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Dynamic social support networks of younger black men who have sex with men with new HIV infection

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Abstract

Rising rates of HIV-infection among younger black men who have sex with men (YBMSM) in the United States have generated a public health emergency. Living with HIV requires deep and persistent social support often available only from close confidants. Enlisting endogenous support network members into the care of HIV-infected YBMSM may help shape sustainable supportive environments, leading to long-term improvements in mental and HIV-specific health outcomes. The present study examined trends in support network change over time after new HIV diagnoses among fourteen YBMSM. Participants completed a social network survey that utilized sociograms to record support confidants (SCs) preceding HIV diagnosis and at one and nine months post-diagnosis. Reported SCs included family of origin, friends, sex partners, and other associates. Analysis revealed three distinct patterns of change: high gain, high turnover, and stable networks. These patterns offer valuable insights into the social support of YBMSM during the period following diagnosis. This research underscores a growing movement to embrace key support figures in the lives of YBMSM, who may be critical to promoting overall health and adherence to HIV-care.

Introduction

HIV incidence among younger black men who have sex with men (YBMSM) in the United States increased by 48% between 2006–2009 – more than in any other age, race, or risk group (Prejean et al., 2011). This disparity is driven by a complex syndemic of environmental, psychosocial, and network factors (Dyer et al., 2012; Feldman, 2010; Laumann & Youm, 1999; Oster et al., 2011) that also predict poor engagement in care and virologic failure (Christopoulos, Das, & Colfax, 2011; Giordano et al., 2007).

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Current strategies to increase engagement in care among YBMSM often focus on exogenous support systems including peer outreach (Hightow-Weidman et al., 2011; Magnus et al., 2010) and intensive case management (Wohl, Garland, et al., 2011). While effective, these programs are resource-taxing and may be difficult to support in the long-term (Hidalgo et al., 2011; Mugavero, Norton, & Saag, 2011). Harnessing existing social support networks of HIV-infected individuals offers a promising alternative, whereby the close confidants of a patient are recruited to enhance his or her adherence to care. Social support networks can play a powerful role in the well-being of HIV-infected persons by attenuating the burdens of treatment and social stigma, and by affecting positive changes in health behaviors (Burgoyne, 2005; Buttram, Kurtz, & Surratt, 2012; George et al., 2009; Wohl, Galvan, et al., 2011).

This approach emerges from social network theory, which dictates that individuals are embedded within distinct social networks that vary based on dyadic and structural metrics (Bandura, 1986; Laumann, 1973; Valente, 2010). Within these networks, behavior change is possible through naturally existing mechanisms of influence that operate via exchanges of information, support, and other social relations (Akers, 1973; Barrington et al., 2009; Davey-Rothwell & Latkin, 2008; Schneider et al., 2013). These mechanisms also draw on a model of social support positing that interpersonal transactions of various forms (e.g., emotional, financial) may mediate the achievement of HIV-specific outcomes, including sexual risk reduction, medication adherence, and retention in care.

Living with HIV requires deep and persistent social support; support often available from existing *confidants*–friends, partners, kin and other individuals–with whom one shares personal information and may be influenced by (Elkington, Bauermeister, & Zimmerman, 2011; Foss, Vickerman, Heise, & Watts, 2003). For example, a growing body of evidence suggests that capitalizing on the family networks of HIV-infected or at-risk YBMSM may improve long-term engagement in HIV care and overall well-being (Lauby et al., 2012; Serovich, Grafsky, & Craft, 2011). In a recent study, YBMSM with higher family network proportions engaged in less risk behaviors and even discouraged risk behaviors in their MSM friend networks (Schneider, Michaels, & Bouris, 2012). In short, enlisting endogenous network members in the care plans of HIV-infected YBMSM may help shape a sustainable and deeply impactful supportive environment, while also overcoming the resource limitations of existing strategies.

An important step in recruiting support is the disclosure of one's HIV status. The decision to disclose is a highly individualized process affected by a complex interplay of factors, including relationship dynamics, financial dependencies, and the appearance of disease symptoms (Bird, Fingerhut, & McKirnan, 2011; Kalichman, DiMarco, Austin, Luke, & DiFonzo, 2003, and both disclosure and postponed or non-disclosure are associated with significant levels of anxiety (Overstreet, Earnshaw, Kalichman, & Quinn, 2012; Wohl et al., 2010). In addition to disclosing their HIV status, YBMSM may simultaneously reveal their sexual behavior to unaware network members, potentially causing additional stress and disruption (Latkin et al., 2012).

