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Network stigma towards people living with HIV/AIDS and their caregivers: An egocentric network study

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Abstract

HIV stigma occurs among peers in social networks. However, the features of social networks that drive HIV stigma are not well understood. The objective of this study is to investigate anticipated HIV stigma within the social networks of people living with HIV/AIDS (PLWHAs) (N=147) and the social networks of PLWHAs' caregivers (N=148). The egocentric social network data were collected in Guangxi, China. More than half of PLWHAs (58%) and their caregivers (53%) anticipated HIV stigma from their network peers. Both PLWHAs and their caregivers anticipated that spouses or other family members were less likely to stigmatise them, compared to friend peers or other relationships. Married network peers were believed to stigmatise caregivers more than unmarried peers. The association between frequent contacts and anticipated stigma was negative among caregivers. Being in a close relationship with PLWHAs or caregivers (e.g. a spouse or other family member) was associated with less anticipated stigma. Lower network density was associated with higher anticipated stigma among PLWHAs' alters, but not among caregivers' alters. Findings may shed light on innovative stigma reduction interventions at the social network level and therefore improve HIV/AIDS treatment utilization.

Keywords

HIV; stigma; egocentric social network; China

Introduction *HIV Stigma*

HIV stigma has served as a long-standing obstacle to uptake and retention in services such as HIV testing and Antiretroviral Therapy (ART) among people living with HIV/AIDS (PLWHAs) (Mahajan et al., 2008). Stigma refers to the social process of labeling individuals based on an undesirable trait that reflects “deviance” from the social norm (Goffman, 2009; Link & Phelan, 2001). Individuals may perceive or experience stigmatising attitudes or actions from their peers through social interactions in the form of avoidance, group exclusion (e.g., rejection of friendship or employment), verbal discrimination, reluctance to

provide help, as well as subtle forms such as fear of receiving adverse treatment from the public (Singh, Chaudoir, Escobar, & Kalichman, 2011; Soliman & Almotgly, 2011). HIV stigma occurs in many settings, including family settings and healthcare institutions, leading to a lack of social support, avoidance of treatment and care (Chesney & Smith, 1999; Mak et al., 2007; Mahajan et al., 2008; Sengupta et al., 2010), and ultimately to poor health outcomes (Mahajan et al., 2008; Sengupta et al., 2010). Individuals who provide care (e.g., spouses, parents, siblings, and children) to PLWHAs are also subject to ‘courtesy stigma’ simply because of their close association to an HIV-infected individual (Wight, Aneshensel, Murphy, Miller-Martinez, & Beals, 2006), resulting in compromised health, mental health, and quality of life (Abler et al., 2013; Liu et al., 2006; Soliman & Almotgly, 2011; Zhou, 2007). In spite of policy initiatives and consequent progress made to reduce discrimination (Han et al., 2010), HIV stigma persists in China. For example, recent studies conducted in Guangxi, China, found that 18% of respondents agreed that PLWHAs should be punished and 40% agreed that PLWHAs should be isolated (Abler et al., 2013).

Social network and stigma

Social networks are defined as a set of members linked by a particular behaviour or social interaction (Scott, 1991). The influence of network members may stem from consensus, as well as from coercion, depending on the type and characteristics of the relationship (Miller & Neaigus, 2001). As peers in social networks typically maintain regular social activities and serve as sources of social support (emotional or tangible support), network members of PLWHAs and their caregivers may also have stigmatising attitudes or actions against them. In other words, social network peers may be one of the sources of stigma towards PLWHAs and their caregivers.

To develop specific HIV stigma reduction interventions, it is important to investigate who these peers are that may possess stigma against PLWHAs and caregivers and what characteristics are associated with their stigmatising attitudes and actions. Previous research on HIV stigma tends to focus on the individual level and little is known about how social network attributes (e.g., types of relationships, social support, and intimate connections) are associated with stigma at the interpersonal level (Liu, Xu, Lin, Shi, & Chen, 2013; Stangl, Lloyd, Brady, Holland, & Baral, 2013). For instance, Stangl et al.'s (2013) systemic review of 48 stigma reduction studies only found two interventions targeted the interpersonal level.

