Published in final edited form as:

Arch Sex Behav. 2016 August ; 45(6): 1347–1355. doi:10.1007/s10508-015-0641-y.

Association of Internalized and Social Network Level HIV Stigma With High-Risk Condomless Sex Among HIV-Positive African American Men

Glenn J. Wagner¹, Laura M. Bogart^{1,2,3}, David J. Klein^{1,2}, Harold D. Green Jr.¹, Matt G. Mutchler^{4,5}, Bryce McDavitt^{4,5,6}, and Charles Hilliard⁷

Glenn J. Wagner: gwagner@rand.org

¹Health Unit, RAND Corporation, 1776 Main St., Santa Monica, CA 90407, USA

²Division of General Pediatrics, Department of Medicine, Boston Children's Hospital, Boston, MA, USA

³Department of Pediatrics, Harvard Medical School, Boston, MA, USA

⁴Department of Sociology, California State University, Dominguez Hills, Carson, CA, USA

⁵Community-Based Research, AIDS Project Los Angeles, Los Angeles, CA, USA

⁶Clinical Psychology, Pacifica Graduate Institute, Carpinteria, CA, USA

⁷Department of Psychiatry & Human Behavior, Charles Drew University of Medicine and Science, Los Angeles, CA, USA

Abstract

We examined whether internalized HIV stigma and perceived HIV stigma from social network members (alters), including the most popular and most similar alter, predicted condomless intercourse with negative or unknown HIV status partners among 125 African American HIV-positive men. In a prospective, observational study, participants were administered surveys at baseline and months 6 and 12, with measures including sexual behavior, internalized HIV stigma, and an egocentric social network assessment that included several measures of perceived HIV stigma among alters. In longitudinal multivariable models comparing the relative predictive value of internalized stigma versus various measures of alter stigma, significant predictors of having had condomless intercourse included greater internalized HIV stigma (in all models), the perception that a popular (well-connected) alter or alter most like the participant agrees with an HIV stigma belief, and the interaction of network density with having any alter that agrees with a stigma belief. The interaction indicated that the protective effect of greater density (connectedness between alters) in terms of reduced risk behavior dissipated in the presence of perceived alter stigma. These findings call for interventions that help people living with HIV to cope with their diagnosis and reduce stigma, and inform the targets of social network-based and peer-driven HIV prevention interventions.

Keywords

HIV; African American; HIV stigma; Social networks; Condomless sex

Introduction

HIV stigma, both internal and external, is a major deterrent to HIV prevention (Bogart et al., 2008, 2013; Earnshaw, Bogart, Dovidio, & Williams, 2013; Herek, Capitanio, & Widaman, 2003; Tsai et al., 2013). “Prevention with Positives” is an HIV prevention approach that promotes reduction of transmission risk behaviors among persons living with HIV/AIDS (PLHA) (Auerbach, 2004; Gordon, Stall, & Cheever, 2004; Janssen et al., 2001), and studies have identified both internalized HIV stigma and perceived HIV stigma (i.e., discrimination or enacted stigma) from others as correlates of condomless intercourse among PLHA (Hatzenbuehler, O’Cleirigh, Mayer, Mimiaga, & Safren, 2011; Radcliffe et al., 2010; Wolitski, Pals, Kidder, Courtenay-Quirk, & Holtgrave, 2009). This prior research is consistent with the minority stress model of health behavior (Meyer, 1995), which highlights the role of stressors such as stigma and discrimination as significant contributors to unhealthy behaviors such as sexual risk taking among sexual and racial/ethnic minority populations.

Few studies have examined the social context in which stigma influences the sexual behavior of PLHA, despite HIV stigma being fundamentally a social phenomenon driven by how others perceive PLHA based on their HIV-serostatus. Most studies of external HIV stigma use a global measure in which respondents rate their perception or experiences of stigma from others in general, rather than from specific individuals or groups of individuals within their social network. Yet, HIV stigma from others maybe particularly influential on the sexual behavior of PLHA when in reference to the people closest to the HIV-positive individual. Receipt of instrumental support from network members and having a confidant have been found to be associated with lower internalized HIV stigma among PLHA (Emlet, 2006). Therefore, it would be expected that the converse—having network members who express HIV stigma—would be related to greater internalized stigma and perhaps in turn greater risk taking. Internalized stigma may also influence network composition and network selection, as individuals could choose to form relationships with people who share their attitudes, though it is also conceivable that individuals who struggle with internalized stigma could seek relationships with people who challenge these attitudes and provide HIV-related social support.

Furthermore, research suggests that individuals within one’s social network may be more or less influential to a person’s behavior depending on their structural position or status within the network, or relation to the person. Studies based on the popular opinion leader model suggest that the most popular member in the network (i.e., the individual most connected to other network members) can influence behavior of other network members (Kelly, 2004; Maiorana et al., 2007), and the peer change agent model (Medley, Kennedy, O’Reilly, & Sweat, 2009) and data on the behavioral influence of perceived peer norms (Bell, Montoya,

Atkinson, & Yang, 2002) suggest that network members who are most similar to each other on key characteristics may be more likely to influence each others' behavior.

