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Social Support and HIV-related Risk Behaviors: A Systematic Review of the Global Literature

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Abstract

Existing empirical evidence has well documented the role of social support in both physical and psychological well-being among various populations. In the context of HIV prevention, the rapid increase of studies on social support merits a systematic review to synthesize the current global literature on association between social support and HIV-related risk behaviors. The current review reveals a complex picture of this relationship across diverse populations. Existing studies indicate that higher levels of social support are related to fewer HIV-related risk behaviors among female sex workers and people living with HIV/AIDS and heterosexual adults in general. However, influences of social support on HIV-related risk behaviors are inconsistent within drug users, men who have sex with men and adolescents. These variations in findings may be attributed to different measurement of social support in different studies, specific context of social support for diverse population, or various characteristics of the social networks the study population obtained support from. Future studies are needed to explore the mechanism of how social support affects HIV-related risk behaviors. HIV prevention intervention efforts need to focus on the positive effect of social support for various vulnerable and at-risk populations. Future efforts also need to incorporate necessary structure change and utilize technical innovation in order to maximize the protective role of social support in HIV risk prevention or reduction.

Keywords

HIV/AIDS; HIV-related risk behaviors; Social support

Introduction

HIV has been significantly threatening the health of human beings since the early 1980s. Globally an estimated 34 million persons were living with HIV (PWHIV) at the end of 2010; an estimated 1.8 million people died from AIDS-related causes during 2010 [1]. As HIV transmits through risky behaviors, behavior change is regarded as an important component of HIV prevention strategies [2]. Recent studies of HIV prevention intervention have presented that HIV-related risk behaviors are influenced by both individual level factors and socio-cultural level factors [3, 4]. Since the 1990s, the relationship between social support and HIV-related risk behaviors has been drawing increased attention in both research and practice fields [5, 6]. To date, this relationship has been examined in diverse

populations including drug users [7], men who have sex with men (MSM) [8], and female sexual workers (FSWs) [9].

Lakey and Cohen [10] presented three theoretical perspectives on the relationship between social support and health: the stress and coping perspective, the social constructionist perspective and the relationship perspective. The stress and coping perspective proposes that social support indirectly influences health by buffering negative impact of stressors [11]. The social constructionist perspective, drawing from social-cognitive theories of personality [10] and symbolic interactionism [12], proposes that social support directly affects health by promoting self-esteem and self-regulation [13, 14]. The relationship perspective attributes social support to relationship qualities or processes [10]. According to the relationship perspective, relationship qualities including positive ties (e.g., companionship, intimacy) and negative ties (social conflict) among people can predict psychological and physical well-being [15–17].

Social network approach can be another theoretical perspective on social support study. Mitchell [18] has defined a social network as “a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole be used to interpret the social behavior of the person involved” (18:p2). Social networks describe social relationships, some of which may provide social support. Therefore, the functional characteristics of a defined social network, which refer to the functions provided by network members, often manifest in the form of social support [17].

The diversity of theoretical perspectives of social support results in various definitions of this concept. Some frequently cited definitions of social support focus on structure of social support, such as structure of support networks (size, density, characteristics of members, etc.). Some definitions focus on sources of social support, such as the types of interpersonal relationships [19]. Some focus on functions of social support including emotional support (affect, esteem, concern), appraisal support (feedback, affirmation), informational (suggestion, advice, information), and instrumental support (aid in labor, money, time) [20–22]. Some studies also focus on the quality of social support, such as the adequacy or satisfaction of the support [23]. The term of “social support” in the current review is used in its broader meaning to cover most aspects of this concept in both theoretical and empirical research.

Although social support has been recognized as an important socio-cultural level factor in HIV prevention intervention, limited literature has synthesized studies regarding relationships between social support and HIV-related risk behaviors. In a review mainly focusing on U.S. Caucasian homosexual men at a symptomatic stage of HIV infection, Green [23] highlighted the importance of exploring the association between functions of social support and health and how this association might change over time through different stages of the disease and by socio-cultural characteristics of the study population. However, the review did not include the studies among other vulnerable populations. The scope of the review was also limited by the small number of the studies at the time of the review. Hall [24] conducted a review of studies among homosexual men living with HIV by analyzing three specific areas: structure of social support (e.g., social network), relationship between coping and social support, and relationship between mental health and social support. The review indicated a positive role of social support in coping with HIV and improving psychological well-being among homosexual men with HIV [24]. In addition, the review suggested that for Caucasian homosexual men with HIV social support from friends or partners were more important than that from the family [24]. Two additional reviews addressed the issues of social support measurement. One discussed different measurements adopted by various theoretical perspectives [10], and the other examined social support

measurement with a focus on measurements that were related to the role of families in prevention and adaptation to HIV/AIDS [25].

These existing reviews have shed light on the effects of social support in improving psychological well-being and quality of life of PWHIV. However, several knowledge gaps still remain. First, the studies covered in existing reviews lacked sufficient representation of diverse populations. Data were limited regarding ethnic minority PWHIV, or other vulnerable groups (e.g., drug users, FSWs, etc.) who are at high risk of HIV infection or transmission. Second, existing reviews lacked a focus on how social support might influence HIV-related risk behaviors. Third, these reviews did not systematically examine the measurements of social support and their potential effect on various findings of existing studies. The rapid increase of research and practice on social support and HIV prevention during the past two decades merits an updated review that will summarize and synthesize the current literature on social support and HIV-related risk behaviors.

The current review focuses on the association between social support and HIV-related risk behaviors with three primary objectives: first, to review measurement of social support used in empirical studies and the main findings of these studies regarding the association; second, to compare and interpret how this association may vary across different populations; third, to provide recommendations for further research and practice in this area. The term of “HIV-related risk behaviors” in the current review refers to drug-related risk behaviors (e.g., drug use, sharing needles) and sex-related risk behaviors (e.g., multiple sexual partners, unprotected sexual intercourse). It is necessary to clarify that behavioral outcomes in this review will not include psychological adaption to HIV/AIDS (e.g., coping with HIV infection or AIDS symptoms), or HIV-related “health seeking behaviors” (e.g., accessing health care providers, seeking HIV/STI consulting and testing), or adherence to medication. Although these behaviors are critical for the psychological or physical well-being of HIV-infected individuals, the scope and depth of these issues deserve a separate review.

Method

Data Source

The literature search was conducted in May 2013 using electronic bibliographic databases: CINAHL, PsycINFO, PubMed/Medline, and Web of Science. We generated a master list of search terms and tailored search queries to each electronic database. The search terms included social support, social network, HIV and AIDS. We used the controlled vocabulary tool MeSH if available (e.g., controlled “social support” in PubMed/Medline) to more efficiently retrieve the target articles. All the citations were imported into EndNote X5.0 for data management. The search of these four databases yielded 5,699 citations in total. After deleting duplications and non-English journals, 2,681 citations remained in the EndNote data set for further screening.

Inclusion and Exclusion Criteria

Our literature review aimed to identify studies that were: (1) peer-reviewed and published in English-language journals prior to May 2013, (2) studies reporting the association between social support and at least one of the HIV-related risk behaviors (drug-related risk behaviors and sex-related risk behaviors), and (3) empirical studies using either qualitative or quantitative methodology. Articles were excluded if they met one the following criteria: (1) used language other than English, (2) were not empirical studies, (3) focused on health outcomes (physical or psychological well-being) rather than behaviors, (4) examined the relationship between social support and other behaviors (caregiving, coping with HIV,

disclosing HIV status, medication adherence, etc.), (5) focused on the influence of spiritual or religious support.