A recent development in HIV/AIDS behavioural research focuses on the association between social network characteristics and network members' behaviours (Rice, 2010; Young & Rice, 2011). For example, past research has demonstrated that different network features (e.g., composition, structure, density, centrality, etc.) are closely related to HIV risky behaviour such as unprotected sex (Kennedy, Tucker, Green, Golinelli, & Ewing, 2012; Kennedy, Wenzel, Brown, Tucker, & Golinelli, 2013); protective behaviour such as disclosure of HIV serostatus (Latkin et al., 2001; 2012); and access to HIV treatment and care such as testing (Huang et al., 2012). Instead of investigating a complete social network (sociocentric network) in a community or population, studies often examine the characteristics of a given person (ego) and his/her “egocentric” or “personal” social network, consisting of peers (alters) that are meaningful to the ego (Friedman et al., 2007; McCarty,

2002). An egocentric network approach is preferable for obtaining sensitive information from stigmatised and marginalized populations because data are collected from one person (ego) as opposed to the entire social network (Zang, He, Liu, 2014). This study lends itself to an egocentric social network study to examine the characteristics of an ego and his/her alters in relation to HIV stigma.

This egocentric network study intends to answer three research questions: (1) To what extent does network stigma occur within the social networks of PLWHAs and their caregivers? (2) What characteristics do PLWHAs and caregivers (egos) possess that make them more likely to be stigmatised by their network alters? (3) Who are the stigmatising alters identified by PLWHAs and caregivers and what social network features are associated with network stigma? Egos were either PLWHAs or caregivers, and network alters were defined as peers who would provide social support to egos. 'Network stigma' was defined as level of HIV stigma anticipated by PLWHAs and caregivers from their network alters. Specific aims of the study include: (1) describing the patterns and levels of network stigma among PLWHAs and caregivers (addressing question one); (2) investigating the relationships between social-demographic characteristics of PLWHAs/caregivers and stigma they anticipated to receive from their social networks (addressing question two); (3) examining the potential influence of social-demographic and network characteristics of alters on network stigma (addressing question three).

Methods

Study procedures and materials were reviewed and approved by the Institutional Review Boards of Virginia Commonwealth University and Guangxi Center for Disease Control and Prevention. All study participants provided written consent before data collection was carried out.

Study sites and subjects

The egocentric social network study was conducted in Nanning, the capital city of Guangxi province in China in 2010-2011 (Liu et al., 2013). Sentinel surveillance data show that the total number of reported HIV/AIDS cases in Guangxi ranks the second highest among all 31 Chinese provinces (China Ministry of Health, 2012). Injection drug use and sexual contact were the major modes of HIV/AIDS transmission in Guangxi.

The study methodology has been reported previously (Liu et al., 2013). Briefly, a two-stage sampling approach was used. Eligibility criteria included PLWHAs who were at least 18 years old and able to participate in a face-to-face interview. At the first stage, we purposefully selected three study sites that provided HIV care and treatment services to the majority of PLWHAs in the city: an infectious disease hospital that was designated to provide care and treatment for PLWHAs, a methadone maintenance treatment (MMT) clinic, and a healthcare center run by PLWHAs volunteers. At the second stage, all eligible subjects were invited to participate in the study. HIV status was confirmed by the surveillance data provided by the Nanning Center for Disease Control and Prevention.

PLWHAs' caregivers were then invited to the study sites to participate in a face-to-face interview in a private room. Caregivers were eligible if they were: (1) the primary caregivers to the indexed HIV-positive participants, (2) 18 years or older, and (3) HIV negative. Among the 170 PLWHA and caregiver dyads, 20 dyads refused to participate in the study, and two dyads and one HIV-infected individual were excluded because of missing stigma and social network data. A total of 147 PLWHAs and 148 caregivers were included in the analytic sample of the present study.

Measures

The Chinese Social Network Questionnaire (CSNQ) was used during face-to-face interviews with PLWHAs and their caregivers. The CSNQ was first created in English and then translated into Chinese by multiple research team members who are fluent in both languages. The research team also conducted an extensive review of the questionnaire to ensure cultural appropriateness.

