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Individual and Community Risk Factors and Sexually Transmitted Diseases Among Arrested Youths: A Two Level Analysis

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Scholars have long acknowledged a connection between individual conditions and community factors. Contemporary research in public health and epidemiology, in particular, has demonstrated that the health of the individual and the health of the community are linked. This is particularly important when studying the prevalence and transmission of communicable diseases such as sexually transmitted diseases (STDs). While the importance of multilevel research in public health and other paradigms has been asserted, existing multilevel studies of conditions such as STDs are limited. The present study examines the connection between individual-level attributes and community-level characteristics in explaining the prevalence of STDs among an at-risk sample of juvenile offenders.

Individual Level Factors Associated with STDs

More than twenty years ago, Bell, Farrow, Stamm, Critchlow, and Holmes (1985:33) suggested that “adolescent detainees may be disproportionately important as a core-group of transmitters of STDs.” Recent estimates from incarcerated youth indicate this statement remains true (Canterbury et al., 1995; Joesoef, Kahn, & Weinstock, 2006; Kahn et al., 2005; Morris, Baker, Valentine, & Pennisi, 1998; Pack, DiClemente, Hook, & Oh, 2000). In particular, chlamydia and gonorrhea rates among male adolescent detainees have been found to be 152 times greater than the general population in the same age range (Centers for Disease Control and Prevention [CDC], 1996). More recently, the CDC (2006) reported a 6.3 percent median state STD positive rate for females aged 15 to 24 tested at family clinics, whereas the median state positive rate for females tested in juvenile correctional facilities was over twice that (14.2%).

These high rates of STD infection among juvenile delinquents highlight the need to address this critical public health concern. Identifying the risk factors associated with sexually transmitted diseases is a first, and much needed, step towards obtaining an in-depth understanding of the high STD prevalence rates among juvenile offenders. Such knowledge

can inform the development of interventions to reduce risk behaviors and increase access to STD testing and treatment that target at-risk subgroups of youths.

Prior research indicates that risky sexual behavior, including STD infection, among juvenile offenders varies by important individual-level characteristics including race (CDC, 2002), gender (Joesoef et al., 2006; Kahn et al., 2005), age (Teplin, Mericle, McClelland, & Abram, 2003), and drug use (Teplin et al., 2005). Female juvenile offenders consistently have disproportionately higher rates of STDs than their male counterparts (Kahn et al., 2005; Mertz, Voigt, Hutchins, & Levine, 2002). For example, Joesoef et al. (2006) estimate that chlamydia positive rates range from 13.0 percent to 24.7 percent in incarcerated adolescent female populations and from 4.8 percent to 8.1 percent among incarcerated male adolescents; and gonorrhea positive rates range from 4.5 percent to 7.3 percent among incarcerated females and from 0.9 percent to 6.7 percent for males in the same population. On average, minority juvenile offenders (Kahn et al., 2005; Lofy et al., 2006; Mertz et al., 2002) and older youths (Kahn et al., 2005; Risser, Risser, Gefter, Brandstetter, & Cromwell, 2001; Robertson, Thomas, St. Lawrence, & Pack, 2005) are more likely to be STD positive.

Related research reveals significantly higher rates of STD infection among substance users compared to non-substance users (Malow et al., 2001; Morris, et al., 1995; Morris et al., 1998; Robertson et al., 2005). Studies examining the relationship between substance use and risky sexual behaviors among delinquent youths indicate substance users engage in risky sexual behaviors at a substantially higher rate than non-users (Barthlow, Horan, DiClemente, & Lanier, 1995; Kingree, Braithwaite, & Woodring, 2000; Shafer et al., 1993; Teplin et al., 2005).

Current knowledge of STD prevalence among juvenile offenders, however, is primarily based on studies of incarcerated youths, particularly those in secure detention centers (Belenko et al., 2008a). To our knowledge, with the exception of our recent work, there are no studies on STD prevalence or the factors associated with STD risk among newly arrested youths who are returned to the community. This is a noteworthy gap considering nearly 80% of arrested youths are not placed in detention centers or incarcerated, but instead are released back to the community following arrest (Stahl, Finnegan, & Kang, 2006). In our own recent work in Hillsborough County (FL), the only study we are aware of that has examined STD prevalence among newly arrested youths prior to detention, we found infection rates for chlamydia and gonorrhea that were comparable to those found among detained and incarcerated youths (Belenko et al., 2008b).

Community Level Factors Associated with STDs

Merely examining individual level predictors of STDs, substance use, and risky sexual behavior limits understanding of this complex, multi-dimensional public health issue, and prevents insight into how multiple level factors influence sexual behavior and health (Voisin, DiClemente, Salazar, Crosby, & Yarber, 2006). Increasingly, researchers and epidemiologists are recognizing the important roles that community contexts and structural factors play in determining STD and other health risk (Leventhal & Brooks-Gunn, 2000) as well as delinquency and drug use. In particular, it is important to consider the social context in which individuallevel factors are operating. The characteristics of the neighborhood setting in which an adolescent resides provide a context that has the potential to influence substance use and risky sexual behavior, and to inform the development and expansion of accessible and effective community-based STD prevention and treatment services.

