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At the intersection of criminal justice involvement and sexual orientation: Dynamic networks and health among a population-based sample of young Black men who have sex with men

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Abstract

Mass incarceration of young Black men has a significant impact on their network composition and stability that, in turn, may have major implications for health and well-being. A sub-group of young Black men with criminal justice involvement (CJI) identify as gay, bisexual or are non-identified men who have sex with men (hereafter MSM). This paper focuses on the potential effects of CJI on the composition of Black MSM social and sexual networks, their stability over time, and concomitant health and social outcomes. We use data from the UConnect study, a population-based cohort of young Black MSM 16–29 years of age (n=618) selected using respondent-driven sampling in Chicago from 2013–2016. Both confidant and sexual network name generators and interpreters were administered at 9-month intervals over three waves of data collection. Ego and dyadic-level data were collected on behaviors prevalent among MSM and including factors associated with network CJI, network stability, and health outcomes. Generalized Structural Equation Models (GSEM) were utilized to determine the relationship between CJI network composition, network stability and behaviors prevalent among young Black MSM and their networks. In the UConnect cohort, 46% had at least once been detained, arrested or spent time in jail or prison. In addition, 20% of participants reported incident CJI over the study period. Respondents with a history of CJI were significantly more likely to have CJI homophily in their confidant and sexual networks. Multivariate analyses demonstrate that the association between one's history of CJI, housing instability and drug use is partially explained by one's network CJI. In addition, a higher prevalence of network CJI is associated with increased turnover in the confidant network, and this network instability is also related to important health and social outcomes. This analysis describes the networks of criminal justice involved men among a representative sample of young Black MSM and demonstrates the relationship between CJI network homophily, network stability and their impact on several key health and social outcomes relevant to this population.

1. Introduction

In the United States, an estimated 2.3 million people are held in prisons and jails on any given day (Glaze, 2015). In addition, approximately 11 million people cycle through local jails each year (Minton, 2015). Black men are disproportionately affected by criminal justice involvement (CJI), making up 13% of the U.S. male population, but accounting for 38% of the male prison population (Carson, 2015). There is an even greater disparity seen among young men between 18–24 years of age. Black men in the 18–19 and 20–24 age groups have rates of incarceration 10.5 and 6.6 times the rate of white men in the same respective age groups despite constituting nearly 5 times fewer the population size of Whites (U.S. Census Bureau).

Mass incarceration of young Black men can have a significant impact on their network composition and stability that, in turn, can have major implications for health and well-being. A sub-group of young Black men with criminal justice involvement (CJI) identify as gay, bisexual or are non-identified men who have sex with men (hereafter YBMSM). Limited information exists on the composition and dynamics of the social and sexual networks among this sub-group, in particular, the extent to which these men are embedded within networks of CJI MSM, how stable these networks are over time and how these networks are associated with health conditions that disproportionately impact YBMSM such as substance use, housing instability and mental illness. This paper focuses on the potential effects of CJI on the composition of MSM social and sexual networks, their stability over time, and concomitant health and social conditions.

1.1 Intersectionality – Sexual Orientation and Race - within Criminal Justice Involved Contexts

Criminal justice research often focuses on a single social group (i.e. African Americans, women) in attempts to focus on how one group may have different outcomes compared to a reference group or how public health intervention may be differentially applied or targeted (Binswanger, Redmond, Steiner, & Hicks, 2012). Such a focus ignores the complexity of intersectional identities and can result in limited attention to multiple social attributes that can drive the same outcomes of interest. 'Intersectionality' is the study of how multiple systems of social stratification (e.g., race, ethnicity, gender, sexual orientation) influence an individuals' identity and lived experience, recognizing that every person holds a position (privilege or disadvantage) in different systems simultaneously, and that such positions can vary in magnitude and direction depending on time, place, and circumstance (L. Bowleg, 2008; Jones & McEwen, 2000; Purdie-Vaughns & Eibach, 2008). For example, in jail, it is likely that a Black same gender loving man, may be observed as Black, and may move his Black identity to the forefront given the disadvantage that a non-normative sexual orientation might experience. Certainly, this might quickly change if the same individual is detained in a special populations unit that privileges men who have sex with men. Intersectionality also explores how different levels of a social framework influence individuals experiences, including the intrapersonal level (e.g., internalized racism) (Mossakowski, 2003), the interpersonal level (e.g., bias,discrimination) (Kessler, Mickelson, & Williams, 1999), the contextual level (e.g., societal victimization such as hate crimes)

(Klest, 2012), and the macro-level, where structural inequalities (e.g., education, income distribution). The study of intersectionality within institutions has also been examined including health-care contexts and how patients and providers both view and are viewed within health care institutions (Peek et al., 2016).

One of the theoretical questions that arise from intersectionality of Black men who have sex with men in the criminal justice system is whether the intersectionality of race and sexual orientation represents an advantage or disadvantage with respect to ongoing criminal justice involvement, excessive policing or targeting for punishment. In other words, do Black men who have sex with other men experience more criminal justice involvement than Black men who have sex with women only. One could imagine that because of the number of syndemic factors that MSM experience including substance use and interpersonal violence that they would more likely be involved with criminal justice involvement (Wilson et al., 2014). In addition, following basic tenets of social network theory such as homophily, would suggest that MSM are more likely to be in social groups with other men (J. A. Schneider, Cornwell, B., Jonas, A., et al., 2017); which would put them at risk as compared to groups that are more heterogeneous by gender and thus in social proximity to groups that have lower incarceration rates. In recent work, Meyer finds that sexual minority men (including those who self-identify as gay or bisexual) are disproportionately incarcerated as compared to men who identify as straight and report having sex with women only (I. H. Meyer et al., 2017). In this analysis, however, special units are described, however, we do not know to what extent intersectionality plays a role in the lived experiences of sexual and racial minority men. The analyses described here begins that discussion and in particular how these men are engaged with others in their social environment.

1.2 Criminal justice involvement among young Black men who have sex with men

The important role of criminal justice involvement has intensified in the context of Black communities with rapidly increasing rates of incarceration over the past few decades that peaked in 2008 and continue to be higher than anywhere else in the world – with approximately 6.9 million individuals under some form of adult CJ supervision, including 1 in 108 adults incarcerated in jails or prisons and 1 in 35 under some form of correctional control (M. Epperson, El-Bassel, Gilbert, Orellana, & Chang, 2008; Harrison & Beck, 2006; Pew, 2009; PewCenter, 2008). The vast majority of the criminal justice population spends short periods locked-up prior to being returned to community as opposed to longer-term prison settings. While most criminal justice data includes race, sexual orientation and behavior have not been typically collected in most jail settings, and when collected, response bias would likely be an important limitation to the data, given the risk that some sexual minorities can face while incarcerated (Beck AJ, 2010; Dumond, 2000; Hensley, Tewksbury, & Castle, 2003; Saum, 1995). These risks have been much of the focus in prior scholarly work examining MSM in CJI contexts, particularly around HIV risk given concerns that sex, whether it be consensual or non-consensual, can increase chances of HIV acquisition within jails (T. M. Hammett, Harmon, & Rhodes, 2002; Robertson, 2003). More recent data has instead focused on reports of transmission outside of jail and a seminal meta-analysis of determinants of HIV infection has suggested that Black MSM in the US and elsewhere are more than twice as likely to have experienced incarceration as other MSM (Millett et al.,

2012), and CJI is a known factor associated with HIV infection. Recent empirical data has documented high prevalence of CJI among Black men who have sex with men (31% Lim, 60% Brewer, 51% Bland) (Bland et al., 2012; Brewer et al., 2014b; Lim, Sullivan, Salazar, Spaulding, & Dinenno, 2011) and these rates are higher than that of Black men in general, suggesting that there may be other factors driving CJI among YBMSM. It may be that increased rates of substance use, mental health problems and housing instability, or so-called "syndemic factors" (Stall R, 2008; Stall et al., 2003) drive CJI among YBMSM. Alternatively, it may be that network forces, such as homophily may be greater in this population given larger numbers and higher proportions of other Black men in these networks which could increase the numbers of individuals who are criminal justice involved, or who may be experiencing factors associated with CJI such as exposure to violence, substance use and connections to other Black men.