Ego characteristics—PLWHAs and caregiver participants reported their demographic characteristics, including gender, age, highest level of education completed, and marital status. HIV/AIDS knowledge regarding HIV transmission and prevention was measured with an 11-item scale (0-11, where each item was recorded as 1=yes, 0=no or don't know) with a higher composite score (defined as the total number of correctly answered items) indicating better HIV knowledge. We created and successfully used this scale in our previous studies (Li, Liu, Li, Lou, Koram, & Detels, 2011; Liu et al., 2006).

Social network characteristics—Our study focused on two social networks including PLWHAs' networks and their caregivers' networks. The CSNQ (Liu et al., 2009) was used to measure network properties. First, PLWHAs and their caregivers were asked to provide nicknames of individuals they knew, who knew them, and who would provide tangible and emotional support under six scenarios (e.g., lend money to the ego, take care of the ego if confined to bed, and keep secrets if the ego confided in them). Second, information on each alters' demographic characteristics, such as sex, age, education, and marital status, was collected to show PLWHAs' and their caregivers' network composition. Third, network structure of the two egocentric networks was indicated by: (1) ego-alter relationship (e.g., partner, parent, sibling, friend, neighbor, colleague, etc.); (2) length of the specified relationship (<3 years vs. ≥3 years (based on the Chinese culture, a relationship that lasts three years or longer is considered as a stable relation); and (3) ego-alter contact frequency (i.e., daily, a few times a week, a few times a month, or less than once a month). Finally, network density was calculated as the total number of actual ties divided by the total number of possible ties (Kennedy et al., 2012).

Ego anticipated network stigma—PLWHAs' and their caregivers' anticipated HIV stigma was measured from their network alters on three 0-4 likert scales (0=not likely, 1=not sure, 2=somewhat likely, 3=very likely, and 4=definitely): *If this particular alter knew that you were HIV positive or there was an HIV infected member in your family, how likely would he/she (1) get estranged from you; (2) stop providing help or support to you or your*

family and; (3) look down on you? The three types of HIV stigma were selected based on our previous studies in China (Liu et al., 2009; Liu et al., 2006; Liu et al., 2013).

Data analysis

All analyses were performed with SAS 9.3 (SAS Institute Inc., Cary, NC). Descriptive analyses were conducted for ego and alter demographic variables, HIV knowledge, network composition, structure and density, and anticipated network stigma (addressing research question one).

We performed negative binomial (NB) regression analysis to investigate if egos' socioeconomic characteristics were associated with the number of stigmatising alters perceived by PLWHAs and caregiver egos (addressing research question two). NB regression was used instead of Poisson regression because it is more appropriate for over-dispersed count data (Allison, 2012). In order to adjust for the influence of network size on the number of alters anticipated to stigmatise egos (i.e., larger social networks may have more stigmatising alters), network size was treated as an “offset” in the NB regression models. The level of the association was measured by the estimated regression coefficient in an exponential form, $\exp(\beta)$, and its 95% confidence interval (95% CI) for each explanatory variable in the NB model. An inclusion of one (1) in the 95% CI indicates that the association is not statistically significant ($p > 0.05$).

In addressing research question three, we assessed the potential influence of alters' characteristics and network components on network stigma. The dependent variable was binary (alters who were believed by egos to have at least one type of stigma were coded as 1; alters who anticipated no stigma were coded as 0). Since alters' responses were correlated within each egocentric network, Generalized Estimating Equation (GEE) models were used, taking into consideration dependent observations within each egocentric network (Diggle, Heagerty, Liang, & Zeger, 2002). We estimated odds ratios (ORs) and their 95% confidence intervals (95% CIs) to assess the association between network stigma and variables related to alters' socio-demographic characteristics and network components.

Results

Ego and alter characteristics

Seventy percent of 147 PLWHA participants were male, and 61% of 148 caregivers were female (Table 1). The mean age for PLWHAs was 41.2 years (SD = 11.6) and 38.0 years (SD = 11.2) for their caregivers. Only 23% of PLWHAs and 36% of caregivers completed a high school education or higher. The majority of PLWHAs (70%) and their caregivers (80%) were married. The mean HIV knowledge score was 9.7 (SD = 2.7) among PLWHAs and 9.5 (SD = 2.7) among caregivers. Of the 148 caregivers, 37% were PLWHAs' spouse, 28% were their brother or sister, 25% were their parents, and 10% were other relationships (e.g., grandparents, brother in law, or sister in law).

