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Social Network-Based Interventions to Promote Condom Use: A Systematic Review

Kaidi Wang,

Harvard Medical School, 25 Shattuck Street, Boston, MA 02115, USA

Katherine Brown,

Columbia University College of Physicians and Surgeons, 630 W. 168th St., New York, NY 10032, USA

Song-Ying Shen, and

Guangzhou Birth Cohort Office, Guangzhou Women and Children's Medical Center, 9 Jinsui Road, Guangzhou 510623, China

Joseph Tucker

Division of Infectious Diseases, Massachusetts General Hospital, 55 Fruit Street, GRJ 504, Boston 02114, USA

Joseph Tucker: jtucker4@partners.org

Abstract

Effective sexually transmitted infection (STIs)/HIV prevention programs are urgently needed, but translating evidence-based methods of STI/HIV prevention into sustainable programs has been difficult. Social influences are critical for establishing condom use norms. This study systematically reviewed social network-based interventions focused on condom promotion. Social networks were defined as groups who self-identified prior to the research study. Eleven eligible research studies were identified and included in this review. Only three studies measured biological endpoints and five studies used validated measures of condom use. Among the nine studies with control groups, eight showed significant improvements in at least one measure of condom use. There were large differences in how social network members were identified and involved in the interventions. This systematic review highlights the potential utility of social network-based condom promotion programs. More research is needed to show how these promising studies can be expanded.

Keywords

Social network; HIV prevention intervention; Condom use; Condom promotion

Introduction

Unsafe sex is a major contributor to mortality and morbidity in low-income settings [1]. Each year, there are more than one billion newly acquired sexually transmitted infections [1]. Despite the known effectiveness of condoms in preventing sexually transmitted

infections (STIs) [2], effective condom promotion programs have been challenging to scale up and sustain [3].

Individual-based condom promotion interventions have many drawbacks. While individual behaviors do influence HIV risk, it is also important to consider the broader interpersonal and societal factors that contribute to HIV risk [4]. For example, heterosexual condom promotion interventions that focus on one sex ignore the broader dimensions of male–female sexuality and the power dynamics that influence sexual risk and HIV/STI acquisition [5]. Social situational factors tend to have stronger influences on behavior compared to individual level attributes [6]. Furthermore, given the tendency of individual intervention effects to wane over time, exploring and accounting for social influences on condom use may be critical for sustaining safe sex behaviors [7].

Multifaceted condom promotion interventions that incorporate individual, small group, community, and structural level methods have shown promise [8]. Social and structural influences are increasingly recognized as important in establishing an environment conducive to safe sex. Conceptual models of behaviour change have been developed that explicitly account for these social influences [9, 10].

Several studies have analyzed social networks and their effects on condom use. For the purposes of this paper, we define social network as a group of individuals who knew each other prior to the condom intervention. This social network definition is separate from peer education where peers may not know or interact with their peer group. Our more specific definition of social network was used because some studies are either unclear about recruitment methods or the networks are defined post-hoc by the researchers. Social networks influence group norms linked to health behaviors such as needle sharing and condom use, facilitate health-seeking behaviors, enhance our ability to reach vulnerable groups, and may promote condom use [11–14]. This study systematically reviews social network-based condom promotion interventions.

Methods

Search Strategy

Pubmed, Embase, Psycinfo, and Cochrane Systematic Reviews were systematically searched for articles fulfilling search criteria that were indexed on or before July 13th, 2010. The search was updated on April 1, 2011 to find articles meeting the search criteria that were published after the initial search date. Search terms included “condom” and “social support or social network or peer group or peer network” (see supplemental data). No language or date restrictions were placed on the search.

Article Selection

A total of 1,244 citations were identified using our search algorithm. After removing duplicates, a total of 815 citations remained. Two researchers (KW and SY) independently evaluated article titles and only included titles mentioning social/peer networks and support with relation to condom usage. Articles that focused solely on manager influences or sexual partner networks were excluded. Studies that assessed condom use as a secondary measure were included. When there was doubt about an individual citation title, KW and SY examined the citation’s abstract. Discordant articles were resolved by a third researcher (JT) through abstract review. All articles had English abstracts. A total of 568 were excluded.