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Given these factors, the aim of the present study was to evaluate the social support networks of newly HIV-diagnosed YBMSM. To achieve this goal, we (1) employed a network perspective to identify types of network members (e.g., parents, friends, sex partners); (2) evaluated the relative stability and persistence of these relationships over nine months; and (3) detected trends in HIV-status disclosure and their relationship to network dynamics.

Methods

Participants and Recruitment

Data were generated from a cohort of 14 YBMSM newly diagnosed with HIV who were referred from a social network study (Schneider et al., 2013). YBMSM were included if they: (1) identified as Black/African American; (2) were aged 18–30, inclusive; (3) self-reported sexual intercourse with a male partner in the previous 12 months; and (4) had their first confirmed reactive HIV test within three months prior to recruitment. Network variables were collected during interviews following regularly scheduled appointments with an HIV provider. Interviews were conducted by HIV clinic staff with previous training in post-test counseling, crisis management and cultural competency with long-time histories working with YBMSM. All study procedures were approved by two Institutional Review Boards.

Measures

Index Attributes

Structural stability indicators of housing status, employment, and insurance type at time of diagnosis were abstracted from patients' medical records. In addition, CD4 count and viral load at HIV diagnosis were abstracted as indicators of health.

Name generator

We extended the standard *confidant* name generator "Who do you share important information with?" to include "…*and* would you expect to help you out in a time of need?" (Laumann, 1973; Marin, 2004; Marsden, 1987) to ensure the inclusion of network members who provide instrumental and emotional support (Cohen & Wills, 1985). The name generator was limited to ten confidants, as this has been sufficient in eliciting all network members meeting the generator criterion (Burt, Marsden, & Rossi, 1985). The list of network members, referred to hereafter as support confidants (SCs), was reviewed by YBMSM for completeness before proceeding with SC-specific questions.

Network Visualization and Name Interpreter

We used participant-aided network diagrams, or sociograms (Hogan, Carrasco, & Wellman, 2007), to assist in network elicitation. Respondent-directed visualization of personal networks has been demonstrated to improve participation, accelerate name generation, and provide reliable checks for various network measures (Hogan et al., 2007). This technique is engaging, well-suited to resource limited settings, and has been previously employed by the research team (Schneider et al., 2010; Schneider et al., 2012).

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SCs elicited by the name generator were ascribed three attributes. First, YBMSM identified their role in the network by answering the question: "What is your relationship to this person?" A limit of one role per SC was deemed sufficient. Second, a binary variable for "closeness" was used to separate "very close" from "less close" members; "very close" SCs were sketched into the "inner circle" of the sociogram. Third, YBMSM indicated which SCs they had disclosed their HIV status to, which was marked on the sociogram. Participants were also asked to identify alter-alter ties, or ties between network members. This was accomplished by asking "Does A talk to B when you aren't around?" The question was phrased to identify inter-SC relationships that existed independent of the ego-participant's mediation, and these ties were indicated by a line drawn between respective SCs. Data were collected at the first clinical visit after learning their HIV status, 1 month and 9 months (e.g., at t=0, t=1, and t=9, respectively).

Network Analysis

Figure 1 provides standard definitions for each network metric used in the study. These included standard egocentric measures such as size, density, constraint and betweenness, which were calculated for each sociogram at each time point using UCINET (Borgatti, Everett, & Freeman, 2002). The stability of each participant's network was calculated using the following equation (Bien, Marbach, & Neyer, 1991; Han, Ghose, & Iyengar, 2011):

$$\text{Network Stability} = \frac{\text{Number of SCs named at both t=0 and time t=1}}{\text{Number of SCs } i \text{ named at t=0}}$$

Other measures included the proportion of SCs who the participant had disclosed to at each time period and the proportion of SCs in distinct role categories. SCs were consolidated into four categories: (1) family of origin, (2) friend, (3) sex partner, and (4) other.

