT: 1 intervention group | Theory of gender and power, community empowerment, harm reduction, body empowerment | *Body empowerment intervention:* In a women-only space and through the promotion of women's solidarity, sought to increase knowledge, comfort and ownership of the body, especially of the genital and reproductive tract (5 sessions; 900 min; 5 weeks) | Group; CBO staff; peer counselor | 12 months; 92 % retained | *NS outcomes:* body knowledge<br>*NR outcomes:* # UPS; proportion UPS |
| Bowser, 2008<br>2001–2007 | 1 group | NR | *California prevention and education project (CAL-PEP):* Outreach-based, outpatient harm reduction drug treatment (ongoing; 12 months) | Individual, group; health outreach worker, psychologist | 6 and 12 months | *Drug outcomes:* over the study period, decreased mean # days used of past 30 for poly-drug/alcohol use 30 (27.7, 15.1, 16.9; $p < 0.01$), # poly-drug use (17.9, 9.6, 11.7; $p < 0.01$), and crack-cocaine use (8.4, 4.6, 5.9, $p < 0.01$)<br>*Other outcomes:* increased proportion employed, proportion housed, # case management sessions and service intensity; decreased # nights in jail<br>*NS outcomes:* Monthly income; heroin use; cannabis use |
| Torres, 2008 | Description only | NR | *Risk reduction counseling-puerto rico (RReduC-PR):*Rapid HIV testing and culturally sensitive HIV risk reduction | Individual; facilitator | NR | NR |
| Koblin, 2010<br>2005–2007 | RCT: 1 intervention group | Social cognitive theory | *UNITY study:* enhanced HIV risk-reduction counseling coupled with HIV vaccine trial education (4 sessions; 6 months) | Individual; HIV counselor | 1, 6 and 12 months; 83 % retained at 12 months | *NS outcomes:* UPS—steady, main, casual partners; HIV vaccine knowledge |

[a] Greatest retention at a time point $\geq$ 3 months post-intervention

[b] Study compared two interventions (Women's Co-Op and a NIDA standard HIV prevention intervention) against a waitlist control. This review compares the Women's Co-Op intervention to the waitlist control

interventions that reported a sex-risk reduction outcome, and five out of the ten interventions that reported a drug-related risk reduction outcome significantly reduced HIV risk-taking behaviors. Five interventions reported a sex-work-related outcome; two of these were successful in decreasing sex work. Of the nine interventions that reported other outcomes (e.g. mental health, violence/abuse, homelessness, employment, etc.), four reported significant intervention effects.

Three target interventions reported a significant sex or drug risk reduction [48, 52, 53]. Sherman et al. [52] microenterprise intervention reported reductions in the greatest number of risk behavior outcomes spanning multiple categories such as increased condom use, decreased number of sex trade partners (sex-risk behavior); decreased injection drug use, daily general drug use, daily crack use, money spent on drugs per day, income from selling drugs (drug-risk behavior); and decreased income from sex work (sex work-related risk behavior). Unfortunately, this microenterprise intervention did not include a comparison group to evaluate efficacy [52].

Many majority interventions reported significant reductions in several substance use behaviors, such as general or specific drug use (e.g. heroin, crack), as well as other outcomes, including homelessness, employment, and recidivism. Bowser et al. [54] harm-reduction-based drug treatment intervention reported the greatest number of significant effects, including a reduction in the number of days a participant used drugs and spent time in jail, and an increase in the proportion of participants who found housing and employment. Wechsberg et al. [44] Women's Co-Op, a gender and culturally sensitive intervention created to reduce sex- and drug-risk behaviors among high-risk crack-using African American women, also reported a number of significant intervention effects, including reductions in unprotected sex, the number of days a participant smoked crack, sex trading, homelessness, and unemployment.

## Discussion

Our systematic review of US-based HIV/STI prevention intervention studies of FSW highlights important factors that have been addressed by current efforts as well as gaps that should be addressed in future research. The overall findings of our review demonstrate that few rigorously implemented or evaluated HIV/STI behavioral prevention interventions exist that address the needs of FSW in the US.

