ABSTRACT

Title of Dissertation: SEXUAL BEHAVIOR AND RISK OF SEXUALLY TRANSMITTED DISEASES: DO COMMUNITY CHARACTERISTICS MODERATE THE RELATIONSHIP BETWEEN INDIVIDUAL BEHAVIORS AND STD RISK?

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This study examined individual demographic and behavioral characteristics associated with the risk of infection with two bacterial sexually transmitted diseases (STDs), *Neisseria gonorrhoeae* and *Chlamydia trachomatis.* Unlike other studies of STDs, this study also investigated how the neighborhood composition may influence individual behaviors and STD risk.

Individual-level data were derived from a probability sample of 560 adults residing in households in Baltimore, Maryland in 1997-1998. The Baltimore STD and Behavior Study (BSBS) combined use of urine-based diagnostic tests for gonorrhea (GC) and chlamydial (CT) infection with a population-based survey of health and STD-related risk behaviors. Neighborhood-level data on the geographic and social characteristics of Baltimore's neighborhoods were obtained from 1990 Census data and the Baltimore City Department of Planning (1993).

Urine assays revealed that 8.3 percent of adults ages 18-35 were currently infected with gonorrhea and/or chlamydia. A self-reported history of GC/CT infection was assessed from BSBS interview data; 26.1 percent reported previous treatment for GC/CT.

As predicted by the STD literature, bivariate and logistic regression analyses suggested that self-reported infections were significantly associated with individual and behavioral characteristics. However, the lack of STD-related risk behaviors among respondents currently infected was somewhat unexpected. Compared with uninfected participants, respondents with a current infection, for example, were less likely to report multiple sex partners, new partners, paid sex, or concurrent sexual relationships.

Hierarchichal logistic regression models indicated only the proportion of black residents within the neighborhood was positively and significantly associated with self-reported GC/CT infection after controlling for individual- and community-level characteristics. However, multilevel analyses did not detect an association between neighborhood characteristics and *current* infection. Neighborhood characteristics did not seem to matter when examining differences in the distribution of current infection in Baltimore.

Unlike individuals with a self-reported infection, currently infected individuals were not more likely to report high-risk sexual behaviors or STD-related symptoms. One plausible explanation is that the partners of these 'low-risk' individuals may have engaged in 'high-risk' behaviors. These data urge further exploration of the social context of gonorrhea and chlamydial infection in conjuction with an investigation of the interactions between individuals and their sexual partners.

SEXUAL BEHAVIOR AND RISK OF SEXUALLY TRANSMITTED DISEASES: DO COMMUNITY CHARACTERISTICS MODERATE THE RELATIONSHIP BETWEEN INDIVIDUAL BEHAVIORS AND STD RISK?

by

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1. Relevance of the Problem: Gonorrhea and Chlamydial Infection

Sexual behaviors include perhaps the most private of acts, yet they are inherent to one of society's major public health challenges -- the acquisition and transmission of sexually transmitted diseases (STDs). Demographers have had a long-standing interest in fertility-related research, but the onset of the AIDS epidemic revealed gaps in scientific knowledge related to STDs that could not be addressed with the existing data from contraceptive and fertility studies (DiMauro, 1995; Turner, Miller, and Moses, 1989; Institute of Medicine, 1996). Over the past two decades, important studies have been conducted to address these gaps, providing valuable data on the variation and distribution of sexual behaviors in national samples of men and women and subpopulations at increased risk for HIV and other STDs. While these studies have generated important information on the behaviors that place individuals at increased risk for STDs, few have looked at how risk behaviors are shaped by the larger social context. Consequently, the existing data "may not reflect adequately the complex and powerful effects of the social environment on health in their entirety" (Aral, 1996:11). This research attempts to address this need by investigating the impact of the social context on sexual risk taking and STDs. Specifically, it looks at the effects of an inner-city environment on individual risk behaviors for infection with two of the most common bacterial STDs, *Neisseria gonorrhoeae* and *Chlamydia trachomatis.*

This study focuses on gonorrhea and chlamydial infection for several reasons. These diseases affect a broad spectrum of society. Individuals of all racial, ethnic,

socioeconomic, and cultural backgrounds are at risk, although rates of infection are disproportionately higher among the poor, minorities, young adults, and women (CDC, 1998). Unfortunately, many Americans are unaware of these diseases or the behaviors that place them at risk (Institute of Medicine, 1996). Unlike HIV, both of these bacterial STDs are easy to diagnose, treat, and cure. Not all cases of gonorrhea and chlamydial infection produce symptoms, however, and few clinicians outside public health STD clinics routinely evaluate their patients for STDs or obtain sufficient patient sexual histories to assess patients' risk for STDs (Institute of Medicine, 1996). Furthermore, the social stigma attached to sexually transmitted infection may inhibit some individuals from seeking health care (Brandt, 1987; Institute of Medicine, 1996). Thus, many cases elude detection and treatment. The morbidity associated with untreated infection can be serious, particularly for women. Infected individuals are at increased risk for HIV if exposed, and untreated women are at risk for pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancy, and infertility (Cates, Rolfs, and Aral, 1990; Institute of Medicine, 1996; Wasserheit et al., 1991). While both gonorrhea and chlamydial infection are inexpensive to diagnose and treat, the high prevalence of these diseases claim substantial public health resources. According to CDC surveillance data, an estimated 4.8 million Americans are infected with gonorrhea or chlamydia each year. That is roughly 40 times the number of new cases of tuberculosis, HIV infection, and AIDS combined (Institute of Medicine, 1996). Conservative estimates of the direct costs associated with these two infections total almost $1.5 billion annually (Wasserheit, Valdisseri, and Wood, 1999).