The structure of a social network may also factor into the influence that network members have on the behavior of each other. Studies of social networks among drug users have found that a more inter-connected or dense network is associated with greater sexual risk behaviors (Gyarmathy & Neaigus, 2009; Latkin, Forman, Knowlton, & Sherman, 2003), but in contrast, a study of ethnic minority men who have sex with men (MSM) in the U.S. found that greater network density was associated with less sexual risk taking (Choi, Ayala, Paul, Boylan, & Gregorich, 2013). Moreover, a study in China of MSM found greater network density was associated with less sexual risk behavior when more network members provided social support (Liu et al., 2009), suggesting that level of connectedness within a network may not influence member behavior indirectly, but through interactions with member characteristics such as social support and HIV stigma. More dense networks may accentuate or magnify the effects of specific network member traits, as a greater concentration of inter-connected relationships may increase exposure to the trait, while more fragmented networks may serve to dilute the influence of network member traits.

With data from a longitudinal sample of African American men living with HIV, we examined how high-risk sexual activity, defined as condomless intercourse with negative or unknown HIV status partners, was associated with internalized HIV stigma and perceived HIV stigma among social network members, including the most popular members and those most similar to the participant. We also explored how network structure interacts with perceived stigma among network members to influence condom use.

Method

Participants and Procedure

African Americans living with HIV were recruited via direct contact, print advertising, and flyers posted at AIDS service organizations and HIV medical clinics from August 2010 to September 2012 in Los Angeles, California. Participants were screened by telephone or in person on the following eligibility criteria: (1) self-identify as Black or African American; (2) HIV-positive serostatus; (3) English speaking; and (4) aged 18 or older. All participants provided written informed consent for the study as well as a Health Insurance Portability and Accountability Act form for release of medical record information (CD4 cell count and HIV viral load). Institutional review board approval was obtained from the RAND Corporation, which was the institutional review board of record for this study. The National Institutes of Health issued a Certificate of Confidentiality for the research.

Enrolled participants completed assessment interviews at baseline and months 6 and 12. One of the primary objectives of the overall study was to examine determinants of antiretroviral treatment (ART) adherence, which was measured using electronic monitoring caps; however, these data were not included in the analysis for this paper. Participants received \$50 for completion of assessments at baseline and \$30 at months 6 and 12, as well as \$10 for check-in appointments at months 2, 4, 8, and 10 to download electronic ART adherence data and update contact information.

Measures

Participants completed an audio computer-assisted self-interview, followed by an interviewer-administered social network assessment. All assessments were conducted in English and at each of the three time-points unless otherwise noted.

Sociodemographics—At baseline, participants reported their age, race/ethnicity, sexual orientation (i.e., heterosexual, gay, bisexual, or something other than heterosexual), employment status, highest level of education, and relationship status.

Condom Use—Participants reported the number of male and female partners in the past 3 months, along with the frequency of insertive and receptive anal intercourse with and without condoms with men, and anal and vaginal intercourse with and without condoms with women. Separate questions were asked for each sexual behavior for all partners who were HIV-positive (as a whole, not for each individual partner), then for all partners who were HIV-negative, and for all partners whose HIV status was unknown. For analysis, responses for sexual behavior with men and women were combined, as well as sexual behavior with HIV-negative and unknown HIV status partners, which enabled us to derive two dichotomous variables—any condomless sexual intercourse (regardless of HIV status of partners), and any condomless sexual intercourse with negative or unknown HIV status partners.

Social Network Characteristics

Elicitation of Social Network Members: Using standard methods for eliciting egocentric social network data (McCarty, 2002; McCarty, Bernard, Killworth, Shelley, & Johnsen, 1997) participants were asked to list up to 20 social network members (alters) with whom they had contact sometime in the past year (at baseline) or in the last 6 months (at months 6 and 12), either in person or by phone, mail, or email. Participants were told that they could list family members, friends, people in their community (e.g., neighbors, storekeepers, ministers), other people with HIV, and people involved in providing their HIV care or support (e.g., doctors, nurses, case managers, treatment educators, drug treatment counselors, social workers). Participants were asked to list first “the people who are most important to you” followed by “people who have been less important.” To protect confidentiality, participants were asked to list initials rather than full names.

Social Network Composition: For each alter, the respondent was asked to report several characteristics including the alter’s age, gender, race/ethnicity, HIV status, and relationship to participant including separate questions for whether the respondent is in a romantic relationship with the alter and whether the alter is a sex partner.

Social Network Structure: To assess the level of connectedness among alters, for each alter participants indicated the level of interaction with each other alter by responding to the question, “How frequently would you say [initials] and [initials] have had contact with each other in the past year, either face-to-face, by phone, mail, or email?” and using the response options 0 = never, 1 = almost never, 2 = sometimes, and 3 = always/always/always. From this question, we calculated network density (percentage of ties between alters that exist

proportionate to the total number of possible ties) and percentage of alters who are isolates (without strong ties to any other alter), with a tie or connection between alters defined as having interaction at the “almost always/always” level.

Perceived HIV Stigma Among Social Network Members—For each alter, participants were asked, “Does [initials of alter] ever talk about HIV?” and to respond with “never,” “sometimes,” or “often”; if the alter had talked about HIV, the participant was asked to indicate (1) how often the alter had ever stated (on a scale from 0 “never” to 3 “often”) each of two stigmatizing beliefs about HIV adapted from items used in prior research (Herek, Capitanio, & Widaman, 2003): “Most people with AIDS are responsible for having their illness,” and “A person with AIDS must have done something wrong and deserves to be punished;” and (2) whether they think the alter agrees with each of these two beliefs (on a scale from 1 “strongly disagree” to 5 “strongly agree”). If the respondent had not heard the alter talk about HIV, the alter was rated as having never stated, nor agreed with, either stigma belief. (Note, the proportion of alters who never talked about HIV was 48 %.) For analysis, the mean alter frequency of stating HIV stigma beliefs was computed (mean of responses of the two items, and then the mean across all alters), and a dichotomous variable was derived to represent whether any alter agreed (at least “slightly”) with either of the two stigma beliefs.