1.3. CJI network homophily

There are high levels of CJI among Black MSM and Black communities due to drug policy and the War on Drugs, racial bias in arrests and sentencing and other structural factors, which may account for the high prevalence of CJI among young Black men and their networks (N Freudenberg, 2001). Because of the high numbers of incarcerated Black men it is not surprising that individuals who have previously experienced CJI are likely connected to others who have experienced CJI. Because of these biases, CJI has a level of randomness that might make network factors less relevant to predicting future CJI in a given individual. On the other hand, because of the density of CJI among young Black men, it may be that social influence resulting from embeddedness in criminal justice involved networks may continue to drive CJI. Much of the literature that has examined homophily in young Black men has examined gang networks and the processes that set-up homophily in experiences of community violence (Papachristos, Wildeman, & Roberto, 2015; Tracy, Braga, & Papachristos, 2016). Group identity, reciprocity (Papachristos, 2009), and assortative mixing patterns (Young, 2011) on attributes related to the characteristics or behavior of interest have been identified as the mechanistic undergirding to homophily. Similarly, among YBMSM experiencing CJI, there are multiplex associations that are shared by these men including being young, Black and living in a segregated community – all of which are related to CJI homophily. In addition, there are other aspects that further drive homophily, which include membership in cultural organizations, such as the House Ball Community (Arnold; Murrill et al., 2008; Phillips et al., 2011), experiencing high levels of community violence (Voisin, Hotton, & Neilands, 2014; Voisin et al., 2007), health conditions such as HIV (Khanna et al., 2016) and higher than average numbers of relationships with other young men in mostly friendship and sexual relationships (Shah et al., 2014). Homophilous attributes or behaviors do manifest in important health outcomes. For example, there is evidence that enabling effects of social network members may affect risk behavior and outcomes (Latkin, Forman, Knowlton, & Sherman, 2003; J. A. Schneider et al., 2013; Skeem, Eno Louden, Manchak, Vidal, & Haddad, 2009). An important area of investigation is the extent to which dynamic attributes (i.e. CJI) at the individual or network level impacts ongoing CJI or other social or health sequelae. This has implications for intervention design and policy which may need to target groups of individuals as opposed to current practices which engage individuals in

service provision. The extent to which homophily of criminal justice involved persons is a major driver of health and social outcomes is unclear.

1.4 CJI and network stability

Another potential driver of incident CJI, which can also be conceptualized as a potential consequence of CJI, is network stability. Network instability may occur during socially disruptive processes and may particularly sensitive to CJI. CJI can alter networks by removing individuals from mutually supportive family and community relationships (N Freudenberg, 2001; Lopoo & Western, 2005; Western, 2000). CJI can also disrupt social networks by causing strain on family and existing friends who are dependent on the individual (Browning S, 2001; Comfort, Grinstead, McCartney, Bourgois, & Knight, 2005). Important life events can impact network turnover (Wrzus, Hanel, Wagner, & Neyer, 2013), and these can in turn impact distal health events (E. Y. Cornwell & Waite, 2009). Increasing evidence suggests that network turnover is higher among Black communities and resilience to the turnover in the form of replacing individuals is lower (B. Cornwell, 2015) among older African Americans.

CJI can also lead to formation of new ties and relationships and introduce individuals into high-risk networks with high levels of drug trade and use (N Freudenberg, 2001; Moore J, 1996). The disruptive effect of CJI on existing intimate partnerships has been well documented. Periods of incarceration disrupt stable sexual relationships, which have been found to protect against new, multiple, and concurrent partnerships (Khan et al., 2009b; Khan et al., 2008). Studies have found associations between CJI, partners with CJI and risky sexual partnerships (Adimora et al., 2004; Adimora et al., 2003; Khan et al., 2015). Most of these studies have focused on heterosexual partnerships.

Given the barriers and complex interactions a formerly incarcerated person must negotiate upon release, the experience of transitioning from the correctional setting to the community is marked by network disruption, which we conceptualize as abrupt and involuntary network change. The network disruptions experienced at the time of detention and release have important health implications for CJI YBMSM and even those connected more distally. Disruptions to social networks through the spread of infectious disease have been described in instances of disasters (e.g. earthquakes, civil wars causing genocide) and are extended to mass incarceration(Golembeski & Fullilove, 2005). For example among young men re-entering the community after detention, an estimated 50% report inconsistent social networks (interactions with different individuals pre- and post-incarceration) (D. W. Seal et al., 2007). The impact of CJI-induced disruptions to social networks has yet to be evaluated and represents a critical factor tied to the effectiveness of HIV prevention and substance-abuse interventions for CJI BMSM. A recent study in the Netherlands examined discussion network stability in Dutch prisoners measured before and after incarceration. They found that discussion networks remained relatively constant in size, however, the majority of network members had changed over the time period studied (an average of 4 months) (Volker B, 2016). Additional work is needed to examine how these network changes impact health and well-being, particularly in vulnerable populations who are targeted by the criminal justice system.

1.5 CJI implications on the health of young Black men who have sex with men

There is great body of research of the detrimental impact of criminal justice involvement on the health and well-being of Black men and their networks. Upon release, formerly incarcerated people face a range of barriers such as a lack of community-based HIV or substance-abuse treatment options, a lack of connectivity between medical records maintained by the correctional facility and those maintained by a community provider, and disruptions in their social and sexual networks (Adimora & Schoenbach, 2005; Butler, 2012). CJI is also associated with negative health and socioeconomic consequences including unemployment, homelessness and poor health. There is a high prevalence of health conditions in CJI populations including HIV, sexually transmitted infections (STI), substance use, prior sexual abuse and assault as a child and adult and mental illness (R. L. Braithwaite & Arriola, 2003; N Freudenberg, 2001; T. M. Hammett et al., 2002). Levels of HIV in incarcerated populations are 3 to 5 times higher than in the general population (Maruschak, 2009). The stress and disruption associated with repeated criminal justice involvement exacerbates ongoing social stressors and heightens CJI's impact upon substance use and HIV risk (Blankenship, Smoyer, Bray, & Mattocks, 2005; Khan et al., 2009a) (M. W. Epperson, El-Bassel, N., Chang, M., & Gilbert, L., 2010; Luther, 2011). Moreover, mental health conditions, addiction, and unemployment upon release from custody disproportionately impact justice-involved people ("Behind Bars II: Substance Abuse and America's Prison Population," 2010; Lisa Bowleg, Teti, Malebranche, & Tschann, 2013; Theodore M Hammett, Gaiter, & Crawford, 1998). These risk factors are also associated with underutilization of antiretroviral therapy which further increases HIV transmission risk (Westergaard, Spaulding, & Flanigan, 2013). Those serving time in the community under probation or parole may, in fact, have higher rates of risk factors, with lesser exposure to HIV education, prevention, and treatment interventions, than among those in custody (Belenko, Langley, Crimmins, & Chaple, 2004). For example, 35% of CJ systems have mandatory pre-release HIV instruction in the context of a constitutional right to HIV medical care (Nicholas Freudenberg, Daniels, Crum, Peridns, & Richie, 2005; Theodore M Hammett et al., 1998; T. M. Hammett, Roberts, & Kennedy, 2001).

HIV is notable among criminal justice involved populations with rates of HIV three to five times the rate of HIV in the general population (Maruschak, 2009; McQuillan et al., 2006). The HIV disparity among men in the CJ system (most of whom have a drug related charge) is well established as a serious public health concern (Boutwell & Rich, 2004; Ronald L Braithwaite, Hammett, & Arriola, 2002; David Wyatt Seal, 2005). Increased prevalence of HIV has been demonstrated in studies of offenders at various levels of CJI, including men on probation or parole (Belenko et al., 2004), formerly incarcerated drug-involved populations (D. W. Seal et al., 2007), and other individuals with history of incarceration (Boutwell & Rich, 2004). The reason for higher rates of infection are multifactorial; what is clear is that HIV transmission while in jail is likely not a major factor in the transmission pathway (Krebs & Simmons, 2002; D. W. Seal et al., 2007; Wohl et al., 2000). The social milieu that exists before and after criminal justice involvement is thus likely a key driver of transmission, which contributes to the astonishingly high rates of HIV for example among Black men who have sex with men (BMSM). Recent data from the CDC suggests that 1 in 2 will become infected within their lifetime (Centers for Disease Control and Prevention,

2015). While there is geographic variability in rates of HIV infection, these rates are similar to the high CJI rates where if current trends continue, 1 in every 3 black males born today will go to prison in their lifetime (Mauer, 2011).

We focus on Black men who have sex with men to examine these phenomena. We do this given the syndemic factors (Stall et al., 2003) that increase their likelihood of incarceration, and the unique composition of their networks which are made up predominantly of other men (J. Schneider, Michaels, & Bouris, 2012). MSM in general are more likely to use substances, experience intimate partner violence and participate in exchange sex than other men (Finneran & Stephenson, 2013; Newman, Rhodes, & Weiss, 2004; Rietmeijer, Wolitski, Fishbein, Corby, & Cohn, 1998; Stall et al., 2001). All of these factors place them at higher risk of CJI. We examine the potential effect that network composition and stability exhibit in this milieu, to what extent they mediate the relationship between CJI and health outcomes men.