Screening

The two authors conducted citation screenings by three steps: title review, abstract review, and article review. At the stage of title review, we independently reviewed the titles and resolved disagreements through discussions until we reached a consensus. We decided to apply only exclusion criteria at this stage in order to be cautious in excluding citations. Therefore, some citations might remain for the next step of screening even though their titles did not explicitly indicate they met all the inclusion criteria. We first excluded 239 extraneous articles which did not examine the relationship between social support and HIV prevention/ treatment. We then excluded 713 non-empirical studies and 77 studies with focuses on program implementation. Applying exclusion criteria 3–5, we further excluded 392 articles that did not examine HIV-related risk behaviors and 984 articles that did not focus on associations between social support and HIV-related risk behaviors. Using both inclusion and exclusion criteria, we reviewed abstracts from the remaining 277 articles, further excluding 196 additional articles. At the article review step, two authors reviewed the full text of the remaining 81 articles. We decided to exclude 45 articles, of which nine were descriptions on projects providing social support for high risk population or PWHIV, six focused on social network, three were studies conducted among special populations (rape survivors, released prisoners, and women with severely mental illness), six examined health-seeking outcomes rather than behavioral outcomes, and 21 articles did not explicitly explore associations between social support and HIV-related risk behaviors. The three-step screening then left 36 peer-reviewed articles. The references of these 36 eligible articles were also searched until no new references were identified. We also reviewed the citations from prior literature reviews on social support and/or HIV-related risk behaviors for possible references. An additional four articles identified from this hand search process survived the title-review, abstract-review and full-text-review screening, yielding a total of 40 articles for further analysis. Figure 1 summarized the screening results for each step and presented the reasons for excluding articles.

We used a structured data abstraction form to extract key information from each of the 40 articles (e.g., study location, study population, study design, measurement for social support, main findings). We then created tables to display and categorize the information we extracted. The 40 articles were organized by types of HIV-related risk behaviors and study populations in the current review. Because of the focus on different types of HIV-related risk behaviors in this review, studies that addressed both drug-related and sex-related risk behaviors were counted as separate studies. This approach results in a total of 41 studies from the 40 publications (See Table 1).

Results

Characteristics of the Reviewed Studies

As shown in Table 1, most of the studies (34/41) in this review focused on sex-related risk behaviors with the remainder focusing on drug-related risk behaviors. The studies explored the relationship between social support and HIV risk behaviors across diverse populations, including both most-at-risk populations such as drug users ($n = 14$ studies), MSM ($n = 8$ studies), FSWs ($n = 5$ studies), PWHIV ($n = 4$ studies), transgender women ($n = 1$ study), and general populations such as adolescents ($n = 5$ studies) and heterosexual adults ($n = 4$ studies). The measurements of behavioral outcomes are presented in Table 2; and the measurement instruments for social support used in these studies are summarized in terms of type and dimension by Table 3. The key characteristics of the reviewed studies are

summarized in terms of authors, publication year, study location, sample size, study design, and main findings (See Table 4). All the studies employed quantitative methodology except one applied both quantitative and qualitative methodologies [26, 27]. Of the 40 quantitative studies, 83 % (33/40) used a cross-sectional design, 8 % (3/40) used a pre-/post-test design, and 10 % (4/40) used a longitudinal design.

Measures of HIV Risk Behaviors

The measures of behavioral outcomes were inconsistent across the existing studies. First, the measures varied with diverse populations. For example, the measures for drug users focused on whether or not using drugs, number of injections, and sharing of needles. The studies on FSWs assessed condom use with clients and the ones on MSM measured unprotected anal intercourse and number of sexual partners. Second, the measures applied different lengths of recall period. The respondents might be asked to recall their sexual behaviors during the past 30 days ($n = 4$ studies), the past 2 months ($n = 3$ studies), the past 3 months ($n = 8$ studies), the past 6 months ($n = 6$ studies) or the past 1 year ($n = 2$ studies). Third, the scope of sex-related risk behaviors diverted according to specific study populations and research emphasis. In some studies on MSM, the unprotected sexual intercourse defined as unprotected anal intercourse, while in other studies among MSM it also included vaginal and oral sexual acts. Similarly, some studies on FSWs assessed condom use with clients, and other studies also measured condom use with their sexual partners. In addition, although most studies used single-item measure to assess HIV risk behaviors, some employed measures based on multiple items. For instance, two studies calculated an HIV risk behaviors index by combining multiple risky behaviors including drug-related risks, sex-related risks and alcohol abuse [28, 29]. Some studies dichotomized sexual behavioral outcomes into “high risk” and “low risk” based on different items (e.g., numbers of sexual partners, having high risk partners, having sex for drugs or money) [30, 31].

Measures of Social Support

The measures of social support were categorized into “established social support scales” and “self-developed measures” in the current review (See Table 3). About 45 % of the studies ($n = 19$) adapted or directly used established scales and 55 % ($n = 23$) created measures based on specific research questions. In total, 16 established social support scales were used in the reviewed studies. The most frequently used scales were the Social Provisions Scale [32] ($n = 4$), followed by the Arizona Social Support Interview Schedule [33] ($n = 3$), and the Multidimensional Scale of Perceived Social Support [34] ($n = 3$).

We depicted and compared two types of social support measurements with respects to the aspects of social support they assessed, including type and content of support, size of support networks, as well as sources, functions and satisfaction of support. The established scales and self-developed measures were similar with respect to the types of social support they examined. Most of these measurement instruments assessed perceived support rather than actual support. Of the 16 established scales, 14 scales focused on perceived support and 2 scales focused on actual support [35, 36]. Similarly, of the 23 self-developed measures, 19 examined perceived support and 4 examined actual support [27, 37–39].

However, the established scales and self-developed measure were different with respect to the content of social support they focused on. Two of the established scales (i.e. Social Support Behavior Code and UCLA Social Support Inventory) were adapted to measure both general support and HIV-specific support, but the remaining 14 scales only measured general support. By contrast, the majority (61 %) of self-developed measures focused on HIV-specific support rather than general support. Of the 23 measures, nine assessed general

support, 12 assessed HIV-specific support, and two assessed both general and HIV-specific support [40, 41].

The characteristics of measurement instruments for social support were also summarized in terms of various dimensions (i.e. size of support networks, sources of support, functions of support, satisfaction of support). As shown in Table 2, 5 of 16 established scales focused on size of support networks. The Arizona Social Support Interview Schedule [33], Social Network Inventory [42], and the Perceived Social Support Network Inventory [43] measured the size of networks, and characteristics of network members. The Norbeck Social Support Questionnaire [44] also assessed the size of networks and the social relationship between the subject and the network member. One self-developed measure examined the size of support networks and the drug use behaviors of the network members [41].

The majority of measures examined sources of social support. 11 of the 16 established scales and 19 of the 23 self-developed measures identified the sources of support (e.g., family, friends, and relatives). Of the 11 studies using established scales, nine examined support from almost all available interpersonal relationships, but two just focused on support from certain relationships such as friends, family [29], and primary caregivers [31]. Among the 19 studies using self-developed measures, eight assessed support from a single specific source such as sexual partners, gatekeepers in commercial sex venues; seven examined all available informal and formal sources of support [31, 39, 41]; two examined support from both friends and sexual partners [45]; and another two measured support from friends, relatives and sexual partners [27, 46].

As for functions of social support, most of the established scales assessed different functions of general social support (e.g., emotional, tangible, information, feedback, etc.). Two scales were adapted to measure HIV-related support including HIV/STI information support and health seeking support [36], as well as support for people living with HIV/ AIDS [47]. By contrast, most of the self-developed measures focused on functions related to HIV-related protective behaviors (e.g., using condoms, dealing with clients, reducing drug use). Few measurements examined satisfactions of social support. Two self-developed measures assessed satisfaction of support [31, 39]. Four established scales contained this dimension. They were the Social Support for Adolescents Scale [48], the Perceived Social Support Network Inventory [43], the Arizona Social Support Interview Schedule [33], and the UCLA Social Support Inventory [49].

Drug Users

Existing studies examined both drug-related risk behaviors and sex-related risk behaviors among drug users. Studies on social support and drug use behaviors mainly focused on drug use frequency and risky drug use behaviors such as needle-sharing among injection drug users and methadone clinic patients. It seems that more social support might be associated with less frequent drug use. One study among Puerto Rican injection drug users showed that emotional support was negatively associated to injection frequency in the sub-group of migrant drug users [50]. In an evaluation study on drug recovery program for female crack cocaine users, Nyamathi et al. [51] reported that the improvement in social support was significantly lower for women who continued using cocaine than the ones who did not maintain drug use. However, another study among methadone clinic patients indicated that perceived general social support, as measured by the Interpersonal Support Evaluation List [11], was not correlated with drug use during the previous 3 months [52].