To assess the influence of HIV stigma expressed by individual alters specifically positioned within the respondent’s social network, we created two variables to indicate whether or not the most popular alter (i.e., the alter with the most ties to other alters) had ever stated, and was perceived to agree with, either of the two stigma beliefs. Similar variables were created for the alter that was determined to be most like the respondent on five selected key characteristics (age, gender, HIV status, sexual orientation, race) using a coefficient of similarity developed by Gower (1971). Each alter was assigned a numerator equal to the sum of the four binary characteristics where the respondent and alter were the same (for example, if both respondent and alter were male), as well as a score of how similar their ages were relative to the total range of ages ($1 - [D/R]$) where D = absolute value of the difference, and R = total range, which in this study was 92 since some participants named infants as alters. Each alter was assigned a denominator equal to the number of the five characteristics for which information was available for both the alter and the respondent (range of 0–5). The final score has a range of 0–1 (which was derived by dividing the numerator by the denominator), with higher numbers representing more similarity across the five characteristics.

Internalized HIV Stigma—This construct was assessed with 7 items from the scale developed by Kalichman et al. (2005). Examples of items include “Being HIV positive makes me feel dirty” and “I am ashamed that I am HIV positive”; we did not use the eight item of the scale that was related to HIV disclosure, which we view as related to but a distinct construct from internalized stigma. Response options range from 1 “strongly disagree” to 5 “strongly agree”; a mean item score was calculated and higher scores represent greater stigma.

Data Analysis

Descriptive statistics were used to examine sample characteristics, including sociodemographics, condom use, internalized HIV stigma, perceived HIV stigma within the social network, and network structure and composition. The dependent variable in the analysis was any condomless intercourse with an HIV-negative or unknown HIV status partner at either the 6- or 12-month follow-up. Independent variables were all measured at baseline and included (1) internalized HIV stigma, (2) perceived HIV stigma among social network alters (mean alter frequency of stating, and whether or not any alter agreed with, the two stigma beliefs), (3) measures of HIV stigma (stated and agreed with either stigma belief) among the most popular alter and alter most like the participant, and (4) interactions of the above named alter stigma variables with the social network structure parameters (density and percentage of isolates). The independent variables were missing for less than 4 % of records; when missing, data for these variables were imputed using the mean for the sample. Measures of HIV stigma for the most popular or most like alter were not imputed when missing, since imputation would involve using data from other alters who could not be presumed to be representative of the most popular or most like alter.

For each independent variable, bivariate logistic regression models (or unadjusted logistic regression models when interaction terms were included) were conducted to examine the association with the dependent variable. We then used multivariable logistic regression models to examine the relative predictive value of internalized and alter HIV stigma, with a separate model for each of the alter stigma variables that was at least marginally associated with the dependent variable in the bivariate models. Results from both bivariate and multivariable logistic regressions are reported using odds ratios and their associated confidence intervals; in addition, to facilitate comparison of the relative magnitude of effects of independent variables that may have widely different ranges, we report standardized logistic regression coefficients, labeled as β in the text below. The interactions of the alter stigma measure with network density and percentage of isolates were included in the multivariable models if they were at least marginally significant in the unadjusted logistic regression models without covariates. Age and education (whether or not participant graduated from high school) were included as covariates in each multivariate regression model. Odds ratios for interactions at different levels of the predictors were calculated with post-estimation contrasts of regression coefficients.

Results

Sample Characteristics

A sample of 246 participants enrolled, including 184 men and 62 women; however, the analytic sample for this paper involved only the subset of 125 male participants who reported having any sex partners during the past 3 months (and, therefore, were asked about condom use) at either the month 6 or 12 interview, which would enable us to carry out the longitudinal regression analyses. In this subgroup of 125 men, study retention was very high as 106 (85 %) completed all three assessments.

Baseline characteristics of the subgroup of 125 men included an average age of 45.3 years ($SD = 9.9$; range: 21–65), 78 % ($n = 98$) said that they were gay, bisexual, or something other than heterosexual, 76 % ($n = 95$) were single, 87 % ($n = 109$) were not employed, and 82 % ($n = 102$) had a high school degree or equivalent. Participants had been diagnosed with HIV for an average of 13.1 ($SD = 8.1$) years. Most (84 %; $n = 102$) were on ART at baseline, and of the 94 participants for whom we were able to obtain recent laboratory records, mean CD4 cell count was 543 ($SD = 332$; 18 % < 200) and 49 % had an undetectable HIV viral load.

With regard to the respondents' social network, 38 % of alters were women and mean alter age was 44.0 years; within each respondent's network, an average of 36 % of alters were HIV-positive, 37 % reported at least one alter who they were in a romantic relationship with (and 89 % of these alters were also indicated to be sex partners), 47 % reported at least one alter who was a sex partner, and the mean number of alters who were sex partners was 0.8. The mean density of the social networks of the participants was 10 % ($SD = 14$), and the mean percentage of alters who were isolates (i.e., who had no strong ties to other alters) was 54 % ($SD = 29$).

