Are social organizational factors independently associated with a current bacterial sexually transmitted infection among urban adolescents and young adults?

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Abstract:

This study explored the relationship between the social organization of neighborhoods including informal social control and social cohesion and a current bacterial sexually transmitted infection (STI) among adolescents and young adults in one U.S. urban setting. Data for the current study were collected from April 2004 to April 2007 in a cross-sectional household study. The target population included English-speaking, sexually-active persons between the ages of 15 and 24 years who resided in 486 neighborhoods. The study sample included 599 participants from 63 neighborhoods. A current bacterial STI was defined as diagnosis of a chlamydia and/or gonorrhea infection at the time of study participation. Participants reported on informal social control (i.e. scale comprised of 9 items) and social cohesion (i.e. scale comprised of 5 items) in their neighborhood. In a series of weighted multilevel logistic regression models stratified by gender, greater informal social control was significantly associated with a decreased odds of a current bacterial STI among females (AOR 0.53, 95% CI 0.34, 0.84) after controlling for individual social support and other factors. The association, while in a similar direction, was not significant for males (AOR 0.73, 95% CI 0.48, 1.12). Social cohesion was not significantly associated with a current bacterial STI among females (OR 0.85, 95% CI 0.61, 1.19) and separately, males (OR 0.98, 95% CI 0.67, 1.44). Greater individual social support was associated with an almost seven-fold increase in the odds of a bacterial STI among males (AOR 6.85, 95% CI 1.99, 23.53), a finding which is in contrast to our hypotheses. The findings suggest that neighborhood social organizational factors such as informal social control have an independent relationship with sexual health among U.S. urban youth. The causality of the relationship remains to be determined.

Keywords: Social epidemiology | Sexually transmitted infections | Social capital | Informal social control | Adolescents | Infectious disease

Article:

1. Introduction

There is an emerging body of research that suggests that sexual behavior and risks for sexually transmitted infections (STIs) including HIV are complex phenomena. Individual level models of sexual risk propose that demographic and behavioral factors affect sexual health outcomes (Ellen et al., 1997, Hallfors et al., 2007). For instance, individuals are more likely to become infected with an STI if they are female, younger, do not consistently use condoms, and/or have multiple or concurrent sexual partners (Burnstein et al., 1998, Ellen et al., 2004, Rosenberg et al., 1999). More recent research suggests that structural level factors also affect sexual health outcomes (Cubbin et al., 2005, Ellen et al., 2004, Jennings et al., 2005, Jennings et al., 2012, Mosher, 2003). Structural level factors are often defined as the economic, social and/or policy organizational environments that create and shape the context in which risk production occurs (Rhodes, 2002).

Research into structural level factors suggests that relationships between structural factors and health outcomes seem to endure even when controlling for individual risk factors and despite changing populations (Sampson, 2003). The structural level factors explored have largely focused on neighborhood measures of socioeconomic status (e.g., poverty concentration, disadvantage), which are important but challenging to address (Crosby and Holtgrave, 2006). A handful of other studies have explored social organizational factors (Berkman and Kawachi, 2000, Cohen et al., 2000, Crosby et al., 2003, Ellen et al., 2005, Putnam, 2000, Sampson, 1997). Crosby et al. (2003) found a significant relationships between state-level social capital (defined using 14 variables which span domains of community organizational life, involvement in public affairs, volunteerism, informal sociability, and social trust) and state-level sexual risk and protective behaviors among youth based on data from the 1999 Youth Risk Behavior Surveillance (YRBS) Survey (Crosby et al., 2003). Many of these studies, however including the one cited by Crosby et al., have explored the relationship between social organizational factors and sexual health at the ecologic level, i.e. not including the individual level. Ecologic study designs do not allow for an explicit examination as to whether the structural and individual relationships exist independent of one another and/or whether there are mediational pathways between the structural and individual factors. Few if any studies have been designed, for example, to determine whether the association between neighborhood level social organizational factors and sexual health are independent of individual level social support.

Understanding whether and the extent to which social organizational factors are independent of individual social support is critical information for interventions designed to decrease STIs among youth. To date, STI prevention efforts by and large have focused on individual-level risk-reduction measures such as promotion of condom use. Such interventions have shown only very limited ability to reduce STI incidence consistently and over time among at-risk youth. It may be that the efforts have failed because they largely ignore the influence of neighborhood social organizational factors or it may be that they have failed because the intervention targets were incorrectly specified at the individual level rather than at the neighborhood level.

