ann. behav. med. (2015) 49:865–872
DOI 10.1007/s12160-015-9724-1

ORIGINAL ARTICLE

# Social Network Characteristics Moderate the Association Between Stigmatizing Attributions About HIV and Non-adherence Among Black Americans Living with HIV: a Longitudinal Assessment

**Laura M. Bogart, PhD**[1,2,3] · **Glenn J. Wagner, PhD**[3] · **Harold D. Green Jr. PhD**[3] ·
**Matt G. Mutchler, PhD**[4,5] · **David J. Klein, MS**[1] · **Bryce McDavitt, PhD**[4,5,6]

**Abstract**

***Background*** Stigma may contribute to HIV-related disparities among HIV-positive Black Americans.

***Purpose*** We examined whether social network characteristics moderate stigma's effects.

***Methods*** At baseline and 6 months post-baseline, 147 HIV-positive Black Americans on antiretroviral treatment completed egocentric social network assessments, from which we derived a structural social support capacity measure (i.e., ability to leverage support from the network, represented by the average interaction frequency between the participant and each alter). Stigma was operationalized with an indicator of whether any social network member had expressed stigmatizing attributions of blame or responsibility about HIV. Daily medication adherence was monitored electronically.

***Results*** In a multivariate regression, baseline stigma was significantly related to decreased adherence over time. The association between stigma and non-adherence was attenuated among participants who increased the frequency of their interactions with alters over time.

***Conclusions*** Well-connected social networks have the potential to buffer the effects of stigma.

**Keywords** Adherence · African American/Black · Discrimination · Disparities · HIV/AIDS · Social networks · Stigma

## Introduction

A central goal of the US National HIV/AIDS Strategy is to reduce HIV disparities, in large part by increasing the proportion of Black Americans living with HIV who have an undetectable HIV viral load by 20 % [1]. Compared to other races/ethnicities, HIV-positive Black Americans are less likely to be diagnosed, to be engaged in care, to receive and adhere to antiretroviral treatment, and to show viral suppression [2–5].

A key step to reducing disparities recommended by the US National HIV/AIDS Strategy is to reduce HIV-related stigma and discrimination. A recent literature review concluded that stigma contributes to HIV disparities from diagnosis to survival [6]. Qualitative and quantitative studies suggest relationships between perceived discrimination experiences and stigma due to HIV serostatus, and lower antiretroviral therapy adherence [7–10]. A wealth of studies outside of the behavioral HIV research field similarly indicate that perceived discrimination is a significant stressor that has detrimental effects on health and health behaviors [11].

Discrimination is a social process, between a perpetrator and a target. A substantial number of HIV-related discrimination events occur in the context of interpersonal relationships,

✉ Harold D. Green, Jr.
hgreen@rand.org

[1] Division of General Pediatrics, Department of Medicine, Boston Children's Hospital, Boston, MA, USA

[2] Department of Pediatrics, Harvard Medical School, Boston, MA, USA

[3] Health Unit, RAND Corporation, 1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138, USA

[4] Department of Sociology, California State University, Dominguez Hills, Long Beach, CA, USA

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

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

enacted by people who are known to the target [12–17]. For example, in qualitative interviews, people living with HIV have described friends and family members who ask them to use separate or disposable tableware, not to touch children, or not to prepare food [12, 13, 15]. A study of a convenience sample of 181 HIV-positive Black men who have sex with men found that 17 % reported being ignored, excluded, or avoided by people close to them, and 18 % reported being insulted or made fun of because of their serostatus in the past year [18].

Few studies have investigated potential moderators of the association between perceived discrimination and non-adherence, especially at the social network level. Social support, which can buffer the impact of stress on physical and mental health symptoms [19], may similarly moderate the effects of discrimination, a type of stressor [20–22], on non-adherence. Although research has established the buffering role of social support [19] on physical and mental health, few studies have examined health behaviors such as adherence specifically. In the one pilot study we identified, peer victimization was associated with lower medication adherence among children with inflammatory bowel disease, and positive social interactions with other children buffered this association [23]. Further, few studies examining the buffering effects of social support have used social network methods to examine whether capacity for engaging with different sources of social support at the structural, network level (i.e., extent and types of linkages within a person's social network) can serve as a resilience factor above the effects of functional social support (i.e., the level and quality of support available to a person) [24]. Social network structures characterized by strong relationships are associated with a range of health benefits, but few studies have examined the mechanisms by which social network structure may be related to health outcomes [24].