Several explanatory models have been proposed to account for community variations in social (e.g., poverty, inequality, family disruption) and health (e.g., disease, mental illness, poor prenatal care) ills. One contextual perspective, in particular, that has been articulated in an

empirically viable explanation for how variation in community factors relates to variation in delinquency and health consequences is social disorganization theory (Bursik, 1988; Sampson & Groves, 1989; Shaw & McKay, 1969). According to social disorganization theory, neighborhood disadvantage, such as economic inequality, racial heterogeneity, and residential mobility, inhibits the general effectiveness of local institutions (e.g., schools, churches, health providers) and prevents the development and maintenance of social support and cohesion. More specifically, neighborhoods characterized by higher levels of poverty, economic inequality, and unemployment are less able to provide effective resources and institutions for their residents; thus, they are postulated to demonstrate higher levels of delinquency and other social ills. Communities marked by racial and ethnic variation are less likely to experience social cohesion and to develop strong mechanisms of social control due to potential language and cultural barriers. Neighborhoods with higher levels of residential mobility also experience weakened social control mechanisms because high population turnover leads to inconsistent values and norms within the community, and low investment in the community. Social control mechanisms are also threatened by higher levels of family disruption (i.e., divorce, single parent households) and unsupervised youth. Family disruption is associated with lower family income levels, longer work hours for single parents, and decreased parental supervision of children. Unsupervised children are more likely to become involved in antisocial behavior, including risky sexual practices. All of the aforementioned factors work to undermine the social cohesion and collective efficacy within communities.

Social disorganization theory describes several community characteristics that can affect social control mechanisms and behavioral modeling resources available to youth in their community. The theory has received strong empirical support for explaining neighborhood variation in crime and delinquency. The theory has also demonstrated promise for explaining variations in neighborhood levels of risky sexual behavior. Specifically, communities experiencing higher levels of disorder and lower levels of cohesion tend to have significantly fewer institutional resources available, which can increase the rate of STD infection and inhibit communication regarding such issues (Cohen et al., 2003). Neighborhood disadvantage can have both direct and indirect effects on adolescent risk behavior and health-related outcomes (Browning, Leventhal, & Brooks-Gunn, 2004; Upchurch, Aneshensel, Sucoff, & Levy-Storms, 1999).

Research has documented macro-level or structural factors that are associated with sexual behavior among youths. Poverty and economic inequality have been found to be associated with high rates of sexual activity, pregnancy, premarital births, abortions, and low rates of contraception use among adolescents (Baumer & South, 2001; Billy, Brewster, & Grady, 1994; Browning et al., 2004; Hogan, Astone, & Kitagawa, 1985; South & Baumer, 2001; South & Crowder, 1999). The racial composition of neighborhoods, specifically residing in neighborhoods with higher proportions of minority populations, has also been linked with risky sexual behavior (Brewster, 1994; Crane, 1991; Driscoll, Sugland, Manlove, & Papillo, 2005; Hogan & Kitagawa, 1985; but see Brewster, Billy, & Grady, 1993; Ku, Sonenstein, & Pleck, 1993). Other studies have found residential instability is positively related to premarital sex, premarital pregnancy, and multiple sexual partners (Brewster, et al., 1993; Browning & Olinger-Wilbon, 2003; Sucoff & Upchurch, 1998; however, see: Browning et al., 2004).

A few studies have examined the association between community characteristics and STD infection rates among adolescents. These studies suggest that disadvantaged communities have higher STD rates (Krieger, Waterman, Chen, Soobader, & Subramanian, 2003; Shahmanesh et al., 2000). Additionally, adolescents living in urban or inner-city settings have higher STD prevalence rates, than youths living in rural or suburban areas (Farely, 2006). Taken together, these studies suggest that adolescents residing in more disadvantaged neighborhoods engage in greater risks associated with sexual activity, which consequently place them at increased risk for contracting STDs.

Although the available evidence indicates the magnitude of neighborhood effects on risk behavior is relatively small when compared to individual-level effects (Liska, 1990), the above noted studies suggest community factors have the potential to influence an individual's likelihood of contracting an STD. However, there are at least two limitations in this current body of research. First, these studies only consider individual-level *or* community-level variables, and therefore, fail to consider the influence of such factors simultaneously. Second, most of these community studies are based on non-delinquent adolescent samples, rather than high risk subpopulations such as delinquent youths.

Given the high STD prevalence rates among juvenile offenders, it is important to examine the association among community characteristics and STD prevalence rates among juvenile offenders for several reasons. First, there is a strong link between delinquent behavior and STD infection (Morris et al., 1998; Joesoef et al., 2006; Kahn et al., 2005), and it is important to understand how both individual and community factors influence this relationship. Second, it has been documented that juvenile offenders are more likely to reside in poor communities characterized as being socially disorganized (Shaw & McKay, 1969): hence such communities may possess attributes that place delinquents at greater risk for STDs. Third, a large body of research indicates that community level factors significantly predict individual delinquent behavior, as well as risky sexual behavior, above and beyond individual level predictors (e.g., Cattarello, 2000; Elliott et al., 1996; Gottfredson, McNeil & Gottfredson, 1991; Upchurch et al., 1999). Finally, empirical research examining the covariation between macro-level factors and STD infections among juvenile offenders is extremely rare.

The present study sought to overcome the limitations of the research summarized above by examining the relationship between individual-level factors (e.g., gender, age, drug use) and community-level factors (e.g., concentrated disadvantage) and STD prevalence for chlamydia and gonorrhea among newly arrested youths processed at a centralized intake screening facility. This study is unusual in that biological data on both drug use and STDs were used in the analyses. The data provided a unique opportunity to assess the relative influence of these factors on the STD status of a diverse sample of juvenile offenders, including youths released back into the community following arrest and those placed in secure detention.

Methods

Sample

Participants were newly arrested juveniles aged 12-18 processed at the Hillsborough County, FL Juvenile Assessment Center (HJAC) (a centralized intake facility) between June 19 and September 30, 2006 for males (n = 506) and between June 19 and December 31, 2006 for females (n = 442). The study involved collaboration between the HJAC, the Florida Department of Health (DOH), Hillsborough County Health Department (HCHD), and the Florida Department of Juvenile Justice (DJJ). As a standard procedure in Hillsborough County, newly arrested juveniles are transported soon after arrest to the HJAC for intake processing. During the recruitment period, youths processed at the HJAC were asked to voluntarily participate in the project by consenting to have their urine specimens (UA) (taken for drug testing as part of the standard HJAC processing protocol) split tested for chlamydia and gonorrhea. Youths processed more than once at the HJAC for multiple arrests during the enrollment period were tested only on their first admission.