Of the 247 articles remaining, abstracts were read and excluded if they were not interventions. For exclusion categories, see Fig. 1. The methods section of 82 studies were examined and articles in which participants did not know and identify network members

prior to the start of the intervention or did not explicitly describe the process of recruitment were excluded. Articles in which a peer educator identified network members post-hoc after the intervention began were excluded. Nine articles were eligible for qualitative synthesis, and one article was excluded as its dataset was part of another study that was already included in the synthesis. In this case, the more recently published study was included. One eligible study was identified in the second update search. Another two eligible studies, one which was not identified in either search and one which was published after updated the search date, were identified by experts. Qualitative synthesis was performed on eleven studies in total.

Analysis Plan

For each of the eleven studies, data on study date, location, recruitment, network member involvement, retention rate, condom use measures, and other outcomes indicative of condom use were extracted. Summary tables of key variables were created using Microsoft Excel version 2008 and the median follow-up time was calculated.

Results

Process of Article Selection

As seen in Fig. 1, 247 abstracts were examined and 82 research studies fulfilled basic inclusion criteria of having a social network component referring to condoms. Most of the 165 records excluded were descriptive studies and news articles. Among the 82 research studies, nine were comprised of self-identified social network interventions targeting condom promotion. Two studies used the same dataset and the most recently published study was chosen for inclusion. One study was identified in the update search and two studies were identified by experts. Eleven studies were identified in total for review.

Date, Number in Study, Locale, and Study Population

Three studies were conducted in the 1990s [15–17] and eight were conducted in the 2000s [11, 18–23]. With the exception of two studies [11, 23], each study had between 250 and 1,000 individuals. Five studies were conducted in high income nations [15–17, 22, 23], five studies in middle income nations [11, 18, 19, 21, 24], and one study in a low-income nation [20] (high, middle and low income nations were defined according to the World Bank designations [25]). Nine studies were conducted in the United States or Europe [11, 15, 16, 19, 21–24] and no studies were conducted in Australia or South America. Five studies focused on drug users [15, 17–19, 22], one on female sex workers [20], two on men who have sex with men [11, 21], and one on African American youth [16]. Only one study focused on commercial sexual interactions [20], while the rest focused on sexual interactions in casual and regular relationships.

Social Network Identification and Involvement

There was a range in both the composition and the identification of social network members. Here index refers to individuals recruited initially by researchers and network member refers to those identified and recruited by indexes. In eight studies, network members did not participate in the intervention directly, but were recipients of diffusion of information from indexes and participated in baseline and/or follow up assessments [11, 15, 18, 19, 21–24]. A ninth study used similar methods, but network members did not complete baseline and follow-up surveys [17].

Two studies used indexes to recruit network members who then had equal participation in the study [16, 20]. In these two studies, individuals in the target population formed self-identified peer groups in which everyone in the group received the intervention or control.

Study Design

Among the eleven interventions, two were designed without a control group [11, 20] and nine had some form of control group (Table 1). Examples of comparison groups included the same group prior to the intervention, standard of care informational or life skills curricula [18, 22, 23], and no intervention [15]. Among the nine studies with control groups, six of these studies had randomization [16, 17, 21–24]. None of these studies reported any measures taken to prevent contamination between intervention and control groups.

Conceptual Framework

Condom promotion interventions were informed by a number of conceptual frameworks (Table 2). Most studies (7/11) described multiple theory-based constructs and three studies did not fully specify theory used [15, 20, 22]. Conceptual models and theories used include persuasion and behavior change theories, behavioural science theory, social identity theory, protection motivation theory, and social cognitive theory.