Condomless Sexual Intercourse

Using data from the first follow-up assessment in which the participant reported at least one sex partner in the previous 3 months, the mean number of sex partners was 1.0 ($SD = 1.2$). More than half (58 %; $n = 73$) reported any condomless intercourse at any follow-up assessment, and almost one-third (30 %; $n = 38$) reported condomless intercourse with an HIV-negative or unknown status partner at any follow-up assessment. Having condomless intercourse with HIV-negative or unknown status partners was not significantly associated with baseline ART status, as 28 % of those on ART reported condomless intercourse compared to 40 % of those not on ART ($p = .30$); condomless intercourse was also not associated with undetectable viral load, with 26 % of those with undetectable viral load reporting condomless intercourse compared to 40 % of those with detectable viral load ($p = .19$).

Relationship Between Condomless Intercourse With Negative and Unknown HIV Status Partners and Measures of HIV Stigma

Bivariate Analysis

Internalized HIV Stigma: The mean score on the measure of internalized HIV stigma was 2.81 ($SD = 1.13$; possible range 1–5), indicating low levels of internalized stigma overall; however, 22 % of the sample reported very high levels of stigma with a score of at least 4.0. In the bivariate logistic regression model, greater internalized HIV stigma was significantly associated with a higher likelihood of having had unprotected intercourse with a negative or unknown HIV status partner [OR (95 % CI) = 1.4 (1.0, 2.0); $\beta = .23$; $p = .04$].

Statement of and Agreement with HIV Stigma Beliefs Among Alters: The mean frequency of alters stating the stigma beliefs was very low at 0.10 ($SD = 0.26$; possible range: 0–3). On average, only 18 % of the alters of each participant agreed with either of the beliefs, and less than half of the sample (41 %; 51/123) reported having any alter who

agreed with either of the beliefs. In a bivariate logistic regression model, more frequent alter stating of HIV stigma beliefs was not associated with a higher likelihood of having had condomless intercourse with a negative or unknown HIV status partner [OR (95 % CI) = 1.8 (0.4, 7.2); $\beta = .08$; $p = .41$], nor was the interaction of social network density and frequency of alter stating stigma beliefs [OR (95 % CI) = 1.2 (0.9, 1.4); $\beta = .22$; $p = .16$] in an unadjusted logistic regression model. Having at least one alter that agreed with either of the stigma beliefs was significantly associated with a higher likelihood of having had condomless intercourse with a negative or unknown HIV status partner [OR (95 % CI) = 2.5 (1.2, 5.4); $\beta = .24$; $p = .03$], while its interaction with social network density was marginally significant [OR (95 % CI) = 1.1 (1.0, 1.2); $\beta = .36$; $p = .06$]. The interactions of percentage of isolates (alters with no strong ties to other alters) with frequency of alters stating stigma beliefs [OR (95 % CI) = 1.0 (0.9, 1.0); $\beta = -.27$; $p = .32$] and having any alter that agrees with a stigma belief [OR (95 % CI) = 0.98 (0.95, 1.01); $\beta = -.41$; $p = .11$] were not associated with condomless intercourse.

Statement of and Agreement With HIV Stigma Beliefs by the Most Popular Alter:

Fourteen percent (15 of 106 participants with data) reported that their most popular alter had stated either of the beliefs, and 25 % of participants (26/106) stated that this alter agreed with either of the beliefs. In bivariate logistic regression models, whether or not the most popular alter stated HIV stigma beliefs was not significantly associated with having condomless intercourse with a negative or unknown HIV status partner [OR (95 % CI) = 1.2 (0.4, 3.8); $\beta = .03$; $p = .77$], nor were the interactions of this variable with network density [OR (95 % CI) = 1.1 (0.9, 1.2); $\beta = .15$; $p = .41$] and percentage of isolates [OR (95 % CI) = 1.0 (1.0, 1.1); $\beta = .01$; $p = .97$] in unadjusted logistic regression models. Engagement in this high-risk sexual activity was significantly associated with the most popular alter agreeing with either of the stigma beliefs [OR(95 % CI) = 4.0 (1.6, 10.2); $\beta = .33$; $p = .004$], but not its interaction with network density [OR (95 % CI) = 1.1 (1.0, 1.2); $\beta = .29$; $p = .15$] and only marginally with percentage of isolates [OR (95 % CI) = 1.0 (0.9, 1.0); $\beta = -.51$; $p = .05$].

Statement of and Agreement With HIV Stigma Beliefs by the Alter Most Similar to the Participant:

As for the alter who was most similar to the participant, 14 % (17 of 123 participants with data) reported this alter had stated either of the stigma beliefs and 23 % (28/123) stated that this alter agreed with either of these beliefs. The bivariate regression models revealed that statement of HIV stigma beliefs by the most similar alter was not associated with having condomless intercourse with a negative or unknown HIV status partner [OR (95 % CI) = 0.7 (0.2, 2.5); $\beta = -.07$; $p = .53$], nor were its interactions with network density [OR (95 % CI) = 1.0 (0.8, 1.2); $\beta = -.03$; $p = .88$] and percentage of isolates [OR (95 % CI) = 0.99(0.95, 1.04); $\beta = -.07$; $p = .82$] in unadjusted logistic regression models. Engagement in this high-risk sexual activity was marginally associated with the most similar alter agreeing with either of the stigma beliefs [OR (95 % CI) = 2.1 (0.9, 5.0); $\beta = .17$; $p = .097$], but not associated with the interactions between this alter stigma measure and network density [OR (95 % CI) = 1.1 (0.9, 1.2); $\beta = .16$; $p = .33$] and percentage of isolates [OR (95 % CI) = 0.98 (0.95, 1.01); $\beta = -.28$; $p = .24$].