All study protocols were approved and monitored by the Treatment Research Institute (previous affiliation of the project PI) and Temple University Institutional Review Boards, oversight IRBs for this project. In order to comply with requirements of the DHHS Office of Human Research Protections (OHRP) and the project IRBs, project research staff could not have direct contact with the youths. In addition, Florida state law protects the confidentiality

of youth aged 12 or older who are tested for STDs, even from their parents, and parental consent for an STD test is not required. After receiving NIH human subjects certification, HJAC staff were trained by the authors to: (1) conduct STD pre-test counseling of project eligible youth (developed in consultation with the HCHD), (2) obtain consent to split their urine specimens for STD testing, and (3) complete a Supplemental Contact Form on consenting youths (to assist HCHD Disease Intervention Specialist staff in locating infected youths for treatment). The agency employing HJAC staff, and coordinating HJAC operations, provided us with a deidentified data file to analyze. In addition to OHRP approval, all recruitment and consent procedures were reviewed and approved by the relevant IRBs.

A total of 759 males and 634 females were recruited and assessed by HJAC assessment staff. Among these, 82.6 percent of both male and female youths agreed to provide UAs for drug testing. Of those providing UAs, 80.7 percent of the males and 84.4 percent of the females also consented to have their urine tested for chlamydia and gonorrhea. No significant differences were found in STD testing participation by gender, HJAC shift, race, age, or HJAC placement. Although the male and female youths involved in this study were not probability samples, comparison of these youths with all HJAC male and female intakes during the data collection period in regard to demographic and charge characteristics do not indicate any substantial differences. All study procedures were approved by the project's Institutional Review Boards.

The home addresses of the participants were geocoded (assigned x and y map coordinates based on street addresses) to permit multilevel analyses. After interactively matching the partial and non-matching addresses of the unweighted 948 youths involved in the study, 924 of the youths (97.5%) were successfully geocoded within a six-county area, covering Hillsborough County and its five adjacent counties (Hardee, Manatee, Pasco, Pinellas, and Polk). For the nongeocoded youths, $n = 2$ (0.2%) provided an out of state address, $n = 8$ (0.8%) provided addresses with missing or incorrect address information, and $n = 14$ (1.5%) lived in counties that were not contiguous to Hillsborough County.

Females represented approximately 25 percent of the overall HJAC population; therefore, they were over-sampled to yield sufficient power for gender-specific analyses. The proportion of potential male enrollees per month from June through September 2006 was used to estimate the number of eligible males booked over the entire recruitment period and to calculate a weighting factor of 1.901 for eligible males. In the analyses, the male cohort was weighted to provide estimates for the full population during the recruitment period. Since the female cohort represented *all* eligible females during the recruitment period, it was not weighted. Therefore, the final weighted sample used in the analyses included 431 females and 937 males residing in 221 census tracts in Hillsborough County and its adjacent counties.

Measures

Dependent Variable

STD status: A non-invasive, FDA-approved, urine-based nucleic acid test, GenProbe APTIMA Combo 2 Assay, was used to test for chlamydia and gonorrhea. The sensitivity of GenProbe's test has been shown to be superior to culture and direct specimen tests. For chlamydia, the sensitivity and specificity of the GenProbe urine-based test are 95.9% and 98.2%, respectively, and for gonorrhea, they are 97.8% and 98.9%, respectively (Chacko, Barnes, Wiemann, & DiClemente, 2004). For analyses purposes, each youth's STD results were recoded into a dichotomous variable representing positive (coded as 1) for any STD (i.e., chlamydia, gonorrhea, or both) or negative (coded as 0) for all STD tests.

Individual-Level Independent Variables

Sociodemographic measures: Information was collected on the youths' gender, age, and race at the time of entry in the HJAC. For the analyses, *gender* was dichotomized as male (coded as 1) and female (coded as 0). *Age* was operationalized as a continuous indicator representing the number of years old. *Race* was dichotomized as African American or Black (coded as 1) and non-African American, mostly Caucasian or White (coded as 0). (Since HJAC staff, who recorded the sociodemographic data, were not always diligent in recording if a youth was Hispanic, the non-African American comparison group includes Hispanic youths as well.)

Drug use results: At the DOH testing lab, the split urine specimens were also tested for drugs using the widely used EMIT procedure. The cutoff levels for a positive for each drug were: marijuana (50 ng/ml of urine) and cocaine (300 ng/ml of urine). Although the urine specimens were tested for opiates and amphetamines, very few youths were found to be positive for these drugs (0.5% and 1.8%, respectively). Hence, these drugs were excluded from analyses. The marijuana and cocaine UA results were dichotomized (0 = negative, 1 = positive) for the analyses.

Post HJAC placement and charge level: In accordance with Florida State law, HJAC personnel must complete a Detention Risk Assessment Instrument (DRAI) for each youth processed at the HJAC (Dembo et al., 1994). The DRAI takes into consideration the youth's most serious current offense, other current offenses and pending charges, prior offense history, current legal status, and aggravating or mitigating circumstances. On the basis of this information, each youth is assigned a point score. Youths assigned 0 to 6 points are released to the community without supervision, awaiting placement in a diversion program. Youths receiving 7 to 11 points are placed on non-secure home detention (i.e., home arrest). Youths receiving 12 or more points are placed in secure detention. Youths receiving a score of 7 or more on the DRAI are placed under the supervision of the DJJ; they are assigned a DJJ case manager who monitors their case until final court disposition. The current *charge level* variable used in analyses differentiates diversion eligible youths (0 = DRAI score 0 to 6 points) from youths whose scores place them under the supervision of DJJ (1 = DRAI score 7 or more).