We propose that CJI in YBMSM's networks is associated with an individual's level of CJI. The goal of this study is to explore how individual CJI, network level CJI, and network stability are related to future CJI and health outcomes in this unique population that has intersectional identity. Accordingly, we have several questions: 1) What is the relationship between the number (proportion) of people in an individual's network (social and/sexual) with CJI and an individual's CJI at baseline and incident CJI over the study period? 2) What is the relationship between network CJI and network stability, particularly in the context of other YBMSM? 3) What is the relative relationship between individual CJI, network CJI, and network stability with associated health outcomes relevant to YBMSM over time? These questions become important given some of the individual-level interventions that are being considered for CJI related contexts (Grant et al., 2010; Harawa, Sweat, George, & Sylla, 2010; Hedrich et al., 2012; Larney, 2010; Lubelczyk, Friedmann, Lemon, Stein, & Gerstein, 2002; Mouttapa et al., 2010). Examination of the networks that these men are embedded within are critical to understanding the pattern of CJI involvement of these men and how these are related to health outcomes most relevant to this often doubly stigmatized population. Work that follows will advance individual-level interventions just highlighted as these existing interventions are not targeted to CJI men experiencing intersectional identities; an area that needs further consideration and research.

2. Methods

2.1 Setting and Population

The South Side of Chicago is the largest contiguous Black urban community in the US (Chicago Police Department; Chicago Policy Research Team, 2010; Mari Gallagher Research & Consulting Group, 2007). Despite its many assets, the region is burdened by lack of basic resources and structural factors, including highest incarceration rates in the city, that contribute to a number of health problems, including a high HIV prevalence. We use data from the uConnect study, a longitudinal population-based cohort of YBMSM on the south side of Chicago that examines how social and sexual networks affect men's behaviors as well as physical and mental health related to risk of sexually transmitted infections (STIs) including HIV (Khanna et al., 2016; Morgan, 2016).

2.2 Sample Selection

Recruitment for the uConnect study has been described previously (Khanna et al., 2016; Morgan, 2016; J. A. Schneider et al., 2013). Using Respondent Driven Sampling (RDS), a sample of 618 eligible YBMSM were recruited between June 2013 and July 2014. The RDS process was initiated by purposively selecting a diverse group of YBMSM to serve as seeds from which the chains were initiated. A total of 62 seeds were recruited through multiple sources including the House/Ball Community, web sites, Facebook postings, community events, college campuses, clinics and support groups. Each seed and subsequent recruit was asked to recruit other MSM into the sample. Study participants (seeds and their subsequent recruits) were eligible to be interviewed if they: 1) self-identified as African American or Black, 2) were born male, 3) were between 16 and 29 years of age; and 4) reported having had oral or anal sex with a male within the past 24 months. The distribution of the number of respondents successfully recruited was: 0 (6.4%), 1 (44.3%), 2 (24.4%), 3 (15.1%), 4 (5.9%), 5 (2.5%) and 6 (1.4%). Each respondent, whether a seed or subsequent recruit, was offered $60 for his participation in the interview and was told he would receive an additional $20 for each recruit who participated. Sample weights designed to account for unequal probabilities of selection were computed using the Giles Sequential Sampling (SS) estimator as implemented in the RDS package in R (Gile & Handcock, 2010).

## 2.3 Survey instrument development and administration

Development of the survey instrument has been described previously (J. A. Schneider et al., 2013). In brief, the survey instrument included items on sociodemographics, sexual behavior, drug use, confidant networks, sexual networks and attitude questions. A major focus of uConnect data collection is the enumeration and description of the social and sexual networks of YBMSM. The approach to egocentric network data collection followed the National Health, Social Life, and Aging Project (NSHAP) (B. S. Cornwell, P. L.; Laumann, E.O.; Kim, J; Kim, Y.J., 2014), although uConnect added a second sex network generator to the confidant generator used in NSHAP. The uConnect generator used the following item to generate the confidant list:

> "In this next section, we will discuss your close social network, that is, the people with whom you discuss things that are important to you. So I can ask some follow-up questions, please list the names of the people with whom you discuss things that are important to you." In a similar fashion the sex network generator was administered following procedures previously described (Laumann, 1994), with sex partners listed in reverse chronology. After generating a list of the five most recent sexual partners, a further question was asked about any current primary sexual partner. If the respondent gave the name of a current primary partner who was not among the five partners, they were added to roster as a sixth alter. Once both generators had been administered the respondent was asked to compare the list of confidants mentioned earlier with the list of sex partners that they had just named. The two lists were displayed side by side on the computer screen.

The same confidant generator was used in Wave 2 as in Wave 1. After the confidant list had been generated, the respondent was asked if any of the confidants in Wave 2 were the same person as the confidants listed in Wave 1. The list of Wave 1 confidants was displayed next

to the newly generated Wave 2 confidants and matches were indicated by the respondent. The Wave 2 sex partner generator was similar to that used in Wave 1, except that the sex partner generator in Wave 2 referred to sexual partners since the last interview instead of the past six months. Similar to the confidant generator, respondents were then asked to compare sex partners listed with the list of sex partners from Wave 1. They were then asked to compare the names of the Wave 2 sex partners with the Wave 2 confidants and to confirm any that referred to the same person. It should be noted that the respondent was *not* asked to compare the sex partners in Wave 2 with the confidants from Wave 1. [See diagram]

Comparisons of alter lists between network generators and interviews
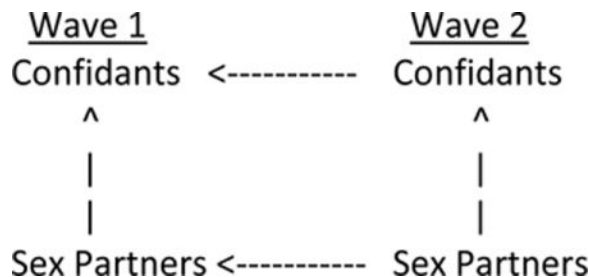
A similar procedure was used in Wave 3, except that the confirmation list was cumulative. For example, respondents in Wave 3 were asked whether any of the confidants listed corresponded to a combined list of confidants and sex partners from the previous interview. And in Wave 3, similarly respondents were asked whether the sex partners listed corresponded to a cumulative list of the confidants and sex partners from the current and previous interview. Name interpreters (range 20–50) were asked regarding the first five confidant and first five sex network members at each wave. Participants were interviewed at three time points approximately 9 months apart. Hereafter we will refer to these data collection time points as Wave 1 (baseline), Wave 2 (9 months) and Wave 3 (18 months).

2.4 Respondent Criminal Justice Involvement measure

History of CJI was self-reported by respondents at the baseline interview. Respondents were asked if they had ever been detained, arrested, or spent time in jail or prison. This was a dichotomous variable of yes/no. Those respondents who reported history of CJI were subsequently asked their age at first incarceration, the number of separate occasions, and the cumulative time they spent in jail or prison during their lifetime (in days, months or years). At the follow up interview, respondents were asked if they had been detained, arrested, or spent time in jail or prison since the date of their last interview. If yes, they were asked the number of times and cumulative time spent in jail since their last visit.

2.5 Confidant and Sex partner incarceration

At the baseline interview, for each sexual partner and confidant alter reported, respondents were asked if that person had ever been detained, arrested, or spent time in jail or prison. This was a dichotomous variable of yes/no. At the follow-up interviews, if the alter was the same person reported in the first wave, they were asked if the alter had been detained, arrested or spent time in jail or prison since the date of their last interview. If the respondent

reported a new alter, they were asked if the alter had ever been detained, arrested or spent time in jail or prison.

2.6 Health Outcomes

Most outcomes were measured as in pilot work for this study (J. A. Schneider et al., 2013). Drug use was asked in the following manner: "Have you used any of these substances in the past 12 months?" Drugs included MDMA, volatile nitrates, cocaine, heroin, psychoactive drugs, methamphetamines, and prescription pain killers. Drug use was a dichotomous measure indicating use of the aforementioned substances in the past 12 months. Marijuana use was measured separate from other drug use. Respondents were asked if they ever used marijuana and frequency of use from several times a day to less than once a year. On the basis of responses to these questions, we coded a 3-level measure of Never, Moderate (less than daily) and Heavy use (once a day or greater) (Morgan, 2016). Depression, anxiety and distress symptoms were analyzed using the Brief Symptom Inventory 18-question survey (BSI-18), a self-report measure of psychological symptoms over the previous week (Derogatis, 2001). For the depression variable, raw scores for the BSI-18 were converted to T-scores and defined as present if the T-score was greater than 62 as in previous research (Mustanski, Garofalo, & Emerson, 2010). Exposure to community violence was measured using the modified Exposure to Violence Probe (Stein, Walker, Hazen, & Forde, 1997), a series of questions assessing the number of times participants had been exposed to community violence in their lifetime. Responses ranged from 0 to 6 or more times. Raw scores were computed by taking the mean of items scores listed and standardized to T-scores following the strategy of previous studies (King, Voisin, & Diclemente, 2015; Voisin, Jenkins, & Takahashi, 2011). HIV infection status was determined by 4th generation, differentiation and viral load testing applied to samples eluted from dry blood spot samples.