Multivariable Analysis—We first examined the relative predictive value of internalized HIV stigma and the measures of agreement with HIV stigma beliefs among alters (see Table 1). Variables associated with higher odds of condomless intercourse with negative or unknown HIV status partners included greater internalized HIV stigma [OR (95 % CI) = 1.6 (1.1, 2.4); $p = .02$], and the interaction of network density with whether or not any alter agreed with either of the stigma beliefs [OR (95 % CI) = 1.1 (1.0, 1.3); $p = .046$]. Higher network density was marginally associated with lower odds of condomless intercourse among participants who did not name any alters which agreed with either stigma belief [OR (95 % CI) = 0.93 (0.85, 1.01); $p = .097$], but this protective effect of higher network density was no longer present among those who had at least one alter who agreed with either of the stigma beliefs [OR (95 % CI) = 1.05 (0.97, 1.13); $p = .25$]; the two odds ratios are also significantly different from each other per the interaction.

We then computed models that compared internalized HIV stigma with measures of agreement with HIV stigma beliefs among the most popular and similar alters (see Table 2). Separate models were computed for each of these two alter stigma measures given that some (13 %) of the most popular alters were also the most similar to the participant. In the model that included HIV stigma among the most popular alters, variables associated with higher odds of engagement in condomless intercourse with partners of negative or unknown HIV status included greater internalized HIV stigma [OR (95 % CI) = 1.6 (1.0, 2.6); $p = .03$] and the most popular alter agreeing with either HIV stigma belief [OR (95 % CI) = 43.4 (3.9, 480.3); $p = .004$]. In the model that included HIV stigma among the most similar alters, variables associated with higher odds of engagement in condomless intercourse with partners of negative or unknown HIV status included greater internalized HIV stigma [OR (95 % CI) = 1.6 (1.1, 2.3); $p = .02$], and perception that the most similar alter agrees with either of the HIV stigma beliefs [OR (95 % CI) = 2.7 (1.1, 6.8); $p = .04$].

We computed a final model (see Table 2) that included the measures of agreement with stigma beliefs in both the most popular and most similar alters, and used data from all participants except those who had an alter that was both the most popular and most similar in order to ensure the independence of alter data. Results showed that greater internalized HIV stigma [OR (95 % CI) = 1.7 (1.0, 2.8); $p = .04$] and the most popular alter agreeing with either HIV stigma belief [OR (95 % CI) = 222.2 (7.4, 6675.9); $p = .002$] were associated with higher odds of engagement in condomless intercourse with partners of negative or unknown HIV status, while the interaction of percentage of alters that were isolates and the most popular alter agreeing with stigma beliefs was associated with lower odds [OR (95 % CI) = 0.94 (0.89, 0.99); $p = .02$]. The percentage of alters that were isolates was marginally associated with higher odds of condomless intercourse among participants who did not name any alters which agreed with either stigma belief [OR (95 % CI) = 1.03 (1.00, 1.06); $p = .06$]; this marginal harmful effect of having more isolated network members was reversed among participants whose most popular alter was perceived to agree with either of the stigma beliefs [OR (95 % CI) = 0.97 (0.93, 1.01); $p = .10$], though this result was also marginal.

Discussion

In this sample of African American HIV-positive men, about one-third reported recent condomless sexual intercourse with negative or unknown HIV status partners. This high-risk condomless sex was associated with the participant's own internalized HIV stigma, as well as perceived HIV stigma among their social network members, including stigma from people holding key positions within the participant's social network, and the level of connectedness within the social network seems to influence how stigma from network members relates to condom use.

Similar to other studies (Hatzenbuehler et al., 2011; Radcliffe et al., 2010; Wolitski et al., 2009), our data support the relationship between greater perceived HIV stigma among individuals in one's social network and high-risk condomless intercourse. However, our data are unique in its examination of stigma within the structure of the HIV-positive individual's social network. Perceived alter agreement with such beliefs was associated with condomless sex in bivariate analysis, and multivariable analysis revealed that more dense networks in general serve to protect against condomless sex in the absence of alter stigma. However, the interaction of having any alter who agreed with a stigma belief with network density revealed that the protective aspect of a more dense network with regard to condomless sex dissipates in the context of having an alter who is stigmatizing. Other studies of social determinants of risk behavior have found that more dense social networks are associated with lower risk behavior when network members are characterized as being supportive (Liu et al., 2009). Together these findings suggest that the "safety net" created by a dense social network is strengthened when network members are supportive, but may be weakened when the network includes those who are unsupportive or encouraging of risky behaviors. Our analysis did not include a direct measure of social support, so this hypothesis needs to be pursued by further research to better understand the interplay between network structure and alter traits related to stigma and support and how these influence health behaviors of individuals. For example, is the influence of alter traits, whether supportive or stigmatizing, accentuated in dense networks given the concentration of relationships and potential for increased exposure to the attribute, as opposed to more fragmented networks where influences can be diluted and alters avoided?