Community-Level Independent Variables—Census tract boundaries for 2000 serve as the unit of analysis for the community. Census tracts represent geographic regions established by the U.S. Census Bureau that are relatively homogeneous areas with respect to demographic and economic characteristics. Census tracts contain anywhere from 1,500 to 8,000 people, with an optimal size of 4,000 people. In 2000, there were 249 census tracts in Hillsborough County. A total of $n = 202$ (88%) Hillsborough County census tracts contained at least one study youth. Furthermore, an additional 19 census tracts within counties adjacent to Hillsborough County contained at least one study youth. Thus, a total of 221 census tracts are included in the analyses.

The decision to use census tracts as the geographic unit of analysis, rather than block-level measures, was informed by conceptual issues of aggregation bias when estimating effects (Hipp, 2007), and the distribution of the community level data analyzed. Conceptually, racial/ethnic heterogeneity has been found to be robust at the census tract level in explaining key constructs of social disorganization theory, and measures of broken homes and disadvantage have been found to increase perceptions of crime at both the block and census tract levels (Hipp, 2007). Further, the distribution of our sample cases within census tracts limited the ability to adequately perform block-level analyses. For the 221 tracts in which the sample resided, 103 tracts (46%) contained only one or two youths. Use of block-level community measures would have substantially increased the number of blocks containing few, if any, cases (for a general discussion on this issue, see: Hipp, 2007).

Each tract-level measure is coded as a continuous variable, using logarithmic transformations of these variables, where indicated, in the analyses. For variables with the lowest kurtosis (i.e., skewed distribution), transforming the data was not necessary. For variables with high kurtosis due to outliers, a logarithmic transformation was used to address the issue of skewness, while preserving the continuous nature of the variable. The correlations among the community level factors were, on average, low in magnitude (mean correlation = 0.296). (A table of these results is available upon request.)

Community disadvantage: Informed by the literature testing social disorganization theory (e.g., Sampson, Morenoff, & Earls, 1999; Sampson, Raudenbush, & Earls, 1997), an index was created involving four socio-economic indicators of disadvantage in racially segregated neighborhoods: the proportion of the population below the poverty line (mean = 0.139, SD = .117), the proportion of the population identifying their race as Black or African American (mean = .174, SD = .225), the proportion of the population 16-years-old or older that were unemployed (mean = .04, SD = .071), and the proportion of families identified as female-headed households with children present (mean = .084, SD = .058). Three variables, the proportion of female-headed households with children, proportion unemployed, and proportion living below the poverty, had high Kurtosis values (i.e., ≥ 5.0); these variables were log transformed at the census tract level for use in further analyses. The correlations among the three log-transformed variables and proportion Black were significant. Separate, confirmatory factor analysis revealed a one-factor solution fit the data best ($\chi^2[2, N = 221] = 1.823$, $p = .40$). Hence, this community level factor, reflecting concentrated disadvantage, was used in subsequent analyses.

While other variations of the construct of concentrated disadvantage have been used in tests of social disorganization theory, the measures consistently include indicators of economic disadvantage (i.e., poverty and unemployment), racial segregation (i.e., percent Black), and family disruption (i.e., female-headed households, with or without the presence of children). The rationale for the measures used in this study is based on Sampson et al.'s (1999) work examining the effects of neighborhood collective efficacy and social disorganization on youth behavior. Similar to this work, the present study examined the influence of social disorganization mechanisms on the youths' STD status.

Residential stability: This variable represents the proportion of the population five-years-old and over living in the same house five years earlier to 1999. The average level of residential stability across the 221 census tracts was 0.472 (SD = .126).

Hispanic: The proportion of the population identifying themselves as Hispanic in 1999 was also included in the analyses. The mean value was 0.166 (SD = .128).

Youth: The size of the adolescent population residing in the area was measured by the proportion of the population less than eighteen years old in 1999. The average of the proportion of youth under the age of 18 residing in the census tracts equals 0.257 (SD = .064).

Ethnic heterogeneity: Similar to Sampson and Groves (1989), among others, a measure of ethnic heterogeneity was included as an indicator of social disorganization. This construct was intended to measure potential ethnic/racial barriers existing within each tract. As noted earlier, according to social disorganization theory, communities that are more heterogeneous in race/ethnicity experience greater challenges to establishing strong social networks and cohesion among their residents due to potential differences in language and culture. Ethnic heterogeneity was calculated as one minus the sum of the squared proportion of each given race/ethnic group in each census tract's population (see Blau, 1977). Values of zero indicated complete ethnic

homogeneity; values of one indicated complete maximum heterogeneity. The mean value for ethnic heterogeneity equaled 0.326 (SD=.159).

Analysis Strategy

As noted earlier, the goal of this study was to simultaneously examine the individual and community level predictors of STD prevalence among a sample of newly arrested juvenile offenders. (Due to the exploratory nature of the study, a stepwise analysis was not pursued.) A two level logistic regression using Mplus version 5.1 (Muthén & Muthén, 2007) was performed. The estimator for the analysis was maximum likelihood with robust standard errors using a numerical integration algorithm. The within part of the model involved the logistic regression of STD status on the six individual level predictor variables. The between part of the model involved the regression of STD status on the six different census tract (i.e., cluster) level characteristics (see Figure 1). In the two level analyses, the cluster setting scaled the within weights from the data, such that they summed to the sample size in each cluster (Muthén & Muthén, 2007: 458).