Descriptive statistics were calculated for network composition and disclosure at each time period, where network composition was evaluated using the proportional value of each SC type. The Wilcoxon signed ranks test was used to compare changes in network composition and disclosure across two periods. Spearman's correlation was calculated to determine the associations for these variables at each sample period. All statistical analyses were conducted using SPSS Version 19 and the level of significance was set at $p < 0.05$.

Results

Respondents & Support Confidants

A total of fourteen individuals were included in the analysis. Table 1 displays the health and structural stability indicators collected for participants. A total of 83 unique SCs were named across all three time periods. Fifty-two SCs were named at time 0, which increased to 62 at t=1 and to 66 members at t=9. Figure 2 summarizes network compositions at each time period. Because the number of SCs designated as "gay" or "play" families was small, these members were typified as "Others" in order to isolate family of origin dynamics. Others also included roommates, pastors, and support group members. Sex partners included former and current partners.

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Composition and Network Metrics

A total of 31 new ties were added to the network between the time of diagnosis and nine months after; 18 of these new SCs were reported at t=1 and the remaining 13 at t=9. Four participants did not gain any SCs over time, and the median increase in network size for the remaining ten participants was 3 [standard deviation (SD) = 1.85]. Eight SCs were lost between t=0 and t=1, including two sex partners, two friends, and four family of origin network members. A single friend SC was gained at t=1 but lost by t=9.

Change in social network metrics including stability, density, constraint and betweenness are presented in Figure 3. The average stability across all fourteen SC networks was 0.83—that is, 40 of the 48 SCs reported at t=0 remained at t=9 (the SCs of two YBMSM for whom network information was unavailable at t=9 are not included here). The average stability across all participants at t=1 was 0.85, and increased to 0.97 at t=9. There was a greater turnover in sex partners, friends, and family of origin network members from t=0 to t=1 (stability 0.71, 0.89, and 0.83, respectively) than from t=1 to t=9 (stability 1.00, 0.95, and 1.00, respectively). While density and constraint averages decreased over time (0.63 to 0.49 for density; 0.71 to 0.53 for constraint), average betweenness increased from 1.42 at t=0 to 4.33 at t=9.

Longitudinal Patterns of Change

Three distinct patterns in network change over time were identified: high gain, high turnover, and stable. Participants with high network gain (n=4) increased their network size by at least four and as many as six new members while losing a maximum of one existing member. These participants had relatively small networks prior to their diagnosis, usually consisting of family of origin and a sex partner. The high gain condition resulted almost exclusively from the adoption of an exogenous supportive network, such as a support group or family of choice, as illustrated in Panels 1 and 2 of Figure 4. High gain networks increased in density over time by inheriting the existing cohesion within the adopted group, and HIV disclosure to SCs was high in this category. Although the change in network size was significant for these participants, it did not affect the stability of their support networks, as measured by the loss of network members.

In a network with high turnover, YBMSM gained and lost approximately the same number of network members. These networks exhibited low stability over time despite little change in overall size, as exiting members were replaced by new SCs. Most participants exhibiting this pattern (n=5) had between three and five SCs before diagnosis, and member loss occurred during the first month after diagnosis. As a whole, this group reported diverse “other” membership before and after diagnosis, including female sex partners, pastors, roommates, and family of choice. Panel 3 in Figure 4 exhibits a sample of this network pattern.

Finally, a portion of participants (n=5) reported zero turnover over the course of the study (a single participant included here reported one new SC but no losses). These networks had high stability measures over time, varied in initial size from 3 to 7, and consisted primarily of friends and secondarily of family of origin. This subset included two YBMSM with the

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lowest disclosure rates, including one who had not disclosed to any network members. An example of this group is presented in Panel 4 of Figure 4.

Disclosure and Network Statistics

Spearman correlations were run for network measures at each time point. At time of diagnosis, density was positively correlated to constraint ($\rho = 0.80$, P = 0.002). At t=1, constraint and density remained positively correlated ($\rho = 0.80$, P = 0.001) and at t=9, the relationship was no longer significant. Results are not reported for constraint and betweenness or density and betweenness because these measures are conceptually similar and negatively correlated.

At t=1, there was a significant negative correlation between the proportion of network members disclosed to and the proportion of friends in the network ($\rho = -0.74$; P = 0.003). There were no other significant associations between disclosure and network composition, density, constraint, or betweenness.

