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ORIGINAL PAPER

Mediating Effects of Depressive Symptoms on Perceived Social Support and HIV Disclosure: Assessing Moderation by Sex

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Abstract

People living with HIV may decide to disclose their HIV-positive status after considering the benefits and costs. Studies have shown associations between perceived social support, depressive symptoms and HIV disclosure among men and women; however, research assessing the mediating pathway among these variables and the associated disparities by sex are lacking. Therefore, the aims of this study were to determine the association between perceived social support from family and friends and HIV disclosure to sexual partners; assess the mediating effects of depressive symptoms; and examine the disparities by sex. Participants included 147 men and 115 women living with HIV who took part in a disclosure intervention study. Mediation analyses were conducted to determine the direct and indirect associations between perceived social support from family and friends, depressive symptoms, and disclosure behavior. Depressive symptoms mediated the association between perceived social support (from family: $\beta = 0.103$, $p = 0.019$; and from friends: $\beta = 0.111$, $p = 0.009$) and HIV disclosure to sexual partners, specifically among women. However, these pathways were not statistically significant among men. Women living with HIV may benefit from two types of interventions: (1) Disclosure to sexual partners interventions, which aim to accentuate perceived social support from family and friends through attenuating depressive symptoms; and (2) Social support interventions, which may increase disclosure to sexual partners via reducing depressive symptoms.

Keywords Depression · Social support · HIV disclosure · Men · Women

Resumen

Las personas viviendo con el VIH pueden decidir a revelar su estado del VIH después de considerar los beneficios y los costos. Las investigaciones han demostrado que existen las asociaciones entre la percepción del apoyo social, los síntomas depresivos y la revelación del estado del VIH para los hombres y las mujeres. Sin embargo, las investigaciones que evalúan el rol mediador de los síntomas depresivos entre la percepción del apoyo social y la revelación del estado de VIH, y las disparidades asociadas por el sexo son limitadas. Por lo tanto, los objetivos de esta investigación fueron determinar la asociación entre la percepción del apoyo social de la familia y los amigos, y la revelación del estado de VIH a sus parejas sexuales; evaluar los efectos mediados de los síntomas depresivos; y examinar las disparidades por el sexo. Los participantes fueron 147 hombres y 115 mujeres viviendo con el VIH que participaron en una investigación del revelamiento del estado de VIH. Los análisis mediadores se llevaron a cabo a determinar las asociaciones directos e indirectos entre el apoyo social de la familia y los amigos, los síntomas depresivos, y la revelación del estado de VIH. Los síntomas depresivos tuvieron un rol mediador entre el apoyo social (de la familia: $\beta = 0.103$, $p = 0.019$; y de los amigos: $\beta = 0.111$, $p = 0.009$) y la revelación del estado de VIH a sus parejas sexuales, específicamente entre las mujeres. Sin embargo, este efecto indirecto no tenía significancia estadística entre los hombres. Las mujeres viviendo con el VIH puede beneficiarse de dos tipos de intervenciones: 1) Las intervenciones que se enfoquen en la revelación del estado del VIH a las parejas sexuales que se enfoquen en acentuar el apoyo social de la familia y los amigos por atenuar los síntomas depresivos; y 2) Las intervenciones del apoyo social que incrementen la revelación del estado del VIH a las parejas sexuales por reducir los síntomas depresivos.

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Introduction

Disclosure of HIV-positive status continues to be an important consideration among people living with HIV. People living with HIV may decide to disclose to sexual partners, family members, friends or others, including health care providers after considering the rewards and costs [1, 2]. HIV disclosure has been found to be associated with psychosocial and behavioral outcomes such as sexual behavior and antiretroviral therapy adherence [3]. Kalichman et al. found that men living with HIV who engaged in condomless sex with partners to whom they did not disclose were less adherent to antiretroviral therapy [3]. This may result in higher viral load and a higher chance of infecting sexual partners. Indeed, disclosure of HIV status has been found to be associated with a lower risk of HIV transmission among men who have sex with men (MSM) [4].

Perceived social support has been found to be associated with psychosocial outcomes, including disclosure, among populations living with HIV. The impact of perceived social support may vary depending on whether this support is from family or friends; however, the majority of studies among populations living with HIV do not differentiate between the two types [5–8]. Social support was positively associated with quality of life among people living with HIV in Taiwan [6] and with health-related quality of life (HRQoL; both physical and mental health status) among adults living with HIV in Ontario, Canada [5]. Perceived social support was also found to be negatively associated with depression among the latter study population [5] and among injection drug users living with HIV in New York City and San Francisco [7]. A positive statistically significant relationship was found between social support and disclosure to anyone among newly diagnosed South African women (within 30 days) [9] and disclosure to family and friends among men and women living with HIV recruited from infectious disease and community services clinics in the U.S. [10]. However, the relationship between social support and disclosure to a sexual partner was not found to be statistically significant [9]. Many studies that have focused on social support and HIV disclosure have focused on non-US populations. Although, Kalichman et al. focused on a US population, they did not assess disclosure to sexual partners as a separate measure [3]. Nevertheless, these studies indicated that the greater support that an individual perceives, the higher the likelihood of better health outcomes, but also warrant further investigation into the differences that may exist in the impact of perceived social support from family and friends.

Depressive symptoms have also been linked to disclosure among populations living with HIV. For example, Kiene et al. found that, among participants who were diagnosed with HIV, disclosure to a partner on a specific day was associated with greater depressive symptoms on that day among outpatients in Uganda following HIV testing. However, if disclosure occurred within 28 days after diagnosis, there were lower depressive symptoms at the end of those 28 days [11]. Nevertheless, Cook and colleagues did not find statistically significant correlations between depressive symptoms and any type of HIV disclosure (to a sex/romantic partner, family member or friend/other person) among young MSM aged 12–24 using data from the Adolescent Trials Network [12]. Other studies have shown that depressive symptoms were negatively associated with disclosure self-efficacy and HIV disclosure to partners among newly diagnosed MSM in New York City [13], and that time to first disclosure of HIV status was positively associated with depression among women living with HIV in Washington, D.C. [14]. Based on these findings, depressive symptoms may be negatively associated with disclosure to sexual partners among men and women in the current study population.

Feeney and Collins formulated a theoretical model on thriving through relationships and identified perceived social support as one of the interpersonal processes impacting thriving [15]. Based on this framework, they suggest that source of strength support promotes thriving through adverse events [15]. Thriving occurs not only through buffering stress, but also through reframing as a way to elicit positive changes in a variety of ways, including improvements to psychological and social well-being. One of the immediate outcomes of receiving source of strength support is change to a person's emotional state, for example, a decrease in distress and an increase in security. This theoretical model may help to explain the mediation pathway between perceived social support, depressive symptoms, and disclosure to sexual partners. Source of strength support (perceived social support from family or friends) may lead to a decrease in distress (fewer depressive symptoms), which may lead to motivation to change or a changed circumstance (disclosure of HIV status to sexual partners).