Since the dependent variable, STD status, was binary, there was no within-level residual variance in the regression of STD status on the within-level predictor variables. The threshold for STD, variance for concentrated disadvantage, and the residual variances of STD test results, African American, female-headed households with children, unemployed, and below poverty were estimated. Preliminary analyses indicated that standard errors of sufficient magnitude existed for correlations between the youths' STD test status and the various within- and between-level variables for the estimation of two-level model.

Results

Table 1 describes the characteristics, by gender, of the weighted sample of 1,368 youths. A significantly larger percent of females were arrested on less serious (misdemeanor, diversion eligible) charges than males. Nearly three out of four females, compared to just over half of the males, were released to the community. On the other hand, more males than females were placed on house arrest or sent to secure detention.

Bivariate Analyses

Table 2 compares the demographic, HJAC processing characteristics, and UA drug test results for the STD positive and STD negative youth. Significant differences were found for STD status in regard to gender, race, and age. Nearly 20 percent of the girls and 11 percent of the boys were STD positive, African-American youths had significantly higher STD positive rates than non-African-American youths, and STD-positive youths were significantly older. Youths arrested on more serious charges (i.e., a DJJ case) and youths placed in secure detention were significantly more likely to be STD positive, than youths arrested on misdemeanor, diversion eligible charges or youths placed on diversion or non-secure home detention. Further, youths who were UA test positive for marijuana or cocaine had significantly higher STD positive rates, than youths who tested negative for these respective drugs.

Multivariate Analyses

Table 3 reports the results of the two-level logistic regression analysis. The critical ratio refers to the ratio of the regression estimate divided by its standard error, in effect a test of its statistical significance. In contrast, the odds-ratios refer to ratio of a difference in “outcome,” when comparing one group to another. At the individual-level, controlling for other factors, female youths, older youths, African-American youths, and youths arrested on more serious charges were significantly more likely to be STD positive. The odds-ratio results indicated the odds of male youths being STD positive were 68 percent lower, than for females. In addition, older

youths were 1.4 times more likely to be STD positive, African-American youths were 4.1 times more likely to be STD positive, and youths arrested on more serious charges were 2.2 times more likely to be STD positive, than their respective comparison groups. (Since charge level and post HJAC placement were highly correlated [r = .883], only seriousness of current arrest charge was included in the analyses.) For the community-level variables, the critical ratio results indicate concentrated disadvantage was significantly related to being STD positive.

The residual variance for the STD results was low, and non-significant. This suggests that most of the variance in the STD test results was accounted for by the individual- and community-level variables in the model.

Ad Hoc Cross-Level Interaction Analyses

The two-level regression analysis reported in Table 3 addressed whether or not individual-level and community-level conditions affected the odds that the juvenile delinquents studied tested positive for one or more STDs. Based on these findings, it is clear that youths who resided in less affluent neighborhoods had an increased likelihood of testing positive for STDs, and that youths who were female, older, African American, and had more severe charges also had an increased odds of testing positive. But this multilevel test (reported in Table 3) did not indicate whether the individual characteristics interacted with the community characteristics to affect STD contraction. That is, does concentrated disadvantage affect the within-level slopes associated with the gender, age, race, and charge level in predicting STD status?

Unfortunately, Mplus does not permit the estimation of cross-level interactions for the model. Therefore, HLM version 6.03 (Raudenbush, Bryk, & Congdon, 2005) was used to examine the cross-level interaction of concentrated disadvantage on STD status. First, the multilevel model reported in Table 3 using Mplus was replicated using HLM to ensure that the findings were comparable. The factor scores for concentrated disadvantage were saved and used as an observed variable in the HLM analyses. The HLM results were comparable to those reported in Table 3. Second, a multilevel model including cross-level interactions for concentrated disadvantage with gender, age, race, and charge level was estimated. As reported in Table 4, concentrated disadvantage interacted with charge level to significantly affect STD status. As community concentrated disadvantage decreased and youths' charge level increased, the probability of being STD positive increased, controlling for all else. In other words, the slope of the line predicting charge level led to STD positive status was significantly affected by concentrated disadvantage.

Discussion

Informed by social disorganization theory (Bursik, 1988; Sampson & Groves, 1989; Shaw & McKay, 1969), this study examined how community factors of disadvantage and individual characteristics affected STD prevalence among a sample of justice-involved youths. More specifically, the study examined the individual and community level characteristics associated with two of the most commonly found STDs among adolescents, chlamydia and gonorrhea. Using a sample of newly arrested youths in Hillsborough County, FL, several individual-level, demographic factors significantly predicted STD status. These factors included being female, older, African American, and arrested on more serious charges.

Older, African-American adolescent females have routinely been considered at heightened risk for STD infection (CDC, 2006), and our findings validate this among new arrestees. This demographic subgroup requires priority attention for prevention and interventions services, especially given the asymptomatic nature of these diseases (Burstein, Gaydos, Diener-West et al., 1998; Kahn, et al., 2005). In addition, STDs are an important secondary risk factor for HIV infection: those with untreated STDs are three to five times more likely to contract HIV (CDC,

1998). Thus, increasing detection and treatment can help to prevent future HIV infections, as well as the spread of disease (ASTHO, 2005).

Although significant at the bivariate level, neither marijuana nor cocaine urine test results were found to be significant individual-level predictors of STD status. This finding is surprising given the large body of literature highlighting a strong association between substance use and risky sexual practices during adolescence (Kingree et al., 2000; Teplin et al., 2005). One possible reason for such contradictory results may be related to our measure of drug use. In the current study, drug use was based on biological data. Although using biological data guards against inaccurate self-reported information, it also has its shortcomings, such as the shortened surveillance window for which drug use can be measured. For heavy users, marijuana only stays in a youth's system for approximately twenty days and cocaine remains in the system for less than four days (Dembo et al., 1999). Therefore, the urine assay test results were only able to capture current drug use. Relying on self-report data, which is often error prone among newly arrested youths, would have permitted as extended time frame for assessing drug use (e.g., past year use) and increased the number of drug users included in the study.