The present research examined the extent to which capacity for social support measured at the social network level moderated the effects of HIV stigma on non-adherence over time, controlling for the effects of functional social support and individual-level socio-demographic covariates previously found to be associated with non-adherence. Consistent with the stress buffering hypothesis [19], it was hypothesized that stronger social network capacity for support and greater functional social support would be protective against the negative effects of stigma on non-adherence. Capacity for social support was conceptualized as ability to leverage social support based on structural characteristics of the network (i.e., strong linkages between self and alters), which would allow for a safety net of individuals that could provide support in the face of stressors. Perceived HIV discrimination was operationalized as stigmatizing attributions of responsibility and blame to people living with HIV advanced by social network members (i.e., "alters," the members of a person's close social circle). Stigma expressed by alters may be particularly damaging, as individuals may depend upon alters for support in some domains (e.g., for relationship issues), while facing stigma from the same alters in other domains (e.g. on health issues). Research indicates that individuals who have negative interactions with members of their social network (e.g., unsympathetic/insensitive behavior) show decrements in mental health, including lower well-being and greater distress [25], as well as worse physical health over time [26].

## Methods

### Participants and Procedures

A total of 246 Black Americans living with HIV were recruited from August 2010 to September 2012 in Los Angeles, CA. Participants were screened by telephone or in-person on the following eligibility criteria: (1) self-identify as African American or Black; (2) HIV-positive; and (3) aged 18 or older. Participants were purposively sampled from non-clinic locations and non-health services settings (e.g., transportation voucher and food bank lines) to obtain a range of individuals who were both engaged and not engaged regularly in HIV care.

The present paper focused on adherence to antiretroviral treatment, operationalized as electronically monitored adherence (see below). Participants who were not on antiretroviral treatment at baseline ($n$=25) were not eligible for the present analysis. None of the remaining 221 participants were lost to follow-up. However, participants were excluded from the present analysis if they did not provide adherence data ($n$=73; due to equipment malfunction or loss of the adherence monitoring device), or if they did not provide survey data ($n$=1), resulting in a final sample of 147.

Participants completed an audio computer-assisted self-interview (ACASI) at baseline and 6 months post-baseline in a confidential space at an AIDS service organization, after which an interviewer guided participants through the social network measures. Adherence was electronically monitored for 6 months post-baseline. Participants received $50 for participation at baseline, $30 at 6 months post-baseline, and $10 for each of two check-in appointments (at 2 and 4 months post-baseline, to download electronic adherence data and update contact information). For tracking purposes, participants provided their phone numbers, email addresses, and residential addresses, as well as contact information of (and permission to contact) others who might know their whereabouts (e.g., personal contacts, healthcare and social service providers).

Participants provided written informed consent as well as a Health Insurance Portability and Accountability Act (HIPAA) form for release of medical record information (HIV viral load). Institutional review board approval was obtained from the RAND Corporation. The National Institutes of Health issued a Certificate of Confidentiality.

### Assessment

**Survey** Participants reported their date of birth (from which age was derived), race/ethnicity, gender identity (i.e., male, female, male-to-female transgender, female-to-male transgender), sexual orientation identity (i.e., heterosexual, gay, bisexual, or something other than heterosexual), annual household income, employment status, highest level of education, housing status, and incarceration history (i.e., whether they had been placed in the criminal justice system in the last 3 months).

Functional social support was measured with the 19-item MOS Social Support Survey [27], which assesses how often different types of support (i.e., emotional/informational, tangible, affectionate, and positive social interaction) are available if needed, using a response scale of 1=none of the time, 2=a little of the time, 3=some of the time, 4=most of the time, and 5=all of the time ($\alpha$=.97). For example, items assessed the availability of "someone to give you good advice about a crisis"; "someone to take you to the doctor if you needed it"; "someone who shows you love and affection"; and "someone to have a good time with." Functional social support change was derived by subtracting baseline from 6-month averages.