Potential Confounders

In assessing the relationship between perceived social support and HIV disclosure, potential confounders, which may alter the association, should be considered. Variables are considered to be confounders if they are associated with perceived social support and HIV disclosure but are not in the pathway between perceived social support and HIV disclosure. Results of studies examining the relationship between perceived social support and time since diagnosis have been mixed [5, 16–19]. Time since diagnosis has been found to be associated with perceived social support from friends

and family where individuals who have known about their diagnosis for longer periods (greater than 10 years) scored higher on perceived social support compared to those who had a shorter time since diagnosis (less than 10 years) [17]. However, Bekele et al. [5] and Hinnen et al. [16] did not find this relationship statistically significant. Other studies have shown that as time since diagnosis increases, disclosure of HIV status also increases [18, 19]. Number of sexual partners was also found to be negatively associated with HIV disclosure [20, 21] and perceived family and other social support [22]. Age has been found to be positively [20] and negatively [23] associated with HIV disclosure, depending on the population and the operationalization of age.

The interaction of sexual orientation and sex was linked to social support where MSM reported relying more on "chosen families" (networks of formed kinship usually due to rejection from biological families compared to women who have sex with women (WSW) [24]. The intersection of sexual orientation and race has been associated with unprotected sexual intercourse and non-disclosure of HIV status to partners [25]. Racial differences have been found in disclosure where White participants were more likely to disclose their HIV status compared to other races and ethnicities [26]. Education level has also been shown to be positively related to HIV disclosure [27] and social support [28, 29]; and being employed was linked to greater perceived social support among adults living with HIV [5], albeit among non-US populations. Based on this review of the literature, potential confounders considered for the current study were time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment.

Potential Moderation by Sex

The pathway between perceived social support, depressive symptoms and disclosure to sexual partners may also vary by sex. Even though research examining social support among populations living with or at-risk for HIV tend to focus on either men [30, 31] or women [32, 33], and not both men and women, one study among European men and women living with HIV found that women reported a higher need for social support compared to men [28]. Risser et al. examined populations at-risk for HIV, and found that lack of social support from a significant other was associated with depressive symptoms for both men and women [34]. Another study examined disclosure of HIV status and social support among people living with HIV in Iran [35], and these authors found that HIV-positive men were less likely to disclose their HIV status to anyone compared to HIV-positive women. By determining the association between perceived social support and HIV disclosure separately for men and women, and depressive symptoms as a potential mediator, we will be able to identify specific target points for future interventions geared specifically towards men and/or women living with HIV.

Rationale and Study Aims

Kalichman et al. examined a generalized model, which showed that HIV disclosure was associated with perceived social support, and perceived social support was associated with depressive symptoms among men and women living with HIV [10]. However, Kalichman et al. assessed disclosure to family and friends, and did not examine disclosure to sexual partners. A more recent study examining social support and disclosure among youth aged 12–24 living with HIV found that social support did not differ by disclosure to family members [36]. Bekele et al. also found that perceived social support had a stronger indirect effect on physical and mental health status via depression [5].

HIV disclosure to family and HIV disclosure to sexual partners may be linked but are considered to be distinct concepts. Kalichman et al. state that disclosure to sexual partners is more associated with focusing on others, such as protecting a partner from exposure, while disclosure to family members may be focused more on the individual in garnering social support and relieving stress from hiding one's status [10]. However, studies examining the association between perceived social support, depressive symptoms, and particularly, HIV disclosure to sexual partners are lacking. In addition, studies are needed that will examine these pathways by sex.

Therefore, the aims of the current study were threefold: (1) Determine the extent to which perceived social support was associated with HIV disclosure to sexual partners; (2) Assess the mediating effects of depressive symptoms on the relationship between perceived social support and HIV disclosure; and (3) Examine the disparities by sex in this relationship. Based on the theoretical model of thriving by Feeney and Collins [15], we hypothesized that: (H1) Perceived social support would be positively associated to HIV disclosure to sexual partners; (H2) Depressive symptoms would mediate the association between perceived social support and HIV disclosure; and (H3) H1 and H2 would be true for both men and women.

Methods

Data Source and Study Population

Data were obtained from 346 people (191 men and 155 women) living with HIV from the baseline assessment of a disclosure intervention randomized clinical trial. This

intervention was designed to help people living with HIV decide whether to disclose their HIV serostatus to family members and took place in a Southeastern metropolitan statistical area (MSA). To be eligible, participants had to be at least 18 years old, living with HIV, expressed an interest in learning more about disclosure to a family member, indicated they had a desire to disclose their HIV status, and had at least one family member who was not aware of their HIV status. Questions at baseline assessed disclosure to family members and to sexual partners.

Due to the lack of research assessing the association between perceived social support and disclosure to sexual partners, disclosure to sexual partners served as the dependent variable. As a complete case approach to handling missing data was used, 84 participants were excluded from the current study for missing data. Therefore, the resultant sample size was 262 (147 men and 115 women). Comparing participants who were missing data on disclosure behavior and those who were included in the study, there were no statistically significant differences in sex, age, sexual orientation, ethnicity, education, employment, and time since diagnosis. There was a statistically significant difference with regards to race, with more Black than White participants remaining in the analysis.

The study did not exclude participants who answered "0" to the question, "How many different sexual partners have you had over the last 30 days?" as it was possible to have disclosed to a sexual partner in the past 30 days without having sex with him/her. The study sample was also not restricted to men and women who had recent sexual partners who were unaware of the respondent's HIV status as disclosure could have been with sex partners with whom no recent activity took place.

Participants were recruited from AIDS service organizations, HIV-related venues, local newspapers and social media websites. Purposive sampling was used to oversample racial minority participants living with HIV. Baseline questionnaires were completed using audio-computer assisted self-interviewing. Participants provided written informed consent and could earn $50 for participating at baseline. The University of South Florida Institutional Review Board approved the study.

Measures

Perceived Social Support

Perceived social support was operationalized by The Perceived Social Support From Family (PSS-Fa) Scale and The Perceived Social Support From Friends (PSS-Fr) Scale [37]. Each scale was used to measure an individual's perception that his/her needs for support and information were met by either their family or friends. The PSS-Fa and PSS-Fr had 20 items each that were scored on a Likert-type scale ranging from *Strongly disagree* (1) to *Strongly agree* (4) for positively worded items and *Strongly agree* (1) to *Strongly disagree* (4) for negatively worded items. An example of a positively worded item was "My friends give the moral support that I need." An example of a negatively worded item was: "Most other people are closer to their family than I am." The 20 items were summed for each scale to obtain a sum score, with higher scores indicating greater perception of family and friend support. The standardized Cronbach's alpha values for the PSS-Fa in the current study were 0.95 overall, 0.94 for men, and 0.95 for women. The standardized Cronbach's alpha values for the PSS-Fr were 0.92 overall, 0.92 for men, and 0.92 for women.