A few studies examined how drug use behaviors were influenced by characteristics of social network and functions of social support. Suh et al. [53] suggested that the size of the drug user network providing support, as measured by the Arizona Social Support Interview

Schedule [33], was positively associated with needle-sharing among injection drug users. Drug use behaviors might not be related to partner's provision of drugs or other instrumental support, but were affected by emotional support [54]. However, the results are mixed about the relationship between emotional support and needle-sharing. Unger et al. [54] reported that male injection drug users were more likely to share needles with partners providing emotional support. A cross-sectional study among Puerto Rican injection drug users reported that emotional support was positively associated with sharing needles in the sub-group of non-migrant drug users [50]. A longitudinal study among injection drug users in the U.S. indicated that increasing number of network members who provided emotional support was negatively associated with needle-sharing [55].

The findings on associations between social support and sexual behaviors were mixed among drug users. A longitudinal study among male alcohol and drug abusers suggested that perceived social support, as measured by the Perceived Social Support Network Inventory [43], did not significantly predict unprotected sex during follow-up [56]. Several cross-sectional studies indicated that social support might be related to safer sexual behaviors. A study among female methadone clinic patients reported that perceived social support, as measured by Social Support Appraisal Index [20], was correlated with communicating about sex with sexual partners and asking partners' HIV status [41]. Latkin et al. [57] reported that a large social network that can provide health advice and financial support, as measured by the Arizona Social Support Interview Schedule [33], might improve condom use among network members ever using heroin or cocaine in the United States. One study applied HIV risk index to assess a variety of drug-and sex-related risk behaviors including using drugs, sharing needles and injection paraphernalia, engaging in unprotected sex, and having sex for drugs or money. This study was conducted among HIV-positive IDUs, indicating that more social support, as measured by the Multidimensional Scale of Perceived Social Support [34], was significantly associated with fewer HIV risk behaviors [28]. In addition, the evaluation study on drug recovery program among female crack cocaine users suggested that improvement in social support was significantly associated with not maintaining multiple partners [51]. However, in a study among HIV seronegative non-injecting heroin users, Miller and Neaigus [58] reported that men with high perceived emotional or material support from sexual partners were more likely to have unprotected sex.

MSM and Transgender Women

The behavioral outcomes for most studies on MSM and transgender women focused on unprotected anal intercourses (UAI) and non-monogamous relationships. Empirical studies indicated that social support was negatively associated with risky sexual behaviors among this population. One study among 75 transgender women reported that higher levels of social support was related to fewer UAI [59]. Another study on young MSM suggested that a larger social support network size was associated with a lower likelihood of engaging in UAI among Hispanic/Latino MSM [60]. Lauby et al. [61] conducted a large-sample study among 1,286 MSM recruited from multiple cities in the U.S., reporting higher supportive relationship scores, as measured by the Medical Outcomes Study Social Support Survey [62], were associated with lower odds of UAI with a casual partner and lower odds of trading sex in the past 3 months [61].

The association between social support and sex-related risk behaviors among MSM might be shaped by their HIV-status, disclosure of their homosexual identities, and characteristics of social support they received. For instance, a study among young MSM recruited from 13 geographically diverse sites in the U.S. indicated that social support was positively associated with safer sexual behaviors among HIV-positive MSM ($n = 171$), but this association was not significant among HIV-negative MSM ($n = 8,064$) [63]. According to a

study among 54 homosexual couples, the association between social support and safer sexual behaviors is more profound among those whose partners disclosed homosexual identities to people [64].

The influence of social support on sex-related risk behaviors among MSM might depend on the source and the functions of support. Having a sexual partner in a social support network was associated with increased odds of UAI among both Hispanic/Latino young MSM [60]. One study among homosexual men with HIV infection reported that actual HIV-risk behaviors were not significantly associated with any social support including perceived social support from friends or families, as measured by the Perceived Social Support-Friends and Perceived Social Support-Family [65], or available social support, as measured by the Arizona Social Support Interview Schedule [33], although higher perceived and actual family support were correlated with the intention to reduce risk behaviors [29]. Siegel et al. [66] reported that MSM having risky sexual behaviors had higher perceived emotional support. However, the safer sexual behaviors among MSM might be promoted by HIV-specific support from peers or partners. One cross-sectional study among African American and Latino MSM suggested that higher perceived support of condom use from peers was related to lower rates of UAI with both casual partners and main partners [67]. One longitudinal study examined both perceived general social support, as measured by the Social Provisions Scale [32], and perceived HIV-specific support from partner among homosexual couples over a period of 6 months [68]. Couples reporting high perceived partner support engaged in less HIV-related risk behavior longitudinally; while couples with high perceived social support from other people did so only at the follow-up survey [68].

FSWs

All the existing studies on FSWs were conducted in Asia, with a focus on the effect of social support on consistent condom use with their clients or sexual partners. Studies suggested that HIV-related support from managers of entertainment and FSWs themselves (peer educators, support groups) played a positive role in promoting condom use with clients. Two cross-sectional studies in China indicated that FSWs' perceived gatekeeper support for condom use was positively associated with their consistent condom use with clients and stable partners [9, 69]. One longitudinal study in South Thailand reported that receiving HIV-specific support from managers of entertainment was related to increased condom use among FSWs [70]. Another evaluation study for an HIV intervention program in Bangladesh assessed type and amount of social support provided to FSWs by peer educators using the Social Support Behavior Code [36]. The FSWs receiving more informational support reported a higher rate of using condoms in previous workday [36]. In a study among FSWs in India, Dandona et al. [40] created a social support measure to assess tangible, informational support and support to deal with abusive and difficult clients. The study indicated significant association between consistent condom use with clients and participation in social support group among FSWs [40].

People Living with HIV/AIDS (PWHIV)

Four studies included in the current review were conducted among PWHIV, applying frequency of condom use during sexual intercourse as a main measure of behavioral outcome. In general, social support was positively associated with consistent condom use among PWHIV. One study in the U.S. indicated that PWHIV with high level of perceived HIV-specific support were more likely to consistently use condoms during sexual intercourse [39]. A study in South Africa suggested that general social support measured using the Medical Outcome Study Social Support Survey [62] was positively associated with condom use among HIV positive women [71]. Another study in Africa examined the relationship between peer support and consistent condom use among HIV positive couples

in clinics in Uganda [72]. The peer support was significantly associated with consistent condom use in the past 6 months in bivariate analysis but not in multivariate analysis [72]. One exceptional finding was reported by Gore-Felton et al. [47], suggesting perceived partner support, as measured by an adapted version of the UCLA Social Support Inventory [49], was positively associated with the number of unprotected (vaginal, oral and/or anal) sex in the past 3 months.

Adults

Some studies were conducted among heterosexual adults who were impoverished but not defined in the current review as high-risk populations for HIV infection and transmission. The behavioral outcomes employed in these studies were mainly sex-related risk behaviors. The findings varied across gender and sources of support. One cross-sectional study among adults in Zimbabwe suggested that a higher level of HIV-specific support was related to fewer sexual partners, fewer prostitute visits and more frequent condom use among men and fewer sexual partners among women [45]. Another study among low-income urban African American heterosexual men in the U.S. indicated that high perceived social support, as measured by Multidimensional Scale of Perceived Social Support [34] might buffer negative impact of racial discrimination on sexual risk behaviors [73]. Among men perceiving high racial discrimination, those with higher social support reported less sexual risk behaviors [73].