Outcome Measures

Only three studies had primary biological outcomes [18, 23, 24] (Table 3). These studies evaluated social network interventions among drug users in Thailand [18], Roma men in Bulgaria [24], and high-risk women in Baltimore, MD, USA [23] and tested participants for several STIs including gonorrhea, chlamydia, syphilis, HSV-2, and HIV. In all reviewed studies, primary outcomes included condom use measures, but varied from ‘last episode of intercourse’ to ‘past 90 days’ or ‘past 5 partners.’ Other outcomes included drug use behaviors, other sexual behaviors, and psychosocial factors including attitudes and knowledge about sex and HIV transmission.

Follow Up

The final follow up visit ranged from 3 to 23 months following the intervention, with a median of 12 months. The retention at the last follow-up visit was generally quite high, ranging from 34 to 97.9% with a mean of 82.2%.

Primary Outcome Analysis

Of the nine studies with controls, eight showed substantial improvement in at least one condom measure comparing control and intervention conditions. The exception was Sherman et al. which showed equal increases in condom use for both control and intervention populations [18]. This was one of the studies that measured biological outcomes and while the authors found a significant difference between incident gonorrhea in the total (index + network) experimental condition compared to control subjects (control subjects participated in the life-skills curriculum on methamphetamine use), they did not find significant differences in the incidence of other STIs. In the two studies without controls [11, 20], there was a significant increase in at least one condom outcome measure at post-intervention compared to baseline pre-intervention.

The reviewed studies classified index and network participants (both within the intervention arm) in several different ways. Two studies [18, 24] performed separate analyses of index members and total (index + network) members, reporting no significant difference between control and intervention populations in either case. Some studies only analyzed peer leaders [15] or indexes [17, 23], and did not report information on network members. Two studies performed separate analyses of peer educators (indexes) and network members compared to control [19, 22]. Both of these studies found that there were substantial reductions in sex without a condom for indexes versus control participants, but only one of these studies

found that significant increases in condom use extended to network participants as well [22]. The other five studies analyzed total (index + network) populations only.

Analysis related to condom use measures rarely separated the index and network members (2/11 studies). Comparing condom use outcomes was difficult because of differences in measures, follow up time, control conditions, and stratification based on casual/main partners.

Six studies were able to assess condom use at multiple follow-up periods [16, 18, 21–24]. Kelly et al. found fewer cases of reported unprotected intercourse with all sexual partners at 3 and 12 month follow-up. Amirkhanian et al. found a substantial difference between intervention and control at 3 months that disappeared at the 12 month follow up visit among Russian participants, but remained significant among those in Bulgaria [21]. Another study found substantial differences between condom use at 6 and 18 months, but not at the 12 month follow up point [16]. Tobin et al. similarly found significant increases in 100% condom use and decreases in sex risk overall, but that those findings were not statistically significant at the 12 and 18 month follow-ups among indexes [22].

Studies differed in their classification of types of sexual partners. Five studies [11, 17, 20, 23, 24] stratified results based on casual partners and main partners. Amirkhanian et al. 2003 found substantial differences between experimental and control condom use behaviors with casual sex partners among men who have sex with men, but no effect with main sex partners [11]. Three other studies also found that changes in condom use did not extend to encounters with main sexual partners [17, 20, 23]. However, Kelly et al. found decreases in unprotected intercourse regardless of the type of partner [24].

Discussion

This study systematically reviewed network-based condom promotion interventions. All of the eleven selected network intervention studies found substantial improvement in condom use or biological outcomes when comparing control and intervention conditions. This is the first systematic review focused on social-network based condom promotion interventions among pre-existing social networks. Although the reviewed interventions are not mutually exclusive from community popular opinion leader (CPOL) studies and other peer intervention programs, there are several distinctions that differentiate these social network based condom promotions. Most importantly, these social network interventions all used social networks that were defined by the individuals themselves. The CPOL model chooses leaders of the community, but may not identify the smaller social networks that impact one's daily interactions. Most of these reviewed studies (10/11) had some measure of intervention effect within the identified network. The network members were either directly involved in the intervention, or indirectly when receiving information from the index participants. Focusing the review on pre-existing social networks allowed us to compare studies that were not post-hoc defined by researchers or others who may be unfamiliar with endogenous social connections. This review demonstrates the benefits and limitations of incorporating pre-existing social networks and relationships when designing condom promotion interventions.