**Social Network Assessment** Using established procedures for an egocentric network approach [28–30], at baseline and 6 months post-baseline, participants were asked to list 20 social network members (alters) with whom they had contact sometime in the past year (at baseline) and in the last 6 months (at follow-up), in-person or by phone, mail, or email. To protect confidentiality, participants were asked to list initials rather than full names. 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" and were prompted by the interviewer until they listed 20 alters. For example, participants who listed less than 20 alters were told, "We have [number] more people to name. Are there any other people whom you haven't named already? Think about people who you come into contact with regularly in your family and community, and people involved with your HIV care and support." While there is likely a large amount of variation in individuals' personal network sizes, research has demonstrated that 20 alters reliably captures the variability of most network characteristics [31].

To assess social network structure, participants indicated the strength of ties between themselves and each alter, from which we calculated structural social support capacity. To assess usual interaction patterns with alters, participants were asked, "How much do you see, talk to, or email with [initials] in a typical month?" from 0=never to 4=every day or nearly every day; average interaction frequency rating across alters was derived. Social network change in social support capacity was derived by subtracting baseline from 6-month values of average interaction frequency.

HIV stigma within networks was operationalized as alters' stigmatizing attributions of blame or responsibility to people living with HIV, using items adapted from a study of individual-level HIV stigma [32]. Participants were asked whether they had heard each alter express either or both of the following two beliefs indicative of stigmatizing attributions: "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." If participants stated that they had heard an alter express a stigmatizing attribution, they were asked how often the alter had expressed the attribution on the scale, 0=not at all/never, 1=a little bit (one to two times), 2=sometimes, and 3=often. Following Herek et al. [32] and because responses were highly skewed, we dichotomized responses as 0=never and 1=ever/at least once. We further combined the beliefs into one measure of HIV stigmatizing attributions for the network with an indicator of whether participants had heard any alter express at least one of the two HIV stigmatizing attributions ($r$=.33, $p$<.001 between the two dichotomized stigma items). We selected these items because they represent beliefs that were relatively prevalent (e.g., endorsed by one quarter to one half) in general US samples in prior research [32], and because they also mirror perceived discrimination and internal attributions by people living with HIV that have emerged in qualitative and quantitative research [12, 13, 33].

Demonstrating construct validity, the dichotomized alter stigma items were each significantly associated with participants' responses to the Multiple Discrimination Scale-HIV, which assesses interpersonal, traumatic, and institutional perceived discrimination due to serostatus ($r$=.16, $p$=.05 for the item about responsibility; $r$=.19, $p$<.05 for the item about punishment) [18]; the combination of both items was marginally associated with the Multiple Discrimination Scale-HIV ($r$=.15, $p$<.10). Furthermore, both items, as well as the combined item score, were significantly associated with individual interpersonal discrimination items on the Multiple Discrimination Scale-HIV, including whether someone insulted or made fun of them due to their HIV in the past year ($r$=.26, $p$<.01 for the item about responsibility; $r$=.37, $p$<.0001 for the item about punishment; $r$=.28, $p$<.001 for the combined items).

**Electronic Monitoring of Adherence** Participants provided electronically monitored adherence data daily for 6 months post-baseline using the Medication Event Monitoring System (AARDEX, Inc.). Participants were given bottle caps that recorded times when their medication bottle was opened. Only one medication was monitored; if more than one medication was prescribed, only the medication with the most complex dosing schedule or the base of the drug regimen was monitored, if all medications had the same dosing schedule [34].

At 2 and 6 months post-baseline, interviewers downloaded electronic adherence data and participants completed a brief survey designed to assess instances in which the cap was not used as intended in the past 2 weeks (i.e., how often the bottle was opened without removing a dose, a dose was taken from a source other than the bottle, and whether multiple doses were removed at a time and pocketed for later use). Data for the past 2 weeks at 2 and 6 months post-baseline were adjusted using these responses for a more valid assessment [35].