As for women, the association between social support and sexual behavior varied across sources of social support and characteristics of their social network. For instance, among homeless women in the U.S., those who reported higher support from non-substance users were less likely to engage in substance use or have multiple sexual partners [46]. One study conducted among impoverished inner-city women in the U.S. suggested that women who received regular financial assistance and other resources or aid (e.g., materials, entertainment, housework) from family and friends might be more likely to use condoms compared to those that received limited or no support from their network [27]. Women who were dependent on sexual partners for emotional fulfillment and self-esteem were more likely to engage in unsafe sex [27]. The other study among Puerto Rican women used a measurement instrument that combined subscales from the Source-Specific Social Provisions Scale [74] and the Interpersonal Support Evaluation List [75]. This study suggested unprotected vaginal sex was associated with higher guidance and tangible support from partners but not with support from family or friends [76]. The effect of social support on sexual behaviors among vulnerable women might be reshaped by the characteristics of their social networks. Among urban African American women with a high prevalence of drug use, having multiple sexual partners in the past 3 months was significantly associated with larger personal networkers, more members who provided instrumental support and financial support [35].

Adolescents

The results of studies among adolescent population were mixed. Findings of two studies supported positive effect of social support on promoting safer sexual behaviors among adolescents. One study conducted among African American adolescents in the U.S. suggested that adolescents with higher perceived general social support, as measured by the Social Provisions Scale [32], were less likely to engage in casual sex, have more sexual partners, report more frequent coercions into unwanted sex, and show higher rates of STIs [77]. Another study conducted in Ghana indicated that male adolescents with a higher level of social support were more likely to have used a condom [78]. However, three studies indicated that perceived social support was not associated with or negatively associated with safer sexual behaviors among adolescents. According to a study among African American

girls (aged 12–19), adolescents' perceived social support, as measured by the Medical Outcomes Study Social Support Survey [62], was not significantly related to their engaging in risky sexual behaviors [79]. Another study among adolescents in rural Kenya reported higher perceived support from primary caregivers, as measured by the Parental Social Support for Adolescents Scale [48], was associated with higher sexual behaviors risk based on bivariate analysis, but this association was not significant in multivariate analysis [31]. Based on a study among undergraduate students in the U.S., Basen-Engquist [80] reported that perceived social support for condom use was positively associated with self-efficacy of condom use, but negatively associated with condom use.

Discussion

Although there are considerable theoretical rationales for the association between social support and HIV-related risk behaviors, empirical studies present a complex picture of this relationship. Findings of existing studies have suggested that higher level of social support (either general or HIV-specific) might be generally related to fewer HIV-related risk behaviors among FSWs, PLWHIV and heterosexual adults. However, results about relationships between social support and HIV-related risk behaviors varied across populations and they were inconsistent within drug users, MSM, and adolescents.

The inconsistent findings may result from different potential confounders in the studies. Although the majority of existing studies controlled basic demographic characteristics, there might be considerable protective and risk factors for performing HIV-related behaviors that were not included in the final analysis models. For instance, individuals with different level of social support might report different levels of condom use self-efficacy, negotiation skills with sexual partners, and HIV prevention knowledge, etc. The associations between social support and behavioral outcomes then might be confounded by these uncontrolled factors. Therefore, findings of these studies might vary with different potential confounders.

The complicated and mixed findings may result from the complexity of social support as a concept with multiple dimensions. The empirical studies suggested that the effect of social support on HIV-related risk behaviors varied with functions and sources of social support the study populations received. For instance, MSM with higher perceived emotional support might be more likely to take unprotected sexual behaviors; while homosexual couples who reported high perceived HIV-specific support from a partner engaged in less HIV-related risk behaviors. The behaviors of diverse populations may be affected by various matrixes of social support composed of its functions and sources through different mechanisms. The influence of social support on HIV-related behaviors then varies with these mechanisms in terms of direction and magnitude.

Another possible reason for the mixed findings may be that the effect of social support is context dependent. Social support is generally viewed as a positive and important aspect of healthy behaviors or positive behavior change [81]. However, social support may be a resource to promote HIV-related risk behaviors under some circumstances [2]. Because social support is often embedded in a certain network, the association between social support and HIV-related risk behaviors may be influenced by characteristics or social norms of the support networks. Fisher [82] suggested that social norms being consistent with HIV prevention efforts will promote protective behaviors while social norms being inconsistent with HIV prevention will be barriers of positive behavior change. For example, the support from a drug-using network thus may reinforce HIV-related risk behaviors when its social norms encourage risky behaviors [83].

Some of the inconsistent findings may also attribute to different measurements of behavioral outcomes and social support in different studies. The measurements for HIV-related risk behaviors varied across diverse populations with different demographic and behavioral characteristics. In addition, the existing studies employed inconsistent recalling periods in the measures of self-reported behaviors. As for measures of social support, a few studies developed their own measures of social support due to specific research needs. Both established scales and self-developed scales varied from study to study in terms of dimensions or items. The difference in measurements may contribute to the variation of study findings. For example, most of the studies used self-developed measures that tended to be more HIV-specific. These studies indicated a positive role of social support in reducing HIV-related risk behaviors.

There are some limitations in the current literature review. First, non-English-language articles or unpublished studies (e.g., dissertations) were not included in this review because of concerns regarding the accessibility to these studies for a general audience. Second, we did not conduct meta-analysis to calculate and compare effective size of the studies in the review because of the large variation or inconsistency in measurements for both social support and HIV-related behaviors in the existing studies. Third, the current review was largely focusing on the issues of HIV-related risk behaviors but not on the HIV treatment and care, although social support may also play an important role in HIV treatment and care. Forth, a majority of the studies included in the current review were cross-sectional studies, which provided empirical evidence for associations rather than causality between social support and HIV-related risk behaviors. Fifth, data collections of the reviewed studies are subject to recall bias, social desirable bias due to self-reported social support and HIV-related risk behaviors. In addition, confounders (e.g., demographic characteristics, features of social networks) controlled in data analyses were inconsistent in different studies, which may inevitably introduce bias into the comparison and synthesis of the findings.

Despite these limitations, the findings of the current review have several important implications for future research and intervention. First, future research needs to pay attention to several issues related to research methodology. For example, future studies should be guided by theoretical models to examine the mechanism of how social support may affect HIV-related risk behaviors. Only three studies explicitly applied theoretical models to guide the research hypothesis [38, 79, 80]. Future studies should employ a longitudinal study design whenever possible to establish a meaningful causal relationship between social support and HIV-related risk behaviors and recruit an adequate number of respondents to ensure the power of analysis. The number of existing longitudinal studies was limited ($n = 4$). About 43 % (17/40) of the existing quantitative studies had no more than 250 respondents.

Second, future studies need to pay attention to measurement issues related to social support. Measurement of social support varied across existing studies in terms of type, content and dimensions, which made it difficult to compare or generalize the findings across studies. Generally, established scales were widely used and well tested in terms of validity and reliability, but they might not measure HIV-related support. Self-developed measures assessed certain functions or sources of social support in a specific context (e.g., condom use support from gatekeepers in commercial sex venues), but they were often non-validated or non-standardized. Researchers should choose appropriate measurement instruments of social support based on their study population, as well as specific questions and hypothesis. In addition, as Lakey and Cohen [10] highlighted, researchers should also pay attention on the theoretical frameworks that different scales were derived from.

Third, carefully designed evaluation studies related to social support are urgently needed in order to inform effective and sustainable HIV prevention strategies. In the current review, only two studies focused on evaluating impacts of social support provision on reducing HIV-related risk behaviors [36, 70]. Evaluation studies are needed to assess outcomes of the interventions aiming to foster social support [84–86]. Evaluation studies are also needed to examine the effect of social support, as an important social or contextual factor, in mediating the impacts of other types of intervention (rather than social support-based) on HIV-related risk behaviors.

Fourth, future research and practice of HIV prevention intervention using approach of social support should consider specific needs of different populations in different stages of their lives. The needs for different functions of social support vary widely across diverse vulnerable populations. For some groups, tangible support such as clean needles and free condoms may be what they needed to perform and maintain safer behaviors; while for other groups, information support about accessing STI clinics and HIV-testing centers may be a key for seeking medical services. In addition, people may need support from a certain source to reduce HIV-related risk behaviors. Furthermore, individuals at a certain stage of their lifespan may need particular support with regard to HIV prevention. Some researchers have questioned the utility of general social support in exploring health behavior with an argument that general support may be more useful for predicting psychological outcomes but less useful for specific behavioral outcomes [87]. Therefore, future studies need to examine the functions of social support that are stronger predictors for a specific HIV-related risk behavior, and sources of social support that may have more influence on a certain population, and content of support that is more appropriate for individuals in a particular developmental stage.