Discussion

The results offer important insights into social dynamics in the critical period after HIV diagnosis, as well as the potential for interventions that harness organic support systems. The changes in egocentric network measures in Figure 3 offer a unique interpretation of the social adaptations made by YBMSM following their HIV diagnosis. One key finding was the overall increase in betweenness in support networks. Betweenness is traditionally used as an indicator of centrality or control within an egocentric network; an individual with high betweenness can better monitor and regulate the flow of information within their network (Freeman, 1979). This position could enable a YBMSM to enforce the confidentiality of his health and behavior – for example, an SC is more likely to learn of the YBMSM's HIV-status directly, rather than from another member. Additionally, greater social control in one's network has been shown to improve assertiveness and health (Cornwell & Laumann, 2011).

Although HIV-status disclosure did not correlate with any of the egocentric metrics, our analysis of support and disclosure patterns is enriched by incorporating indices of social and structural stability. For instance, YBMSM who disclosed their HIV-status early and to more of their SCs had networks with high stability post-diagnosis. One description of network stability is a resilience to perturbations – stable networks tend to revert to baseline conditions following a disruption, indicating adaptability and coherence (Csermely, 2006). Through early and broad disclosure, YBMSM in stable networks demonstrated confidence in their networks to adjust to the knowledge of their HIV status without significant loss of support. Incidentally, participants with stable networks also reported more stable housing and had higher CD4 counts (mean 408 cells/mm^3) upon initiation of HIV care. Resilient networks provide an opportunity for interventions that *include* the SCs of YBMSM with a demonstrated propensity to offer the sustained social support necessary in HIV-care.

Interventions targeting YBMSM with weak support networks could pose a greater challenge. In this study, YBMSM with high gain networks had few SCs at time of diagnosis

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and more often reported unemployment and transient housing. Additionally, they had overall lower CD4 and high viral load results (means = 229 cells/mm^3 and 89,119 copies/mL, respectively). Taken together, these structural and health outcomes indicate fragmented support systems and substantial volatility in the lives of these YBMSM. The "accumulation" of SCs following HIV diagnosis may signify a heightened perception of vulnerability and the need to reach out for support. Moreover, YBMSM with high gain networks reported high rates of HIV status disclosure to their new SCs (27 of 31 new SCs). The support-seeking behavior in this group poses another unique opportunity for intervention wherein a new SC to whom the HIV-infected individual has disclosed to could be recruited to provide personal support and health promotion.

A growing body of evidence suggests that family members, especially parents, can be critical for supporting the health of YBMSM (Bouris et al., 2010; Garofalo et al., 2008; Schneider et al., 2012), including research that fruitfully involves parents to influence the health of young people (Guilamo-Ramos et al., 2011). In the present study, YBMSM reported high family of origin membership (i.e., biological parents and siblings) in their support networks at all three time periods (55% at t=0; 34% at t=1; 42% at t=2). This finding supports the effort to develop family- and parent-based interventions to enhance health outcomes within this population.

While these results augment the current literature on social support networks and HIV-care, important limitations must be noted. First, the small sample restricts external validity and prevents deeper contextualization of network dynamics. Additionally, given the significant personal and social disturbance that receiving an HIV-diagnosis may cause, recall bias may have impacted the construction of participants' support networks prior to their diagnosis (Ferligoj & Hlebec, 1999). Finally, we did not elicit information on the kinds of support perceived or received or the reasons for the addition or loss of SCs, important areas for future research.

Despite these limitations, the present study underscores a growing movement to embrace the position of key support figures in the lives of YBMSM with HIV. Interventions that harness the organic support systems of YBMSM to improve health outcomes, particularly related to HIV infection, offer great promise for long-term efficacy with conservative resource utilization. However, it is important to acknowledge that the time period following HIV diagnosis may entail significant restructuring of social networks, and these dynamics may vary greatly depending on previously existent support conditions. In order to design appropriate and safe interventions, it is key to establish a baseline understanding of these dynamics and patterns. Not only does this information inform the intervention framework, it would assist in thorough process and outcomes evaluation. Future qualitative and quantitative work should seek to deepen our understanding of interpersonal dynamics within the support networks of HIV-infected YBMSM, to inform the development of interventions that improve health outcomes within this population.