1.1. Social organizational characteristics of neighborhoods

Of particular interest to this study are two social organizational factors of neighborhoods – informal *social control* and *social cohesion* (Carpiano, 2006). *Informal social control* reflects the ability of residents to maintain social order (Carpiano, 2006) and/or the capacity of a group to regulate its members according to desired principles (Janowitz, 1975, Sampson, 1997). For example, informal social control may include the willingness of neighborhood residents to intervene to prevent illegal behaviors such as drug markets and commercial sex work from occurring within the neighborhood. Informal social control relies on the mutual trust and respect within a group or geographic area, which can lead to members or residents taking responsibility for one another (Berkman and Kawachi, 2000, Crosby et al., 2003) and realizing common goals (Janowitz, 1975, Sampson, 1997). *Social cohesion*, on the other hand, is defined as the mutual trust and solidarity among neighbors. Social cohesion depends on social ties or social connections and is thought by some to be the foundation of informal social control. Sampson (1997) suggests for example that neighborhood residents will be unlikely to intervene if they do not feel a sense of common goals and/or they mistrust or fear their neighbors. An example of social cohesion is the likelihood that local residents in a neighborhood are willing to help out their neighbors. These social organizational factors may have independent associations with individual level health outcomes or they may operate through other individual level factors such as individual level social support to impact health. According to the buffering model, individual social support may operate through the perceived availability of interpersonal resources (such as availability at the structural and/or for youth, peer level) to help in coping with stressful life events (Cohen and Wills, 1985).

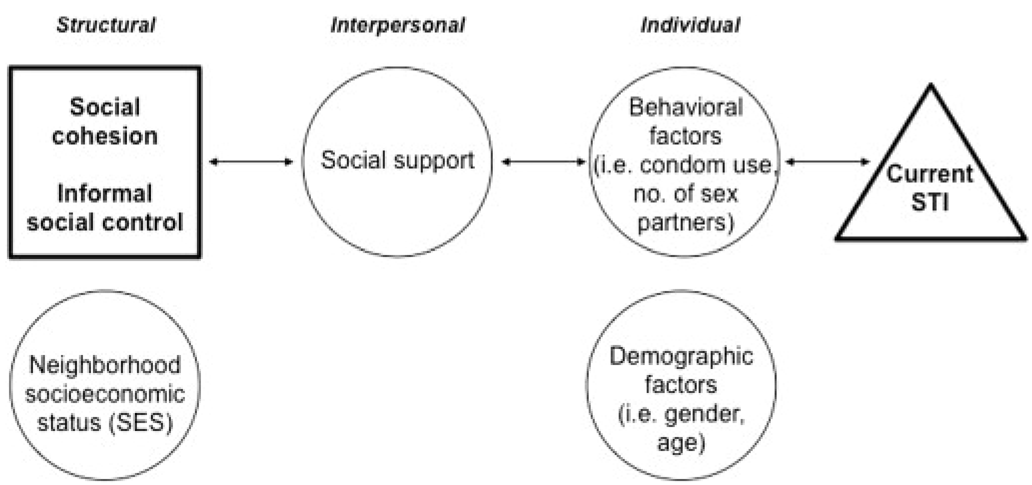

Fig. 1. Conceptual framework linking social cohesion and informal social control to a current bacterial sexually transmitted infection (STI), controlling for social support, demographic characteristics, and behavioral factors. Main exposures and outcome are indicated in bold and by squares and a triangle, respectively. Control variables are indicated by circles.

1.2. Informal social control, social cohesion and STIs – mechanisms of action

In the current study the hypothesized mechanisms through which informal social control and social cohesion may affect risks for STIs are presented in a conceptual framework (Fig. 1). The framework builds on a Bourdieu-based conceptual model (adapted from Carpiano, 2006) and sets the dynamics investigated in the current study within a broader outline of how social organizational factors may link to sexual risk behaviors and ultimately, a current bacterial STI among adolescents and young adults.

Our central hypothesis is that these social organizational factors have a direct relationship with STI outcomes based on the idea that they may alter social and sexual network structures and the availability of infected sex partners. The same social connections that lead to increased social cohesion may impact sexual network connections, increasing their density. The density of the local sexual networks connections may increase access to local pools of sex partners. In areas with low (compared to high) STI incidence, increased social cohesion would result in connectivity to fewer infected sex partners and decreased opportunities for STI transmission (Berkman and Kawachi, 2000, Crosby et al., 2003, Jennings et al., 2010). In areas where the incidence of STIs is high (compared to low), increased social cohesion may result in connectivity to greater numbers of infected sex partners, thereby increasing STI transmission.