The PLWHA egos reported 940 network alters, and caregiver egos nominated 990 alters (Table I). Slightly more than half of PLWHAs' alters (55%) and caregivers' alters (51%) were male. In both networks, alters who were 45 years old or older were the largest group

(35% and 33% among PLWHAs' and caregivers' alters, respectively) and alters younger than 25 years of age were the smallest age group (9% and 13% of PLWHAs and caregivers, respectively). One third (32%) of PLWHAs' alters and 36% of caregiver's alters received a high-school education. More than 80% of PLWHAs' and caregiver's alters were married.

Characteristics of social networks

The average network size was 6.4 (940/147) for PLWHA egos and 6.7 (990/148) for caregiver egos (Table 1). Within both PLWHAs' and their caregivers' support networks, immediate and extended family members constituted the largest group of alters; friends and peers were the second group; and all other types of relationships such as neighbors, colleagues, teachers, and doctors were grouped together. Ten percent of alters were the spouses of egos, 58% were egos' other family members such as parents and siblings, 20% were egos' friends, and 10% had other relationships with ego such as neighbor, colleague, or doctor. More than 90% of alters had a relationship with their egos for longer than three years. About one third of PLWHAs' alters (35%) and caregivers' alters (32%) maintained daily contact with ego, while 15% and 20% of alters had less than monthly contact with ego. Network density was similar for PLWHAs and their caregivers (mean density=0.3).

Network stigma

This study asked PLWHA and caregiver egos to report three types of anticipated stigma from their social network. Specifically, we asked which alters would (1) become estranged from egos; (2) stop providing assistance to egos; and (3) look down on egos. More than half of PLWHAs (58%) and their caregivers (53%) anticipated receiving at least one type of HIV stigma from their network peers. Among the 147 PLWHA egos, 44% anticipated all three types of stigma from their network alters, 9% indicated two types of stigma, 6% anticipated only one type of stigma, and 42% anticipated no stigma from their alters. For the 148 caregivers, 39% believed that they would experience all three types of stigma from alters, 5% anticipated two types of stigma, 10% indicated only one type of stigma, and 47% did not think they would receive any stigma from alters.

The number of alters anticipated to stigmatise PLWHAs and caregivers varied in their personal networks (Table 1). Forty-two percent of PLWHA egos and 47% of caregiver egos reported that less than 10% of their alters would stigmatise them if they knew the ego was HIV positive or had an HIV-infected family member; 42% of PLWHA egos and 29% caregiver egos anticipated that 11% to 50% of their alters would stigmatise them; and 16% of PLWHA egos and 24% of caregiver egos believed that over half of their network alters would stigmatise them.

The majority of alters (about two-thirds) were not perceived by PLWHA egos to possess stigmatising attitudes. Of the 940 alters in the PLWHAs' egocentric network, 25% were believed to estrange their egos once they learnt about ego's HIV status and 19% would stop providing assistance or look down on egos. Among 990 alters in the caregivers' egocentric networks, 22% would estrange their egos or stop helping them and 24% were anticipated to look down on their egos. Sixteen percent of PLWHAs' alters and 17% of caregivers' alters would likely show all three types of stigma toward their egos, approximately 4% of the

PLWHAs' and caregivers' alters would display two types of stigma, and 6% of PLWHAs' alters and 7% of caregivers' alters would possibly possess one type of stigma towards their egos.

Ego-alter relationships and stigma

Table 2 summarizes alters in the social networks of PLWHAs and caregivers who would possess stigma against egos. PLWHAs' alters and caregivers' alters showed very similar network stigma patterns. As the reported relationships went from close (spouse and other family) to far (friends, colleagues, neighbors, etc.), the proportion of alters who were anticipated to stigmatise egos increased. Compared to spouses and other family members, more friends, colleagues, and neighbors in the two egocentric networks were believed to hold stigma against their egos.