Network-based condom promotion interventions have several advantages that were highlighted in these studies. Ten of the eleven reviewed studies showed substantial improvements in condom outcome measures. The one study that did not find increases in condom use, did find decreases in incident gonorrhea in the intervention group compared to the control. The median time of terminal follow-up was 12 months, substantially greater than 6.3 months found in a systematic review including non-network based condom promotion interventions [26]. In addition, ten of the 11 studies had retention rates exceeding

80% at the last follow-up visit. The extended follow-up and high retention rate at terminal follow-up visit suggests that groups who are recruited through social network based methods may be easier to follow and retain compared to non-network recruitment methods. Social network based interventions may also be a valuable tool for recruiting marginalized and hard-to-reach populations.

This systematic review also highlighted several limitations both of network based condom promotions and in the assessment of their efficacy. First, social network interventions require the motivation of index participants to recruit network participants as well as disseminate information among their social networks. Additionally, these interventions are methodologically complex, and understanding the social networks before program implementation is crucial. Contamination is a somewhat inevitable research limitation in the studies that used controls, especially in those that studied densely connected social networks. However, while contamination does impact the evaluation of these types of interventions, it does not compromise the potential utility in implementing social network interventions and HIV prevention programs. The reviewed studies only assessed individual outcomes because there are not standardized measures for condom use norms or other group-level determinants of condom use. Several studies have analyzed group norms, but there have been no validated measures focused at this level of analysis [27, 28].

This systematic review has several limitations. First, different methods of demonstrating the effect of a social network based intervention were used. While nine studies had a control group, these studies used varying condom outcome measures. Other reviews of condom promotion interventions have noted heterogeneity in outcome measures [26]. Differential effects of the intervention on casual versus regular partners may have underestimated the net effect of the intervention in the six studies that did not make this differentiation. Second, the reviewed studies had different recruitment methods and differed slightly in the way in which networks were defined and analyzed. Third, measurement of study quality was difficult as there currently is no gold standard for assessing study quality in social network based intervention studies. Finally, although we conducted an extensive search of the literature, some articles that did not focus on condom promotion as a means of HIV/STI prevention may not have been included.

This systematic review demonstrates some areas that are critical for future social network research focused on HIV prevention. More standardized mechanisms for evaluating contamination between intervention and control groups are essential for clearly showing the effect of social network based interventions. Although social relationships between peers and members of risk groups have been studied in greater detail, the local social worlds of brothels and other commercial sex establishments are less clear. Social networks bridging pimps, managers, and other men who control local sex industries may have a strong influence on condom use, either positive or negative. In addition, better understanding networks of men who purchase sex may provide a strong force for organizing condom promotion and related HIV prevention programs [29] in some regions where such networks exist.

The results of this review highlight the potential utility of social network based intervention programs. Previous network studies of high risk groups have focused on passive disease transmission, but this body of research reveals how high risk social networks can be used to actively promote STI/HIV prevention. The results of the reviewed interventions suggest that the use of network-based approaches lead to increases in condom use and decreases in other HIV-risk behaviors. Further research on how to recruit, retain, and change behaviors among social networks may hold great promise for behavioral STI/HIV prevention.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1.

Flow chart of the research study selection (Original search completed July 13, 2010)