Additionally, areas with low (compared to areas with high) levels of informal social control are likely to be areas with social disorder such as vandalism, truancy and drug use and sales. Research has shown that drug markets tend to proliferate in areas characterized by lower informal control (Eck, 1995, Reuter and MacCoun, 1992). There is considerable evidence that individuals engaged in drug markets have high rates of STIs and HIV as compared to other groups (Centers for Disease Control and Prevention, 2009, Friedman et al., 2005). Previous multilevel analyses have shown that urban areas with drug markets are associated with a ten-fold increased odds of a current bacterial STI among youth in Baltimore City (Jennings et al., 2012). Thus, youth living in areas with low (vs. high) levels of informal social control may be more likely to have a sexual relationship with an infected sex partner, i.e. a sex partner from their local neighborhood who may be involved in local drug market activities.

It may also be, however, that social organizational factors do not operate independent of individual level social support. Areas with high social cohesion and high informal social control may impact STI outcomes because social cohesion at the structural level may increase individual level social support. Numerous studies have shown an association between individual level social support and STI outcomes. A review of the global literature looking at the relationship between social support and STI/HIV-related risk behaviors found that higher levels of individual level social support were related to fewer STI/HIV-related risk behaviors among female sex workers, people living with HIV/AIDS, and heterosexual adults in general (Qiao et al., 2014). The associations were variable, however, among drug users, men who have sex with men, and adolescents (Qiao et al., 2014).

In addition to individual level social support, associations between social organizational factors and STIs may be confounded by other individual level factors. In the conceptual framework, individual level demographic and behavioral factors including age, condom use at last sex and number of sex partners are represented as potential confounders as these factors have been consistently associated with risk for a current STI (Ellen et al., 2004, Rosenberg et al., 1999).

1.3. Current focus

The objective of this paper is to determine whether informal social control and social cohesion are independently associated with a current bacterial STI after controlling for individual social support and other neighborhood and individual level factors among urban adolescents and young adults. Our overarching hypothesis is that greater informal social control and independently, social cohesion decrease risks for a current bacterial STI. The study population, adolescents and young adults, 15–24 years of age, is of particular interest as this age group suffers from the greatest STI morbidity (CDC, 2013) and has been largely absent from the social environment literature (Morrow, 1999). In addition, research suggests that adolescents and young adults may be more geographically limited (e.g., neighborhood schools) as compared to adults greater than 24 years of age and thus, the social environment may be particularly salient for this group (Cubbin et al., 2005, Duncan and Albert, 2002, Weihe et al., 2008). We hypothesized that these relationships will differ by gender because evidence suggests that sexual risk (Boyer et al., 1999, Bryan et al., 2012, Bryan et al., 2007, Houck et al., 2006, MacDonald et al., 1994, MacKellar et al., 2000) interactions with a local neighborhood environment (Lloyd and Anthony, 2003) differ between male and female youth.

2. Methods

2.1. Study setting

The setting for the current study, Baltimore City, Maryland, presents a unique opportunity to investigate the study objectives. Baltimore has a long history of syndemics of poverty and STIs. Baltimore is located in the Mid-Atlantic United States (U.S.) with an estimated 2010 population of 619,493 people (US Census Bureau, 2011). The city has a 22.4% poverty rate, nearly double that of the U.S., ranking it as the sixth poorest metropolitan area (US Census Bureau, 2012a, US Census Bureau, 2012b). Approximately 35.6% percent of Baltimore's children live below the poverty line, compared to just 13.9% statewide and 22.5% nationally (US Census Bureau, 2012a, US Census Bureau, 2012b). About 79.6% of the city's residents are high school graduates and about 26.1% have a Bachelor's degree or higher, compared to respective rates of nearly 88.5% and about 36.3% in the state (US Census Bureau, 2012a, US Census Bureau, 2012b). Only 48.8% of Baltimore residents own their homes, while these numbers are approximately 68.1% and 65.5% for the state and nation (US Census Bureau, 2012a, US Census Bureau, 2012b). Baltimore also has endemic rates of STIs (Becker et al., 1998, Jennings et al., 2005) and is a city with racial and ethnic disparities in STIs that are two to four times the national average (CDC, 2012). In 2011, Baltimore had the sixth highest chlamydia and tenth highest gonorrhea incidence among U.S. counties and independent cities (CDC, 2012). In 2011, the Baltimore–Towson metropolitan area had the sixth highest HIV incidence of any U.S. metropolitan area (CDC, 2013).

2.2. Study design and sampling strategy

Data for the current study were collected from the cross-sectional Neighborhood Influences on Adolescent and Adult Health (NIAAH) household study conducted from April 2004 to April 2007 in Baltimore City. The NIAAH study included biologic testing for a current gonorrhea and/or chlamydia infection. The target population included English-speaking, sexually-active persons between the ages of 15 and 24 years who resided in 486 neighborhoods or census block groups. We estimate that the target population represented approximately 58,299 persons living in the 486 neighborhoods in 2005. In the following, we briefly describe the household study design, sampling strategy and study procedures; additional details are described elsewhere (Jennings et al., 2010).