Relationship between egos' social-demographic characteristics and anticipated network stigma

Table 3 presents the results of the two NB models (one for PLWHAs and the other for caregivers). After controlling for network size, we found that social demographic characteristics and HIV knowledge were not significantly associated with number of possible stigmatising alters in the PLWHA network. Only one of the caregivers' characteristics, age (estimated $\exp(\beta)=1.06$, $p < 0.01$), was significantly related to the anticipated number of stigmatising alters in their network; indicating that older caregivers anticipated more alters with stigmatising attitudes.

Relationships between alters' social-demographic and network characteristics and network stigma

Table 4 shows the results of the two GEE models. The demographic characteristics of PLWHAs' alters, including age, sex, education, and marital status, were not significantly associated with the odds of stigma. Two network features showed a significant association with network stigma. Lower network density was associated with higher odds of anticipated stigma ($OR = 0.07$, $p = 0.01$). The network feature of ego-alter relationship was also significantly associated with anticipated stigma among alters of PLWHAs. Compared to friends, spouses ($OR = 0.07$, $p < 0.01$) and other family members ($OR = 0.22$, $p < 0.01$) were less likely to show stigmatising attitudes or actions toward PLWHA egos. Although it did not reach statistical significance, network stigma was negatively associated with the frequency of contacts.

Caregivers' alters who were not married showed a lower odds of stigma ($OR = 0.49$, $p < 0.01$) than married ones. Alters who kept contact with their egos less than once a month ($OR = 3.11$, $p < 0.01$) showed a significantly higher odds of stigma compared to alters who maintained daily contact with their egos. While other alters in the network did not show a significantly higher odds of stigma than friends, spouses ($OR = 0.07$, $p < 0.01$) and other family members ($OR = 0.14$, $p < 0.01$) reported a significantly lower odds of stigma.

Discussion

We found that more than half of the PLWHAs and their caregivers in this study anticipated stigmatising attitudes and actions from their network members. Ego-alter relationship was the most significant predictor of the level of stigma that PLWHAs and their caregivers anticipated from their network members. As the ego-alter relationship expands outward from spouse and other family members, to friends and other relationships, anticipated stigmatising attitudes and actions towards PLWHAs and their caregivers grew stronger. Caregivers' alters who were not married and kept at least monthly contact with egos had a lower level of anticipated network stigma.

Stigma towards PLWHAs and courtesy stigma toward their caregivers exists within their close social networks. As soon as PLWHAs and their caregivers step outside the family arena, they are more likely to encounter stigma from people in their social networks who can serve as their sources of tangible or emotional support. Close to two-thirds of the PLWHAs and caregivers in our study anticipated receiving stigma from their network alters, which is similar to HIV stigma among the general public in the same region (Abler et al., 2013). What our study adds is that we helped identify who the stigma senders are – about half of non-kin alters and less than 20% of kin alters. No medical professionals were considered as caregivers in this study. As medical professionals form an important and unique source of support for PLWHAs and their caregivers, future research is needed to address issues related to possible stigma possessed by medical providers. As pointed out by Liu et al. (Liu et al., 2013), what is unique about Chinese PLWHAs' treatment and support seeking is the safety net formed by HIV-affected families. In China, families are obligated to provide tangible and emotional support to PLWHAs or their caregivers. This traditional value may explain why PLWHA and caregiver egos anticipated less stigma from close family members. However, family apparently cannot satisfy all social and medical needs of PLWHAs and their caregivers. Anticipated network stigma may restrict PLWHAs and caregivers to smaller and similar connections, forcing them to forgo support of a more dynamic network outside of the family realm. The consequences of restricted and more homogenous networks may potentially impede optimal HIV medical care (Latkin et al., 2001; Latkin et al., 2012).

Network density indicates the degree of cohesion within a certain social network, and past research has concluded that stigmatised individuals tend to keep small social networks without diverse foci, which severely limit their source of support (Carter & Feld, 2004). For PLWHAs in our study, lower density or less cohesive networks were associated with a higher odds of anticipated stigma from alters. However, this finding cannot be applied to the caregivers' alters. Both PLWHAs and caregivers in our study kept small family oriented social networks as their primary source of support. However, PLWHAs appear even more confined within the family support system. The cohesion of their support networks matters because they may try to avoid the risk of being stigmatised by non-kin alters. As PLWHAs' networks extend beyond the family realm and become more diverse, PLWHAs may be more likely to experience stigma. Staying within the family protection net where people are highly connected saves them from stigma, but limits their potential to obtain new relationships and social support. On the contrary, whether alters knew each other had no effect on caregivers' anticipated stigma. Their caregiving responsibility may force them to reach out to diverse

people to provide necessary care regardless of whether or not they are cohesive. However, future studies need to explore the reasons for the different findings between PLWHAs and their caregivers.