Depressive Symptoms

Depressive symptoms were measured by the Center for Epidemiologic Studies-Depression (CES-D) Scale [38]. The CES-D has 20 items, which measure symptoms such as hopelessness, poor appetite and sleeplessness, and are scored on a Likert-type scale ranging from *Rarely or None of the time* (0) to *Most or all of the time* (3). An example item was: "I was bothered by things that usually don't bother me." Scores of items were summed to obtain a sum score where higher scores represented greater depressive symptoms. The standardized Cronbach's alpha values for the CES-D were 0.91 for the overall population, 0.91 for men, and 0.90 for women.

HIV Disclosure Behavior

Disclosure of HIV status to sexual partners was measured by the Disclosure Behavior Scale (DBS), which has 10 items and asked participants about their disclosure behavior within the last 30 days. Items were scored on a Likert-type scale with answers ranging from *None* (1) to *All* (5). Items in the DBS differed based on if the participant identified as male or female. For example, questions asked of men included "I have disclosed my HIV status to ___ of the partners with whom I had insertive anal/vaginal sex with/without a condom." Questions that were asked of women: "I have disclosed my HIV status to ___ of the partners with whom I had receptive vaginal sex with/without a condom." An example of a question that was asked of both men and women included: "I have disclosed my HIV status to ___ of the partners with whom I had receptive anal sex with/without a condom." The variable was created by calculating the mean across the corresponding items. The standardized Cronbach's alpha values for the DBS were 0.98 for men and 0.97 for women.

Table 1 Distribution of sociodemographic characteristics, perceived social support from family and friends, depressive symptoms and HIV disclosure behavior to sexual partners

Characteristic	N (%)	Perceived social support family	*p* value	Perceived social support friends	*p* value	Depressive symptoms	*p* value	HIV disclosure behavior	*p* value
		Mean (SD)				Mean (SD)		Mean (SD)	
Age (Mean, SD)	45.2 (11.4)	−0.01	0.815	−0.12	0.057	−0.10	0.125	−0.08	0.206
18–24	13 (5.0)	51.2 (15.2)	0.567	59.1 (11.7)	0.174	26.2 (15.7)	0.133	3.3 (1.8)	0.555
25–34	40 (15.3)	52.2 (13.3)		57.2 (12.5)		25.2 (12.0)		3.6 (1.8)	
35–49	108 (41.2)	49.1 (12.9)		53.3 (10.5)		24.3 (11.3)		3.2 (1.8)	
50+	101 (38.6)	51.0 (13.2)		54.6 (9.2)		21.2 (10.9)		3.2 (1.8)	
Sex									
Male	147 (56.1)	50.7 (13.0)	0.694	55.9 (10.4)	**0.036**	22.5 (11.7)	0.151	3.6 (1.7)	–[a]
Female	115 (43.9)	50.0 (13.4)		53.1 (10.4)		24.5 (11.3)		2.9 (1.8)	
Sexual orientation									
MSM	111 (42.4)	49.8 (13.3)	0.378	56.8 (10.7)	**0.048**	21.7 (11.4)	0.271	3.7 (1.6)	**0.002**
Heterosexual Men	36 (13.7)	53.4 (11.9)		52.9 (9.1)		24.8 (12.5)		3.2 (1.9)	
Heterosexual Women	97 (37.0)	50.5 (13.2)		53.3 (10.6)		24.2 (10.9)		2.8 (1.7)	
WSW	18 (6.9)	47.6 (14.7)		52.5 (9.0)		26.1 (13.5)		3.4 (1.8)	
Race									
Black	159 (61.2)	51.5 (11.9)	0.218	53.8 (10.1)	0.213	24.0 (10.9)	0.541	3.0 (1.8)	**0.034**
White	91 (35.0)	48.2 (14.8)		55.8 (11.3)		22.2 (12.4)		3.7 (1.7)	
Other	10 (3.9)	50.5 (16.5)		57.7 (8.2)		23.7 (13.9)		3.0 (1.9)	
Ethnicity									
Hispanic	29 (11.1)	51.6 (13.3)	0.618	57.7 (11.7)	0.145	24.2 (12.4)	0.687	3.3 (1.8)	0.596
Non-Hispanic	233 (88.9)	50.2 (13.2)		54.3 (10.3)		23.3 (11.5)		3.4 (1.8)	
Education									
Less than high school	64 (24.5)	48.4 (13.4)	0.542	52.7 (11.1)	**0.016**	26.7 (10.5)	**0.009**	2.7 (1.7)	**0.002**
High school	78 (30.0)	50.9 (11.5)		53.1 (9.0)		23.6 (10.3)		3.2 (1.8)	
Some college	95 (36.4)	51.5 (14.1)		56.2 (10.9)		22.2 (13.0)		3.8 (1.6)	
Bachelor's/Post-grad	24 (9.2)	49.9 (14.5)		59.3 (10.3)		18.4 (10.5)		3.2 (1.9)	
Employed									
Full-time	30 (11.5)	55.5 (13.2)	0.087	60.7 (10.6)	**0.007**	16.3 (11.5)	**0.003**	3.6 (1.9)	0.464
Part-time	27 (10.3)	48.6 (13.4)		54.8 (8.9)		22.6 (11.7)		3.0 (1.9)	
Student/retired/disabled/unemployed	205 (78.2)	49.9 (13.0)		53.8 (10.4)		24.5 (11.2)		3.3 (1.7)	
Income									
$0–$500	87 (33.2)	49.0 (13.6)	0.389	54.1 (11.1)	**< 0.001**	27.2 (11.4)	**< 0.001**	3.0 (1.8)	**0.021**
$500–$1000	102 (38.9)	50.3 (12.2)		52.4 (9.2)		22.7 (9.9)		3.2 (1.7)	
≥ $1001	73 (27.9)	52.1 (14.0)		58.5 (10.5)		19.7 (12.6)		3.7 (1.7)	
Time since diagnosis (Mean, SD)	13.0 (8.6)	−0.09	0.15	−0.15	**0.013**	0.02	0.747	−0.04	0.533
≤ 1 year	17 (6.5)	53.5 (12.2)	0.571	57.7 (11.5)	0.208	22.9 (11.3)	0.053	3.4 (1.8)	0.590
> 1 year to ≤ 5 years	42 (16.0)	49.8 (14.9)		55.5 (11.7)		27.0 (10.4)		3.0 (1.9)	
> 5 years to ≤ 10 years	55 (21.0)	51.5 (12.9)		56.4 (11.0)		20.0 (11.6)		3.6 (1.7)	
> 10 years to ≤ 20 years	87 (33.2)	50.7 (13.2)		54.0 (10.4)		23.7 (12.0)		3.2 (1.7)	
> 20 years	61 (23.3)	48.5 (12.6)		52.7 (8.6)		23.5 (11.2)		3.2 (1.8)	

Bolded *p* values are statistically significant at $p < 0.05$

[a] *p* value comparison not obtained for men and women because different questions were asked of men and women

Analytic Approach

The distribution of sociodemographic characteristics was assessed using descriptive statistics. Mean and standard deviation values of perceived social support from family and friends, depressive symptoms and disclosure behavior by sociodemographic characteristics were obtained. Pearson correlation coefficients measuring the linear relationship between age and time since diagnosis (as continuous variables) and perceived social support, depressive symptoms and