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Network Measure	Definition
Size	Number of network members (alters) in ego's network. Limited to ten support confidants (SCs) in this study.
Density	Number of ties in a network expressed as a proportion of total possible ties; the degree that an individual's SCs know each other. (Valente, 2010)
Constraint	Measure of the degree to which alters within the ego's network are connected to other alters in the same network. Low constraint signifies minimal alter-alter connections, so alters are less likely to act or communicate without ego's knowledge and ego has better access to his/her network. (Ronald S. Burt, 1992; Valente, 2010)
Betweenness	The sum of the frequency that ego lies on the shortest paths between alters in the network; measures the degree to which ego occupies a strategic position within his/her network and is able to monitor the flow of information. (Freeman, 1977; Valente, 2010)

Figure 1.
Standard Egocentric Network Measures and Definitions

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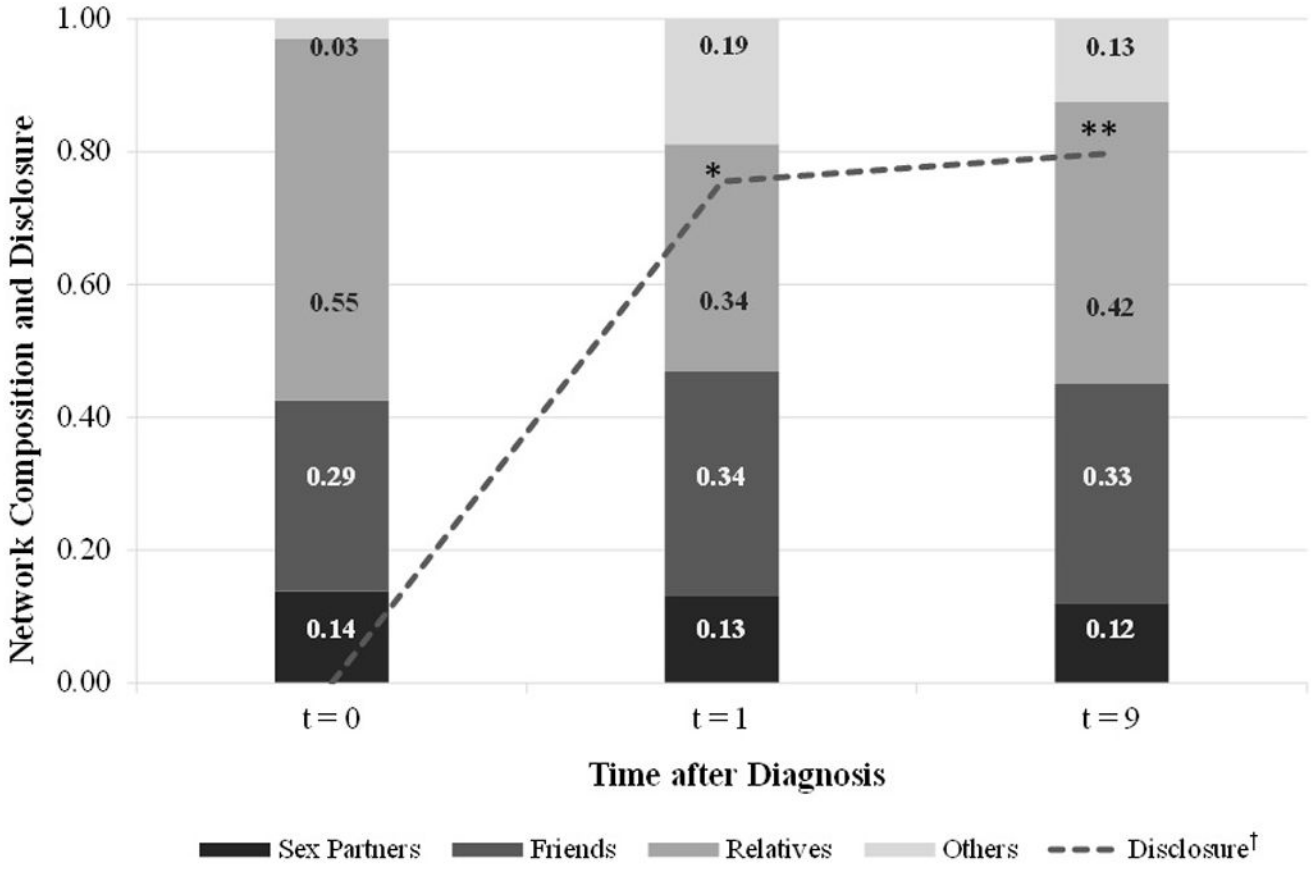

Figure 2. Social network composition and HIV disclosure among newly diagnosed younger black men who have sex with men over time (n=14)

*Change from time 0 significant at ≤ 0.001.