Our findings regarding the influence of popular alters and alters who are similar to the respondent further the understanding of how stigmatization from social network members can influence sexual risk behavior. While a general perception of stigma in one's network is influential, specific network members may have the potential to be particularly important. Our data showed that those who reported high-risk condomless sex were more likely to perceive their most popular network member to be stigmatizing towards HIV, which could be a testament to the hypothesis that popular network members have greater influence on the behavior and attitudes of people around them, as suggested by the popular opinion leader model (Kelly, 2004). Our data also show that condomless sex is more likely if the network member most like the respondent is stigmatizing towards HIV; this finding is consistent with theories of social identity and influence (Broadhead et al., 1998), and empirical evidence of the influence of peer norms (Bell et al., 2002), which suggest that our own behavior is influenced by the behaviors we view in our peers and others who are like us.

In addition to the influences of HIV stigma perceived among others, our study, like others (Hatzenbuehler et al., 2011), found that internalized HIV stigma was associated with high-risk condomless sex, even when each measure of alter stigma was controlled for. This finding highlights the potential role that shame, self-esteem, and adjustment to HIV diagnosis may have in determining condom use. One could argue that internalized stigma in itself could account for our findings related to alter stigma, as internalized shame could increase awareness or sensitivity to stigma (Pinel, 1999), rendering someone more likely to perceive others as stigmatizing even if they are not. Internalized stigma can also influence these selection of persons with whom one chooses to interact with and form relationships with, thus influencing the level of support or stigma towards HIV in one's social network. However, the fact that our measures of alter stigma (either independently or in interaction with network density) were significantly associated with condomless sex after controlling for internalized stigma supports the influence of stigma among network members on condom use over and above the influence of internalized HIV stigma.

A number of study limitations should be noted. First, HIV stigma among network members or alters was assessed with regards to only two stigma beliefs (people living with HIV are responsible for contracting HIV, and the virus is a form of punishment), as opposed to a more comprehensive measure that includes other aspects of stigma, which could have resulted in a conservative measure with low sensitivity. The measure assessed the subjective perception of alter stigma from the perspective of the study participant, rather than a more objective measure created by asking network members directly; however, one could argue that it is the perception of the participant that is most relevant in terms of influencing his or her behavior (Moskowitz, 2005). Furthermore, recent studies suggest that respondents can be accurate in describing the characteristics and attitudes of their alters (Green, Hoover, Wagner, Ryan, & Ssegujja, 2014), and this may be particularly so with more extreme and less ambiguous forms of stigma such as those reflected in the two stigma beliefs assessed in this study. Also, network members who are reported by the participant as never talking about HIV are assumed to not have stated the HIV stigma beliefs, nor to agree with these beliefs in our analysis, but these assumptions may not have been directly confirmed by the network member. Another limitation is our inability to make causal inferences from our data; while our longitudinal data set enables us to examine associations and temporal precedence, the observed relationships may be due to third variables that were not measured. Our data did not enable us to distinguish between casual and main sex partners, and other studies suggest that individuals are more likely to use condoms with casual partners than with main sex partners (Reece et al., 2010). Lastly, our analysis of condomless sex combined data from both male and female sex partners, as the low frequency of sex with female partners and associated low statistical power prevented us from being able to adequately examine the empirical relationships with male and female partners separately.

Studies of condomless sex and risk of HIV transmission among people living with HIV must take into account the use of ART and viral load levels, particularly in light of findings from HPTN-052 that showed that undetectable viral load resulting from ART reduces the risk of transmission by 96 % (Cohen, Chen, McCauley, Gamble, & HPTN 052 Study Team, 2011). The vast majority of our sample was on ART, but only half had an undetectable viral, indicating that for many condomless sex did constitute a viable risk for transmission. ART

status and detectable viral load were not associated with reports of condomless sex with negative or unknown status partners in this study, but the findings from HPTN-052 were released only mid-way through this study and may not have penetrated the consciousness of the HIV population until much later. Also, we did not measure our participants' knowledge of pre-exposure prophylaxis (PrEP) use among their sexual partners. To the extent that PrEP is found to be efficacious in preventing new HIV infections, future research should consider using a measure of sexual risk that incorporates use of PrEP, in addition to ART use, viral load, and condom use in studies of people living with HIV.

To summarize, our study data highlight the influence that HIV stigma may have on condom use with partners at risk for HIV transmission among HIV-infected African American men. HIV stigma that is internalized by the HIV-positive individual, as well as perceived HIV stigma among social network members, and in particular network members who are popular or most like the HIV-positive individual, appear to influence high-risk condomless sex. Furthermore, more dense, inter-connected networks can serve a protective function and reduce sexual risk behavior when network members are not stigmatizing. These findings support the value of Prevention with Positives interventions that focus on the HIV-positive individual and helping them to cope effectively with their HIV diagnosis and reduce behaviors that risk transmitting the virus to others (Gore-Felton et al., 2005; Healthy Living Project Team, 2007), as well as social network-based and peer-driven HIV prevention interventions such as those based on the popular opinion leader (Kelly, 2004) and peer change agent (Medley et al., 2009) models. Strategies to promote sexual health among PLHA could target the support provided by the most popular members of their networks, or work with PLHA to examine who they interact with and consider changes that would elevate well-connected, non-stigmatizing network members to greater prominence within the network. Further research is needed to continue to improve our understanding of how social network composition and structure influence individual condom use decisions, as this will facilitate the development of more innovative, nuanced, network-based approaches to HIV prevention.