Respondents were asked separately whether they encouraged or discouraged other MSM from engaging in the following behaviors: using condoms during anal sex, taking part in group sex, using drugs to make sex easier, last longer or feel better, and drinking alcohol to make sex easier, last longer or feel better. As has been previously described, members of at-risk communities often talk to each other about how to protect themselves. The content of such communications, which we have called intraventions, helps to maintain or establish social norms about health (Friedman, Bolyard, Maslow, Mateu-Gelabert, & Sandoval, 2005; Friedman et al., 2007; Friedman et al., 2004; Friedman et al., 2013; Mateu-Gelabert et al., 2008). An exploratory factor analysis demonstrated that discouraging condom use and encouraging group sex, drug and alcohol use loaded on a different factor from encouraging condom use and discouraging group sex, drug and alcohol use. Scales formed from the two sets of items yielded reliabilities (via Cronbach's alpha) of 0.72 (discouraging risk behavior) and 0.50 (encouraging risk behavior). Since the two alcohol use items were not asked at 18 months, we computed each scale from the remaining three items. These three item scales were highly correlated with scales formed from all 4 items (r = 0.97 for discouraging risk behavior and 0.91 for encouraging risk behavior). Finally, as an exploratory outcome, in the last wave, we asked respondents about involvement in political movements (ie. Black Lives Matter): "In the past 12 months, have you taken part in any protests, marches, or demonstrations related to police brutality or other issues?"

2.7 Additional covariates measured

The uConnect survey instrument measured a wide range of respondent- (ego-) level sociodemographic characteristics, risk and prevention behaviors and socio-structural factors that are potentially associated with history of CJI and health outcomes. Individual-level variables that are utilized in multivariable regression models, and in particular health and risk variables, were selected based upon the existing YBMSM literature. We included respondent age at the time of the interview as a covariate. Sexual identity was collected based upon 21 unique and overlapping categories and due to the low numbers of respondents identifying in several categories (i.e., same gender loving, straight), we operationalized sexual identity into gay, bisexual and other. During instrument development, pilot interviews and cognitive testing of questions was conducted by the Survey Research Lab at the University of Chicago.

2.8 Statistical analysis

The weighted distributions of several demographic and behavioral characteristics were computed, both for the sample as a whole and separately for those with and without a history of CJI. Comparisons between these two subgroups were performed via the appropriate Wald test—either a comparison of subgroup means or test for independence in a two-way table—using the sample weights and robust variance estimates. Because the weighted distributions were very similar to the unweighted distributions (suggesting that the sample is fairly representative), and to avoid relying on the assumptions involved in the calculation of the weights or the resulting loss in precision, the remaining analyses were performed without the weights.

Generalized Linear, Latent And Mixed Models (GLLAMMs) were used to analyze the data from all three waves (Skrondal A, 2004). Let J_{iw} be a binary (0/1) variable with $J_{iw} = 1$ indicating that the ith respondent had been in jail (at least once) at wave w. Similarly, let $A_{ijw} = 1$ indicate that the jth alter (i.e., confidant or sex partner) reported by the ith respondent at wave w had been in jail (as of wave w). We started by using logistic regression to model ($J_{i1} = 1$) as a function of the respondent's age and sexual orientation (both also measured at wave 1). Using the data for confidants only (i.e., excluding sex partners), we then fit a mixed effects logistic regression to $P(A_{ij1} = 1)$ using J_{i1}, age and orientation as covariates, and including a random effect at the respondent level to account for the correlation among multiple wave 1 confidants reported. To further investigate the association between a respondent's jail history and the composition of his network, we fit a second mixed effects logistic regression to ($A_{ijw} = 1$) for $w = 2, 3$ and $j \in$ new confidants at wave w, using the occurrence of a respondent's arrest between waves ($w - 1$) and w as a covariate, and adjusting for J_{i1}, age, orientation and wave (3 versus 2). As with the previous model, this three-level model included a random effect at the respondent level, together with a second random effect to account for possible correlation within respondent among confidants named in a given wave.

A key question of this study was the extent to which criminal justice involvement within a respondent's network is associated with *subsequent* behavioral and health outcomes,

adjusting for the respondent's own criminal justice involvement. To determine this, we began with the following model for A_{ij1}:

$$\text{Logit}[P(A_{ij1}=1)]=\lambda_0+\lambda_1\alpha_i$$

This allows us to account explicitly for the fact that respondents may report only a subset of their network members during the interview, with $\lambda_0 + \lambda_1 a_i$ being interpreted as the logit of the underlying (unobserved) proportion of respondent i's network (including here both confidants and sex partners) at wave 1 who have been to jail. The distribution of a_i was then modeled as

$$\alpha_i=\gamma_0+\gamma_1 J_{i1}+\boldsymbol{X}\boldsymbol{\gamma}_2+e_{1i}$$

where X includes age and sexual orientation, and the e_{1i} are assumed to be distributed normally with mean zero and variance one (these assumptions are necessary to identify the model). Finally, letting Y_i be a continuous longitudinal outcome measured during the course of the study, we used

$$Y_i=\beta_0+\beta_1 J_{i1}+\beta_2\alpha_i+\boldsymbol{X}\boldsymbol{\beta}_3+e_{2i}$$

in which a_1 describes the direct association between the respondent's jail history at baseline and the subsequent outcome, while a_2 describes the association between the prevalence of jail among the respondent's network and the outcome (an analogous logistic regression was used for binary outcomes). This model was first fit with only J_{i1} and then refit with a_i added, to determine the effect of adding the network measure on a_1. Figure 1a shows the model in graphical form, using the standard conventions for representing Generalized Structural Equation Models (GSEMs).

While the preceding analysis focuses on network composition, we also wanted to determine whether having spent time in jail affects network dynamics, such as the change in membership of a respondent's confidant network between waves. Two distinct events provide information about the change in a respondent's network between successive waves. Let $R_{ijw}=1$ represent the event that at wave w ($w=2, 3$), respondent i retains (i.e., names again) confidant j from the previous wave, with $R_{ijw}=0$ indicating that confidant j (named during the last wave) is not retained. In addition, let $N_{ijw}=1$ represent the event that a new confidant is added on line j at wave w, with $N_{ijw}=0$ indicating that line j is left blank. Note that for any respondent at a given wave, both R_{ijw} and N_{ijw} may be observed multiple times, with R_{ijw} observed once for every confidant (up to five) named during the previous wave and N_{ijw} observed once for each of the roster lines (up to five) left available after the retained confidants have been accounted for. We modeled these events jointly using the following two logistic regressions:

$$\begin{aligned}\text{Logit}[P(R_{ijw}=1)]&=\lambda_0+\boldsymbol{A}_{ij,w-1}\boldsymbol{\lambda}_1+\boldsymbol{Z}_{iw}\boldsymbol{\lambda}_2+\lambda_3 S_i\\ \text{Logit}[P(N_{ijw}=1)]&=\lambda_0^* \qquad +\boldsymbol{Z}_{iw}\boldsymbol{\lambda}_2^*+\lambda_3^* S_i\end{aligned}$$

In this model, $A_{ij,w-1}$ consists of covariates that describe each confidant (e.g., whether they have been in jail) named at the previous wave and/or their relationship with the respondent (e.g., the order in which they were named on the roster), while Z_{iw} contains time-varying (including lagged) covariates thought to directly affect the likelihood of retaining and/or naming new confidants (e.g., network size as measured by the total number of confidants named at the previous wave, and a binary indicator of wave 3 versus 2). S_i is a respondent-specific latent variable representing *network stability*, which is hypothesized to positively affect the likelihood of retaining previous confidants and negatively affect the likelihood of naming new ones. This model thus allows us to identify the effect of stability—conceptualized here as a property of a respondent's network that is stable over the course of the 18-month study—as distinct from other network-level and relationship-level characteristics that may on their own affect the likelihood of renaming a previous confidant and/or naming a new one.

To determine the association between network stability and respondent characteristics, we incorporated the following regression for S_i (same as for a_i above):

$$S_i = \gamma_0 + \gamma_1 J_{i1} + \boldsymbol{X}\boldsymbol{\gamma}_2 + e_{1i}$$

where as before, the e_{1i} are assumed to be distributed normally with mean zero and variance one. We also incorporated the following regression for continuous respondent outcomes Y_i observed over the course of the study:

$$Y_i = \beta_0 + \beta_1 J_{i1} + \beta_2 S_i + \boldsymbol{X}\boldsymbol{\beta}_3 + e_{2i}$$

where a_1 describes the direct association between the respondent's jail history at baseline and the subsequent outcome, while a_2 describes the association between network stability and the outcome, both adjusting for age and sexual orientation. This model is shown in Figure 1b. As before, an analogous logistic regression was used for binary outcomes.

Finally, to estimate the association between network stability and outcomes adjusting for differences in the prevalence of jail among respondents' networks (and vice versa), we combined the two GSEMs in Figure 1. For consistency, we modified the model for A_{ijw} as follows:

$$\text{Logit}[P(A_{ijw} = 1)] = \lambda_0^* + \lambda_1^* \alpha_i + \lambda_2^* I_{[w=3]} \quad w = 1, 2$$

where only confidants are included (not sex partners). This combined model thus allows us to estimate the association between both network jail prevalence at waves 1 and 2 and network stability from waves 1–2 and 2–3, on the one hand, and longitudinal outcomes on the other, adjusting for respondents' age, sexual orientation and jail history (yes or no) at baseline.