**Change from time 0 significant at ≤ 0.01. No significant change from time 1.

† Disclosure of positive HIV serostatus was always zero at the pre-diagnosis stage, t = 0, though this did not reflect the patient's situation at the time the interview was conducted. To obtain information on the network immediately prior to an HIV diagnosis, clients were asked to identify network members who were part of the support network prior to their diagnosis. No patients were approached during the same visit that they received their positive HIV test results.

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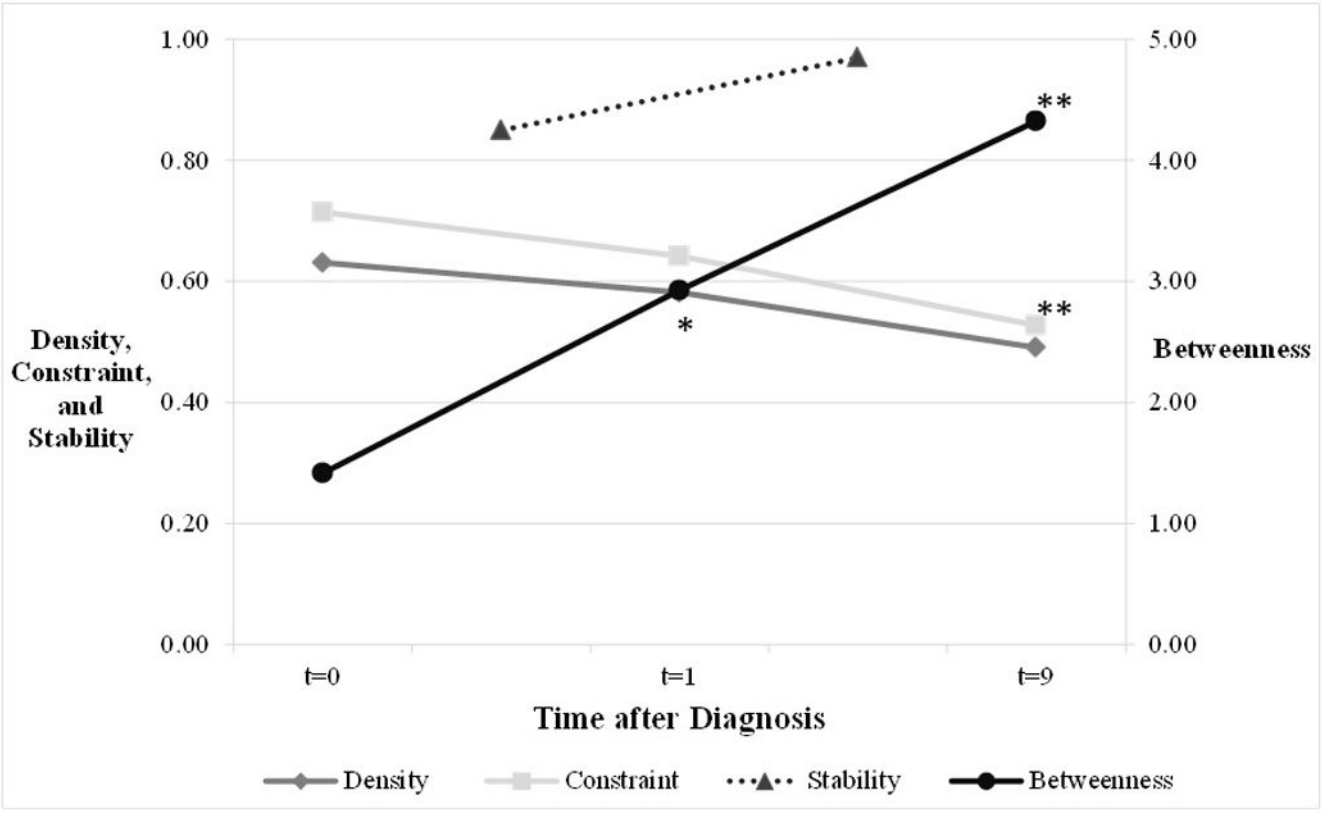