The sampling selection for the study was conducted in two stages. In the first stage, among the 710 neighborhoods in Baltimore City, 75% (533/710) neighborhoods were selected consisting of neighborhoods with greater than the 25th percentile in gonorrhea prevalence. This subsample was selected to increase the likelihood of identifying infected individuals, and to focus on distinguishing factors associated with a current STI among higher risk areas. Gonorrhea prevalence was generated from public health surveillance data among 15–49 year olds per 100,000 per neighborhood from 2004 to 2005. Eligible neighborhoods were further restricted to neighborhoods estimated to contain 35 or more households with age-eligible participants (486/533 or 91%) using Census 2000 information (U.S. Census Bureau, 2000). A final sample of 65 neighborhoods was selected using a stratified, systematic probability proportional to size sampling strategy.

In the second sampling stage, a total of 27,194 addresses within the 65 selected neighborhoods were obtained from three different purchasable address lists. These addresses served as the household sampling frame. We then used non-linear optimization to allocate a sample of 13,873 households to the three lists in a way that reduced screening costs while controlling for design effects (Chong and Zak, 1996) Our target enrollment for each block group was 10 participants.

2.3. Study population

In the household study, of the 27,194 addresses in the second stage sampling frame, 50% (13,699) were fielded and of these, 74% (10,173) households were successfully screened. During the screening, two of the 65 neighborhoods were found to be comprised exclusively of retirement communities and thus were excluded. Among households enumerated, 12% (1270) had at least one English-speaking person between the ages of 15 and 24. One age-eligible person was randomly selected for screening from each household. Among these households, screenings for sexual activity were attempted in 77% (981) of the age-eligible households with a completion rate of 70% (682) yielding a response rate to the interview among those selected of 68%. The overall interview with a biologic specimen response rate was 50% (599) (The American Association for Public Opinion Research, 2011). The 599 participants lived within 63 neighborhoods.

2.4. Study procedures

All sampled households received a lead letter describing the study approximately two weeks before the households were contacted for enumeration. Enumeration, to determine whether the household had at least one age-eligible individual, was conducted by telephone or in-person. Screening was conducted to determine eligibility. In selected households with more than one age-eligible person, one was randomly selected for screening. Eligible, consenting individuals were enrolled and research assistants administered an audio computer-assisted self-interview (ACASI) in a private setting.

Biologic samples including urine samples for males and self-administered vaginal swabs for females were collected for polymerase chain reaction amplification testing (Amplicor® CT/NG Test, Roche) for gonorrhea and chlamydia. Self-administered vaginal swabs for females and urine samples for males have been shown in previous research to be feasible and acceptable methods for collecting biologic samples for STI testing and to have high sensitivity and specificity with Nucleic Acid Amplification Testing [NAAT] (Gaydos and Rompalo, 2002, Marrazzo et al., 2007, Masek et al., 2009, Rompalo et al., 2001). Participants received $25 to $45 remuneration for participation in the study dependent on their year of entry. The study protocol was approved by the Western Institutional Review Board for Johns Hopkins University.

2.5. Measures

2.5.1. Outcomes

The main outcome of interest was a current infection with a bacterial STI (gonorrhea and/or chlamydia).

2.5.2. Main independent variables

The main variables of interest were informal social control and social cohesion. Informal social control was measured using 9 items reported by participants about their neighborhood (Cronbach's $\alpha = 0.83$) (Sampson, 1997). There were three scenarios including: 1) “Suppose some older teenagers were spray painting or grafittiing a building on your street”; 2) “Suppose a fight was breaking out in front of a house on your street”; and 3) “Suppose some teenagers were shouting and making a loud disturbance on your street around 11:00 pm” (Sampson, 1997). For each scenario, the participant was asked to respond yes or no to whether or not they would tell the teenagers to stop, get another neighbor to stop the teenagers, or call the police. The overall mean and standard deviation (SD) of informal social control was 3.03 (SD 0.94) and the range was 1–7.

Social cohesion was measured using 5 items reported by participants about their neighborhood (Cronbach's $\alpha = 0.72$) (Sampson, 1997). The five social cohesion items included: 1) “People in this neighborhood can be trusted”; 2) “This is a close knit neighborhood”; 3) “People around here are willing to help their neighbors”; 4) “People in this neighborhood don't really get along with each other” [reverse coded]; and 5) “People in this neighborhood don't share the same values” [reverse coded]. The overall mean and standard deviation (SD) of social cohesion was 15.02 (SD 1.16) and the range was 10–18.