Fifth, future research and practice regarding social support and HIV prevention should consider dynamics of relationships within the social networks of the target population. The practice of providing and receiving social support may be embedded in power dynamics within social relationships. Social support may also mask dependence and be intermingled with coercion within relationships with unbalanced power [58]. For instance, women with smaller external support networks may be more dependent on their partners for social and emotional support and thus would like to maintain the emotional closeness with their partners even through unsafe sex [27, 88, 89]. Similarly, female drug users who have sexual relationships with male drug users may have fewer negotiation abilities or options for risk reduction behaviors because of their dependence on men in accessing drugs or obtaining other support [90, 91]. Therefore, not all types of social support can result in desirable behavior outcomes. HIV-prevention programs need to understand social norms and power dynamics of the target networks prior to design and implement interventions related to social support, and develop appropriate strategies to address challenges resulting from these specific characteristics of the networks. Organizing support group, empowering women with alternative resources may promote their HIV-preventive behaviors by reducing their dependence on negative resources and improving their self-efficacy to perform positive health behaviors [92].

Sixth, the future research and interventions also need to incorporate necessary structure change and utilize technical innovation. Structural interventions may provide social support to not only individuals but also facilitate a supportive environment. For example, micro-economic interventions may enable individuals to avoid vulnerable situations and thus protect them from engaging in HIV-related risk behaviors [93]. Community-based interventions for adolescents may also influence not only networks of target adolescents but also their teachers and family members [94]. In addition, new technical innovations such as internet and mobile technology may be incorporated into HIV prevention interventions to

facilitate social support [95]. One study in China indicated that online HIV prevention programs may be a promising form of informational support for FSWs [96]. Using short message service may also help notifying support groups and other educational opportunities [97].

In summary, increasing empirical studies on social support and HIV-related risk behavior indicate the importance of social support in HIV prevention. However, the findings about associations between social support and HIV-related risk behaviors vary widely across diverse populations. Although previous theoretical and empirical studies suggest that social support can play a positive role in maintaining human well-beings, the current review indicates that increasing level of social support may not necessarily result in desirable HIV-related behaviors. Researchers and health professionals need to be cautious in the issue about the impact of social support on reducing HIV-related risk behaviors, considering context-dependent social support practice, different characteristics of individuals and their social networks, various needs for diverse populations, and complicated power dynamics within social relationships. There are numerous knowledge gaps regarding the mechanism of how social support affects HIV-related behaviors. Future studies need to be guided by solid theoretical frameworks, with appropriate study design and measurement, with efforts to examine how characteristics of social networks may affect the relationship between social support and specific behaviors. Social support is a two-edge sword. Future HIV prevention intervention efforts need to focus on the positive effect of social support for various vulnerable and at-risk populations. Future efforts also need to incorporate necessary structure change and utilize technical innovation in order to maximize the protective role of social support in HIV risk reduction.

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Fig. 1.
Process of screening studies

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Table 2

Summary of measurement instruments for HIV-related risk behaviors used in the reviewed studies

Articles	Drug-related risk behaviors	Sex-related risk behaviors
Adih and Alexander [78]	n/a	Lifetime condom use; condom use at last sexual intercourse
Avants et al. [28]	Assessed by RISK Assessment Battery, a semistructured interview a variety of drug- and sex- related risk behaviors (e.g., sharing needles, cotton, cooker, water; having multiple sexual partners; sex-for-drugs/money transactions; and engaging in unprotected sex)	
Bachanas et al. [79]	n/a	Previous experience of willing sexual intercourse, number of sexual partners in the last 60 days, percentage of sexual encounters where condoms were used, history of STDs, pregnancies over the past 12 months
Basen-Engquist [80]	n/a	Frequency of discussion about AIDS/STDs and past partners with sexual partners in the past 2 months; frequency of condom use in the past 2 months
Bowleg et al. [73]	n/a	Low risk: monogamous and used condoms 100 % of the time in the past 2 months; moderate risk: monogamous and used condoms inconsistently or never, or non-monogamous but used condoms consistently; high risk: non-monogamous and used condoms inconsistently or never
Carlos et al. [67]	n/a	Unprotected anal intercourse (UAI) with main partners in the past 3 months; UAI with casual partners in the past 3 months
Dandona et al. [40]	n/a	No or inconsistent use of condom with last three clients during penetrative sex
Darbes and Lewis [68]	n/a	A HIV risk behavior score was calculated by three components: sum of incidence of unprotected anal intercourse with both primary and secondary partners; monogamous relationship; HIV-status
Dixon et al. [76]	n/a	Frequency of condom use during vaginal and anal intercourse in the past 6 months (5-point scale from "never" to "always")
el-Bassel and Schilling [41]	n/a	Frequency of using condoms in the past 6 months; frequency of sex with injection drug users in the past 6 months
Forney and Miller [63]	n/a	Ever engaged in unprotected anal intercourse with men in the past 3 months
Fergus et al. [64]	n/a	Having risky sexual intercourse in the past 30 days, i.e. at least one following condition applied: unprotected anal intercourse (UAI) with partner while partner had sex with others; UAI with casual sex partner; UAI with HIV-positive partner
Gaede et al. [71]	n/a	Frequency of condom use
Goehl et al. [52] USA	Proportion of urine screens positive for one or more illicit substances out of the 12 urine screens over the 3-month period	n/a
Golub et al. [59]	n/a	Any unprotected anal sex with a non-main partner (casual partners, trade partners for money or drug or other goods) in the past 3 months
Gore-Felton et al. [47]	n/a	Number of times unprotected (vaginal, oral or anal) sex within the past 3 months
Kapadia et al. [60]	n/a	Ever engaged in unprotected anal intercourse with men in the past 30 days
Kimberly and Serovich [29]	Index of risky behaviors including 10 items: unprotected intercourse, receptive anal intercourse, drug use, needles sharing, alcohol use, etc	
Lauby et al. [61]	n/a	Ever engaged in unprotected anal intercourse with men in the past 3 months; ever traded sex for money or drugs in the past 3 months
Latkin et al. [57]	n/a	Number of main and casual partners in the past 90 days; frequency of condom use during vaginal, oral and anal sex with main partners and casual sex partners (5- point scale)
Li et al. [69]	n/a	Consistent condom use with clients during sexual life and during the last three sexual encounters

Articles	Drug-related risk behaviors	Sex-related risk behaviors
McMahon et al. [56]	n/a	Percentage of unprotected sex across all sexual acts (vaginal, oral, and anal) in the past 30 days
Miller and Neaigus [58]		Unprotected vaginal or anal sex in the past 30 days
Mino et al. [50]	Sharing of needles; sharing of drug injection paraphernalia (cookers, cotton and rinse water); number of monthly injections in the past 30 days	n/a
Neblett et al. [35]		Multiple sex partners (having two or more partners) in the past 90 days; a high-risk partner (who injected drugs, was HIV positive, smoked crack, or had an STD) in the past 90 days
Nyamathi et al. [51]	Ever used crack cocaine in the past 6 months	Having multiple sexual partners in the past 6 months
Nyamathi et al. [38, 46]	Substance use: lifetime use and frequency of recent use, including alcohol, marijuana, hallucinogens, crack/freebase, other cocaine, heroin, and street methadone	Number of sexual partners in the past 6 months, whether engaged in unprotected sex in this period
Puffer et al. [31]	n/a	High risk: multiple sexual partners in the past year or not using a condom at last sexual encounter; low risk: having only one partner and using a condom at last sexual encounter
Reilly and Woo [39]	n/a	Unsafe sex: at least one occasion of unprotected anal or vaginal intercourse in the past 6 months
Sarafian [36]	n/a	Condom use with clients in the last day of work
Siegel et al. [66]	n/a	Engaged in any of the 10 high-risk behaviors including unprotected anal intercourse, oral sex intercourse, etc
Sobo [89]	n/a	Frequency of condom use during lifetime (6-point-scale from “never” to “always”); condom use during the last sexual encounter
St. Lawrence et al. [77]	n/a	Number of sexual partners in the past 12 months; frequency of unprotected vaginal, oral and anal intercourse
Suh et al. [53]	Whether or not sharing needles in the past 6 months; whether or not injecting drugs in shooting galleries in the past 6 months	n/a
Unger et al. [54]	Whether or not sharing needles in the past 30 days	n/a
van Griensven et al. [70]	n/a	Condom use with all last three customers
Wagner et al. [72]	n/a	Frequency of condom use during sexual intercourse in the past 6 months (5-point rating scale from “never” to “always”)
Wilson et al. [45]	n/a	Whether or not reduced number of sexual partners since learning about AIDS; increased condom use; reduced number of visits a prostitute
Yang [9]	n/a	Condom use with clients (over sex life), during last three sexual encounters; condom use with stable sexual partners (over sex life), during last three sexual encounters
Zapka et al. [55]	Injection summary variable with four categories: no sharing of workers, sharing and always cleaning with bleach, sharing and sometimes using bleach, sharing without bleaching.	n/a