The Medical Events Monitoring System software package was used to calculate the percentage of total scheduled doses actually taken, which was dichotomized at ≥85 % of doses taken at each time-point ("optimal adherence"), following research suggesting that adherence at moderate levels may have clinically significant effects on HIV viral load [36–38].

### Statistical Analysis

Multivariate logistic regressions were used to predict dichotomous adherence (operationalized as ≥85 % adherence from 2 to 6 months post-baseline), controlling for socio-demographic characteristics that have been associated with adherence in prior research (i.e., age, gender, education, prior incarceration) [7, 39–42] and initial adherence level (past 2-week adherence at 2 months post-baseline), in order to examine change in adherence.

The main predictor variables were alter stigmatizing attributions of blame or responsibility (referred to as "alter stigma"), functional social support, and structural social support capacity. In the first regression, only main effects were entered. We then conducted two moderation effect regressions, adding each interaction term separately: Baseline Alter Stigma × Functional Social Support Change and Baseline Alter Stigma × Structural Social Support Capacity Change (i.e., average interaction frequency between participants and each of their alters). Odds ratios for each interaction at different levels of the predictors were calculated with post-estimation contrasts of regression coefficients. Post-hoc contrasts of coefficients were used to estimate the effects of alter stigma on adherence at high and low levels of social support change (i.e., increase or decrease to 1 standard deviation above the population mean for social support over time).

## Results

### Participant Characteristics

We first compared the 147 participants included in the present analysis to the 74 eligible participants who were missing electronic adherence data ($n$=73) or a survey assessment ($n$=1). The 147 participants included in the present analysis did not significantly differ from the 74 excluded participants with respect to gender identity, education, recent incarceration, income, employment status, or sexual orientation identity (in Fisher's exact tests), or baseline values of functional social support or average amount of alter interaction (in $t$ tests). However, they were older [$M$ (SD)=48.6 (9.3) vs. 44.3 (9.9), respectively, $t$ test $p$=.002] and more likely to have stable housing (79 % vs. 64 %), Fisher's exact $p$=.02. Participants who were included also were more likely to have stigmatizing alters (33 %) than were those who were dropped (20 %), Fisher's exact $p$=.04.

The average age of the sample was 48.6 (SD=9.3; range=23–69). A total of 24 % were females, 5 % were male-to-female transgender, and 63 % (78 % of the men and 9 % of the women) said they were gay, bisexual, or something other than heterosexual. The sample was composed mainly of individuals of lower socio-economic status, with 65 % ($n$=95) having incomes below $10,000 annually and 91 % ($n$=134) not employed (full- or part-time). The majority (79 %; $n$=116) had a high school degree or equivalent. Over a fifth (21 %; $n$=31) were homeless or not stably housed, and 7 % ($n$=10) had been placed in the criminal justice system in the last 3 months. Participants had been diagnosed with HIV an average of 14.1 (SD=7.3) years.

On average, 33 % reported that at least one alter expressed stigmatizing attributions: 32 % of participants reported that at least one alter said, "Most people with AIDS are responsible for having their illness," and 12 % of participants reported that at least one alter said, "A person with AIDS must have done something wrong and deserves to be punished." Participants were generally in the mid-range of the scale on functional social support at baseline [$M$ (SD)=3.3 (1.0)] and follow-up [$M$ (SD)=3.4 (1.2)], as well as average interaction with alters [$M$ (SD)=2.32 (0.83) at baseline and 2.36 (0.73) at follow-up]. Although all participants were asked to list 20 alters, network size varied across participants ($M$=14.7, SD=5.6, Md=16), possibly due to differences in interviewer elicitation strategies between participants.

Medical records (obtained for $n$=128) indicated that 65 % had an undetectable viral load (<50 copies) and average CD4 cell counts were 591. At 2-month follow-up, 43 % took ≥85 % of doses as prescribed in the past 2 weeks [$M$ (SD)=65 % (32 %)], and at 6-month follow-up, 41 % took ≥85 % of doses as prescribed [$M$ (SD)=63 % (34 %)]. Dichotomous adherence was significantly associated with undetectable (<50 copies) HIV viral load ($r$=.29, $p$=.009) as measured by medical records, suggesting the validity of the adherence assessment.