Acknowledgments

This study was funded by National Institute of Minority Health and Health Disparities (Grant R01MD003964).

References

- Auerbach JD. Principles of positive prevention. *Journal of Acquired Immune Deficiency Syndromes*. 2004; 37(Suppl 2):S122–S125. [PubMed: 15385909]
- Bell DC, Montoya ID, Atkinson JS, Yang SJ. Social networks and forecasting the spread of HIV infection. *Journal of Acquired Immune Deficiency Syndrome*. 2002; 31(2):218–229.
- Bogart LM, Chetty S, Giddy J, Sypek A, Sticklor L, Walensky RP, Bassett IV. Barriers to care among people living with HIV in South Africa: Contrasts between patient and healthcare provider perspectives. *AIDS Care*. 2013; 25(7):843–853. [PubMed: 23061894]
- Bogart LM, Cowgill BO, Kennedy D, Ryan G, Murphy DA, Elijah J, Schuster MA. HIV-related stigma among people with HIV and their families: A qualitative analysis. *AIDS and Behavior*. 2008; 12(2): 244–254. [PubMed: 17458691]

- Broadhead RS, Heckathorn DD, Weakliem DL, Anthony DL, Madray H, Mills RJ, Hughes J. Harnessing peer networks as an instrument for AIDS prevention: Results from a peer-driven intervention. *Public Health Reports*. 1998; 113(S1):42–47. [PubMed: 9722809]
- Choi KH, Ayala G, Paul J, Boylan R, Gregorich SE. Social network characteristics and HIV risk among African American, Asian/Pacific Islander, and Latino men who have sex with men. *Journal of Acquired Immune Deficiency Syndromes*. 2013; 64:496–501. [PubMed: 23933767]
- Cohen MS, Chen YQ, McCauley M, Gamble T. HPTN 052 Study Team. Prevention of HIV-1 infection with early antiretroviral therapy. *New England Journal of Medicine*. 2011; 365:493–505. [PubMed: 21767103]
- Earnshaw VA, Bogart LM, Dovidio JF, Williams DR. Stigma and racial/ethnic HIV disparities: Moving toward resilience. *American Psychologist*. 2013; 68(4):225–236. [PubMed: 23688090]
- Emlet CA. An examination of the social networks and social isolation in older and younger adults living with HIV/AIDS. *Health and Social Work*. 2006; 31(4):299–308. [PubMed: 17176977]
- Gordon CM, Stall R, Cheever LW. Prevention interventions with persons living with HIV/AIDS: Challenges, progress, and research priorities. *Journal of Acquired Immune Deficiency Syndrome*. 2004; 37:S53–S57.
- Gore-Felton C, Rotheram-Borus MJ, Weinhardt LS, Kelly JA, Lightfoot M, Kirshenbaum SB. Project Team NHL. The Healthy Living Project: An individually tailored, multidimensional intervention for HIV-infected persons. *AIDS Education & Prevention*. 2005; 17:21–39. [PubMed: 15843115]
- Gower JC. A general coefficient of similarity and some of its properties. *Biometrics*. 1971; 27:857–871.
- Green HD, Hoover MA, Wagner GJ, Ryan GW, Ssegujja E. Measuring agreement between egos and alters understanding informant accuracy in personal network studies. *Field Methods*. 2014; 26(2):126–140.
- Gyarmathy VA, Neaigus A. The relationship of sexual dyad and personal network characteristics and individual attributes to unprotected sex among young injecting drug users. *AIDS and Behavior*. 2009; 13(2):196–206. [PubMed: 17690975]
- Hatzenbuehler ML, O’Cleirigh C, Mayer KH, Mimiaga MJ, Safren SA. Prospective associations between HIV-related stigma, transmission risk behaviors, and adverse mental health outcomes in men who have sex with men. *Annals of Behavioral Medicine*. 2011; 42(2):227–234. [PubMed: 21533623]
- Healthy Living Project Team. Effects of a behavioral intervention to reduce risk of transmission among people living with HIV: The healthy living project randomized controlled study. *Journal of Acquired Immune Deficiency Syndromes*. 2007; 44(2):213–221. [PubMed: 17146375]
- Herek GM, Capitanio JP, Widaman KF. Stigma, social risk, and health policy: Public attitudes toward HIV surveillance policies and the social construction of illness. *Health Psychology*. 2003; 22(5):533. [PubMed: 14570537]
- Janssen RS, Holtgrave DR, Valdiserri RO, Shepherd M, Gayle HD, De Cock KM. The serostatus approach to fighting the HIV epidemic: Prevention strategies for infected individuals. *American Journal of Public Health*. 2001; 91(7):1019. [PubMed: 11441723]
- Kalichman SC, Simbayi LC, Jooste S, Toefy Y, Cain D, Cherry C, Kagee A. Development of a brief scale to measure AIDS-related stigma in South Africa. *AIDS and Behavior*. 2005; 9(2):135–143. [PubMed: 15933833]
- Kelly JA. Popular opinion leaders and HIV prevention peer education: Resolving discrepant findings, and implications for the development of effective community programmes. *AIDSCare*. 2004; 16(2):139–150.
- Latkin CA, Forman V, Knowlton A, Sherman S. Norms, social networks, and HIV-related risk behaviors among urban disadvantaged drug users. *Social Science and Medicine*. 2003; 56(3):465–476. [PubMed: 12570967]
- Liu H, Feng T, Liu H, Feng H, Cai Y, Rhodes AG, Grusky O. Egocentric networks of Chinese men who have sex with men: Network components, condom use norms, and safer sex. *AIDS Patient Care and STDs*. 2009; 23(10):885–893. [PubMed: 19803695]