Table 3
Summary of measurement instruments for social support used in the reviewed studies

Authors	Scales' names	Perceived vs. Actual support	General vs. HIV-specific support	Dimensions		Sources of support*	Functions of support	Satisfaction of support
				Size of support networks				
Established measures								
Avants et al. [28]	Multidimensional Scale of Perceived Social Support (MSPSS)	Perceived support	General	no		M	Not clear defined	no
Bachanas et al. [79]	The Medical Outcomes Study Social Support Survey (MOS)	Perceived support	General	no		M	Emotional/informational, tangible, affectionate and positive social support	no
Bowleg et al. [73]	Multidimensional Scale of Perceived Social Support (MSPSS)	Perceived support	General	no		M	Not clear defined	no
Dalla et al. [26]	Norbeck Social Support Questionnaire (NSSQ)	Perceived support	General	Yes, up to 20 network member		N	Emotional, practical	no
Darbes and Lewis [68]	Social Provision Scale (SPS)	Perceived support	General	no		N	Attachment, social integration, self-affirmation, assistance, guidance, nurturance	no
Dixon et al. [76]	Source-Specific Social Provisions Scale (SS- SPS) subscales	Perceived support	General	no		M	Guidance and tangible support	no
el-Bassel and Schilling [41]	International Support Evaluation List (ISEL)	Perceived support	General	no		N		
	Social Support Appraisal Index (SS- A)	Perceived support	General	no		M	Loved by, esteemed by, and involved	no
Fergus et al. [64]	Social Provisions Scale (SPS)	Perceived support	General	no		N	Reliable alliance, attachment, nurturance, social integration, reassurance of worth, guidance	no
Gaede et al. [71]	The Medical Outcomes Study Social Support Survey (MOS)	Perceived support	General	no		M	Emotional/informational, tangible, affectionate and positive social support	no
Goehl et al. [52]	Adapted Interpersonal Support Evaluation List (ISEL)	Perceived support	General	no		N	Tangible, belonging, appraisal, self-esteem	no
Golub et al. [59]	Multidimensional Scale of Perceived Social Support (MSPSS)	Perceived support	General	no		N	Not clear defined	no

Authors	Scales' names	Perceived vs. Actual support	General vs. HIV-specific support	Dimensions		Sources of support*	Functions of support	Satisfaction of support
				Size of support networks	General vs. HIV-specific support			
Kimberly and Serovich [29]	Perceived Social Support-Friends and Perceived Social Support-Family	Perceived support	General	no	no	M	Support, information and feedback	
	Adapted Arizona Social Support Interview Schedule (ASSIS)	Perceived support	General	Available family#, utilized family#, available friends#, utilized friends#	M		Intimate interaction, social participation, positive feedback, advice	yes
Knowlton et al. [7]	Perceived sources of social support, characteristics of members in support networks	Perceived support	General	Size, demographic characteristics of members in support networks	N, but number of females, kin and drug users in support networks were calculated		Emotional, financial, physical assistance and health advice	
Lauby et al. [61]	The Medical Outcomes Study Social Support Survey (MOS)		General	no	M		Emotional/informational, tangible, affectionate and positive social support	no
Latkin et al. [57]	Arizona Social Support Interview Schedule(ASSIS)	Perceived support	General	Size of support networks, characteristics of network member	M		Intimate interaction, physical assistance, material aid, social participation, positive feedback, health information	yes
McMahon et al. [56]	Perceived Social Support Network Inventory (PSNI)	Perceived support	General	Size of support networks	N		no	yes
Neblett et al. [35]	Social network inventory	Actual support	General	Size of support networks	M		Emotional support, financial support, instrumental support, entertainment	no
Puffer et al. [31]	Adapted Parental Social Support for Adolescents Scale (PSSAS)	Perceived support	General	no	Primary caregivers		Levels of caring and understanding in parental and adolescent relationship	no
Sarafian [36]	Adapted Social Support Behavior Code(SSBC)	Actual support	Both	no	M		Informational, instrumental, appraisal, emotional, companionship, negative comments; HIV/STI information, health seeking support, HIV-related norms	no
St. Lawrence et al. [77]	The Social Provision Scale (SPS)	Perceived support	General	no	N		Attachment, social integration, self-affirmation, assistance, guidance, nurturance	no

Authors	Scales' names	Perceived vs. Actual support	General vs. HIV-specific support	Dimensions		Sources of support*	Functions of support	Satisfaction of support
				Size of support networks	Size of support networks, characteristics of network member			
Suh et al. [53]	Arizona Social Support Interview Schedule (ASSIS)	Perceived support	General	no	Size of support networks, characteristics of network member	M	Intimate interaction, physical assistance, material aid, social participation, positive feedback, health information	yes
Self-developed measures								
Adih and Alexander [78]	Perceived social support to use condom ^a	Perceived support	Specific	no		Friends and girlfriends (partners)	Support on condom use	no
Basen-Engquist [80]	Adapted perceived social support scale ^b	Perceived support	Specific	no		M	Discussing sexual matters or changing sexual behaviors	no
Carlos et al. [67]	Peer support of condom use	Perceived support	Specific	no		Peers	Peer norms	no
Dandona et al. [40]	Social support score	Perceived support	Both	no		N	Tangible, informational, deal with abuse and clients	no
Darbes and Lewis [68]	HIV-specific partner support	Perceived support	Specific	no		Partners	HIV-specific partner support	no
el-Bassel and Schilling [41]	Characteristics of supportive network: size, sources of support and chemical dependency of members	Perceived support	Both	yes		M	Emotional, drug-related, financial, crisis, advice, companionship	no
Fergus et al. [64]	HIV-specific partner support	Perceived support	Specific	no		Partners	HIV-specific partner support	no
Forney and Miller [63]	Social support related to sex ^c	Perceived support	Specific	no		N	Social support related to sex	no
Grosso [37]	How often to get social and emotional support needed	Actual support	General	no		N	Social support and emotional support	no
Kapadia et al. [60]	Social support network characteristics	Perceived support	General	yes		M	Frequency of communication	no
Li et al. [69]	Gatekeeper support for condom use	Perceived support	Specific	no		Gatekeepers	Condom use (positive condom use attitudes and practices)	no
Miller and Neaigus [58]	Binary variable if sex partner provide support	Perceived support	General	no		Sex partners	Emotional, material	no
Mino et al. [50]	Practical support and emotional support	Perceived support	General	no		N	Practical, emotional	no
Nyamathi et al. [51]	A perceived social support scale ^d	Perceived support	General	no		N	Not clear defined	no
Nyamathi et al. [38, 46]	Received support from friends, family and partners	Actual support	General	no		M	Emotional support, instrumental support, accompany	no