Our cross-sectional study could not determine the time sequence between network stigma and network features. Unlike the length of the ego-alter relationship and network density, contact frequency can be altered by anticipated stigma. Alters may still keep their previous relationship with ego, but reduce the amount of interaction upon learning of an ego's HIV status or association to a HIV positive person (Liu et al., 2009). Similarly, egos may also reduce contact frequency with alters due to fear of stigma and discrimination from alters once their HIV status or association with a HIV positive person is disclosed (Smith, Rossetto, & Peterson, 2008). Frequent contact was associated with less network stigma among both PLWHAs and caregivers, but the relationship was only statistically significant among caregiver egos. One possible explanation is that it may be more difficult for PLWHAs to increase or maintain contact frequency with alters since HIV positive status is more stigmatised than being related to a HIV positive family member in China (Liu et al., 2013). As suggested by previous evidence, frequent contact between stigmatised individuals and the “public” may be one way to establish and maintain meaningful relationships (Kennedy et al., 2012; Kennedy et al., 2013), as well as reduce existing stigma (Corrigan, Morris, Michaels, Rafacz, & Rüsçh, 2012). Reduced contact frequency may inhibit the potential to create new relationships through alters leading to less diverse networks and more social isolation.

Past literature shows that stigma and discrimination toward PLWHAs and caregivers can be attributed to multiple characteristics such as gender, education background, and income in addition to HIV status (Link & Phelan, 2001). However, our study showed little association between ego's socio-demographic characteristics and network stigma. One interesting finding is that level of egos' and alters' education, as well as egos' HIV knowledge showed no relationship with stigma. That is, no matter how educated you are and how well you understand HIV, stigma from peers was believed to occur. Previous research has demonstrated that training in HIV knowledge does not always remove HIV stigma, especially within the Chinese culture (Huang et al., 2012). According to Abler et al.'s study of HIV stigma in Guangxi, knowledge of HIV transmission is fairly widespread in China (Abler et al., 2013), indicating that the lack of knowledge and fear of infection may not be the main cause. Stigma against PLWHAs and their caregivers could be rooted deeply in China's unique social and cultural context (Zhou, 2013).

We need to interpret these findings under the context of the study limitations. First, a cross-sectional analysis cannot establish causal inferences between ego and alter characteristics and network stigma. Second, other forms of stigma beside the three types reported in this study may be necessary to capture a complete picture of the various manifestations of stigmatising attitudes and actions toward PLWHAs and their caregivers from their close social networks. Third, alters' stigmatising attitudes towards egos were indirectly measured by egos, not directly measured from alters, leading to possible discrepancy between ego-anticipated stigma from alters and alter-reported stigma. Future research needs to address this discrepancy. Finally, large regional differences exist in China and this current study

only captured network stigma in one area. Results may lack generalizability in other localities and cultures.

Despite these limitations, our study has important theoretical and practical implications, including conceptualizing and mapping stigma within PLWHAs' and their caregivers' social networks. In addition, it provides specific future directions for HIV stigma reduction interventions in China's endeavor to improve access to HIV/AIDS related care and treatment, reduce new infections, and enhance PLWHAs and their caregivers' quality of life. Past stigma reduction interventions in China are limited and have mainly focused on the individual level (Lau, Tsui, & Chan, 2005; Li, Liang, Wu, Lin, & Guan, 2013; Li, Lin, Guan, & Wu, 2013) of healthcare providers (Li et al., 2013; Wang et al., 2009; Williams et al., 2006) or students (Lau et al., 2005; Li et al., 2011; Yiu et al., 2010), ignoring critical mechanisms like social relationships (Smith & Baker, 2012). Social network analysis provides a platform for addressing HIV stigma in multiple socio-ecological mechanisms (Kennedy et al., 2012). As part of the effort to optimize HIV treatment and care in China and other parts of the world, stigma reduction interventions need to break out from the family-based support net and to improve interpersonal interactions between PLWHAs, caregivers, and individuals in their broader social context, including people in their living environment, work places, and health professionals.