- Maiorana A, Kegeles S, Fernandez P, Salazar X, Caceres C, Sandoval C, Coates T. Implementation and evaluation of an HIV/STD intervention in Peru. *Evaluation and Program Planning*. 2007; 30(1): 82–93. [PubMed: 17689315]
- McCarty C. Structure in personal networks. *Journal of Social Structure*. 2002; 3(1):20–26.
- McCarty C, Bernard HR, Killworth PD, Shelley GA, Johnsen EC. Eliciting representative samples of personal networks. *Social Networks*. 1997; 19(4):303–323.
- Medley A, Kennedy C, O'Reilly K, Sweat M. Effectiveness of peer education interventions for HIV prevention in developing countries: A systematic review and meta-analysis. *AIDS Education and Prevention*. 2009; 21(3):181–206. [PubMed: 19519235]
- Meyer IH. Minority stress and mental health in gay men. *Journal of Health and Social Behavior*. 1995; 36:38–56. [PubMed: 7738327]
- Moskowitz, GB. *Social cognition: Understanding self and others*. New York: Guilford Press; 2005.
- Pinel EC. Stigma consciousness: The psychological legacy of social stereotypes. *Journal of Personality and Social Psychology*. 1999; 76(1):114. [PubMed: 9972557]
- Radcliffe J, Doty N, Hawkins LA, Gaskins CS, Beidas R, Rudy BJ. Stigma and sexual health risk in HIV-positive African American young men who have sex with men. *AIDS Patient Care and STDs*. 2010; 24(8):493–499. [PubMed: 20673080]
- Reece M, Herbenick D, Schick V, Sanders SA, Dodge B, Fortenberry JD. Condom use rates in a national probability sample of males and females ages 14–94 in the United States. *Journal of Sexual Medicine*. 2010; 7(s5):266–276. [PubMed: 21029384]
- Tsai AC, Bangsberg DR, Kegeles SM, Katz IT, Haberer JE, Muzoora C, Weiser SD. Internalized stigma, social distance, and disclosure of HIV seropositivity in rural Uganda. *Annals of Behavioral Medicine*. 2013; 46(3):285–294. [PubMed: 23690283]
- Wolitski RJ, Pals SL, Kidder DP, Courtenay-Quirk C, Holtgrave DR. The effects of HIV stigma on health, disclosure of HIV status, and risk behavior of homeless and unstably housed persons living with HIV. *AIDS and Behavior*. 2009; 13(6):1222–1232. [PubMed: 18770023]

Table 1

Multivariable logistic regression analysis of internalized and alter HIV stigma measures as predictors of condomless intercourse with negative and unknown HIV status partners

Independent variables (predictors)	Engagement in condomless intercourse	
	OR (95 % CI)	Standardized beta
Internalized HIV stigma	1.6 (1.1, 2.4) *	0.30
Any alter agrees with stigma belief	1.0 (0.3, 3.2)	−0.01
Network density	0.9 (0.9, 1.0) ^a	−0.57
Density × any alter agrees with stigma belief	1.1 (1.0, 1.3) *	0.42
Age	1.0 (1.0, 1.1)	0.00
No high school degree	0.3 (0.1, 1.2)	−0.26

*
 $p < .05$

^aDue to the presence of the interaction in the model, this odds ratio represents the effects of network density among participants who did not report any alters agreeing with stigma beliefs. Among participants who did report alters agreeing with stigma beliefs, the odds ratio (95 % CI) of network density is 1.05 (0.97, 1.13); $p = .25$. The two odds ratios are statistically different per the interaction

Multivariable logistic regression analyses of internalized HIV stigma and perceived HIV stigma from most popular and similar network members as predictors of condomless intercourse with negative and unknown HIV status partners

Table 2

Independent variables	Condomless intercourse (stigma from most popular alter)		Condomless intercourse (stigma from most similar alter)		Condomless intercourse (stigma from most popular alter and most popular alter)	
	OR (95 % CI)	Std. beta	OR (95 % CI)	Std. beta	OR (95 % CI)	Std. beta
Internalized HIV stigma	1.6 (1.0, 2.6) *	.31	1.6 (1.1, 2.3) *	0.28	1.7 (1.0, 2.8) *	0.32
Percentage of alters who are isolates	1.0 (1.0, 1.0)	.25	–	–	1.03 (1.00, 1.06)	0.38
Most popular alter agrees with stigma belief	43.4 (3.9, 480.3) **	.90	–	–	222.2 (7.4, 6675.9) **	1.29
Most similar alter agrees with stigma belief	–	–	2.7 (1.1, 6.8) *	0.23	0.4 (0.1, 2.4)	–0.21
Percentage of alters who are isolates × most popular alter agrees with stigma belief	1.0 (0.9, 1.0)	–0.60	–	–	0.94 (0.89, 0.99) *	–0.80
Age	1.0 (0.9, 1.0)	–0.06	1.0 (1.0, 1.0)	–0.07	1.0 (0.9, 1.0)	–0.15
No high school degree	0.3 (0.1, 1.2)	–0.28	0.3 (0.1, 1.0)	–0.29	0.6 (0.1, 2.9)	–0.10

* $p < .05$;

** $p < .01$