Authors	Scales' names	Perceived vs. Actual support	General vs. HIV-specific support	Dimensions		Sources of support*	Functions of support	Satisfaction of support
				Size of support networks	Size of support networks			
Puffer et al. [31]	Social support related to HIV		Specific	no		M	Satisfaction on receiving information about sex and HIV	yes
Reilly and Woo [39]	Received HIV-specific support and perceived helpfulness of support	Actual support	Specific	no		M	Received help for HIV/AIDS-related issue, perceived helpfulness of support	yes
Siegel et al. [66]	Perceived emotional support	Perceived support	General	no		N	Emotional support	no
Sobo [89]	Received support from partner, received financial support from individuals	Actual support	General	no		M	Regular financial assistance, ten specific types of resources or aid (materials, entertainment, housework)	no
van Griensven et al. [70]	Manager support	Perceived support	Specific	no		Managers	AIDS, sex work conditions	no
Wagner et al. [72]	Support from family and friends	Perceived support	General	no		N	Not clear defined	no
	Peer community support	Perceived support	Specific	no		HIV clients in clinics	Sense of community among HIV clients, mutual support among HIV clients	no
Wilson et al. [45]	Friends' support and sexual partners' support	Perceived support	Specific	no		Friends sexual partners	Fidelity to one sexual partner, consistent condom use	no
Yang [9]	Gatekeeper support for condom use	Perceived support	Specific	no		Gatekeepers	Condom use (positive condom use attitudes and practices)	no

* M multiple sources (over 2 sources), N not specify sources

^a Adopted from a previous study [91]

^b Adopted from a previous study [92]

^c Adopted from a previous study [93]

^d Adopted from a previous study [94]

Table 4

Summary of the reviewed studies

Author, Study site(s)	Sample size	Study design	Main findings
Adih and Alexander [78] Ghana	601 male adolescents aged 15–24	Cross-sectional	Young men who reported a high level of social support were more likely to ever to have used a condom than those who did not (a OR = 1.67, 95 % CI = 1.11, 2.53, $p < 0.05$)
Avants et al. [28] a methadone program in an inner city USA	94 HIV-positive IDUs	Cross-sectional	Lack of social support was significantly associated with HIV risk behaviors (including drug- and sex-related risk behaviors) ($\beta = -0.239$, $p = 0.026$) after controlling demographic variables, health status, and time since HIV testing
Bachanas et al. [79] clinics Atlanta, USA ^a	158 African American girls, ages 12–19	Cross-sectional	Adolescents' perceived social support was not significantly related to their engaging in risky sexual behaviors
Basen-Engquist [80] a large university, USA ^a	275 undergraduate students	Cross-sectional	Perceived social support for preventive behaviors was positively associated with self-efficacy of condom use ($\beta = 0.18$, $p < 0.01$), but negatively associated with condom use ($\beta = -0.13$, $p < 0.05$)
Bowleg et al. [73] USA	526 African American heterosexual men low-income urban sample ranged in age from 18 to 45.	Cross-sectional	Among men reporting high racial discrimination, those with more social support from friends ($\beta = -0.10$, $p < 0.05$) and significant others ($\beta = -0.13$, $p < 0.01$) reported less sexual risk than men with low social support
Carlos et al. [67] New York, Philadelphia and Los Angeles County	1,154 African American MSM 1,081 Latino MSM	Cross-sectional	Low peer support of condom use was associated with increased recent unprotected anal intercourse among both African American MSM (with casual partners: OR = 2.30, 95 % CI = 1.80, 2.93; with main partners: OR = 1.44, 95 % CI = 0.99, 2.09) and Latino MSM (with casual partners: OR = 1.96, 95 % CI = 1.60, 2.40; with main partners: OR = 1.74, 95 % CI = 1.36, 2.21)
Dandona et al. [40] India	6,648 FSWs	Cross-sectional	Inconsistent condom use with clients was associated with low social support score (OR = 2.60; 95 % CI = 2.17, 3.12) and not participating in FSW support group (OR = 2.02; 95 % CI = 1.50, 2.70)
Darbes and Lewis [68] USA	47 heterosexual male couples	Longitudinal (6 months)	Couples reporting greater levels of HIV-specific social support engaged in less HIV risk behavior at each time point (Wave 1: $F(1, 54) = 7.18$, $p = 0.01$, $\beta = -0.166$; Wave 2: $F(1, 44) = 16.94$, $p < 0.001$, $\beta = -0.220$) as well as longitudinally ($F(1, 43) = 9.92$, $p = 0.003$, $\beta = -0.133$). General social support was related to less HIV risk behavior at Wave 2 ($F(1, 44) = 8.40$, $p = 0.006$, $\beta = -0.203$)
Dixon et al. [76] New York, USA	187 Puerto Rican women aged 18–35 without lifetime history of drug use	Cross-sectional	Unprotected vaginal sex was associated with living with the partner, residing with children, current employment, heightened negative mood, and greater social support from the partner ($r = -0.21$, $p < 0.01$)
el-Bassel and Schilling [41] New York, USA	109 female methadone patients	Cross-sectional	Appraised social support was correlated with talking about sex with sexual partners ($r = 0.29$, $p < 0.001$), asking partners' HIV status ($t = 3.09$, $p < 0.003$); but it was not associated with sexual risk behaviors

Author, Study site(s)	Sample size	Study design	Main findings
Forney and Miller [63] 13 geographically diverse sites in USA	8235MSM aged 15–25, including 8,064 HIV-negative and 171HIV-positive MSM	Cross-sectional	Social support was positively associated with safer sex (aOR = 1.17, 95 % CI = 1.06, 1.30, $p < 0.01$) among HIV-positive MSM, but was not significantly related to safer sex among HIV- negative MSM
Fergus et al. [64] Colorado, USA	54 homosexual male couples (108 individuals)	Cross-sectional	The association b/w social support and safer sexual behaviors is more profound among those with less social engagement (OR = 2.89, 95 % CI = 1.10, 7.61), and the association b/w partner-reported social support and safer sexual behaviors is more profound among those whose partners disclosed homosexual identity to more people (OR = 0.58, 95 % CI = 0.35, 0.96)
Gaede et al. [71] South Africa	262 HIV+ women, 165 from urban area and 97 from rural area	Cross-sectional	Higher level social support was associated with condom use ($F = 18.84$, $df = 1$, $\beta = 0.301$, $p < 0.001$), support group attendance ($F = 12.80$, $df = 1$, $\beta = 0.249$, $p < 0.001$) and taking vitamins ($F = 13.08$, $df = 1$, $\beta = 0.229$, $p < 0.001$)
Goehl et al. [52] USA	70 methadone clinic patients	Longitudinal (3 months)	Social support was correlated with positive effects of mood ($r = 0.5$, $p < 0.001$), but was not correlated with drug positive urines
Golub et al. [59] New York, Northern New Jersey	75 transgender women	Cross-sectional	Social support was a significant negative predictor of unprotected anal sex (OR = 0.953, 95 % CI = 0.911, 0.996, $p < 0.05$). Unprotected anal sex was least likely among individuals with high- level social support but low-level religious behaviors and beliefs
Gore-Felton et al. [47] California, USA	122 HIV-positive adults (60 women and 62 men)	Cross-sectional	Sexual risk behavior in the past 3 months was associated with perceived partner support ($\beta = 0.17$, $t = 2.00$, $p < 0.05$)
Kapadia et al. [60] New York City, USA	501 MSM aged from 18 to 19	Cross-sectional	Having a sexual partner in social support network was associated with an increased odds of unprotected anal intercourse (UAI) among both Hispanic/Latino MSM (aOR = 3.90, 95 % CI = 1.30, 11.72) and Caucasian MSM (aOR = 4.93, 95 % CI = 1.54, 15.86). A larger social support network size was associated with a lower likelihood of engaging in UAI among Hispanic/Latino MSM (aOR = 0.44, 95 % CI = 0.20, 0.97)
Kimberly and Serovich [29] Midwestern USA	142 HIV+ homosexual men	Cross-sectional	Perceived and actual family support was correlated with intention to reduce risk behaviors (to limit sexual partners, remain monogamous, and abstain from sex), respectively; However, all the social support variables were not significantly associated with actual risk behaviors
Knowlton et al. [7] Baltimore, USA	295 African American former or current injection drug users	Cross-sectional	Outpatient service use was associated with more females in support networks and more emotional support. Emergency use for non-emergent care was associated with more active drug users in support networks. Having a supportive sex partner was associated with lower access to medical care, and kin support was not related to medical service use
Lauby et al. [61] New York City, Philadelphia, and Los Angeles County, USA	1,286 MSM including 618 African American and 668 Latino MSM	Cross-sectional	Higher supportive relationship scores were associated with lower odds of UAI with a non-main male partner in the past 3 months (aOR = 0.73, 95 % CI = 0.61, 0.87), and lower odds of trading sex in the past 3 months (aOR = 0.63, 95 % CI = 0.52, 0.77)