Table 2 Sexual behaviors in the past 30 days among men and women living with HIV in study sample

Sexual behavior	Men N (%)	Women N (%)
Number of sex partners (Mean, SD)*	2.7 (5.5)	1.1 (2.5)
Insertive anal sex with a condom	51 (34.7)	–
Insertive anal sex without a condom	41 (27.9)	–
Receptive anal sex with a condom	51 (34.7)	19 (16.5)
Receptive anal sex without a condom	39 (26.5)	9 (7.8)
Giving oral sex with a condom	25 (17.0)	30 (26.1)
Giving oral sex without a condom	77 (52.4)	31 (27.0)
Receiving oral sex with a condom	28 (19.0)	21 (18.3)
Receiving oral sex without a condom	68 (46.3)	25 (21.7)
Insertive vaginal sex with a condom	28 (19.0)	–
Insertive vaginal sex without a condom	13 (8.8)	–
Receptive vaginal sex with a condom	–	62 (53.9)
Receptive vaginal sex without a condom	–	27 (23.5)

*Range of partners (Men: 0–40; Women: 0–27)

disclosure behavior were also examined (Table 1). Descriptive statistics were also used to describe sexual behaviors of the study sample (Table 2). PROC CALIS was used to conduct path analyses to determine the direct and indirect associations between perceived social support from family and from friends (independent variables), depressive symptoms (potential mediator), and HIV disclosure behavior (dependent variable). Using PROC CALIS, the matrices of indirect effects were calculated by the difference between the total effects and direct effects matrices [39]. One mediational model was analyzed for each study population (overall, men, and women) and for each independent variable using Shrout and Bolger's recommendations [40]. Shrout and Bolger found that in a mediational model, the effect of the independent variable on the dependent variable should not be a deciding factor for mediation analyses. Direct standardized estimates are provided in Tables 3 and 4, and indirect standardized estimates are provided in Tables 4, 5 and 6. Figures 1, 2, 3 and 4 show the adjusted direct estimates for men and women. Values for the proportion of variance

Table 3 Direct standardized estimates between perceived social support from family, depressive symptoms and HIV disclosure behavior to sexual partners among men and women

	Perceived social support → Depressive symptoms		Perceived social support → HIV disclosure behavior		Depressive symptoms → HIV disclosure behavior	
	β	*p* value	β	*p* value	β	*p* value
Crude (unadjusted)						
Overall	−0.309	**< 0.001**	0.104	0.098	−0.164	**0.009**
Men	−0.223	**0.005**	0.083	0.328	−0.127	0.126
Women	−0.417	**< 0.001**	0.132	0.182	−0.175	0.075
Adjusted[a]						
Overall	−0.290	**< 0.001**	0.117	0.061	−0.162	**0.011**
Men	−0.224	**0.004**	0.094	0.260	−0.128	0.137
Women	−0.400	**< 0.001**	0.149	0.118	−0.257	**0.008**

Bolded *p* values are statistically significant at $p < 0.05$

[a]Adjusted estimates controlled for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment

Table 4 Direct standardized estimates between perceived social support from friends, depressive symptoms and HIV disclosure behavior to sexual partners among men and women

	Perceived social support → Depressive symptoms		Perceived social support → Disclosure behavior		Depressive symptoms → HIV disclosure behavior	
	β	*p* value	β	*p* value	β	*p* value
Crude (unadjusted)						
Overall	−0.383	**< 0.001**	0.999	0.125	−0.158	**0.015**
Men	−0.383	**< 0.001**	0.193	0.025	−0.072	0.409
Women	−0.368	**< 0.001**	−0.056	0.567	−0.251	**0.008**
Adjusted[a]						
Overall	−0.366	**< 0.001**	0.044	0.505	−0.182	**0.006**
Men	−0.396	**< 0.001**	0.141	0.123	−0.096	0.295
Women	−0.337	**< 0.001**	−0.029	0.759	−0.328	**< 0.001**

Bolded *p* values are statistically significant at $p < 0.05$

[a]Adjusted estimates controlled for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment

Table 5 Indirect standardized estimates between perceived social support from family, depressive symptoms and HIV disclosure behavior to sexual partners among men and women

	β	*p* value
Crude (unadjusted)		
Overall	0.051	**0.019**
Men	0.028	0.180
Women	0.073	0.094
Adjusted[a]		
Overall	0.047	**0.024**
Men	0.029	0.187
Women	0.103	**0.019**

Bolded *p* values are statistically significant at $p < 0.05$

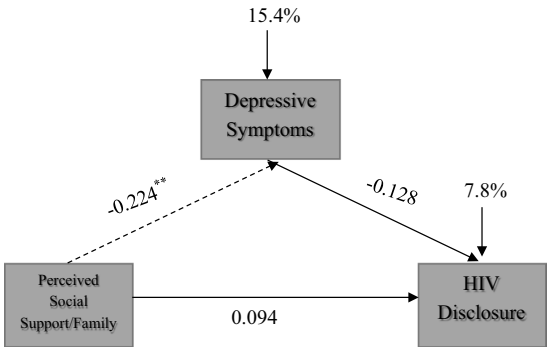
[a]Adjusted estimates controlled for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment

Table 6 Indirect standardized estimates between perceived social support from friends, depressive symptoms and HIV disclosure behavior to sexual partners among men and women

	β	*p* value
Crude (unadjusted)		
Overall	0.061	0.022
Men	0.028	0.416
Women	0.092	**0.025**
Adjusted[a]		
Overall	0.067	**0.011**
Men	0.038	0.305
Women	0.111	**0.009**

Bolded *p* values are statistically significant at $p < 0.05$

[a]Adjusted estimates controlled for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment

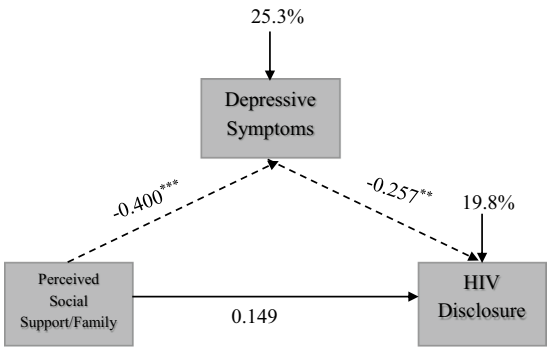


Note: **p<0.01

represent statistically significant pathways

Values for the proportion of variance explained are shown in percentages.

Fig. 1 Mediation diagram showing adjusted model for perceived social support from family, depression, and HIV disclosure to sexual partners among men. *Note* $**p < 0.01$. Dotted arrow represent statistically significant pathways. Values for the proportion of variance explained are shown in percentages



Note: ***p<0.001; **p<0.01

represent statistically significant pathways

Values for the proportion of variance explained are shown in percentages.

Fig. 2 Mediation diagram showing adjusted model for perceived social support from family, depression, and HIV disclosure to sexual partners among women. *Note* $***p < 0.001$; $**p < 0.01$ represent statistically significant pathways Values for the proportion of variance explained are shown in percentages

explained are also shown in the figures. All models were adjusted for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education level, and employment. All analyses were performed in SAS 9.4 (SAS Institute, Cary, NC).