GSEMs were fit with the `gsem` command in Stata version 14.1 (StataCorp, 2015), using Full Information Maximum Likelihood (FIML) evaluated via mean-variance adaptive Gauss-

Hermite quadrature. For all models with multiple observations per respondent (i.e., mixed effects models and GSEMs), variances were obtained using sandwich (i.e., robust) estimator taking the clustering within respondent into account, to allow for possible misspecification of the model. P-values and confidence intervals were based on the corresponding Wald statistics.

3. Results

3.1 Descriptives

Forty-six percent of the 618 respondents in the study had been in jail at least once. The likelihood of having been in jail increased with age, and was higher among those who identified as bisexual versus those who identified as gay (Table 1, Figure 2a). As has been reported previously, a history of CJI was associated with several HIV related behaviors and poor health outcomes, such as housing instability, using and selling substances, higher likelihood of exposure to violence, a larger number of sexual partners, exchanging sex for money and a higher prevalence of STIs such as HIV and syphilis.

Among those who had been in jail, nearly two-thirds (62%) had been in jail more than once, and nearly one-quarter (23%) had been in jail four or more times (Figure 2b). The average age at first detention was 18, with 28% first detained at age 16 or younger (Figure 2c). Although most had spent no more than one week total in jail, a significant minority had spent one month or more (Figure 2d). Twenty percent of respondents reported being in jail at least once during the 18-month study, and this was more likely among those with a history of CJI at baseline than those without (28% versus 13%) (Table 1). This increased the overall percentage of respondents who had been incarcerated to 53% by the end of the study.

3.2 Factors associated with criminal justice involvement

Half of all respondents had at least one confidant who had been in jail, and on average, one-third (29%) of all confidants in respondents' networks had been in jail. In addition, forty percent of respondents had at least one sexual partner who had been in jail during the past six months. CJI involvement of network members (both confidants and sex partners) was much higher among respondents with CJI involvement themselves. For example, the odds of a confidant having been in jail were 4.04 (95% CI [2.86, 5.70]) times higher if the respondent had also been in jail (Table 2). Moreover, even after taking this into account, there remained considerable clustering in CJI involvement within confidant networks (i.e., the estimated variance of the respondent-level random effect was 1.22, which translates into an odds ratio for a one SD increase of 3.02). Interestingly, although both age and sexual orientation were associated with the likelihood of respondent CJI, neither was associated with the likelihood of CJI among confidants. Finally, the likelihood of newly-acquired confidants (i.e., newly identified in waves 2 and 3) having been in jail was also higher for those with CJI involvement at baseline (OR = 3.51, 95% CI [2.26, 5.45]). There was also modest evidence of an association between jail incidence during the study among respondents and the likelihood of new confidants having been to jail (OR = 1.62, 95% CI [0.95, 2.77]).

3.3 Network homophily on CJI and health outcomes

Table 3 shows results of the GSEM in Figure 1a fit separately to a variety of behavioral and health outcomes. Higher prevalence of CJI among respondents' networks (including both confidants and sex partners) was associated with a higher likelihood of CJI incidence (OR = 1.40, 95% CI [0.97, 2.01]), drug use (OR = 1.48, 95% CI [1.05, 2.10]) and housing instability (OR = 1.45, 95% CI [1.02, 2.06]), and was associated with higher anxiety (coefficient = 0.15, 95% CI [0.03, 0.27]), distress (coefficient = 0.16, 95% CI [0.04, 0.28]) and the tendency to encourage risky sexual behavior (coefficient = 0.15, 95% CI [0.00, 0.29]). In several of these cases, adding network CJI prevalence substantially reduced the association between respondent's own CJI involvement and the outcome, consistent with the possibility that part of the association between one's history of CJI and poorer outcomes is due to its effect on the composition of one's network.

3.4 Network stability and health outcomes

Results of the GSEM in Figure 1b—fit initially without the outcomes—are shown in Table 4. As might be expected, the order in which a confidant was named was negatively associated with the likelihood that that confidant was retained at the next wave. Confidants were more likely to be retained at wave 3 (versus wave 2) and new confidants were less likely to be named, possibly reflecting a learning effect (e.g., respondents limiting the number of new confidants in order to avoid being asked for additional information about them). Consistent with our interpretation, network stability was positively associated with the likelihood of retaining previous confidants (OR = 2.28, 95% CI [1.94, 2.68]) and negatively associated with the likelihood of naming new ones (OR = 0.66, 95% CI [0.58, 0.76]). Network stability was greater among older respondents, but substantially less among respondents who had been in jail at baseline (coefficient = −0.48, 95% CI [−0.74, −0.23]). Interestingly, there was no association between whether a specific confidant had been in jail and his or her likelihood of being retained.

The association between confidant network stability and outcomes is shown in Table 5. Despite adjusting for respondents' CJI history, network stability was associated with a reduction in the likelihood of drug use (OR = 0.76, 95% CI [0.55, 1.04]), housing instability (OR = 0.70, 95% CI [0.52, 0.95]) and depression (OR = 0.67, 95% CI [0.45, 0.99]). Network stability was also associated with less distress (coefficient = −0.15, 95% CI [−0.29, −0.01]) and exposure to violence (coefficient = −0.15, 95% CI [−0.27, −0.03]). Finally, those with more stable networks were less likely to participate in protests, demonstrations, etc. (OR = 0.64, 95% CI [0.43, 0.95]). These effects were essentially unchanged when adjusting for the prevalence of CJI involvement in the confidant network, indicating that stability and CJI involvement represent distinct mechanisms by which social networks may affect outcomes in this population.

4. Discussion

The uConnect sample is one of the first representative samples of young Black MSM and the largest single location sample of young Black MSM. Within uConnect we find high rates of CJI, with nearly half of respondents experiencing CJI prior to the baseline interview. This

high rate of CJI is similar to those reported in other cohorts of YBMSM (Brewer et al., 2014a, 2014b; Lim et al., 2011).

We also observe a high rate of homophily with respect to CJI, reflected not only in the tendency of respondents with a history of CJI to name confidants who also have a history of CJI but also in the clustering of CJI within confidant networks (i.e., even after adjusting for respondent/alter homophily). This CJI homophily raises questions about the possible underlying mechanisms and their relationship to subsequent CJI. For example, despite adjusting for the well documented association between one's past and future CJI (Gendreau, Little, & Goggin, 1996; Uggen, 2000)), our data suggest an association between past *network* CJI and a respondent's subsequent CJI. Moreover, both past and current CJI (i.e., during the study period) are associated with the likelihood that new confidants will have a history of CJI. This strong evidence for an association between network CJI and one's own CJI has important implications for recidivism interventions which have tended to focus only on the individual (Lipsey & Cullen, 2007; MacKenzie, Wilson, & Kider, 2001). At the same time however, more work is needed to disentangle the effects of one's network on one's own CJI (e.g., via peer influence regarding behaviors that are tied to CJI such as drug use) from the effects of CJI on one's network (e.g., via consequences such as unemployment which create circumstances for other close network members to become involved in criminal justice (The Pew Charitable Trusts, 2010)). The direct relationship between unemployment and recidivism and the impacts of recidivism on unemployment are well established. Important health effects from recidivism, including virological failure in HIV infected persons and the resulting poor health, can also serve as indirect effects on future employment.(J. P. Meyer et al., 2014)

In addition to future episodes of CJI, we also find evidence of strong associations between network CJI and a range of important health and social outcomes, and this appears to account for a large portion of the association between an individual's prior experiences with CJI and such outcomes. For example, adding network CJI prevalence to models predicting drug use and housing instability yields significant coefficients and substantially reduces the (previously large) effect of the respondent's own CJI involvement. Drug use usually occurs with other network members and housing instability is related to an ability to secure housing within networks which themselves may be subject to housing instability due to CJI. Network CJI was also associated with higher levels of anxiety and distress. An explanation for this finding may be that network CJI involvement limits access to the types of relationships that are required to maintain mental health (Kawachi & Berkman, 2001) and/or creates situations of economic and social instability which further exacerbate mental health problems by those who are left to manage life on the outside (Christian, Mellow, & Thomas, 2006; Mumola, 2000).

Finally, there is strong evidence that network stability affects both an individual's likelihood to have CJI as well as specific health and social outcomes. These effects were essentially unchanged when adjusting for the prevalence of CJI involvement in the confidant network, indicating that stability and CJI involvement represent distinct mechanisms by which social networks may affect outcomes in this population. Network instability reflects instability in the broader social environment which may include lack of reliable familial and other social

support. Previous research has shown that network instability with emphasis on network losses is associated with increased morbidity (d'Epinay, 2010; Gerstorf, Rocke, & Lachman, 2011; Stroebe, 2007). These circumstances may be different from CJI network homophily. Network instability can include loss and gain of individuals who are CJI involved as well as loss and gain of those who are not. For gains and losses of CJI network members, there is limited evidence that gaining or losing these individuals has any net benefit on the health and well-being of individuals. Regardless of CJI involvement, network members who are designated as confidants often provide social support and their presence have been shown to be associated with health outcomes and behaviors such as excessive risk taking (J. Schneider et al., 2012). Network stability, thus exhibits protective qualities with respect to health and social outcomes. It should be noted that one of our outcomes, participation in protest movements around police brutality was associated with network instability. While it may be that social justice efforts are of benefit if realized in marginalized communities, the motivation of specific individuals to these movements may be based upon previous experiences with criminal justice systems or other systems deemed to be oppressive (Klandermans, 2007). The role that CJI persons participating in political movements plays requires additional study to determine what are the drivers of involvement in such movements and whether network instability is a driver or symptom of this participation.