## Multivariate Logistic Regression: Main Effects Model

As shown in Table 1, the main effects-only multivariate logistic regression controlling for socio-demographic characteristics and network change yielded a significant main effect for alter stigma, indicating that participants who reported at baseline that at least one alter had expressed stigmatizing attributions also showed a lower likelihood of optimal medication adherence over time. The main effects of change in functional social support and change in structural social support capacity were not significant.

## Multivariate Logistic Regression: Moderation (Buffering) Models

The structural social support capacity by stigma interaction was statistically significant, whereas the functional social support by stigma interaction was marginally significant (see Table 1). The structural social support capacity interaction indicated that the negative association between stigma and adherence was significant among participants who decreased the frequency of their interactions with alters over time, but attenuated for participants who had more frequent interactions with alters over time.

The structural social support capacity by stigma interaction is depicted in Fig. 1. The $y$-axis shows the predicted probabilities (i.e., covariate-adjusted probability) of optimal adherence to medications (i.e., ≥85 % of doses taken as prescribed) for four hypothetical populations of people: (1) those with no reported alter stigma and "low" change in social support capacity (i.e., 1 standard deviation below average); (2) those with no reported alter stigma and "high" change in social support capacity (i.e., 1 standard deviation above average); (3) those with any reported alter stigma and "low" change in social support capacity; and (4) those with any reported alter stigma and "high" change in social support capacity. The predicted probabilities were generated from logistic regressions modeling optimal adherence with an interaction between alter stigma and change in social support capacity, controlling for the covariates (age, gender, education, and history of incarceration). The $x$-axis indicates the presence in the network of any alter expressing stigmatizing attributions.

The lines in the middle of the graph show the moderating effect of increased social support capacity with alters over a 6-month period on the relationship between alter stigma and adherence. The dark gray line shows the effects of alter HIV stigma for those with a below-average change (i.e., a decrease to 1 standard deviation below the population mean) in average interaction frequency, indicating that, for participants whose average interaction frequency with alters decreased over time, the adjusted association between alter stigmatizing attributions and adherence was significant and negative (odds ratio

**Table 1** Logistic regressions predicting optimal antiretroviral treatment adherence (i.e., ≥85 % of doses taken as prescribed) with stigma and social support

| | Predictor | Unadjusted OR (95 % CI) | Main effects model adjusted OR (95 % CI) | Moderation model, average alter interaction adjusted OR (95 % CI) | Moderation model, functional social support adjusted OR (95 % CI) |
|---|---|---|---|---|---|
| Individual-level | Baseline adherence | 13.53 [6.08, 30.08]*** | 14.67 [6.19, 34.76]*** | 16.77 [6.83, 41.13]*** | 16.21 [6.68, 39.35]*** |
| | Age | 1.04 [1.00, 1.08] $^{+}$ | 1.02 [.98, 1.07] | 1.03 [.98, 1.07] | 1.02 [.97, 1.06] |
| | Female gender | 1.69 [.82, 3.49] | 1.87 [.71, 4.95] | 1.53 [.57, 4.11] | 1.84 [.68, 4.98] |
| | Education (low) | 1.06 [.48, 2.37] | .90 [.30, 2.74] | 1.08 [.35, 3.38] | .88 [.28, 2.70] |
| | Incarceration, past 3 months | .62 [.15, 2.48] | .70 [.11, 4.29] | .29 [.04, 2.00] | .64 [.10, 4.18] |
| | Functional social support (change) | .96 [.68, 1.35] | .92 [.59, 1.42] | .87 [.55, 1.39] | .70 [.41, 1.19] |
| Alter characteristics | Average alter interaction (change) | 1.06 [.71, 1.60] | 1.45 [.87, 2.42] | .77 [.38, 1.56] | 1.41 [.84, 2.37] |
| | Alter stigma[a] | .36 [.17, .76]** | .32 [.12, .82]* | .24 [.09, .70]** | .33 [.13, .87]* |
| Social support × stigma interactions | Alter interaction × stigma | N/A | N/A | 5.40 [1.53, 19.15]** | N/A |
| | Functional social support × stigma | N/A | N/A | N/A | 2.65 [.95, 7.36]$^{+}$ |