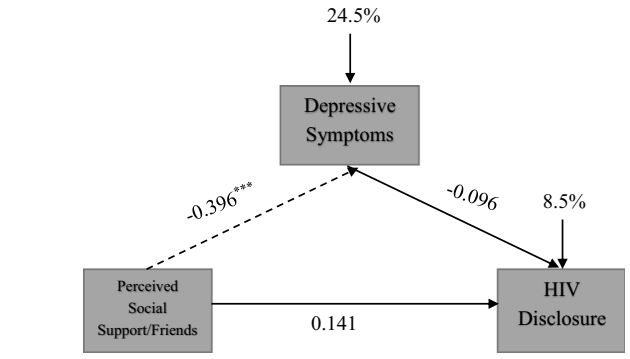


Fig. 3 Mediation diagram showing adjusted model for perceived social support from friends, depression, and HIV disclosure to sexual partners among men. *Note* ***$p < 0.001$. Dotted arrow represent statistically significant pathways. Values for the proportion of variance explained are shown in percentages

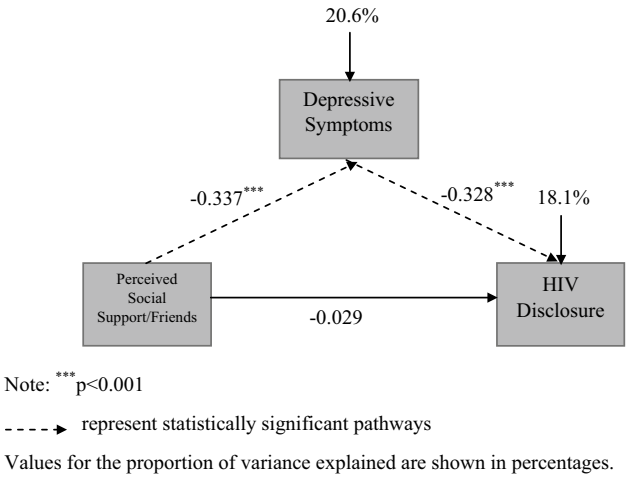


Fig. 4 Mediation diagram showing adjusted model for perceived social support from friends, depression, and HIV disclosure to sexual partners among women. *Note* ***$p < 0.001$. Dotted arrow represent statistically significant pathways. Values for the proportion of variance explained are shown in percentages

Results

Table 1 shows the distribution of sociodemographics, perceived social support from family, perceived social support from friends, depressive symptoms, and HIV disclosure behavior. There were no statistically significant differences in perceived social support from family by any sociodemographic characteristic. However, there were statistically significant differences in perceived social support from friends by sex, sexual orientation, education, employment, income, and time since diagnosis. Men had a higher mean value of perceived social support from friends compared to women, and MSM had the highest mean value compared to heterosexual men and women, and women who have sex with women (WSW). As education increased, perceived social support by friends increased. Participants reporting full-time employment and earning more than $1000 per month also reported the highest mean value compared to those reporting part-time employment, unemployment and earning $1000 per month or less. In addition, as time since diagnosis (as a continuous variable) increased, perceived social support from friends decreased.

There were also statistical differences in depressive symptoms by education, employment status and income. As education and income level increased, mean score of depressive symptoms decreased. Participants who were employed full-time had the lowest mean (*SD*) value of depressive symptoms at 16.3 (11.5) while those who had student/retired/disabled/unemployed status had the highest mean (*SD*) value of depressive symptoms at 24.5 (11.2). With regards to HIV disclosure behavior, there were statistically significant differences by sexual orientation, race, education, and income. MSM had the highest mean HIV disclosure behavior and heterosexual women had the lowest. White participants had higher disclosure behavior than Black and "Other" participants. Pertaining to education, participants with some college experience had higher disclosure behavior than those with less than high school. Finally, as income increased so did disclosure behavior.

Descriptive statistics of sexual behaviors of the study sample among men and women are shown in Table 2. On average, participants reported two sexual partners in the past 30 days (data not shown), with men reporting an average of three partners and women reporting an average of one partner.

Table 3 shows the direct standardized estimates between perceived social support from family and depressive symptoms, perceived social support from family and disclosure behavior, and depressive symptoms and disclosure behavior among the overall study population and among men and women. After adjusting for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment, perceived social support from family was statistically significantly and negatively associated with depression overall ($\beta = -0.290$, $p \leq 0.001$), and among men ($\beta = -0.224$, $p = 0.004$) and women ($\beta = -0.400$, $p \leq 0.001$). There were no statistically significant associations between perceived social support from family and HIV disclosure behavior. However, depressive symptoms were negatively associated with HIV disclosure behavior among the overall population ($\beta = -0.162$, $p = 0.011$), and women ($\beta = -0.257$, $p = 0.008$).

Table 4 shows the direct standardized estimates between perceived social support from friends and depressive symptoms, perceived social support from friends and HIV disclosure behavior, and depressive symptoms and HIV disclosure behavior among the overall study population, and among men and women. After adjusting for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment, perceived social support from friends was statistically significantly and negatively associated with depression overall ($\beta = -0.366$, $p \leq 0.001$), and among men ($\beta = -0.396$, $p \leq 0.001$), and women ($\beta = -0.337$, $p \leq 0.001$). There were no statistically significant associations between perceived social support from friends and HIV disclosure behavior. However, depressive symptoms were negatively associated with disclosure behavior overall ($\beta = -0.182$, $p = 0.006$) and among women ($\beta = -0.328$, $p \leq 0.001$).

Figures 1 and 2 show the mediation diagrams for men and women, respectively with perceived social support from family as the main independent variable. Figures 3 and 4 show the mediation diagrams for men and women, respectively, with perceived social support from friends as the main independent variable.

The indirect standardized estimates between perceived social support from family, depressive symptoms, and disclosure behavior overall and among men and women are shown in Table 5. After adjusting for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment, there was a statistically significant indirect effect between perceived social support from family and HIV disclosure behavior via depressive symptoms among the overall study population ($\beta = 0.047$, $p = 0.024$) and among women ($\beta = 0.103$, $p = 0.019$). Table 6 shows the indirect standardized estimates between perceived social support from friends, depressive symptoms, and HIV disclosure behavior. After adjusting for time since diagnosis, number of sexual partners in the past 30 days, age, sexual orientation, race, education, and employment, there was a statistically significant indirect effect between perceived social support from friends and HIV disclosure behavior via depressive symptoms among the overall study population ($\beta = 0.067$, $p = 0.011$) and among women ($\beta = 0.111$, $p = 0.009$).

Discussion

To our knowledge, this is the first study to examine the mediating effects of depressive symptoms between perceived social support from family and friends, and HIV disclosure to sexual partners. The primary findings of this study were that perceived social support from family or friends was not directly related to HIV disclosure to sexual partners, which did not support H1. However, depressive symptoms mediated the association between perceived social support from family and friends, specifically among women, which supported H2 and partially supported H3.