Author, Study site(s)	Sample size	Study design	Main findings
Latkin et al. [57] Baltimore, USA	1,051 individuals who reported ever using heroin or cocaine	Cross-sectional	Size of health advice and the financial support networks was positively related to condom norms
Li et al. [69] Guangxi, China	318 FSWs from 29 entertainment establishments	Cross-sectional	Perceived gatekeeper support was positively associated with consistent condom use with clients (aOR = 1.80, 95 % CI = 1.08, 3.03)
McMahon et al. [56] USA	141 male veterans participating in alcohol and drug abuse treatment	Longitudinal (12 months)	Perceived social support did not significantly predict level of unprotected sex during follow-up
Miller and Neaigus [58] New York, USA	257 HIV-negative non-injecting heroin users	Cross-sectional	Sex partner support was associated with unprotected sex for men (aOR = 3.4; 95 % CI = 1.5, 7.4), but not for women (aOR = 0.9; 95 % CI = 0.2, 3.7)
Mino et al. [50] New York, USA	561 Puerto Rican injection drug users (221 migrants, 340 non-migrants)	Cross-sectional	Emotional support was negatively associated to injection frequency ($\beta = -0.168, p = 0.02$) and gallery use (aOR = 0.76, 95 % CI = 0.62, 0.94, $p = 0.011$) among migrants, but it was positively associated with sharing syringes (aOR = 1.87, 95 % CI = 1.02, 3.43, $p = 0.04$) among non-migrants
Neblett et al. [35] Baltimore, USA	513 urban African American women with high prevalence of drug use	Cross-sectional	Having multiple sexual partners with the past 3 months was associated with larger personal network (aOR = 1.11, 95 % CI = 1.06, 1.17), more members who provided instrumental support (aOR = 1.22, 95 % CI = 1.04, 1.44), and financial support (aOR = 1.33, 95 % CI = 1.11, 1.60)
Nyamathi et al. [51] Los Angeles, USA	924 female crack cocaine users and 767 homeless women with multiple sex partners	Pre/post-test (interval 2–4 weeks)	Women who continued to have multiple partners reported less social support at baseline than those who did not (mean 4.17 vs. 4.81, $p < 0.05$). The improvement in social support was significantly lower for women who maintained multiple partners (mean -0.15 vs. $0.85, p < 0.01$) and who maintained drug use (mean -0.12 vs. $0.98, p < 0.01$)
Nyamathi et al. [38, 46] Los Angeles, USA ^a	1,302 homeless women	Cross-sectional	Support from non-substance users only was associated with less risky behaviors and more health services uses ($p < 0.05$)
Puffer et al. [31] rural Kenya	325 adolescents ages 10–18	Cross-sectional	General social support was associated with high-risk sex in bivariate analysis (OR = 1.04, 95 % CI = 1.00, 1.08, $p < 0.05$), but not in multivariate analysis (aOR = 0.99, 95 % CI = 0.94, 1.04)
Reilly and Woo [39] Nevada, USA	360 HIV-positive adults (68 women and 292 men)	Cross-sectional	Perceived helpfulness of support was related to reduced unsafe sex ($\beta = -0.11, t = -1.65, p < 0.05$)
Sarafian [36] Dhaka, Bangladesh	290 hotel-based FSWs who participated in a peer education	Pre-test/post-test (23 weeks)	Seeing more peer educators providing high informational support was related to higher sex worker self-efficacy ($\beta = 0.23, t = 1.92, p = 0.06$) and condom use in last sex ($\beta = 0.30, t = 2.28, p < 0.05$) at follow-up; seeing more peer educators providing high emotional support was related to more seeking treatment behaviors among sex workers ($\beta = 0.31, t = 1.90, p = 0.066$)
Siegel et al. [66] New York City, USA	100 MSM	Cross-sectional	MSM who reported risky sexual behaviors at two time-points had higher level of perceived emotional support (3.04 vs. 2.74, $t = 2.27, p = 0.026$)
Sobo [89] Midwestern, USA	30 impoverished inner-city women receiving prenatal care	Qualitative study (in-depth interviews) and quantitative study (cross-sectional)	Women who felt supported by extra-conjugal networks were less likely to depend on men for emotional fulfillment,

Author, Study site(s)	Sample size	Study design	Main findings
St. Lawrence et al. [77] USA	295 African American adolescents	Cross-sectional	self-esteem, less likely to engage in unsafe sex, or have jealous partners Adolescents with fewer social supports were more likely to engage in casual sex, report more non-monogamous partners, more frequent coercions into unwanted sex, and higher rates of STDs (all $p < 0.004$); Males with fewer social supports engaged in more frequent unprotected sex, with more sex partners and used condoms less often (all $p < 0.001$)
Suh et al. [53] Baltimore, USA	499 injection drug users	Cross-sectional	Size of drug network providing support was positively associated with sharing needles (aOR = 1.87; 95 % CI: 1.18–2.96); size of drug network not providing support was positively associated with injecting in shooting galleries (aOR = 2.25; 95 % CI: 1.26–4.00)
Unger et al. [54] Los Angeles, USA	173 young injection drug users who had shared needles (age 15–23, 96 men, and 77 women)	Cross-sectional	Male IDUs were more likely to share needles with partners who gave them emotional support ($\beta = 0.103$, $p = 0.01$). Among both genders, needle-sharing was not associated with partner's provision of drugs or other instrumental support
van Griensven et al. [70] South of Thailand	283 FSWs in a HIV prevention program	Pre-test/post-test with comparison group (6 months)	Receiving support from manager was related to increased condom use ($\beta = 0.13$, $p < 0.05$)
Wagner et al. [72] Uganda	272 coupled HIV clients	Cross-sectional	Peer community support was correlated with consistent condom use (in past 6 months) in bivariate analysis ($t = -4.340$, $p < 0.01$), but not in multivariate analysis
Wilson et al. [45] Bulawayo, Zimbabwe	202 men and 100 women	Cross-sectional	Social support was related to reduced number of sexual partners ($\beta = 0.14$, $p < 0.05$), increased condom use ($\beta = 0.19$, $p < 0.01$) and reduced prostitute contacts ($\beta = 0.30$, $p < 0.05$) among men and to reduced number of sexual partners ($\beta = 0.35$, $p < 0.05$) among women
Yang [9] Guangxi, China	454 establishment-based FSWs from 57 entertainment establishments	Cross-sectional	Perceived gatekeeper support was positively associated with condom communication (with clients: aOR = 1.99, 95 % CI = 1.35–2.95; with stable partners: aOR = 1.44, 95 % CI = 1.02–2.06), and consistent condom use (with clients: aOR = 1.45, 95 % CI = 1.07–1.96; with stable partners: aOR = 1.5, 95 % CI = 1.09–2.08), but it was not associated with proper use of condoms (with clients/stable partners)
Zapka et al. [55] USA	244 injection drug users participating in detoxification program	Longitudinal (at least 6 months)	Increase in the number of people providing emotional support (people whom to talk with when upset) was associated with greater odds of safer drug use behavior (no sharing of works) (aOR = 1.25, $p = 0.0001$)

^aThese studies explicitly applied theoretical models