For all items, participants were provided with a hard-copy map of their census block group and asked to think about this area when asked questions regarding “their neighborhood.” From these individual level measures, we developed additive indices of informal social control and social cohesion. Using these individual measures, we then created single neighborhood-level average measures for use in models. For each measure, a greater numeric value of the scale indicated greater informal social control or separately, great social cohesion.

2.5.3. Potential confounders

In final models, we controlled for individual perceived positive social support (12 items from the Social Provisions Scale including three subdomains – guidance, reliable alliance and social integration, Cronbach's $\alpha = 0.88$) (Cutrona and Russell, 1987). We also controlled for demographic and behavioral factors identified in the literature as being associated with informal social control or social cohesion and STIs. Specifically, at the individual level, we controlled for age (years), condom use at last sex (no/yes) and number of partners (past 90 days). After identifying the final model, we then controlled for neighborhood socioeconomic status (SES) in another set of models to explore whether findings were independent of neighborhood SES. Using data from the U.S. Census 2000, we measured neighborhood SES by constructing an index of four measures: an average of individual *z*-scores for median house value, median household income, percent of the population 25 years of age and older with a greater than or equal to a college education, and percent of households above the poverty line (U.S. Census Bureau, 2000). The neighborhood SES index had acceptable reliability (Cronbach's $\alpha = 0.78$). While race and immigrant status have been shown to be associated with the outcome and main exposure, we did not control for percent race such as percent African American or percent immigrant for two reasons. Race is not a biological determinant of STIs but rather a social determinant which is likely highly collinear with the exposure variables included in the conceptual framework. The study population was largely African American (86.3%) and Baltimore City (as represented in the study population) does not have a large immigrant population.

2.6. Statistical analyses

Analyses began with the generation of weighted summary statistics at both the individual and neighborhood levels, stratified by gender. Next, we conducted a series of weighted multilevel logistic regression models as a means of evaluating study aims. All models were conducted separately by gender (male/female). Multilevel modeling was used as a primary analytical technique to account for the nested data structure; that is, the nesting of participants (level 1) in neighborhoods (level 2). Multilevel analysis accounts for the non-independence of observations within groups, uses empiric Bayes adjustments for the group means, and allows for statistical testing of the between-and within-group variances on the outcome variables (Gelman and Hill, 2007, Raudenbush and Bryk, 2002). Statistical weights were used in all models to adjust model estimates for the unequal probabilities of selection of an individual and/or neighborhood, as well as for potential biases attributable to differential response and coverage between sample members and the target population. In multilevel analysis, the sampling weights need to be constructed differently than the sampling weights for single-level- or population- average models. A common approach and the one utilized in our analyses is a method of computation devised by Pfeffermann et al. (1998) for multi-level data. All models were assessed in HLM 7.0 (Scientific Software International, Inc, Lincolnwood, IL). For all analyses, statistical significance was determined by a 95% confidence interval that did not include 1.0.

For each of the main exposures – informal social control and social cohesion, we conducted a series of four models. We first evaluated an unconditional random effects model to examine the presence or absence of neighborhood level variability in a current bacterial STI. There was significant variability in a current bacterial STI at the neighborhood level (Standard Deviation (SD) 0.6079, variance 0.3700, degrees freedom 61, chi-square 85.9693, *p*-value 0.0019).

Next, in series of building models we tested the following relationships:

Model 1: level 1: STI (outcome).
level 2: informal social control or social cohesion.

Model 2: level 1: STI (outcome), age, gender, number of sex partners, condom use, social support.

Model 3: level 1: STI (outcome), age, gender, number of sex partners, condom use, social support.
level 2: informal social control or social cohesion.

Model 4: level 1: STI (outcome), age, gender, number of sex partners, condom use, social support.
level 2: informal social control or social cohesion and neighborhood SES.

Table 1. Descriptive characteristics of the Neighborhood Influences on Adolescent and young Adult Health (NIAAH) study population overall and by gender, Baltimore, 2004–2007 (n = 599).