There were several limitations to our analysis. First, our analysis was underpowered to determine how CJI networks and network instability might be related to incident HIV infection. We find that over 1/3 of our sample was HIV infected at baseline and that nearly 40 new infections occurred over the 18 month study period. While it is likely that network change and HIV status homophily are linked to incident HIV, these network factors are distal to more proximal causes of HIV transmission such as sex risk behavior and use of some substances (Fujimoto K, in press; Valleroy et al., 2000). Careful attention to these proximal factors in the context of network change would be required in the analyses to examine HIV infection in more detail and was beyond the scope of this analysis. Second, our measure of CJI was not limited to longer jail and prison stays, but included arrest and other shorter term detention. It is unclear whether network stability and CJI homophily is based upon the duration of stay. We find that any CJI at the individual level is associated with important health outcomes when controlling for duration of stay and the main impact that CJI has on health outcomes occurs when CJI events are recurring or cyclical in nature (data not shown). Additional work should examine the relative importance of the different categories of involvement (including probation) and how these impact network composition and dynamism. Finally, we did not explore the potential association between geographic propinquity to crime and its association with future criminal justice involvement. Others have found spatial proximity to be an important factor in future behaviors (Schafer, 2015). For example, Papachristos finds that adjacency of gang turf is independently associated with violence (Papachristos, Hureau, & Braga, 2013). He finds that both networks and spatial properties are important generators of gang violence, however, spatial proximity does not limit the effect of social ties on gang violence. We would expect that spatial proximity would have less of an effect on CJI or health behaviors given that the population we focus on is highly mobile. The high mobility is evidenced by socializing that occurs outside of local

communities throughout the city with over half of sex partners, for example, found outside of local community areas (data not shown).

In conclusion, this analysis is the first to describe the networks of CJI MSM among a representative sample of MSM and to examine the relationship between network composition, stability and important social and health outcomes. We find that individuals who are criminal justice involved MSM are highly likely to be associated with other CJI MSM in both their confidant and sexual networks. In addition, these networks exhibit limited network stability and both the composition of network members who are CJI and the network dynamism have independent effects on health and social outcomes over time. Most notable among these are the effects on drug use and mental health indicators such as anxiety and depression. Health interventions that focus on the individual are thus unlikely to be effective in limiting morbidity and focus on networks of CJI involved persons and those they are connected to are likely to be more effective in achieving outcomes of interest (Bouris et al., 2013). Moreover, recent limitations in programming that have defunded mental health, housing and substance use treatment initiatives in Chicago and elsewhere could exacerbate the impact that networks change due to CJI may have on marginalized populations in the United States.

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Highlights

- Examine the networks of criminal justice involved (CJI) young Black MSM from a population-based cohort

- CJI respondents are more likely to have CJI homophily in their confidant and sexual networks

- Higher prevalence of network CJI is associated with increased turnover in the confidant network

- Network CJI and network instability are related to important health and social outcomes
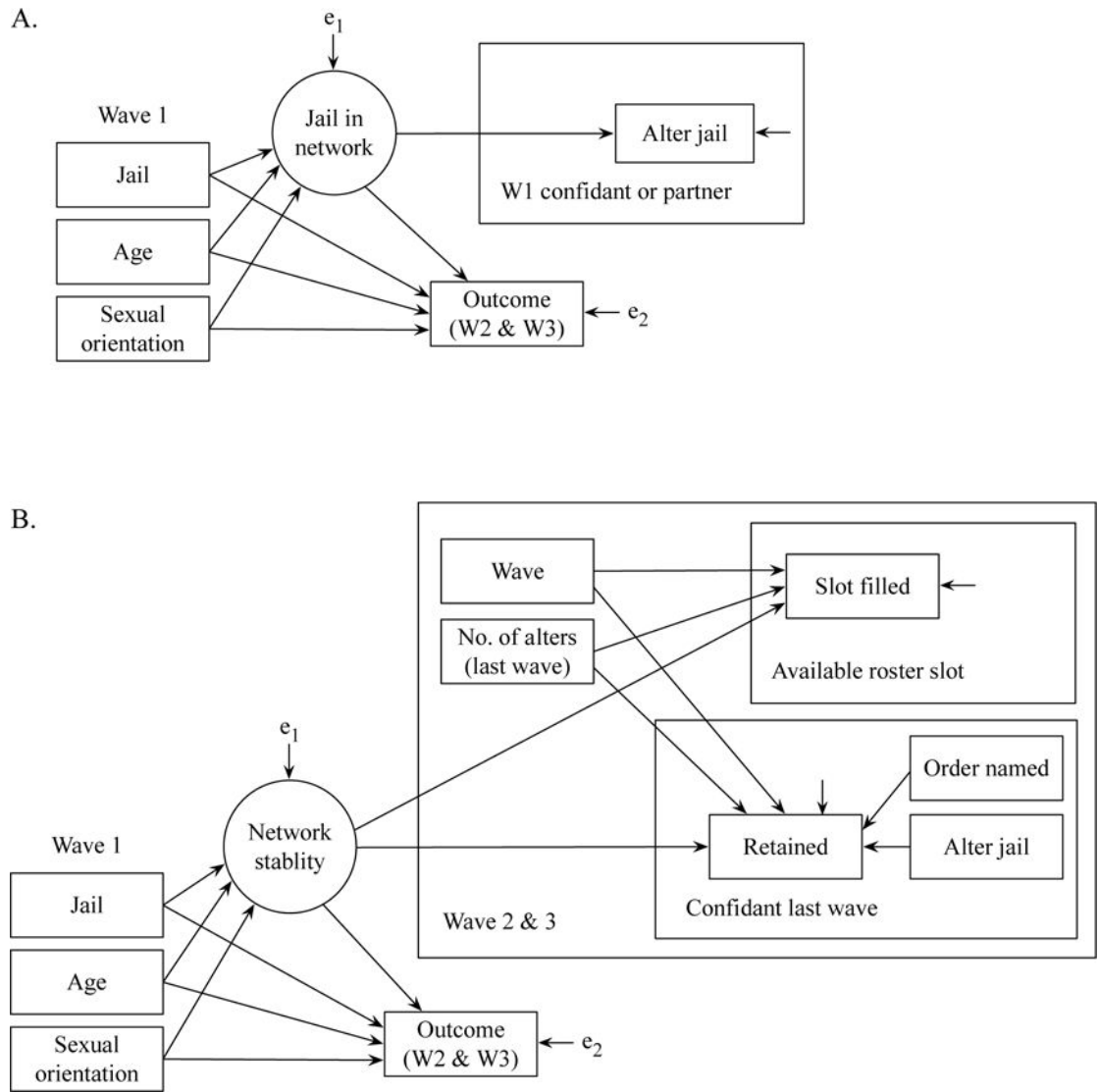
Figure 1.
Generalized Structural Equation Models (GSEMs) used for examining (A) the association between network CJI prevalence and health outcomes (Table 3), and (B) the association between network stability and health outcomes (Tables 4 and 5).
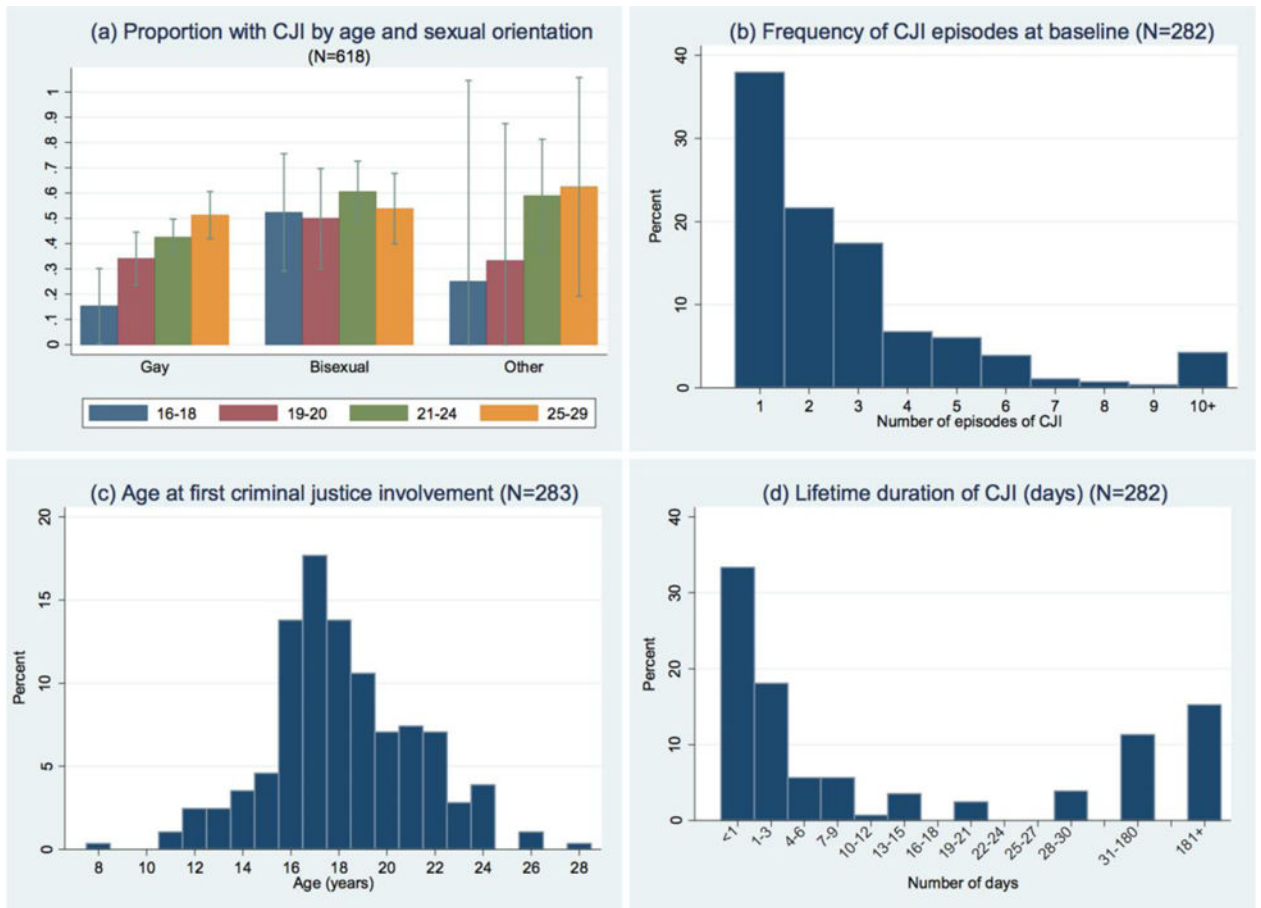
Figure 2.
Criminal justice involvement experiences reported by YBMSM (a) Proportion with CJI
involvement by age and sexual orientation (b) Frequency of CJI (c) Age at first CJI (d)
Duration CJI