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Table 1

Characteristics of egos and alters and perceived network stigma.

Network egos	PLWHAs (n=147)		Caregivers (n=148)	
	<i>n</i>	(%)	<i>n</i>	(%)
Sex				
Male	103	(70.1)	58	(39.2)
Female	44	(29.9)	90	(60.8)
Age, Mean (SD)	41.2	(11.6)	38.0	(11.2)
Education				
Elementary School or less	38	(25.9)	34	(23.0)
Middle School	75	(51.0)	61	(41.2)
High School or more	34	(23.1)	53	(35.8)
Marital Status				
Married	103	(70.1)	118	(79.7)
Unmarried	44	(29.9)	30	(20.3)
Network size, Mean (SD)	6.4	(2.4)	6.7	(2.4)
HIV Knowledge, Mean (SD)	9.7	(2.7)	9.5	(2.7)
Perceived network stigma by ego				
No stigma	61	(41.5)	69	(46.6)
1 type of stigma	9	(6.2)	14	(9.5)
2 types of stigma	13	(8.8)	8	(5.4)
3 types of stigma	64	(43.5)	57	(38.5)
Proportion of alters who would stigmatise egos in ego's network				
0–10% stigmatising alters	62	(42.2)	69	(46.6)
11–30% stigmatising alters	29	(19.7)	19	(12.8)
30–50% stigmatising alters	32	(21.8)	24	(16.2)
50–70% stigmatising alters	10	(6.8)	17	(11.6)
70–100% stigmatising alters	14	(9.5)	19	(12.8)
Network alters	PLWHAs (N=940)		Caregivers (N=990)	
	<i>n</i>	(%)	<i>n</i>	(%)
Sex				
Male	520	(55.3)	501	(50.6)
Female	420	(44.7)	489	(49.4)
Age (years)				
<25	87	(9.2)	127	(12.8)
26–35	293	(31.2)	259	(26.2)
36–45	231	(24.6)	273	(27.6)
>45	329	(35.0)	331	(33.4)
Education				
Elementary School or less	166	(17.7)	216	(21.8)
Middle School	471	(50.1)	423	(42.7)

Network egos	PLWHAs (n=147)		Caregivers (n=148)	
	<i>n</i>	(%)	<i>n</i>	(%)
High School or more	303	(32.2)	351	(35.5)
Marital Status				
Married	772	(82.1)	801	(80.9)
Unmarried	168	(17.9)	189	(19.1)
Relationship with egos				
Spouse	92	(9.8)	104	(10.5)
Other Family	569	(60.5)	576	(58.2)
Friends	200	(21.3)	211	(21.3)
Others*	79	(8.4)	99	(10.0)
Network density, Mean (SD)	0.3	(0.1)	0.3	(0.2)
Length of relationship with egos				
3 years or less	61	(6.5)	79	(8.0)
More than 3 years	879	(93.5)	911	(92.0)
Contact frequency with egos				
Daily	331	(35.2)	315	(31.8)
Few times/week	221	(23.5)	278	(28.1)
Few times/month	243	(25.9)	198	(20.0)
Less than monthly	145	(15.4)	199	(20.1)
Type of stigma perceived by egos				
Alter would estrange ego	235	(25.0)	217	(21.9)
Alter would stop helping ego	181	(19.3)	216	(21.8)
Alter would look down on ego	179	(19.0)	233	(23.5)
Number of alters who would stigmatise egos				
No stigma	692	(73.6)	708	(71.5)
1 type of stigma	54	(5.7)	70	(7.1)
2 types of stigma	41	(4.4)	40	(4.0)
3 types of stigma	153	(16.3)	172	(17.4)

* including colleagues, neighbours, doctors, etc.

Table 2

Network stigma on ego-alter relationship.