Perceived Social Support and HIV Disclosure Behavior

Contrary to expectations, neither social support from family nor social support from friends was directly associated with HIV disclosure to sexual partners among men and women. Previous studies have shown an association between social support and HIV disclosure to anyone [9] including family and friends [10], but not between social support and HIV disclosure to sexual partners [9]. These results along with the current study's findings indicate that perceived social support (from family and friends) may be important for disclosure to family or friends but may not play a significant role in disclosure to sexual partners.

Perceived Social Support and Depressive Symptoms

Prior research both conflicts and supports these findings that perceived social support is negatively associated with depressive symptoms among populations living with HIV [7, 41]. These mixed findings may be due to differences in study populations and the way depression or depressive symptoms were operationalized. Shrestha et al. did not find a statistically significant association between social support and depression among incarcerated Malaysian men with HIV and opioid dependence [42] and similar results were found among Namibian adults living with HIV [43]. Other studies have found that social support was negatively correlated with depression among people living with HIV, including MSM in China [41], hospital patients in Vietnam [44], and among injection drug users in New York City and San Francisco metropolitan statistical areas [7]. The current study's findings also help to confirm the link between social support and better health outcomes among populations living with HIV [41, 45–47] and the need to consider a social support component [7] in interventions geared towards attenuating depression.

As the data for this study were collected at baseline, it is possible there may be a bidirectional association between perceived social support and depressive symptoms, such that depressive symptoms may also impact perceived social support from family and friends. The majority of studies examined perceived social support as a determinant of depressive symptoms [44, 47, 48]; however, it is plausible that the more depressed an individual may feel, the less support he/she may perceive from friends and family [49].

Depressive Symptoms and HIV Disclosure Behavior

The current study also found that depressive symptoms were negatively associated with HIV disclosure behavior among women, but not men. Previous studies' findings on the relationship between depressive symptoms or depression and HIV disclosure have been conflicting. Cook and colleagues did not find statistically significant correlations between depressive symptoms and any type of HIV disclosure (to a sex/romantic partner, family member or friend/other person) among young MSM aged 12–24 from 20 U.S. cities [12]. However, Abler et al. found that depressive symptoms were negatively associated with disclosure to sexual partners among newly diagnosed MSM living with HIV [13]. Patel and colleagues did not find a statistically significant association between depressive symptoms and number of disclosures among women [50]. However, Kiene et al. found that depressive symptoms were associated with HIV disclosure behavior among adult Ugandan men and women, but this relationship was dependent on time since diagnosis [11]. Another study found that a longer time to first HIV disclosure, but not extent of disclosure was associated with depression among women from the Women's Interagency HIV Study in Washington, D.C. [14].

It is possible that the association between depressive symptoms and HIV disclosure vary depending on sociodemographic characteristics. However, in the current study, even after assessing moderation by sex and adjusting for sociodemographics, the association between depressive symptoms and a lower likelihood of disclosure to sexual partners remained statistically significant for women, but not for men. These findings suggest that depressive symptoms may negatively impact women's decision to disclose their HIV status to their partners, but this link may not be significant for men living with HIV.

Mediation of Depressive Symptoms Between Perceived Social Support and HIV Disclosure

Along these lines, depressive symptoms mediated perceived social support from family and friends and HIV disclosure for women, but this pathway was not statistically significant for men. As the relationship between perceived social support and HIV disclosure was not statistically significant, these findings suggest that depressive symptoms fully mediated the association between perceived social support and HIV disclosure for women. Research has shown that women may be more susceptible to social rejection challenges compared to men [51]. This greater susceptibility may also help to explain the higher rates of depression that are usually seen among women compared to men [51]. Lower perceived social support from family and friends may be considered to be "social rejection", especially among populations who are living with HIV, which continues to be a stigmatized illness [52–54]. Indeed, Kendler et al. found that women were more susceptible to depressogenic effects of lower levels social support compared to men [55].

As the study design was cross-sectional, it is also possible that disclosure to sexual partners could have influenced depressive symptoms, which may have then impacted perceived social support among women. Previous studies have shown that disclosure of HIV serostatus to partners may be associated with depressive symptoms among women [56] and depressed individuals may be less likely to feel supported by their family and/or friends compared to those who are not depressed [49].

The Thriving Theoretical Framework

The thriving theoretical framework, which emphasizes immediate outcomes such as self-acceptance, resilience and autonomy as a result of source of strength support such as perceived available support [15] may help to explain the findings in the current study. Based on the current findings, the thriving theoretical framework holds true for women with regard to the mediation pathway between perceived social support from family and friends, and HIV disclosure to sexual partners via depressive symptoms. In other words, social support, whether from family or friends, may have a stronger effect on certain behavioral outcomes among women through the reduction of depressive symptoms. Previous research has found that social support is a strong factor in thriving (excellent or very good) health, especially among women [57].

Limitations and Strengths

There are limitations to consider in the context of these findings. The study design was cross-sectional; therefore, causality cannot be determined. Perceived social support from family in the current study was not specific to HIV. Social support specific to living with HIV may differ from general social support that an individual may receive from family. It may be hypothesized that the greater the social support perceived specific to living with HIV, the greater HIV disclosure may occur. One instrument that may be used in future studies to assess perceived social support specific to living with HIV is the PSS-HIV, which assesses an individual's perceived support based on social interactions [58]. Another limitation to the study was excluding participants who did not answer questions on disclosure. The majority of participants who had no sexual partners in the last 30 days also did not answer the questions on disclosure. Since the questions on HIV disclosure behavior were limited to disclosure in the past 30 days, we were

only able to consider disclosure within this time frame. The study sample was not restricted to men and women who had recent sexual partners, as recent disclosure may have taken place with sex partners with whom no recent sexual activity took place, thereby possibly introducing confounding in the analysis. Future research could examine the association between perceived social support, depressive symptoms, and HIV disclosure longitudinally and determine if these associations remain or change with operationalizing HIV disclosure behavior within other time periods (for example, in the past 6 and 12 months). In addition, understanding disclosure among individuals who have sex less frequently is also important. Future studies should also examine HIV disclosure among individuals who do not report recent sexual activity, for example, in the past month or past 3 months. The study findings are from men and women living in a U.S. southeastern metropolitan statistical area who indicated an interest in learning more about disclosure and a desire to disclose their HIV status to a family member. Therefore, these findings may not be generalizable to men and women living with HIV in other geographical locations. Data on key variables such as engagement in treatment, antiretroviral adherence, viral load, injection drug use, and seropositioning were not collected in the current study. These measures may affect one's decision on whether to disclose to sexual partners and should be considered in future research.

Nevertheless, the study also had some strengths. We had large sample sizes for the overall population ($N = 266$), and for men ($n = 150$) and for women ($n = 116$). All primary variables, perceived social support, depressive symptoms, and disclosure behavior were measured using continuous variables, which protect against loss of power in analyses compared to using categorical variables. In addition, internal consistency was excellent for all primary variables. Finally, participants who were included and excluded from the study differed on one sociodemographic variable: race; with more Blacks remaining in the sample than Whites. As Black men and women continue to be disproportionately affected by HIV, ensuring they are represented in studies continues to be critical.