Table 1

Sociodemographic, behavioral and network characteristics of Wave 1 UConnect participants, overall and by history of criminal justice involvement (N=618)

Baseline Characteristics	All (N=617) Weighted %[a]	History of CJI (N=285) Weighted %[a]	No history of CJI (332) Weighted %[a]	P value[b]
Sociodemographics				
Age (years), mean (SD)	22.7 (3.3)	23.4 (3.3)	22.2 (3.2)	**0.0012**
Education				
Less than high-school (HS)	8.2	10.4	6.5	
HS diploma	38.4	37.5	39.1	0.542
Greater than HS	53.4	52.1	54.4	
Employment				
Unemployed	52.2	53.4	51.6	
Part Time	23.7	24.9	22.9	0.686
Full Time	24.0	21.8	25.5	
Housing instability (past 12 months)	24.0	28.9	20.7	0.063
Low Income (<20,000 annually)	83.5	85.5	82.1	0.412
Income source: selling drugs	5.7	9.1	3.4	0.059
Income source: exchanging sex for money	10.6	16.2	6.7	**0.007**
Sex behavior				
Sexual identity (gay)	59.7	50.8	66.1	**0.003**
Number of partners in past 6 months, mean (SD)	3.7 (5.1)	5.0 (7.3)	2.9 (2.9)	**0.001**
Violence Experiences				
Had close relative or friend die violently	60.6	65.0	57.6	0.156
Had close relative injured through violence	64.5	73.1	58.4	**0.003**
Had a close relative/friend robbed or attacked	81.2	89.6	75.3	**0.005**
Community violence exposure, mean (SD)	2.9 (1.57)	3.25 (1.56)	2.63 (1.51)	**<.0001**
Substance Use				
Used any illicit substance [c] in past 12 months	74.9	89.3	64.9	**<.0001**
Used crack/cocaine in past 12 months	3.0	5.6	1.2	**0.001**
Sexually transmitted infections				
HIV seropositive	34.3	46.0	25.5	**0.001**
Syphilis seropositive	28.0	35.1	22.6	**0.023**
Network characteristics				
At least 1 confidant with history of CJI	46.7	63.9	35.2	**<.0001**
Proportion of confidant network with CJI, mean (SD)	0.29 (0.36)	0.43 (0.41)	0.20 (0.29)	**<.0001**
At least 1 sex partner with history of CJI	39.9	59.3	26.5	**<.0001**
Proportion of sexual network with CJI, mean (SD)	0.30 (0.39)	0.44 (0.42)	0.20 (0.33)	**<.0001**
Proportion of BMSM community with CJI history				
None (0%)	45.2	30.0	56.0	
A few (1–19%)	2.8	2.8	2.9	

	All (N=617)	History of CJI (N=285)	No history of CJI (332)	P value[b]
Baseline Characteristics	**Weighted %[a]**	**Weighted %[a]**	**Weighted %[a]**	
Less than half (20–39%)	16.9	18.3	15.9	
About half (40–59%)	12.6	16.1	10.1	**<.0001**
Most (60–79%)	5.7	9.1	3.3	
All or almost all (80–100%)	16.8	23.8	11.8	
Pooled Wave 2 and 3 outcomes[d]				
Reported CJI since last visit	19.9	28.0	12.8	**<.0001**
HIV infected	10.1	7.96	11.9	0.302

[a]Used stata survey commands with pweight=(Giles Sequential Sampling Weight) to estimate population proportions

[b]P values from Wald chi-square test for categorical variables and t-test for continuous variables

[c]Injection drugs, crack/cocaine, crystal methamphetamine, ecstasy and speed

[d]Outcomes were pooled across study waves. Participants in denominator came to wave 2 or wave 3.

Table 2

Logistic regression models of the likelihood of ever having been in jail, fit to respondents (Wave 1) and their confidants (Wave 1, and new confidants in Waves 2 & 3)

Respondent characteristics	Respondent ever in jail, Wave 1 (n = 616)		Confidants ever in jail, Wave 1 (n = 1,499)		New confidants in Waves 2 & 3 ever in jail (n = 1,227)[a]	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Age (yrs)	1.10***	1.05, 1.16	1.01	0.96, 1.07	1.04	0.97, 1.10
Sexual orientation						
Gay (ref.)						
Bisexual	1.79**	1.24, 2.59	1.10	0.77, 1.58	1.54+	0.99, 2.42
Other	1.70	0.88, 3.29	1.16	0.53, 2.53	1.70	0.63, 4.54
Respondent jail history						
Ever in jail (Wave 1)			4.04***	2.86, 5.70		
In jail since last wave					1.90*	1.16, 3.12
Wave 3 (vs. 2)					0.46***	0.32, 0.66
Constant	0.07***	0.02, 0.25	0.13**	0.04, 0.44	0.09**	0.02, 0.40
Var(respondent)[b]			1.22	0.76, 1.96	1.50	0.89, 2.52

***
$p < 0.001$;

**
$p < 0.01$;

*
$p < 0.05$;

+
$p < 0.10$

[a] Fit to pooled sample of confidants named in Waves 2 and 3 who had not been named during the previous wave.

[b] Estimated variance of respondent-level random effect.