Examination of community-level effects on the youths' STD results found census tracts characterized by concentrated disadvantage significantly predicted their STD status. This important result is consistent with the growing body of literature suggesting community factors affect adolescent sexual behavior (Baumer & South, 2001; Brewster et al., 1993; Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Ku et al., 1993; Ramirez-Valles, Zimmerman, & Juarez, 2002; South & Baumer, 2001; Upchurch et al., 1999). While few of these studies have examined STDs specifically, it seems reasonable to assume that increased risk for early, frequent, and unprotected sex also leads to increased risk for STD infection.

It could be expected that the existence of formal organizations that offer prevention, testing, and treatment for sexually transmitted diseases are important in reducing STD rates (Bursik & Grasmick, 1993; Kubrin & Weizer, 2003). The presence of such agencies providing STD testing and sex education to adolescents would serve to counter the possible influence that living in socially disorganized communities may have on their sexual risk behavior.

We addressed this issue, in part, by conducting ad hoc analyses to examine how individual-level access to STD services (n = 108 STD testing facilities, STD education facilities, and walk-in clinics) via linear and road network distances affected the youths' STD status. Youths' access to STD services did not significantly affect STD status, and the effects of the other independent variables remained unchanged. Examination of the geographic distribution of the STD-related services suggested that access to such services was equally distributed across the census tracts containing the sample, and generally located in more, rather than less, disadvantaged tracts. Although there are other institutions that may affect STD status, the present sample did not appear to be disadvantaged with respect to access to STD-related services. It should, however, be noted that many of these STD-related services are facilitated through the public school system. Since it is likely that at least some of the youths in the high-risk sample we studied did not attend school regularly, they would be less likely to receive such services. Future studies should explore how access to STD-related services affects STD prevalence and whether this relationship is modified by truancy.

At the same time, education of families and youths on sexually risky behavior and its consequences needs to be an important component in public health efforts to reduce the high rate of STDs in stressed communities. We found, for example, significant, positive relationships between the proportion of the census track population with less than a high school education and each of the concentrated disadvantage factor variables (proportion African American, r = .620; female-headed households with children, r = .576; unemployed, r = .612;

below poverty, $r = .822$). Further, as our individual-level effects highlight, there is a need to simultaneously address the STD issue at both the individual and community levels. Our findings suggest the importance to pursuing such a combined effort. Adolescents who live in stressful environments appear to be more likely to engage in sexual risk behavior (Aral & Wasserheit, 1995; Ennett et al., 1999; DiClemente et al., 2008).

In an attempt to better understand how concentrated disadvantage affects individual-level STD status, we examined the cross-level interactions between concentrated disadvantage and the significant individual-level predictors (age, gender, race, and charge level) of STD status. Interestingly, youths who resided in more affluent or less disadvantaged neighborhoods and were arrested on more serious charges were more likely to test positive for STDs than youths with less serious charges in more disadvantaged areas. These findings suggested that there is a risk associated with more severe criminality that can affect risky sexual behavior, despite more protective community conditions. Unfortunately, the data do not permit further investigation into why these effects occurred.

We speculate, however, two possibilities for this cross-level interaction. First, this cross-level interaction may be an artifact of differences in police practices. It may be that police working in more disadvantaged areas are less likely to tolerate deviant behavior among youths in these areas. To the extent that this is the case, the validity of the cross-level interaction effect is questionable. To test this hypothesis, we would need access to police data that include all calls for service and police initiated contact with youth and the consequences of these contacts (e.g., youth warned and released, youth charged without arrest, youth arrested). Unfortunately, such data were not available for us to examine.

Second, the cross-level interaction effect may, in fact, reflect a culture/socialization effect. Consistent with social disorganization theory, youths living in more affluent, less disadvantaged areas tend to be raised in communities characterized by high social cohesion promoting stable, conventional morals, values, and beliefs. In such communities, family disruption is low; and youths receive more parental involvement and supervision. Economic strain is low for families and local institutions, and families and the community are more likely to satisfy the needs of their youths. These areas will also reflect greater residential stability and homogeneity, which serve to strengthen conventional values, and resident commitment to the betterment of the community. Consequently, youths in more affluent communities should be less likely to initiate deviant (e.g., criminal or risky sexual) behavior, and those who do are likely to receive immediate correction of such behavior. It is only among the most persistent and severe “offenders” in affluent communities that we would expect to find a high STD positive rate. Youths residing in highly disadvantaged areas lack the community, family, and mentoring resources to effectively correct unconventional behavior. According to social disorganization theory, we would expect to find even minor offenders in disadvantaged areas to be at high risk of STDs. Future examinations of cross-level interactions for STD risk, as well as replication of this study, are needed to validate and elucidate our findings.

There are some additional limitations to our study. First, the data were collected at one site. There is a need to determine if the findings we obtained are replicated in centralized intake centers in other locations, serving different populations of juvenile arrestees. Second, the surveillance window for the drug tests were, with the exception of heavy and chronic marijuana users, relatively short. Hence, our drug test data refer to recent use. Third, our individual-level data were cross-sectional. Hence, no causal statements about the individual-level relationships can be made.