Characteristics	**Overall (n = 599)**	**Females (n = 368)**	**Males (n = 231)**
Demographic characteristics			
Race/ethnicity (African American), n (%)	517 (86.3)	318 (86.4)	199 (86.1)
Age, mean (SD)	19.22 (2.75)	19.48 (2.71)	18.80 (2.75)
Individual social support, mean (SD)[a]	1.61 (0.45)	1.57 (0.44)	1.66 (0.47)
Neighborhood socioeconomic status (SES), mean (SD)[b]	−0.86 (2.03)	−0.83 (1.97)	−0.91 (2.13)
Sexual behavior characteristics			
Condom use last sex (yes), n (%)	345 (59.6)	195 (52.8)	150 (67.3)
Number of partners in past 90 days, mean (SD)	1.38 (1.21)	1.21 (0.96)	1.64 (1.51)
Outcome			
Current bacterial sexually transmitted infection (STI), n (%)[c]	37 (6.2)	20 (5.4)	17 (7.4)
Main neighborhood variables of interest			
Informal social control, mean (SD)[d]	3.03 (0.94)	3.06 (0.97)	2.88 (0.88)
Social cohesion, mean (SD)[e]	15.02 (1.61)	15.11 (1.55)	14.88 (1.66)

[a] 12-item scale measuring guidance, reliable alliance, and integration, adapted from the Social Provisions Scale.
[b] 4-item index measuring median house value, median household income, percent of population ≥25 years with at least a college education, and percent of households above the poverty line.
[c] Positive test for gonorrhea and/or chlamydia.
[d] 9-item scale measuring how participants would react to scenarios in which teenagers were grafittiing a building, fighting, and shouting on the street.
[e] 5-item scale measuring whether or not people in the neighborhood are trusted, close knit, willing to help neighbors, get along, and share values.

3. Results

3.1. Study population

Eighty-six percent of participants were African American, participants were on average 19 years of age, and the average neighborhood SES was −0.86 (Table 1). Sixty percent of participants reported using a condom at last sex and the average number of sex partners reported in the past 90 days was 1.38. The average scale score for individual social support was 1.61 (SD 0.45). Six percent of participants were infected with a current chlamydia and/or gonorrhea infection. Participants on average reported a score of 3.03 (SD 0.94) on the scale of informal social control and 15.02 (SD 1.61) on the scale for social cohesion. Table 1 also provides each characteristic for females and males separately.

3.2. Informal social control

In unadjusted models, higher informal social control was significantly associated with decreased odds of a current bacterial STI among females (OR = 0.63, 95% CI: 0.42, 0.95), but was not associated with an STI among males (OR = 0.75, 95% CI: 0.53, 1.06) (Table 2, Model 1).

Table 2. Odds Ratios (ORs) and Adjusted Odds Ratios (AORs) and 95% Confidence Intervals (95% CIs) of the association between informal social control and a current bacterial sexually transmitted infection (STI)[a] by gender, Baltimore, 2004–2007 (*n* = 599).

Characteristics	Model 1 OR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 4 AOR (95% CI)
Informal social control[b]				
Females	**0.63 (0.42–0.95)**	~	**0.58 (0.37–0.91)**	**0.53 (0.34–0.84)**
Males	0.75 (0.53–1.06)	~	0.74 (0.50–1.10)	0.73 (0.48–1.12)
Age (yrs)				
Females	~	0.79 (0.69–1.01)	0.79 (0.62–1.01)	**0.79 (0.63–1.00)**
Males	~	0.81 (0.61–1.09)	0.80 (0.60–1.08)	0.80 (0.60–1.09)
Individual social support[c]				
Females	~	0.60 (0.13–2.75)	0.60 (0.16–3.15)	0.60 (0.12–3.20)
Males	~	**6.88 (1.97–23.99)**	**6.57 (2.03–21.35)**	**6.58 (2.08–21.29)**
Condom use last sex (yes)				
Females	~	**0.29 (0.09–0.85)**	**0.26 (0.08–0.76)**	**0.26 (0.08–0.76)**
Males	~	0.63 (0.19–2.03)	0.64 (0.20–2.08)	0.63 (0.20–2.01)
Number of sex partners				
Females	~	1.61 (0.96–2.71)	1.73 (0.95–3.13)	1.70 (0.89–3.21)
Males	~	1.15 (0.78–1.72)	1.24 (0.83–1.84)	1.23 (0.82–1.82)
Neighborhood socioeconomic status (SES)[d]				
Females	~	~	~	0.87 (0.66–1.16)
Males	~	~	~	0.91 (0.78–1.21)

Items in bold are statistically significant.
[a] Positive test for gonorrhea and/or chlamydia.
[b] 9-item scale measuring how participants would react to scenarios in which teenagers were grafittiing a building, fighting, and shouting on the street.
[c] 12-item scale measuring guidance, reliable alliance, and integration, adapted from the Social Provisions Scale.
[d] 4-item index measuring median house value, median household income, percent of population ≥25 years with at least a college education, and percent of households above the poverty line.