Overall, the quality of these intervention studies was low, as less than half of the interventions were evaluated using RCTs and others lacked an adequate control or comparison group. It is unclear why so few US-based studies have been rigorously implemented and evaluated with FSW, particularly since other industrialized countries (e.g. Australia, Canada) have a more developed FSW literature [55]. It may be that the stigmatized and often illegal behaviors in which FSW engage may have dissuaded a dedicated investment in the population. Nevertheless, it is possible that increased risk-reduction efforts may result in lowered HIV/STI risk in this important and marginalized population.

Both target and majority HIV/STI prevention interventions included general HIV/STI and substance abuse prevention information; however, few interventions tailored this content to address issues facing FSW. Although majority interventions did not tailor content to FSW, they included more skill building activities and psychosocial content, and were grounded in behavioral theory. The greater robustness of majority interventions may be reflective of the fact that they were typically developed to meet the needs of high-risk women who use drugs, a priority population during the peak of the HIV epidemic. Indeed, the two interventions that reported the greatest number of significant outcomes were both majority interventions that recruited crack-using women, a population especially important to HIV prevention among high-risk women in the 1990s [25, 56].

As a result of prioritizing HIV/STI prevention among high-risk women who use drugs, much of the extant literature regarding FSW has targeted women who are poor, use drugs, or who have sexual contact with multiple partners. Most interventions included in this review specifically recruited FSW who use drugs to participate in the intervention. Due to this bias, there is information on the risk behavior of FSW who do not use drugs and the types of intervention efforts that would lead to greater risk reduction.

Few included interventions addressed psychosocial risk factors such as victimization and poor mental health, and no study reported rates of violence between a FSW and paying partners, police, or other individuals on the street. This was the case despite prior research demonstrating that FSW experience greater psychological distress, report more physical and sexual abuse, and have more frequent encounters with police than non-FSW [9, 21]. Interventionists interested in working with high-risk FSW [57] could adapt principles of cognitive behavioral therapy to deal with prior trauma and current distress, as this technique has been effective in both curbing risk behaviors and reducing psychological distress among other high-risk populations [58, 59]. Stronger linkages can also be made between community organizations that provide mental health services and participants graduating from an intervention program.

**Table 3** Comparison of intervention content between interventions that targeted FSW or enrolled > 50 % female sex workers (j = 17)

| Intervention content | Target FSW j = 5 k (%) | >50 % FSW j = 12 k (%) |
|---|---|---|
| Addresses issues facing FSW | 2 (40) | 3 (25) |
| Behavioral theories | 2 | 7 |
| Social cognitive theory | 1 (20) | 3 (25) |
| Motivational interviewing | 1 (20) | 0 |
| Theory of gender and power | 0 | 2 (17) |
| Theory of reasoned action | 0 | 3 (25) |
| Theory of planned behavior | 0 | 1 (8) |
| Transtheoretical model of change | 0 | 2 (17) |
| African-American feminism | 0 | 1 (9) |
| Empowerment | 0 | 2 (17) |
| Harm reduction | 0 | 1 (8) |
| Social learning theory | 0 | 1 (8) |
| Health behavior model | 0 | 2 (17) |
| HIV/STI prevention and treatment | 4 | 11 |
| General HIV/STI prevention information | 4 (80) | 11 (92) |
| HIV prevention information specific to FSW | 3 (60) | 2 (17) |
| HIV/STI counseling and testing | 2 (40) | 8 (67) |
| HIV/STI medical care | 0 | 1 (8) |
| Substance abuse prevention and treatment | 4 | 9 |
| FSW substance abuse | 3 (60) | 9 (75) |
| Influence of paying partner's substance abuse | 0 | 0 |
| Influence of non-paying partner's substance abuse | 0 | 1 (8) |
| Substance abuse treatment | 1 (20) | 2 (17) |
| Skill building categories | 3 | 8 |
| Violence prevention | 1 (20) | 0 |
| Syringe/needle cleaning | 1 (20) | 5 (42) |
| Sexual negotiation | 1 (20) | 4 (33) |
| Skill building method | 2 | 8 |
| Condom demonstration/modeling | 1 (20) | 7 (58) |
| Practice | 1 (20) | 2 (17) |
| Role play | 1 (20) | 3 (25) |
| Goal setting | 1 (20) | 2 (17) |
| Homework | 0 | 0 |
| Brainstorming | 0 | 1 (8) |
| Psychosocial | 1 | 9 |
| Gender norms | 0 | 4 (33) |
| Empowerment | 0 | 3 (25) |
| Motivation/Intention | 1 (20) | 4 (33) |
| Attitude | 0 | 3 (25) |
| Normative influence | 0 | 1 (8) |
| Self-efficacy | 2 (40) | 3 (25) |
| Job-related | 1 (20) | 0 |
| Drug and sex risk-reduction | 2 (40) | 0 |
| Unspecified | 0 | 3 (25) |
| Mental health | 1 (20) | 3 (25) |
| General | 0 | 1 (8) |
| Depression | 0 | 1 (8) |
| Anger | 0 | 0 |
| Stress | 0 | 0 |