Figure 3. Social network density, constraint, and betweenness among newly diagnosed younger black men who have sex with men over time (n=14)

*Change in betweenness from time 0 significant at ≤ 0.05

**Change from time 0 significant at ≤ 0.05. No significant change from time 1.

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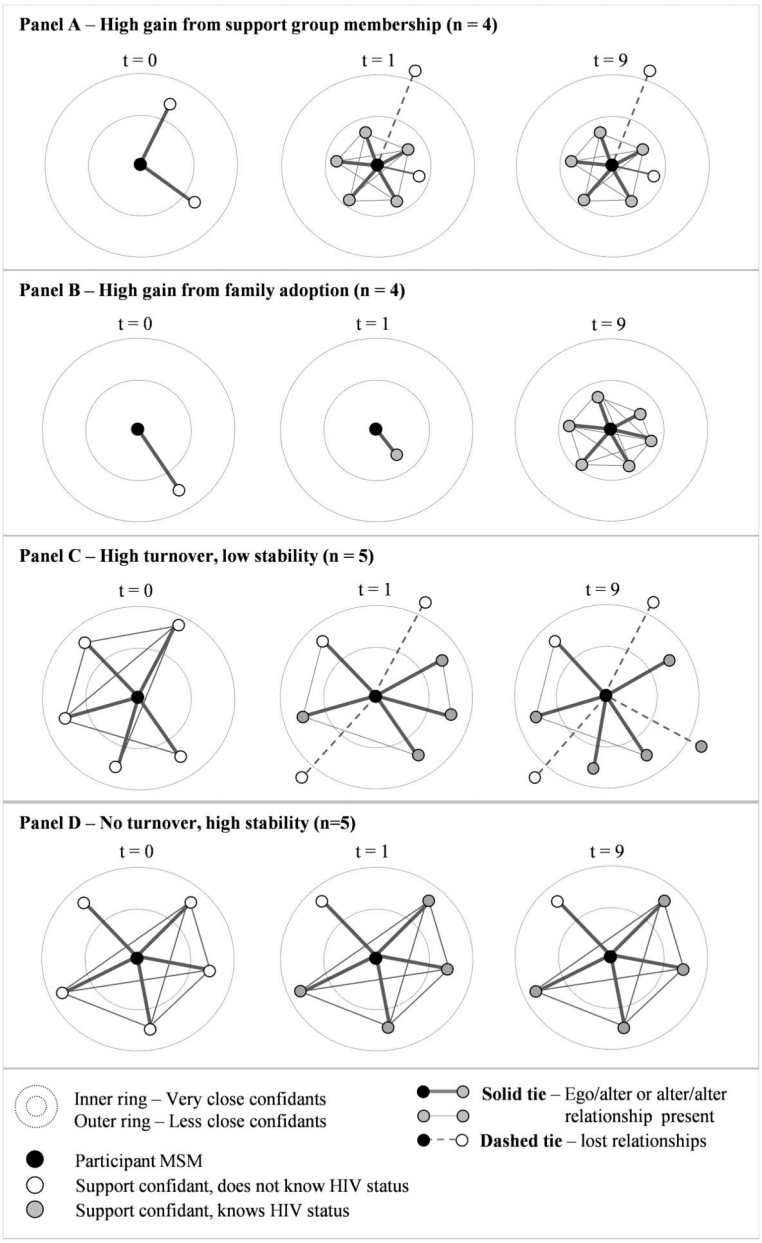

Figure 4.

Trends in the dynamics of the social support networks of newly diagnosed younger black men who have sex with men over time (n=14).

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Table 1

Structural and health characteristics of younger black men who have sex men newly diagnosed with HIV (n=14).

Characteristic	N (%)
Employment	
Student	1 (7)
Employed	4 (27)
Unemployed	9 (67)
Housing	
Permanent	9 (60)
Non-permanent	4 (33)
Insurance	
Private	1 (7)
Public	2 (20)
Uninsured	11 (73)
CD4 upon care initiation	
[Mean (Med)]	360 (372)
Viral Load upon care initiation	
[Mean (Med)]	38,527 (8,670)

*Number non-missing. Percentages may not add to 100% due to rounding. Missing values: Housing – 1