In adjusted models among females, no condom use at last sex was significantly associated with a bacterial STI (AOR = 0.29, 95% CI: 0.09, 0.85), while increased individual social support suggested a protective but not significant association. Among males, younger age, condom use at last sex and greater numbers of sex partners were associated but not significantly with a bacterial STI, while increased individual social support was significantly associated with a bacterial STI (AOR = 6.88, 95% CI: 1.97, 23.99) (Table 2, Model 2).

Increased informal social control was significantly associated with a decreased odds (AOR = 0.58, 95% CI: 0.37, 0.91) of a bacterial STI for females, controlling for individual variables including age, condom use at last sex, number of sex partners and individual level social support (Table 2, Models 3). Increased informal social control remained significantly associated with a decreased odds of a bacterial STI for females (AOR = 0.53, 95% CI: 0.34, 0.84) after additionally controlling for neighborhood SES (Table 2, Model 4). For males, increased informal social control was associated but not significantly with a decreased odds of a bacterial STI (AOR = 0.74, 95% CI: 0.50, 1.10), controlling for age, condom use at last sex, number of sex partners and individual level social support (Table 2, Model 3) with similar results (AOR = 0.73, 95% CI: 0.48, 1.12) after additionally controlling for neighborhood SES (Table 2, Model 4).

3.3. Social cohesion

Increased social cohesion was associated but not significantly with a decreased odds of a current bacterial STI among females and males across all the models (Table 3, Models 1, 3–4). The individual level control variable association findings were the same as above in Table 2, Model 2 for females and males. The findings for social support were similar in models 3 and 4 (Table 3, Models 3 and 4).

Table 3. Odds Ratios (ORs) and Adjusted Odds Ratios (AORs) and 95% Confidence Intervals (95% CIs) of the association between social cohesion and a current bacterial sexually transmitted infection (STI)[a] by gender, Baltimore, 2004–2007 (*n* = 599).

Characteristics	Model 1 OR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 4 AOR (95% CI)
Social cohesion[b]				
Females	0.89 (0.71–1.13)	~	0.87 (0.68–1.14)	0.85 (0.61–1.19)
Males	0.97 (0.73–1.28)	~	0.97 (0.75–1.28)	0.98 (0.67–1.44)
Age (yrs)				
Females	~	0.79 (0.69–1.01)	0.79 (0.62–1.02)	0.79 (0.63–1.01)
Males	~	0.81 (0.61–1.09)	0.81 (0.62–1.06)	0.81 (0.61–1.09)
Individual social support[c]				
Females	~	0.60 (0.13–2.75)	0.61 (0.13–2.88)	0.61 (0.13–2.91)
Males	~	**6.88 (1.97–23.99)**	**6.86 (2.02–23.54)**	**6.85 (1.99–23.53)**
Condom use last sex (yes)				
Females	~	**0.29 (0.09–0.85)**	**0.28 (0.09–0.85)**	**0.28 (0.09–0.84)**
Males	~	0.63 (0.19–2.03)	0.64 (0.20–2.00)	0.64 (0.21–1.99)
Number of sex partners				
Females	~	1.61 (0.96–2.71)	1.65 (0.98–2.81)	1.65 (0.96–2.82)
Males	~	1.15 (0.78–1.72)	1.16 (0.72–1.86)	1.17 (0.78–1.74)
Neighborhood socioeconomic status (SES)[d]				
Females	~	~	~	0.95 (0.71–1.27)
Males	~	~	~	1.01 (0.77–1.35)

Items in bold are statistically significant.

[a] Positive test for gonorrhea and/or chlamydia.

[b] 5-item scale measuring whether or not people in the neighborhood are trusted, close knit, willing to help neighbors, get along, and share values.

[c] 12-item scale measuring guidance, reliable alliance, and integration, adapted from the Social Provisions Scale.

[d] 4-item index measuring median house value, median household income, percent of population ≥25 years with at least a college education, and percent of households above the poverty line.

4. Discussion

This research sought to identify important social organizational factors that may be associated with sexual health above and beyond individual level factors. The conceptual framework for this work is based on the premise that the social organizational factors influence health outcomes directly by creating social conditions that increase or decrease individual level STIs (Crosby and Holtgrave, 2006). Significant evidence exists, however, to suggest that individual social support affects individual level STIs. Previous research in this area has failed to tease out whether social organizational factors are independently associated with STIs or whether they operate via individual social support. Understanding whether and the extent to which social organizational factors are independent of individual social support is critical to inform interventions designed to decrease STIs among youth.