Relations to egos	PLWHAs' alters (N=940) n, %			Caregivers' alters (N=990) n, %				
	No stigma	1 type*	2 types	3 types	No stigma	1 type	2 types	3 types
Spouse	86 (93.5)	3 (3.3)	3 (3.3)	0	96 (97.3)	3 (2.9)	1 (1.0)	4 (3.9)
Other family	467 (82.1)	37 (6.5)	15 (2.6)	50 (8.8)	464 (80.6)	33 (5.7)	13 (2.3)	66 (11.5)
Friends	111 (55.5)	6 (3.0)	15 (7.5)	68 (34.0)	99 (46.9)	24 (11.4)	12 (5.7)	76 (36.0)
Others**	28 (35.4)	8 (10.1)	8 (10.1)	35 (44.3)	49 (49.5)	10 (10.1)	14 (14.1)	26 (26.3)

* 1 type: Alter indicated any one of the three types of stigma;

2 types: Alter indicated any two of the three types of stigma;

3 types: Alters were stigmatising on all three types of stigma;

** including colleagues, neighbours, doctors, etc.

Table 3

Negative binomial regression analysis of the relationships between the number of stigmatising alters and egos' characteristics.

	PLWHA egos (N=147)			Caregiver egos (N=148)		
	<i>Exp(β)^a</i>	<i>95% CI^b</i>	<i>P Value</i>	<i>Exp(β)</i>	<i>95% CI</i>	<i>P Value</i>
Sex (ref: male)	1.85	(0.77, 4.43)	0.17	1.79	(0.69, 4.66)	0.23
Age	0.98	(0.95, 1.02)	0.30	1.06	(1.02, 1.11)	<0.01
Education (ref: high school)						
Elementary School or less	1.57	(0.55, 4.45)	0.40	1.39	(0.40, 4.82)	0.60
Middle School	1.80	(0.75, 4.33)	0.19	1.67	(0.60, 4.62)	0.32
Marital Status (ref: married)	2.33	(0.94, 5.78)	0.07	2.68	(0.85, 8.50)	0.09
HIV knowledge (0–11)	0.89	(0.77, 1.04)	0.13	1.01	(0.86, 1.18)	0.94

^a $\exp(\beta)$ was computed by exponentiating the estimated regression coefficients from negative binomial regression analysis.

^b 95% confidence interval for $\exp(\beta)$.

Associations of network stigma with alters' social-demographic and network characteristics, analysed with Generalized Estimating Equations.

Table 4

	PLWHAs' alters (N=940)			Caregivers' alters (N=990)		
	OR	95% CI	P Value	OR	95% CI	P Value
Sex (ref: male)	0.93	(0.70, 1.25)	0.65	0.96	(0.76, 1.21)	0.72
Age (ref: >45)						
<25	1.04	(0.50, 2.16)	0.92	1.23	(0.72, 2.11)	0.45
26-35	1.07	(0.69, 1.68)	0.76	1.00	(0.68, 1.47)	0.99
36-45	1.32	(0.89, 1.94)	0.17	1.18	(0.80, 1.75)	0.40
Education (ref: high school)						
Elementary School or less	1.02	(0.56, 1.86)	0.94	1.03	(0.65, 1.61)	0.91
Middle School	1.25	(0.86, 1.82)	0.24	1.08	(0.78, 1.50)	0.63
Marital Status (ref: married)	0.83	(0.54, 1.29)	0.41	0.49	(0.30, 0.78)	<0.01
Relation (ref: friends)						
Spouse	0.07	(0.02, 0.21)	<0.01	0.07	(0.03, 0.17)	<0.01
Other family	0.22	(0.14, 0.37)	<0.01	0.14	(0.09, 0.22)	<0.01
Others	1.70	(0.91, 3.17)	0.10	1.05	(0.70, 1.58)	0.81
Network Density	0.07	(0.01, 0.52)	0.01	1.27	(0.20, 8.14)	0.80
Length of Relationship with Egos (ref: 3 years or less)						
More than 3 years	1.22	(0.56, 2.65)	0.62	0.88	(0.54, 1.44)	0.61
Contact Frequency with Egos (ref: daily)						
Few times/week	1.01	(0.59, 1.71)	0.98	1.28	(0.74, 2.20)	0.38
Few times/month	1.11	(0.66, 1.87)	0.70	1.69	(1.08, 2.64)	0.02
Less than monthly	1.30	(0.69, 2.46)	0.41	3.11	(1.70, 5.67)	<0.01