Table 1

Study characteristics

Author	Date of study	Study location	Study design	Study population	Follow-up (months)	Social network intervention	Comparison group
Sherman et al. [18]	04/2005–06/2007	Chang Mai, Thailand	Quasi-experimental	983 18–25 year old sexually active methamphetamine users in recruitment sites	3, 6, 9, 12	Peer educator, network oriented intervention consisting of seven 2-h small group sessions over course of one month and two booster sessions that occurred 3 and 6 months after study entry	Life Skill Curriculum (seven 2-h small group sessions over course of one month)
Amirkhanian et al. 2003 [11]	02/2002–11/2002	St. Petersburg, Russia and Sofia, Bulgaria	Pilot study, pre- post without control and randomization	48 Young MSM in St. Petersburg and 34 in Sofia	4	Leaders trained in 5 weekly group sessions lasting 3–4 h with one maintenance session 2 weeks after last main session.	Compared to baseline
Amirkhanian et al. 2005 [21]	2003–2004	St. Petersburg, Russia and Sofia, Bulgaria	Quasi-experimental	276 Young MSM and network members	3, 12	Network leader attended five weekly group training sessions lasting 3–4 h each with four booster sessions over next 3 months. Sessions taught leaders how to communicate HIV prevention messages/personal risk reduction advice to their network members.	No treatment control condition
Laukin et al. 1998 [15]	07/1994–06/1995	Baltimore, MD, USA	Quasi-experimental	IDUs (36 leader and 78 risk network members)	3	10 90 min sessions. Consisted of four skill building sessions and then proceeded onto the outreach phase of the study.	No treatment control condition from another study
Booth et al. [19]	2004–2006	Ukraine	Quasi-experimental	722 Opiate IDUs age 18 and over	6	5 day network-based sessions delivered in small groups over 2 weeks designed to empower peer educators to be mentors and motivate their network members to reduce HIV risk behaviors	5 month network intervention and comparison intervention
Fang et al. [16]	1993–1994	Large eastern US city	Quasi-experimental	382 African American youth 9–15 years old	6, 12, 18	8 weekly meetings, 6 month booster session held afterwards along with a one-month long booster series at 15 months post-intervention	Attend weekly sessions offered at six sites in the community.
Laukin et al. 2003 [17]	1997–1999	Baltimore, MD, USA	Randomized control trial	250 Drug Users	6	10 session small group trainings lasting 90 min/session	Equal attention control condition.
Odek et al. [20]	5/2003–7/2003 and 7/2005–8/2005	Nairobi, Kenya	Pre-post without control and randomization	273 FSWs age 18 years and above	18–23	Adding micro-enterprise services to already existing HIV prevention intervention	Compared to baseline
Tobin et al. [22]	3/2004–3/2006	Baltimore, MD, USA	RCT with prospective data collection	Indexes: 227 IDUs age 18 or older, Network members: 336 individuals who were aged 18	6, 12, 18	Indexes participated in 5 group based sessions involving skills training, one individual session, and one dyad session with their recruited network participant	5 group-based informational sessions that addressed injection drug-use related topics

Author	Date of study	Study location	Study design	Study population	Follow-up (months)	Social network intervention	Comparison group
Kelly et al. [24]	2003–2005	Sofia, Bulgaria	Randomized control trial	or older and were IDUs and/or sexual partner of index 286 men (52 networks)	3, 12	Indexes attended 5 weekly, two hour-long small group sessions on behavior change. Booster sessions were held after.	Compared to group with no intervention
Davel-Rothwell et al. [23]	09/2005–07/2007	Baltimore, MD, USA	RCT	169 women age 18–55	6, 12, 18	The CHAT intervention consisting of five small group sessions and one individual session focusing on harm reduction and peer mentoring strategies	Standard of care comparison condition consisting of one group session on HIV and STIs