$^{+}p<.10$; *$p<.05$; **$p<.01$; ***$p<.001$

[a] For main effects of stigma with the presence of an interaction in the model, the odds ratio represents the effect of alters' stigmatizing attributions among participants who had no change in social support over time. Per the interaction effects, the negative association of stigma with adherence is attenuated when interaction frequency increases ($p$=.009)

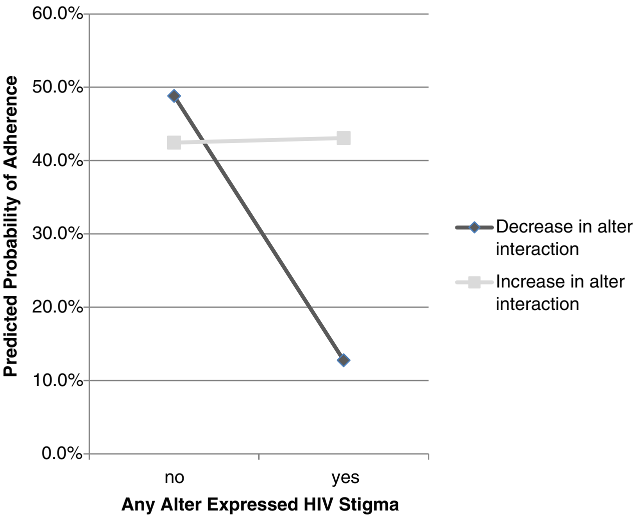

**Fig. 1** Moderating effect of alter interaction frequency on the association between alter stigma and medication adherence. The *y*-axis shows the predicted probabilities of optimal adherence (i.e., ≥85 % of doses taken as prescribed) at four points representing different levels of alter stigma and change in alter interaction frequency. The *x*-axis indicates the presence in the network of any alter expressing stigmatizing attributions. The *lines* show the moderating effect of increased average interaction with alters over 6 months on the association between alter stigma and adherence. The *dark gray line* shows the significant negative relationship between stigma and adherence in the presence of a below-average change (i.e., decrease to 1 standard deviation below the population mean) in average alter interaction frequency, and the *light gray line* shows the non-significant association between stigma and adherence in the presence of an above-average change (i.e., increase to 1 standard deviation above the population mean) in average alter interaction frequency

(OR)=.07, 95 % confidence interval (CI) [.01, .33], $p$=.001). The light gray line shows the covariate-adjusted effects of alter HIV stigma on the likelihood of adherence for those with an above-average change (i.e., increase to 1 standard deviation above the population mean) in alter interaction frequency, and indicates a non-significant association among participants whose interactions with alters increased over time (OR= 1.04, 95 % CI [.28, 3.83], $p$=.95). That is, stigma was not significantly associated with non-adherence when interactions with alters were more frequent over time, suggesting a protective effect of increased interactions with alters.

## Discussion

The present study is the first to operationalize stigma as a phenomenon at the social network level that can be related to health behaviors, and further, to outline conditions under which the association between stigma and health outcomes may be amplified or reduced by structural characteristics of the network. Consistent with prior research [10], our results suggest that HIV stigma is related to medication adherence. Extending prior findings, the present study precisely assessed stigma from specific individual social network members rather than using respondents' global assessments of stigma and examined social network moderators of stigma's statistical effects. Results suggest that social networks with a stronger capacity for social support may help to buffer the relationship between stigma and non-adherence. Notably, the buffering effect of functional social support was only marginally significant.

The present study's longitudinal analysis suggests a direction of the associations among stigma, social network structure, and non-adherence. Alter stigma was measured at baseline, and changes in both social network structure and adherence were assessed over the next 6 months. Stigma was related to non-adherence over time. However, as individuals become more connected from alters and relationships strengthen, stigma may have a weaker association with non-adherence. One critical point to take into account when interpreting these results is that the participants were probably not likely to increase their frequency of interaction with the same alters who expressed stigmatizing attributions at baseline: a post-hoc analysis indicated that participants decreased their frequency of interaction with 44 % of alters who were stigmatizing at baseline, versus only decreasing their frequency of interaction with 27 % of alters who were not. Thus, a potential explanation is that individuals may distance themselves over time from alters who are stigmatizing while simultaneously strengthening other relationships that they perceive to be more supportive of people living with HIV.