Table 3

Regression models and Generalized Structural Equation Models (GSEM) fit separately to prospective outcomes, including CJI history and network CJI prevalence as covariates[a]

Outcome (Wave 2 and Wave 3) and covariates (Wave 1)	Regression models incl. respondent jail history only		GSEM models incl. jail history for respondent and network	
A. Binary outcomes	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
CJI				
Respondent with CJI ever	2.62[***]	(1.63, 4.23)	1.65	(0.82, 3.31)
Network CJI prevalence			1.40[+]	(0.97, 2.01)
Drug use (excluding marijuana)				
Respondent with CJI ever	2.15[***]	(1.42, 3.24)	1.25	(0.66, 2.36)
Network CJI prevalence			1.48[*]	(1.05, 2.10)
Housing instability				
Respondent with CJI ever	1.83[**]	(1.23, 2.71)	1.08	(0.57, 2.08)
Network CJI prevalence			1.45[*]	(1.02, 2.06)
Depressed				
Respondent with CJI ever	0.97	(0.60, 1.58)	0.82	(0.39, 1.72)
Network CJI prevalence			1.13	(0.77, 1.64)
HIV incidence				
Respondent ever with CJI	0.89	(0.35, 2.26)	1.07	(0.29, 4.00)
Network CJI prevalence			0.88	(0.42, 1.85)
Participated in protests, marches[b]				
Respondent ever with CJI	0.87	(0.50, 1.50)	0.49	(0.20, 1.19)
Network CJI prevalence			1.49	(0.91, 2.45)
B. Ordinal outcomes	Odds ratio	95% CI	Odds ratio	95% CI
Frequency of marijuana use[c]				
Respondent ever with CJI	2.89[***]	(2.06, 4.06)	2.11[**]	(1.27, 3.50)
Network CJI prevalence			1.25[+]	(0.97, 1.62)
C. Continuous outcomes	Coefficient	95% CI	Coefficient	95% CI
Anxiety				
Respondent ever with CJI	0.12	(−0.06, 0.29)	−0.10	(−0.34, 0.14)
Network CJI prevalence			0.15[*]	(0.03, 0.27)
Distress				
Respondent ever in jail	0.04	(−0.13, 0.22)	−0.18	(−0.43, 0.06)
Network jail prevalence			0.16[**]	(0.04, 0.28)
Exposure to violence[b]				
Respondent ever in jail	0.29[**]	(0.11, 0.47)	0.19	(−0.08, 0.46)
Network jail prevalence			0.07	(−0.07, 0.21)
Discourage risky sexual behavior				

Outcome (Wave 2 and Wave 3) and covariates (Wave 1)	Regression models incl. respondent jail history only		GSEM models incl. jail history for respondent and network	
A. Binary outcomes	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
Respondent ever in jail	−0.20*	(−0.37, −0.03)	−0.15	(−0.40, 0.10)
Network jail prevalence			−0.04	(−0.18, 0.10)
Encourage risky sexual behavior				
Respondent ever in jail	0.15+	(−0.02, 0.33)	−0.06	(−0.34, 0.23)
Network jail prevalence			0.15*	(0.00, 0.29)

***
$p < 0.001$;

**
$p < 0.01$;

*
$p < 0.05$;

+
$p < 0.10$

[a] All models also include age and sexual orientation (both measured at Wave 1) as covariates in the structural part of the model. GSEM models include a respondent-level latent variable capturing differences between respondents in the likelihood that network members have ever been in jail (i.e., differences in network prevalence of jail history). Networks include both confidant and sex network members.

[b] Measured in Wave 3 only.

[c] Measured in Wave 2 only.

Table 4

Generalized Structural Equation Model (GSEM) showing effect of network stability on the likelihood of retaining confidants from the previous wave and the likelihood of reporting new confidants, fit to pooled changes from W1–W2 and from W2–W3

A. Probability of retaining previous confidant			
	Odds ratio	**p-value**	**95% CI**
Relationship attributes (last wave)			
Order named (1–5)	0.66	< 0.001	(0.60, 0.72)
Confidant ever with CJI	1.07	0.531	(0.87, 1.30)
Respondent attributes			
No. of alters (last wave)	1.16	0.003	(1.05, 1.29)
Network stability (latent)	2.28	< 0.001	(1.94, 2.68)
Wave 3 (vs. Wave 2)	1.30	0.003	(1.09, 1.55)

B. Probability of reporting new confidant			
	Odds ratio	p-value	95% CI
Respondent attributes			
No. of alters (last wave)	0.90	0.003	(0.84, 0.97)
Network stability (latent)	0.66	< 0.001	(0.58, 0.76)
Wave 3 (vs. Wave 2)	0.82	0.004	(0.72, 0.94)

C. Regression of confidant network stability on Wave 1 respondent characteristics			
	Coefficient	p-value	95% CI
Age (per year)	0.08	< 0.001	(0.04, 0.12)
Ever with CJI	−0.48	< 0.001	(−0.74, −0.23)
Sexual orientation			
Gay (ref.)			
Bisexual	−0.04	0.784	(−0.32, 0.24)
Other	−0.13	0.700	(−0.78, 0.52)

Table 5

Generalized Structural Equation Models (GSEM) fit separately to outcomes, including respondent CJI history (Wave 1), confidant network CJI prevalence (Waves 1 & 2) and confidant network stability (W1–W3) as covariates[a]

Outcome (Wave 2 and Wave 3) and covariates	Models incl. respondent jail history and network stability		Models incl. respondent jail history, network stability and confidant jail history	
A. Binary outcomes	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
In jail				
Respondent ever with CJI (Wave 1)	2.45[***]	(1.49, 4.04)	1.86[*]	(1.01, 3.41)
Network stability (since last wave)	0.80	(0.57, 1.14)	0.80	(0.56, 1.15)
Network CJI prevalence (last wave)			1.31[+]	(0.97, 1.78)
Drug use (excluding marijuana)				
Respondent ever with CJI (Wave 1)	1.85[**]	(1.21, 2.83)	1.53	(0.90, 2.59)
Network stability (since last wave)	0.76[+]	(0.55, 1.04)	0.76[+]	(0.56, 1.04)
Network CJI prevalence (last wave)			1.20	(0.91, 1.58)
Housing instability				
Respondent ever with CJI (Wave 1)	1.56[*]	(1.01, 2.43)	1.28	(0.75, 2.16)
Network stability (since last wave)	0.70[*]	(0.52, 0.95)	0.70[*]	(0.51, 0.96)
Network CJI prevalence (last wave)			1.21	(0.93, 1.59)
Depressed				
Respondent ever with CJI (Wave 1)	0.78	(0.46, 1.32)	0.76	(0.41, 1.41)
Network stability (since last wave)	0.67[*]	(0.45, 0.99)	0.67[*]	(0.45, 0.99)
Network CJI prevalence (last wave)			1.03	(0.75, 1.41)
HIV incidence				
Respondent ever with CJI (Wave 1)	1.02	(0.37, 2.83)	1.41	(0.42, 4.80)
Network stability (since last wave)	1.36	(0.72, 2.57)	1.35	(0.70, 2.60)
Network CJI prevalence (last wave)			0.76	(0.43, 1.34)
Participated in protests, marches, etc.[b]				
Respondent ever with CJI (Wave 1)	0.68	(0.38, 1.20)	0.50[+]	(0.25, 1.01)
Network stability (since last wave)	0.64[*]	(0.43, 0.95)	0.64[*]	(0.43, 0.95)
Network CJI prevalence (last wave)			1.33	(0.87, 2.05)
B. Ordinal outcomes	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
Frequency of marijuana use[c]				
Respondent ever with CJI (Wave 1)	2.90[***]	(2.02, 4.16)	2.61[***]	(1.66, 4.10)
Network stability (since last wave)	1.03	(0.82, 1.30)	1.03	(0.82, 1.30)
Network CJI prevalence (last wave)			1.10	(0.88, 1.37)
C. Continuous outcomes	**Coefficient**	**95% CI**	**Coefficient**	**95% CI**
Anxiety				

Outcome (Wave 2 and Wave 3) and covariates	Models incl. respondent jail history and network stability		Models incl. respondent jail history, network stability and confidant jail history	
A. Binary outcomes	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
Respondent ever with CJI (Wave 1)	0.06	(−0.13, 0.25)	−0.07	(−0.29, 0.15)
Network stability (since last wave)	−0.10	(−0.25, 0.04)	−0.10	(−0.24, 0.04)
Network CJI prevalence (last wave)			0.12 *	(0.02, 0.22)
Distress				
Respondent ever with CJI (Wave 1)	−0.04	(−0.22, 0.14)	−0.14	(−0.35, 0.07)
Network stability (since last wave)	−0.15 *	(−0.29, −0.01)	−0.15 *	(−0.29, −0.01)
Network CJI prevalence (last wave)			0.09 +	(−0.01, 0.20)
Exposure to violence[b]				
Respondent ever with CJI (Wave 1)	0.21 *	(0.03, 0.38)	0.16	(−0.06, 0.38)
Network stability (since last wave)	−0.15 *	(−0.27, −0.03)	−0.15 *	(−0.27, −0.02)
Network CJI prevalence (last wave)			0.05	(−0.06, 0.16)
Discourage risky sexual behavior				
Respondent ever with CJI (Wave 1)	−0.19 *	(−0.36, −0.01)	−0.22 *	(−0.42, −0.01)
Network stability (since last wave)	0.04	(−0.09, 0.16)	0.04	(−0.09, 0.16)
Network CJI prevalence (last wave)			0.03	(−0.09, 0.14)
Encourage risky sexual behavior				
Respondent ever in jail (Wave 1)	0.14	(−0.05, 0.33)	−0.07	(−0.31, 0.17)
Network stability (since last wave)	0.01	(−0.14, 0.11)	−0.01	(−0.14, 0.12)
Network jail prevalence (last wave)			0.19 **	(0.06, 0.32)

***
 p < 0.001;

**
 p < 0.01;

*
 p < 0.05;

+
 p < 0.10

[a]Models include age and sexual orientation (both measured at Wave 1) as covariates in the structural part of the model. The measurement model for network stability is identical to that for the model in Table 4. Measurement models fit to pooled dataset of network changes from W1–W2 and from W2–W3.

[b]Measured in Wave 3 only.

[c]Measured in Wave 2 only.