Methods

Table 2

Author	Randomization method (if used)	Method of identifying index	Method of identifying network members	Network member involvement	Theoretical basis for intervention	Control group	Theoretical basis for control group	Participation rate	Retention (control/intervention)
Sherman et al. [18]	Random allocation to 2 arms	Sites of recruitment and target index age ethnographically identified.	All index members recruited sex or drug network member(s) to study within 45 days of initial screening	Recipient of conversations/communication from social network leaders; Completed baseline/follow up surveys	Diffusion of innovation, social learning theory, and social identity theory	Yes	Cognitive behavioral psychology	82.7	89/90/2
Amirkhanian et al. 2003 [11]	None	Ethnographic observations in bars and nightclubs identified social circles	Indexes identified friends in the MSM community and gave invitation cards to these individuals to participate in the study.	Recipient of conversations/communication from social network leaders; Completed baseline/follow up surveys	Multiple constructs	No	Not applicable	NR	87.7% (two arms together)
Amirkhanian et al. 2005 [21]	Networks randomly allocated to 2 arms	Ethnographic observations in bars and nightclubs identified social circles.	Indexes provided names of up to nine of their own network members and invited them to participate in study.	Recipient of conversations/communication from social network leaders; Completed baseline/follow up surveys	Multiple Constructs	Yes	Not applicable	50% index; 93% social network members	89.5%/86.7%
Latkin et al. 1998 [15]	None	IDUs completed the baseline interview and nominated peer leaders (Self-nomination was allowed)	Peer leaders identified and recruited network members who were previous sexual partners and or drug sharing partners	Recipient of conversations from peer leaders. Completed 3 month follow-up survey	Not specified	Yes	Not applicable	38%	33.60%
Booth et al. [19]	None	Recruited by recovering drug users serving as outreach workers	Peer educators in network intervention required to recruit 3 members from their injection network	Participated in baseline/follow up surveys.	Indigenous Leader Outreach Model	Yes	Indigenous Leader Outreach model	Not recorded	88%/83.5%
Fang et al. [16]	Friendship groups were randomized to receive or not receive the intervention	Recruited from recreation centers associated with public housing developments	Interested youth approached friends to form a group of 2–10 same gender friends who were within 3 years of age	Indexes and network members formed study population	Protection Motivation Theory	Yes	Not applicable	Not recorded	
Latkin et al. 2003 [17]	Randomly assigned in 2:1 ratio to intervention or control, respectively	Fliers distributed in areas identified via ethnographic observations, focus groups, and geographic coding of drug related arrests in Baltimore	Index participants recruited two network members	Recipient of conversations/communication from social network leaders.	Social-cognitive, cognitive consistency, social identity, social influence, active learning	Yes	Not applicable	28.60%	
Odek et al. [20]	None	FSWs already enrolled in peer-mediated education programs on STI/HIV prevention	Indexes identified other members with whom they could voluntarily form into credit groups of five to fifteen members	Indexes and network members formed study population	Peer education behavioural risk reduction model (adapted with micro-enterprise initiative)	No	Not applicable	88.90%	
Tobin et al. [22]	Randomized by using a computerized system to achieve equal numbers of men and women in each group	IDUs recruited through street outreach, word of mouth, ads and referrals from community agencies	Index members were asked to make a list of risk network members who might be eligible for the study.	Received communication from social network leaders; Completed baseline/follow up surveys	Social identity theory	Yes	None specified	NR	Index: 95% / 88%, network: 85% / 89%

Author	Randomization method (if used)	Method of identifying index	Method of identifying network members	Network member involvement	Theoretical basis for intervention	Control group	Theoretical basis for control group	Participation rate	Retention (control/ intervention)
Kelly et al. [24]	Randomized to achieve equal number of social networks in intervention and control	Ethnographic observations were used to identify leaders of “social circles”	Indexes were interviewed and asked to provide the interviewer with the first names of the indexes’ closest friends.	Recipient of conversations/ communication from social network leaders. completed baseline/follow up surveys	Behavioral science theory	Yes	None specified	94.4%	96.4%/97.9%
Davey-Rothwell et al. [23]	Randomized to have equal numbers of women in intervention and control	Women were recruited through street outreach, health clinics, and local community agencies	Indexes were asked to create a social network inventory. Researchers identified eligible network members from this inventory and generated a list from which index members could choose.	Recipients of conversations/ communication from social network leaders. Completed baseline surveys.	Social influence, social identity, cognitive dissonance, social diffusion, and social learning theory	Yes	None specified	68%	95%/92%