Finally, we were unable to include individual-level psychosocial factors in our multilevel analyses. Peer behavior and parent monitoring/supervision have been shown to be important

predictors of risky sexual practices (DiClemente et al., 2001; Robertson & Levin, 1999; Spitalnick et al., 2007). We attempted to obtain some youth psychosocial data from agency staff assessments of HJAC processed youths involved in our study. However, these data were of insufficient quantity and quality for us to use. Future research should seek to overcome this limitation by collecting and incorporating such data in their analyses. At the same time, given that this study is the first we are aware of to conduct a multilevel analyses of STD infection among newly arrested juvenile offenders, we believe that identifying socio-demographic risk factors for STD status provides very useful information regarding STD prevalence among this population. Further, this study lays a groundwork for future research in this important area.

Detection of STDs among newly arrested juveniles holds great promise of increasing sexual health and responsible sexual behavior, and at the same time, reducing the spread of HIV/AIDS. The “front door” of the juvenile justice system presents a relatively low cost, procedurally efficient, and effective opportunity to improve these youths' health in a way that directly impacts the health of the general community. Based on our results, prevention and intervention strategies that focus on juvenile offenders found to be at high risk for STDs (female, older, African-American youths) are needed. While the individual-level socio-demographic risk factors of gender, age, and race for STD positive status are arguable immutable to intervention and prevention, the significant relationship between charge level and STD status suggests directions for intervention and treatment. Prevention should focus on first-time juvenile offenders, regardless of the nature of their offenses. Our findings suggest that increased involvement in criminal behavior serves as an indicator of increased likelihood of involvement in risky sexual practices and becoming infected with a STD. STD prevention can improved by requiring STD screening, and subsequent treatment for those testing positive, for all youth coming into contact with the justice system.

Our study also suggests that delinquents residing in more disadvantaged areas are at greater risk of testing positive for STDs. This finding suggests that increased efforts need to be made to provide intervention and treatment for these youth. This effort is challenged by the fact that while most STD prevention efforts are implemented in schools, many justice involved youths do not actively attend or participate in school. More creative, community-based prevention efforts are needed. Illumination of the relative influence of community level, and individual level socio-demographic and psychosocial, factors affecting STD risk among juvenile offenders, and the manner of their influence, awaits additional research.

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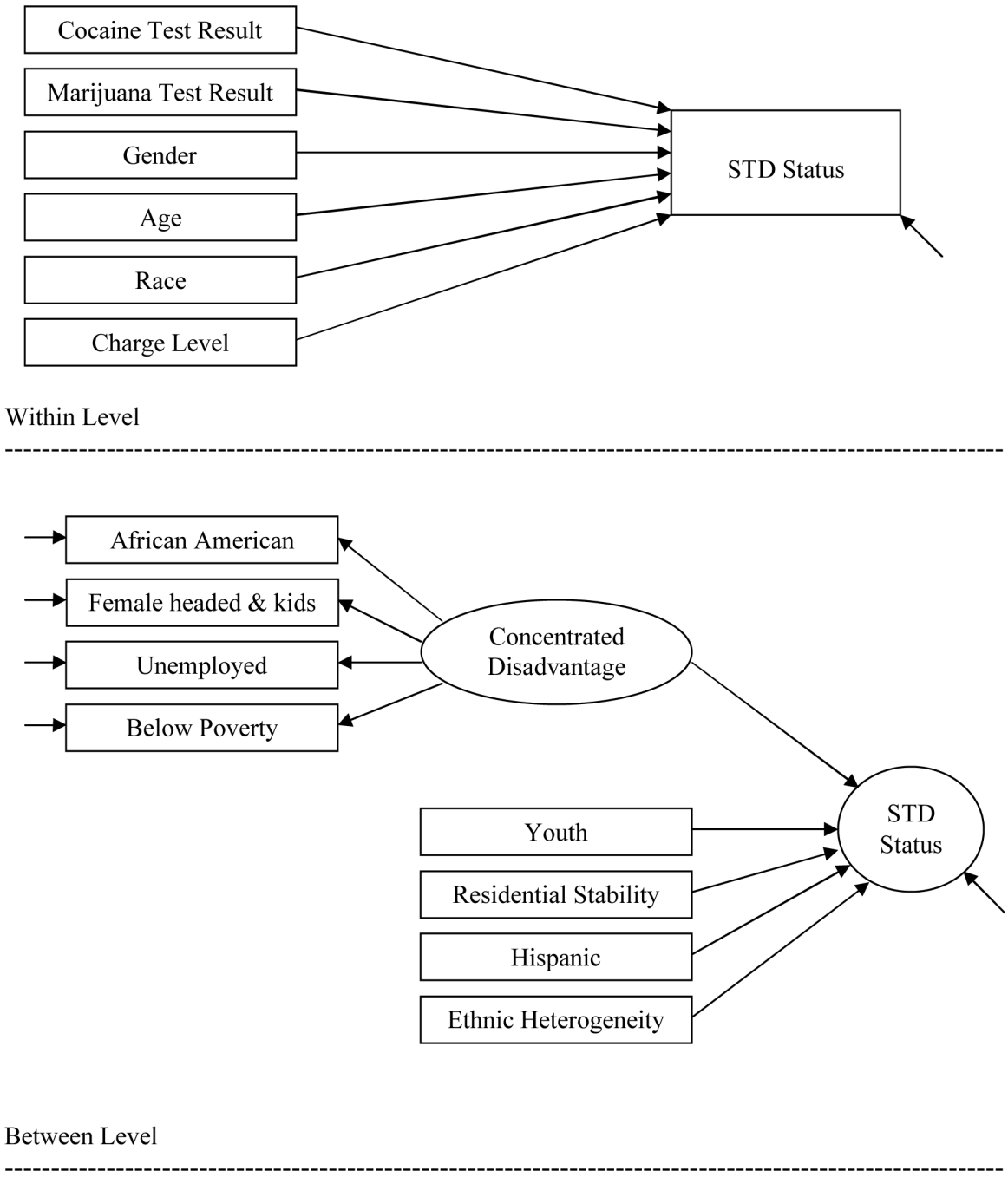

Figure 1. Two-Level STD Logistic Regression Analysis

Notes. Data were derived from 2000 U.S. Census tract information. Concentrated disadvantage = factor of four socio-economic indicators including proportion of unemployed population, proportion African-American population, proportion below poverty, and proportion of female-headed households with children. Youth = proportion of residents less than 18 years old. Divorced = proportion of divorced population 15 years or older. Residential stability = proportion living in same house since 1995. Ethnic heterogeneity = one minus the sum of the proportion of each race/ethnicity. Hispanic = proportion of Hispanic residents.