**Table 3** continued

| Intervention content | Target FSW j = 5 k (%) | >50 % FSW j = 12 k (%) |
|---|---|---|
| Anxiety | 0 | 0 |
| PTSD | 0 | 1 (8) |
| Life stress | 0 | 0 |
| Grief | 0 | 1(8) |
| Mental health treatment | 1 (8) | 3 (25) |
| Victimization | 1 | 1 |
| Preventing future victimization | 1 (20) | 0 |
| Recovery from prior victimization | 0 | 1 (8) |
| Provision of general health care | 1 (20) | 2 (17) |
| Referrals to social service programs | 4 (80) | 5 (42) |
| Legal protection/advice | 0 | 0 |
| Economic resources | 1 | 1 |
| Job training | 1 (20) | 0 |
| Homelessness | 0 | 1 (8) |
| Individualized risk-reduction plans | 1 (20) | 7 (58) |

*j* Number of interventions

Similarly, despite the association between structural issues (e.g. homelessness, access to healthcare, economic resources) and negative outcomes among FSW, few target or majority interventions focused on these content areas. While some interventions referred FSW to social service programs that provided these kinds of resources, few interventions actually offered assistance with these issues or direct linkages to community organizations.

In general, psychosocial and structural factors affecting FSW have been more successfully incorporated in FSW interventions internationally, particularly in sub-Saharan Africa where the greatest HIV burden among FSW has been observed [34, 55, 60]. HIV/STI interventions in this region have included female and male condom promotion, voluntary HIV/STI counseling/testing, peer education, stigma reduction, policy changes, and community empowerment/social support approaches [60]. The current World Health Organization guidelines for HIV prevention among FSW advocate decriminalizing sex work, removing discriminatory laws and regulations, prioritizing the prevention of violence against sex workers, and increasing access to health care and biomedical prevention and treatment options [61].

Two interventions included in this review were replicated among samples of FSW: Wechsberg and colleagues' Women's CoOp in Pretoria, South Africa and Sherman and colleagues' Microenterprise intervention in Chennai, India [62, 63]. These interventions resulted in significant increases in condom use, decreases in the number of paying sexual partners, and increases in the amount of income derived from legal sources (via microenterprise activity). These successful replications of US-based interventions in international contexts suggests that increased communication between international and domestic HIV/STI prevention efforts among FSW may be mutually beneficial to both sides.