The primary study hypothesis was that informal social control and social cohesion, independent of individual social support, would be significantly associated with a current bacterial STI among urban adolescent and young adults. We also hypothesized that these relationships might differ for males and females given differences for males and females in sexual risk (Boyer et al., 1999; A. D. Bryan et al., 2012; A. Bryan et al., 2007, Houck et al., 2006, MacDonald et al., 1994, MacKellar et al., 2000) and interactions with a local neighborhood environment (Lloyd and Anthony, 2003). Among females, increased informal social control was significantly associated with a decreased odds of a current bacterial STI, after controlling for individual and neighborhood factors. This finding, while in the same association direction as females, was not significant for males. We found no significant association between social cohesion and a current bacterial STI for females or males.

Given that there are few multilevel studies examining informal social control, social cohesion and sexual health outcomes and even fewer among adolescent and young adult populations, it is not surprising that the findings are similar and different from prior work. Because of the lack of evidence specifically looking at sexual health outcomes, we review other health outcomes as well. A venue-based study in Baltimore among adults found an association between higher levels of social cohesion and lower gonorrhea rates among young adults (Ellen et al., 2004). Higher levels of social capital have been correlated with self-rated health (Kawachi et al., 1999, Malmström et al., 1999), general indicators of physical and mental health for adults (Veenstra, 2007) and adolescents (Boyce et al., 2008), and tobacco and alcohol use (attenuated by gender) (Chuang and Chuang, 2008). Additional evidence from a study in Chicago found that economic deprivation and low levels of social capital (defined as trust, social ties and reciprocity) were associated with higher all-cause mortality (Lochner et al., 2003). Collective efficacy (a construct incorporating social cohesion and informal social control) has been found to be associated with a decrease in violence, social disorder, and homicide rates in Chicago (Sampson, 1997). The results of this study compared to previous findings suggest that informal social control may operate differently by gender and age.

We also found that increased individual social support was associated with an almost seven-fold increase in odds of a current bacterial STI among males. This finding was in contrast to females where the association, although not significant, was protective, i.e. increased individual social support was associated with a decreased odds of an STI. The findings for males are dissimilar to a cross-sectional study conducted in among U.S. African American adolescents which found that adolescent males with fewer social supports engaged in more frequent unprotected sex with more sex partners (St. Lawrence et al., 1994). In the current study, we can only speculate about the reasons for the opposite direction of the findings in males and females. It may be that the differences are in part attributable to differences in the way in which individual support manifests in male and female youth. It could be that increased social support for males (as compared to females) is associated with greater connectedness to higher risk social networks, such as drug use networks, which may confer greater risk for STIs. To explore this hypothesis, we examined whether a current STI infection was associated with reporting greater numbers of peers engaged in buying drugs for females and males separately. For males, report of greater numbers of peers engaged in buying drugs was significantly associated with a two-fold increase in the odds of a current STI (OR 2.14, 95% CI: 1.41, 4,12). For females the findings were not significant and did not suggest an association (OR 1.06 95% CI: 0.62, 1.82). More research is required to understand these findings.

Our study had a number of limitations. While the multi-stage sampling study design allowed us to randomly recruit adolescents and young adults across census block groups, individual risk behaviors were self-reported and thus, may be underreported. The use of ACASI is helpful in reducing this socially desirable responding bias (Kissinger et al., 1999, Nelson et al., 2007). Adolescents report sensitive behaviors more frequently when questions are asked using computer interviewing techniques than when participating in a face-to-face interview (Kann et al., 2002, Kissinger et al., 1999, Turner et al., 1998). In addition, the use of individual level responses aggregated to reflect the neighborhood level constructs may not adequately capture the social environment constructs (Carpiano, 2006). These constructs are complex and full interpretation of the results, particularly those in the opposite direction as we hypothesized, require further investigation including qualitative research. In addition, the study sample of adolescents and young adults may not be the most appropriate population to report on neighborhood social organizational features. Another limitation is that of dependency of measurement error, given that exposures and outcomes are measured via the same data source (i.e. the NIAAH questionnaire).

In conclusion, our findings suggest that informal social control may be important for sexual health among adolescents and young adults and particularly for female adolescents (Berkman and Kawachi, 2000, Crosby et al., 2003, Putnam, 2000, Sampson, 1997). It is unclear why we found that for males, individual level social support was significantly associated with an increased odds for a current bacterial STI. It may be that individual social support operates differently by gender and among urban male youth, increased individual social support may serve as an indicator of being connected to negative peer networks, such as drug market networks. Further research will be required to confirm these findings and/or identify mechanisms for the associations found. In addition, further research is required to investigate how to bolster informal social control. Promising research in South Africa in a cluster randomized trial suggests that aspects of the social environment may be able to be intentionally generated (Pronyk et al., 2008). Understanding neighborhood social organizational and other structural factors will be important in the development and sustainability of programs and policies to improve adolescent and young adults' sexual health.

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