Table 1

Comparison of Sociodemographic Characteristics, Charge Level, and Post HJAC Placement by Gender (n = 1,368)

Variables	Female (*n* = 431)	Male (*n* = 937)	Statistics
Race/Ethnicity:			
Non-African American	50.3%	46.4%	χ^2 (1) = 1.82, *p* = n.s.
African American	49.7%	53.6%	
Age:			
12	3.7%	2.5%	
13	9.7%	9.3%	
14	16.2%	13.2%	
15	20.2%	18.7%	χ^2 (6) = 7.77, *p* = n.s.
16	23.9%	25.2%	
17	22.3%	27.7%	
18	3.9%	3.4%	
Mean	15.33	15.52	
Charge Level:			
Diversion	72.2%	58.5%	χ^2 (1) = 23.55, *p* <.001
Dept. Juvenile Justice case	27.8%	41.5%	
Post HJAC placement:			
Diversion	72.2%	55.3%	
Non-secure home detention	10.2%	17.9%	χ^2 (2) = 35.48, *p* <.001
Secure detention	17.6%	26.8%	

Table 2

Relationship between Demographic Characteristics, HJAC Processing, Drug Test Results and STD Status

Variables	STD Positive	Statistics
Gender		
Male (*n* = 937)	10.8%	$\chi^2(1) = 20.10$, $p < .001$
Female (*n* = 431)	19.7%	
Race		
Non-African American (*n* = 652)	6.9%	$\chi^2(1) = 47.53$, $p < .001$
African American (*n* = 719)	19.7%	
Age: Positive (*SD*)	15.92 (1.30)	$F(1, 1366) = 20.68$, $p < .001$
Negative (*SD*)	15.39 (1.49)	
Charge level		
Diversion case (*n* = 858)	10.0%	$\chi^2(1) = 25.32$, $p < .001$
DJJ case (*n* = 508)	19.7%	
Post HJAC placement		
Diversion (*n* = 828)	10.4%	
Non-secure detention (*n* = 211)	13.3%	$\chi^2(2) = 26.99$, $p < .001$
Secure detention (*n* = 327)	22.0%	
Drug test results:		
Marijuana		
Negative (*n* = 848)	11.9%	$\chi^2(1) = 5.16$, $p < .05$
Positive (*n* = 517)	16.2%	
Cocaine		
Negative (*n* = 1291)	13.0%	$\chi^2(1) = 5.64$, $p < .05$
Positive (*n* = 75)	22.7%	

Table 3

Results of Two-Level Logistic Regression Analysis

	Estimates	S.E.	Critical Ratio	Odds Ratio
Within Level:				
STD on cocaine test results	0.642	0.363	1.770	1.900
Marijuana test results	0.328	0.263	1.250	1.388
Gender (male)	-1.144	0.201	-5.690***	0.319
Age	0.330	0.086	3.828***	1.390
Race (African American)	1.413	0.255	5.548***	4.109
Charge level (DJJ case)	0.810	0.209	3.868***	2.248
Between Level:				
Concentrated disadvantage by				
African American	1.000	--	--	
Female-headed with kids	1.156	0.111	10.388***	
Unemployed	0.988	0.134	7.392***	
Below poverty	1.487	0.134	11.100***	
STD on concentrated disadvantage	1.561	0.795	1.965*	
Youth	-2.563	2.107	-1.156	
Residential stability	1.192	1.032	1.156	
Hispanic	0.167	1.109	0.151	
Ethnic heterogeneity	-0.760	0.887	-0.856	
Threshold for STD	8.372	1.674	5.084***	
Variance for concentrated disadvantage	0.032	0.006	5.425***	
Residual variance for				
STD	0.190	0.189	1.006	
African American	0.019	0.003	5.793***	
Female-headed with kids	0.026	0.005	5.173***	
Unemployed	0.047	0.018	2.657**	
Below poverty	0.032	0.005	6.344***	

Note. Due to the estimation of random effects, calculation of odd ratios are not appropriate at the between level.

* Two-tailed *p*-values: $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Results of Two-Level Fixed Effect Logistics Regression Analysis with Cross-Level Interactions

Fixed Effect	Coefficient	S.E.	*t* Ratio
Individual level:			
Cocaine test results	0.595	0.354	1.679
Marijuana test results	0.309	0.259	1.191
Gender (male)	-1.229	0.250	-4.908***
Age	0.288	0.104	2.767**
Race (African American)	1.144	0.304	3.766***
Charge level (DJJ case)	1.168	0.242	4.822***
Community level:			
Intercept	-6.492	1.884	-3.446**
Concentrated disadvantage	-4.212	6.143	-0.686
Youth	-3.479	2.043	-1.703
Residential stability	1.072	1.087	0.987
Hispanic	0.165	1.106	0.150
Ethnic heterogeneity	-0.789	0.930	-0.849
Cross-level interactions:			
Disadvantage X gender	0.997	0.935	1.066
Disadvantage X age	0.331	0.371	0.891
Disadvantage X race	2.006	1.294	1.551
Disadvantage X charge level	-2.690	1.105	-2.436*

* Two-tailed p-values: $p < .05$

** $p < .01$

*** $p < .001$