Conclusions

Depressive symptoms mediated the association between perceived social support from family and HIV disclosure to sexual partners among women living with HIV. Disclosure interventions that are aimed towards disclosure to sexual partners should focus on accentuating social support and attenuating depressive symptoms. However, due to the potential bidirectional association, social support interventions with a focus on reducing depressive symptoms may also impact disclosure behaviors. Women living with HIV may benefit greatly from interventions using these dual approaches. Future research is needed to determine if the same results would apply to perceived social support specific to living with HIV; and to determine psychosocial factors associated with HIV disclosure among men living with HIV. Future studies may also delve into alternate mediation pathways leading to HIV disclosure and assessing the associated disparities by sex. Longitudinal studies establishing temporal sequence among social support, depression and HIV disclosure are also warranted to determine the directionality of these pathways.

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Compliance with Ethical Standards

Conflict of interest MJB declares that she has no conflict of interest. JMS declares that she has no conflict of interest. TCL declares that she has no conflict of interest. JAK declares that she has no conflict of interest. CML declares that she has no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. Serovich JM. A test of two HIV disclosure theories. AIDS Educ Prev. 2001;13(4):355–64.
2. Serovich JM, Lim JY, Mason TL. A retest of two HIV disclosure theories: the women's story. Health Soc Work. 2008;33(1):23–31.
3. Kalichman SC, Kalichman MO, Cherry C, Grebler T. HIV disclosure and transmission risks to sex partners among HIV-positive men. AIDS Patient Care STDs. 2016;30(5):221–8.
4. O'Connell AA, Reed SJ, Serovich JA. The efficacy of serostatus disclosure for HIV transmission risk reduction. AIDS Behav. 2015;19(2):283–90.
5. Bekele T, Rourke SB, Tucker R, Greene S, Sobota M, Koornstra J, et al. Direct and indirect effects of perceived social support on health-related quality of life in persons living with HIV/AIDS. AIDS Care. 2013;25(3):337–46.
6. Hou WL, Chen CE, Liu HY, Lai YY, Lee HC, Lee NY, et al. Mediating effects of social support on depression and quality of life among patients with HIV infection in Taiwan. AIDS Care. 2014;26(8):996–1003.
7. Mizuno Y, Purcell DW, Dawson-Rose C, Parsons JT, SUDIS Team. Correlates of depressive symptoms among HIV-positive

injection drug users: the role of social support. AIDS Care. 2003;15(5):689–98.
8. Wang JY, Mann F, Lloyd-Evans B, Ma RM, Johnson S. Associations between loneliness and perceived social support and outcomes of mental health problems: a systematic review. BMC Psychiatry. 2018;18(1):156.
9. Fifield J, O'Sullivan L, Kelvin EA, Mantell JE, Exner T, Ramjee G, et al. Social support and violence-prone relationships as predictors of disclosure of HIV status among newly diagnosed HIV-positive South Africans. AIDS Behav. 2018. https://doi.org/10.1007/s10461-018-2136-z.
10. Kalichman SC, DiMarco M, Austin J, Luke W, DiFonzo K. Stress, social support, and HIV-status disclosure to family and friends among HIV-positive men and women. J Behav Med. 2003;26(4):315–32.
11. Kiene SM, Dove M, Wanyenze RK. Depressive symptoms, disclosure, HIV-related stigma, and coping following HIV testing among outpatients in Uganda: a daily process analysis. AIDS Behav. 2018;22(5):1639–51.
12. Cook SH, Valera P, Wilson PA, Adolescent Trials Network for HIV/AIDS Interventions. HIV status disclosure, depressive symptoms, and sexual risk behavior among HIV-positive young men who have sex with men. J Behav Med. 2015;38(3):507–17.
13. Abler L, Sikkema KJ, Watt MH, Hansen NB, Wilson PA, Kochman A. Depression and HIV serostatus disclosure to sexual partners among newly HIV-diagnosed men who have sex with men. AIDS Patient Care STDs. 2015;29(10):550–8.
14. Liu CL, Goparaju L, Barnett A, Wang CW, Poppen P, Young M, et al. Change in patterns of HIV status disclosure in the HAART era and association of HIV status disclosure with depression level among women. AIDS Care. 2017;29(9):1112–8.
15. Feeney BC, Collins NL. A new look at social support: a theoretical perspective on thriving through relationships. Pers Soc Psychol Rev. 2015;19(2):113–47.
16. Hinnen C, Schreuder I, Jong E, van Duijn M, Dahmen R, van Gorp EC. The contribution of adult attachment and perceived social support to depressive symptoms in patients with HIV. AIDS Care. 2012;24(12):1535–42.
17. Okonkwo NO, Larkan F, Galligan M. An assessment of the levels of perceived social support among older adults living with HIV and AIDS in Dublin. Springerplus. 2016;5(1):726.
18. Batterham P, Rice E, Rotheram-Borus MJ. Predictors of serostatus disclosure to partners among young people living with HIV in the pre- and post-HAART eras. AIDS Behav. 2005;9(3):281–7.
19. Zea MC, Reisen CA, Poppen PJ, Bianchi FT, Echeverry JJ. Predictors of disclosure of human immunovirus-positive serostatus among Latino gay men. Cult Divers Ethnic Minor Psychol. 2007;13(4):304–12.
20. Osinde MO, Kakaire O, Kaye DK. Factors associated with disclosure of HIV serostatus to sexual partners of patients receiving HIV care in Kabale, Uganda. Int J Gynaecol Obstet. 2012;118(1):61–4.
21. Shrestha R, Altice FL, Sibilio B, Copenhaver MM, Joch J. HIV sero-status non-disclosure among HIV-infected opioid-dependent individuals: the roles of HIV-related stigma, risk behavior, and social support. J Community Health. 2018. https://doi.org/10.1007/s10900-018-0560-7.
22. Corliss HL, Austin SB, Roberts AL, Molnar BE. Sexual risk in "mostly heterosexual" young women: influence of social support and caregiver mental health. J Womens Health. 2009;18(12):2005–10.
23. Brown MJ, Serovich JM, Kimberly JA, Umasabor-Bubu O. Disclosure and self-efficacy among HIV-positive men who have sex with men: a comparison between older and younger adults. AIDS Patient Care STDs. 2015;29(11):625–33.
24. Frost DM, Meyer IH, Schwartz S. Social support networks among diverse sexual minority populations. Am J Orthopsychiatr. 2016;86(1):91–102.
25. Mutchler MG, Bogart LM, Elliott MN, McKay T, Suttorp MJ, Schuster MA. Psychosocial correlates of unprotected sex without disclosure of HIV-positivity among African-American, Latino, and White men who have sex with men and women. Arch Sex Behav. 2008;37(5):736–47.
26. Rotzinger A, Locatelli I, Reymermier M, Amico S, Bugnon O, Cavassini M, et al. Association of disclosure of HIV status with medication adherence. Patient Educ Couns. 2016;99(8):1413–20.
27. Ahn JV, Bailey H, Malyuta R, Volokha A, Thorne C. Factors associated with non-disclosure of HIV status in a cohort of childbearing HIV-positive women in Ukraine. AIDS Behav. 2016;20(1):174–83.
28. Rzeszutek M. Social support and posttraumatic growth in a longitudinal study of people living with HIV: the mediating role of positive affect. Eur J Psychotraumatol. 2017;8(1):1412225.
29. Lifson AR, Workneh S, Hailemichael A, Demissie W, Slater L, Shenie T. Perceived social support among HIV patients newly enrolled in care in rural Ethiopia. AIDS Care. 2015;27(11):1382–6.
30. Bowleg L, Burkholder GJ, Massie JS, Wahome R, Teti M, Malebranche DJ, et al. Racial discrimination, social support, and sexual HIV risk among Black heterosexual men. AIDS Behav. 2013;17(1):407–18.
31. McCullagh C, Quinn K, Voisin DR, Schneider J. A longitudinal examination of factors associated with social support satisfaction among HIV-positive young Black men who have sex with men. AIDS Care. 2017;29(12):1598–604.
32. Nemoto T, Bodeker B, Iwamoto M. Social support, exposure to violence and transphobia, and correlates of depression among male-to-female transgender women with a history of sex work. Am J Public Health. 2011;101(10):1980–8.
33. Cederbaum JA, Rice E, Craddock J, Pimentel V, Beaver P. Social networks of HIV-positive women and their association with social support and depression symptoms. Women Health. 2017;57(2):268–82.
34. Risser J, Cates A, Rehman H, Risser W. Gender differences in social support and depression among injection drug users in Houston, Texas. Am J Drug Alcohol Abuse. 2010;36(1):18–24.
35. Shushtari ZJ, Sajjadi H, Forouzan AS, Salimi Y, Dejman M. Disclosure of HIV status and social support among people living with HIV. Iran Red Crescent Med J. 2014;16(8):e11856.
36. Lee S, Yamazaki M, Harris DR, Harper GW, Ellen J. Social support and human immunodeficiency virus-status disclosure to friends and family: implications for human immunodeficiency virus-positive youth. J Adolesc Health. 2015;57(1):73–80.
37. Procidano ME, Heller K. Measures of perceived social support from friends and from family: three validation studies. Am J Commun Psychol. 1983;11(1):1–24.
38. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol Meas. 1977;1:385–401.
39. SAS. The Calis Procedure 2018. https://support.sas.com/documentation/cdl/en/statug/63962/HTML/default/viewer.htm#statug_calis_sect070.htm. Accessed 25 Sept 2018.
40. Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: new procedures and recommendations. Psychol Methods. 2002;7(4):422–45.
41. Li JH, Mo PKH, Wu AMS, Lau JTF. Roles of self-stigma, social support, and positive and negative affects as determinants of depressive symptoms among HIV-infected men who have sex with men in China. AIDS Behav. 2017;21(1):261–73.
42. Shrestha R, Copenhaver M, Bazazi AR, Huedo-Medina TB, Krishnan A, Altice FL. A moderated mediation model of