Table 3

Outcomes

Author	Condom/biological outcomes measured	Condom measure validated	Other outcomes measured	OR/RR in condom use (95% confidence interval) or P value of condom use between two arms or pre-post intervention
Sherman et al. [18]	100% condom use in the 30 days prior to each interview. 2. Presence of a laboratory confirmed sexually transmitted infection	Not specified	Frequency of meth use in 3 months prior to each interview	Always use condoms: 1.09 (0.91,1.31)
Amirkhanian et al. 2003 [11]	Condom use during anal intercourse with main/casual male partners in last 3 months. 2. During last anal intercourse with main/casual male partner	Yes	Intervention Exposure and Psychosocial Scales	Condom use during last anal intercourse with main male partner: 44 vs. 54% (no statistically test)
Amirkhanian et al. 2005 [21]	Unprotected intercourse (composite anal/vaginal) and unprotected anal intercourse with male partners in past 3 months	Yes	Psychological scales, other sexual risks	Mean percentage of condom use: 63.1 vs. 54.0%
Latkin et al. 1998 [15]	For peer leaders: Increase in condom use between baseline and follow up (no specific recall period given). No information on condom outcome measures given for network members	Yes	Safe needle sharing practices, diffusion of information between peer leaders and network members, qualitative results	Peer leaders (Increase in condom use between baseline and follow up): $t = 3.38$, $P < 0.01$
Booth et al. [19]	Vaginal or anal sex with w/o condom in past 30 days	Yes	Needle risks, other sexual risks	Sex with a condom: 58.4 vs. 56.9%, $P > 0.05$
Fang et al. [16]	Condom during last episode of intercourse	Yes	Positive feeling about engaging in intercourse, expect to engage in intercourse, expect to use a condom, other items on the Youth Health Risk Behavioral Inventory	Condom use during last episode of intercourse: 81 vs. 59%, $P \leq 0.05$
Latkin et al. 2003 [17]	Self reported frequency of condom use during vaginal/oral/anal sex with main/casual partners in the past 90 days.	Not specified	Injection risk behaviors, other sexual risk behaviors, outreach assessment	Proportion of increased condom use during vaginal sex with casual partners: 16 vs. 4%, $P < 0.05$
Odek et al. [20]	Self-reported condom use in last week for casual and regular sex partners	Not specified	Number of sex partners and exit from sex work	All used condoms with regular partners: 78.9 vs. 93.5%, $P = 0.031$
Tobin et al. [22]	100% condom use in anal or vaginal sex with all sexual partners in the previous 90 days	Not specified	Injection risks based on use and sharing behaviors, other sex risks based on number of partners and exchanging sex for drugs and/or money and HIV outreach behaviors.	Index participants sex risk: OR 0.53, 95% CI 0.34–0.86, network participants less than 100% vaginal or anal condom use: OR 0.61, 95% CI 0.4–0.89
Kelly et al. [24]	Condom use during intercourse with the previous 5 male and 5 female sexual partners. 2. Presence of a laboratory confirmed sexually transmitted infection (chlamydia, gonorrhea, syphilis)	Not specified	Knowledge of HIV, safer sex peer norms, attitudes towards condom use	Unprotected intercourse: (71 vs. 86%, $P = 0.01$), unprotected intercourse with casual partners: (29 vs. 53%, $P = 0.009$)
Davey-Rothwell et al. [23]	100% Condom use in anal or vaginal sex with all sexual partners in the previous 90 days. 2. Presence of HIV antibodies by Orasure rapid test or Chlamydia or gonorrhea infection by urine testing.	Not specified	Number of sexual partners, risk behaviors of sexual partners, cocaine or heroine use, having conversations among friends about HIV/STIs	Unprotected anal sex (OR 0.70, 95% CI 0.40–1.25), unprotected vaginal sex (OR 0.64, 95% CI 0.40–1.02), unprotected sex with

Author	Condom/biological outcomes measured	Condom measure validated	Other outcomes measured	OR/RR in condom use (95% confidence interval) or P value of condom use between two arms or pre-post intervention
				main partner (OR 0.70, 95% CI 0.45–1.10), unprotected sex with non-main partner (OR 0.59, 95% CI 0.36–0.95)