Results are consistent with qualitative research suggesting the key role that social support plays in helping individuals overcome the effects of stigma [10, 43]. For example, in a four-country qualitative interview study, family members recounted protecting people living with HIV from friends who stigmatized them by serving as gate-keepers who determined who was and was not allowed to visit the home [43]. Moreover, in qualitative interviews with people living with HIV in South Africa, participants who had supportive family members and employers were more able to cope with internalized stigma and adhere to treatment [17]. Combined with our own results, these prior findings suggest that bolstering perceived social support may be one avenue to decreasing the effects of internalized stigma and discrimination.

Our results expand the large body of research demonstrating that social support acts as a buffer against stress. Research in this vein has mainly focused on functional social support; our study showed that structural social support capacity, including the strength of linkages within social networks, may additionally be protective. Such research has rarely examined health behaviors such as adherence.

The present study has several limitations. Social support capacity was operationalized as perceived interaction frequency between participants and their alters, which may not translate into actual social support receipt. We could not use network size as a valid indicator of social support because the number of alters was capped at 20 (and some participants may have had a larger network). Stigma was assessed with only two items indicating that the participant heard alters express stigmatizing attributions of blame or responsibility toward people living with HIV. We did not assess the context of such conversations or other aspects of stigma (e.g., nonverbal or behavioral discrimination; other verbal insults). Moreover, the distributions of the stigma variables were too skewed to analyze whether greater frequency of hearing such beliefs had a larger effect. Further, a relatively high number of participants ($n=73$) were excluded because they did not provide electronic adherence data; many of those excluded were in unstable living situations, where they may have had difficulties in keeping the electronic medication bottle cap, potentially leading to biases in the sample. In addition, egocentric social network methodologies do not directly assess alter characteristics from social network members themselves. However, research comparing participant and alter reports suggests that such assessments can be valid for key alter characteristics such as HIV status and relationships among alters [44], and that eliciting 20 alters reliably captures the variability of most network characteristics [31]. From a social psychological perspective, just as perceived norms have been shown to be related to HIV risk behaviors [45–49], perceived alter beliefs may be important in determining behavior.

The present study has implications for research on the measurement of discrimination and interventions to reduce stigma and improve adherence. Future studies could examine a greater range of types of discrimination and stigma at the social network level, as well as their relative associations with behavior. For example, people living with HIV are also exposed to traumatic discrimination (e.g., hate crimes), microaggressions (e.g., family members not touching them), and institutional discrimination (e.g., from employers). Future research could also examine qualitatively the mechanisms by which social networks may buffer discrimination and how individuals cope with stigmatizing alters.

A recent review concluded that anti-stigma intervention research has not tested the effects of stigma reduction on HIV-related outcomes such as treatment adherence or HIV-related health outcomes [50]. The results presented here suggest that intervening at the social network level, by teaching skills to strengthen ties to support others, may help to reduce the negative effects of stigma. Ideally, interventions are needed to reduce stigma at the societal level and increase acceptance of people living with HIV. Until such structural-level changes can be implemented, interventions are needed to support the well-being and health of people living with HIV directly, by tapping into their existing interpersonal sources of resilience.

**Acknowledgments** This study was funded by National Institute of Minority Health and Health Disparities R01MD003964. Support for manuscript preparation was also provided by P30 AI060354. We are grateful to the staff of APLA and SPECTRUM, including Charles Hilliard, PhD, for helping with recruitment and for providing interview space; to Frank Galvan, PhD, for contributions to study design; and to Denedria Banks, Erin Cooper, Sean Jamar Lawrence, Alan Meyer, Argelis Ortiz, and Sandi Paffen for research assistance.

**Authors' Statement of Conflict of Interest and Adherence to Ethical Standards** Authors Bogart, Wagner, Green, Mutchler, Klein, and McDavitt declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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