Most of the interventions included in this review defined sex work as exchanging sex for money, drugs, or both money and drugs. However, recent reports on the nature of transactional sex in the US suggest that it may be necessary to expand this definition to include other types of sexual relationships. Dunkle et al. [28] reported that of 1,453 randomly selected unmarried women, 13.1 % of African American women and 2.9 % of white women reported having sex because they needed help paying for their housing, groceries, utilities, bills, or child-related expenses. Similarly, 21.6 % of African American women and 10.5 % of white women started a new sexual relationship to receive financial support. It may be the case that relying on an overly narrow definition of female sex work may prevent an accurate understanding of the nature of transactional sex work among women in the US.

Additionally, the majority of the interventions included in our review were conducted over 10 years ago, which suggests that efforts to prevent HIV and STIs among FSW should be updated. Of the 19 interventions included in this review, only three met criteria for inclusion in the CDC's *Compendium of Evidence-Based HIV Prevention Interventions*: the Women's CoOp [44] the Negotiation Intervention [41], and Community PROMISE [64]. Inclusion in the CDC Compendium is based on review criteria that include quality of study design and implementation as well

as strength of the findings (see: http://www.cdc.gov/hiv/dhap/prb/prs/efficacy/rr/criteria/index.html). Many of the interventions included in this review employed designs too weak to be considered for inclusion in the compendium despite even if they reported positive results.

Due to the outdated nature of the literature, some of the newer biomedical, behavioral, and structural advances in HIV prevention are not being utilized or evaluated among FSW despite high vulnerability to contracting and transmitting HIV. Some studies include condom distribution programs [65] or antiretroviral pre-exposure prophylaxis (PrEP) among heterosexually active women and injection drug users [66]. PrEP, in particular, shows promise in preventing HIV transmission among FSW, but adherence can be reduced by factors such as substance use and frequent geographical displacement [66].

In the time since the database was searched, an additional intervention that targeted FSW was published [67]. This intervention tested the efficacy of a case management framework in which FSW were randomly assigned to a strengths-based intervention led by either a professional case manager or by a peer. Results demonstrated that both interventions equally reduced HIV risk behaviors and increased service utilization. Given that this study sought to specifically address issues relevant to the lives of FSW (e.g. housing, social support, stigma), the observed positive results are expected and in line with the recommendations from this review.

There are a few limitations to this study. One of the primary limitations is that the lack of consistent quantitative information reported in the studies precluded a meta-analysis of the outcomes. We did link content areas to reported outcomes to observe possible qualitative trends, but this effort was also limited due to the fact that some content areas were not adequately included in the interventions (e.g. mental health/victimization, economic resources, and psychosocial variables). Similarly, this review identified a relatively limited number of studies, and only 5 studies that specifically targeted FSW. We believe that the small number of studies highlights the relative dearth of female sex-worker focused intervention studies being conducted within STI or HIV prevention in the US, despite the need for such efforts. It is possible that additional intervention research studies did indeed include FSW in their study population, but did not stratify or report results specific to FSW, thus rendering these studies ineligible for our review. In addition, because our search did not extend to the grey literature, it is possible that additional interventions for FSW exist but have not been scientifically tested or published. Despite these limitations, we believe that this review highlights ways in which HIV/STI prevention efforts may have underserved FSW in the United States. It is our hope that this review will inform future efforts to tailor risk-reduction approaches to address issues facing US-based FSW.

## Conclusion

The purpose of this systematic review was to examine HIV/STI behavioral interventions conducted in the US that aim to reduce sexual- or drug-related risk behavior among FSW in order to highlight current gaps and identity potential future directions. We reviewed three types of interventions: interventions that targeted FSW, interventions that stratified data by FSW, and interventions that included a majority of FSW in the intervention without targeting them explicitly. Our findings suggest that majority interventions tended to include more content than targeted interventions, likely due to the prioritization of HIV prevention among high-risk women who used drugs during the height of the HIV epidemic. Our findings also demonstrate that while most interventions typically provided general HIV and substance use prevention information, few interventions tailored content to focus on issues specific to FSW. Existing HIV/STI prevention efforts should be updated to address the unique needs of FSW, including an emphasis on structural and psychosocial risk factors as well as increasing access and adherence to biomedical approaches that can benefit all high risk populations.

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