HIV-related stigma, depression, and social support on health-related quality of life among incarcerated Malaysian men with HIV and opioid dependence. AIDS Behav. 2017;21(4):1059–69.
43. Kalomo EN. Associations between HIV-related stigma, self-esteem, social support, and depressive symptoms in Namibia. Aging Ment Health. 2017. https://doi.org/10.1080/13607863.2017.1387763.
44. Matsumoto S, Yamaoka K, Takahashi K, Tanuma J, Mizushima D, Do CD, et al. Social support as a key protective factor against depression in HIV-infected patients: report from large HIV clinics in Hanoi, Vietnam. Sci Rep. 2017;7(1):15489.
45. Arriola KJ, Spaulding AC, Booker CA, Williams C, Avery A, Porter NJ, et al. Understanding the relationship between social support and physical and mental well-being among jail detainees living with HIV. J Health Psychol. 2015;20(1):3–12.
46. Liu L, Pang R, Sun W, Wu M, Qu P, Lu CM, et al. Functional social support, psychological capital, and depressive and anxiety symptoms among people living with HIV/AIDS employed full-time. BMC Psychiatr. 2013;13(1):324.
47. Xiaowen W, Guangping G, Ling Z, Jiarui Z, Xiumin L, Zhaoqin L, et al. Depression and anxiety mediate perceived social support to predict health-related quality of life in pregnant women living with HIV. AIDS Care. 2018;30(9):1147–55.
48. Rodriguez VJ, Butts SA, Mandell LN, Weiss SM, Kumar M, Jones DL. The role of social support in the association between childhood trauma and depression among HIV-infected and HIV-uninfected individuals. Int J STD AIDS. 2018. https://doi.org/10.1177/0956462418793736.
49. Simoni JM, Pantalone DW. HIV disclosure and safer sex. In: Kalichman SC, editor. Positive prevention: reducing HIV transmission among people living with HIV/AIDS. New York, NY: Kluwer Academic/Plenum; 2005.
50. Patel R, Ratner J, Gore-Felton C, Kadzirange G, Woelk G, Katzenstein D. HIV disclosure patterns, predictors, and psychosocial correlates among HIV positive women in Zimbabwe. AIDS Care. 2012;24(3):358–68.
51. Stroud LR, Salovey P, Epel ES. Sex differences in stress responses: social rejection versus achievement stress. Biol Psychiatr. 2002;52(4):318–27.
52. Shacham E, Rosenburg N, Onen NF, Donovan MF, Overton ET. Persistent HIV-related stigma among an outpatient US clinic population. Int J STD AIDS. 2015;26(4):243–50.
53. Darlington CK, Hutson SP. Understanding HIV-related stigma among women in the Southern United States: a literature review. AIDS Behav. 2017;21(1):12–26.
54. Kay ES, Rice WS, Crockett KB, Atkins GC, Batey DS, Turan B. Experienced HIV-related stigma in health care and community settings: mediated associations with psychosocial and health outcomes. J Acquir Immune Defic Syndr. 2018;77(3):257–63.
55. Kendler KS, Myers J, Prescott CA. Sex differences in the relationship between social support and risk for major depression: a longitudinal study of opposite-sex twin pairs. Am J Psychiatr. 2005;162(2):250–6.
56. Vyavaharkar M, Moneyham L, Corwin S, Tavakoli A, Saunders R, Annang L. HIV-disclosure, social support, and depression among HIV-infected African American women living in the rural southeastern United States. AIDS Educ Prev. 2011;23(1):78–90.
57. Richmond CA, Ross NA, Egeland GM. Social support and thriving health: a new approach to understanding the health of indigenous Canadians. Am J Public Health. 2007;97(10):1827–33.
58. Cortes A, Hunt N, McHale S. Development of the scale of perceived social support in HIV (PSS-HIV). AIDS Behav. 2014;18(12):2274–84.

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