Unique Contributions of this Study: Theory, Data, and Analyses

This study focuses on the impact of the social context on risk behaviors and these STDs because very little STD-related research has been conducted from this perspective (Aral et al., 1991; Wasserheit et al., 1991). The theoretical framework draws upon the work of contemporary urban sociologists who have noted the connections between social and economic conditions of inner-city neighborhoods and patterns of behavior among residents. While none of this work specifically addresses STDs, all touch upon related constructs. For example, Wilson (1987, 1991) observed how the de-industrialization of the urban economy and the loss of manufacturing jobs during the 1970s drove more economically stable residents from the inner city. This decentralization of employment pulled the more highly educated from the city in search of better wages and opportunities, further diminishing opportunities for the least educated inner-city residents (Wilson, 1991). Massey (1993) argues that residential segregation has contributed to the social isolation of inner-city communities. Both attribute unique behaviors and attitudes, which may be at odds with mainstream values, to structural changes in the social environment. Data support their notion that concentrated poverty and segregation are linked to a variety of social and behavioral 'dislocations'. Compared with residents of socially and economically advantaged communities, residents of poor, racially segregated, inner-city neighborhoods are more likely to drop out of high school, less likely to have steady employment, more likely to have a birth as a teenager, and more likely to initiate sexual intercourse at an early age (Brewster, 1993, 1994a, 1994b; Brooks-Gunn, Duncan, and Aber, 1997; Crane, 1991a, 199b; Furstenberg, et al., 1987; Hogan and Kitagawa, 1985; Jencks and Mayer, 1990; Massey, Gross, and Eggers, 1992). STD surveillance data indicate higher rates of

infection in these communities as well (CDC, 1998).

A number of mechanisms have been proposed to explain how neighborhood composition and quality may influence individual behaviors and their consequences. Behaviors may be influenced by the neighborhood opportunity structure, the availability of role models, or commonly-held norms. For example, socially approved behavior is reinforced and socially undesirable behavior is discouraged by the presence of community role models who exemplify success and achievement. Similarly, communities may create an opportunity structure for economic benefits or health services or create a system of normative influences that "define the boundaries of desirable and undesirable behaviors", thereby affecting individuals' decision concerning whether or not they engage in specific behaviors (Billy and Moore, 1992:980). From this perspective, sexual activity is reframed as an adaptation to a community context in which behaviors have "clear social, psychological, and economic benefits and few costs" even though they may be characterized elsewhere as deviant or immoral (Brewster, 1994b:411). Given that behaviors and opportunities are built within a sociocultural context, it is logical for Williams and Collins (1995) to posit that exposure to risk factors is also influenced by contextual factors. To improve our understanding of the dynamics that sustain STD transmission, we need to move beyond individual behavior and look at the culture and larger social structures that influence these behaviors if we hope to intervene more effectively in the future (Turner, Miller, and Moses, 1989).

The present study brings new theories and analytic techniques to the long-standing problem of treatable bacterial STDs. As noted above, this study will investigate how social structural factors moderate individual risk of STD acquisition. By analyzing both individual and macro-level characteristics, this study promises to provide a richer

understanding of the risk factors for STDs than studies of individual characteristics alone. Within this framework, sexual activity and the norms, values, and attitudes regarding sex roles and behaviors are defined within a socially, geographically, and temporally defined context.

Integrating the various factors that result in sustained transmission of disease poses analytic challenges. The few attempts to integrate individual demographic, behavioral, and social factors have relied on fairly simplistic techniques. For example, individual-level factors, such as age, race, education, or marital status, and neighborhood characteristics, such as socioeconomic status, adult labor market experience, or racial composition, are entered simultaneously into multivariate regression models to explain variation in sexual behaviors. Conventional logistic regression techniques, in which contextual variables are entered into the analyses along with individual-level variables, are inappropriate because they ignore the hierarchy implicit in the data: individuals are clustered within neighborhoods. Hierarchical linear and loglinear regression modeling procedures (HLM) correct for the inadequacy of traditional regression techniques when conducting multilevel analyses (Bryk, Raudenbush, and Congdon, 1996; Mason, Wong, and Entwisle, 1985). Unlike other STD-related studies in the literature, this study will use HLM in the final phase of multivariate analyses.

The present study also takes advantage of a new and unique dataset. The Baltimore STD and Behavior Survey (BSBS), conducted by Research Triangle Institute in 1997-1998, collected interview data on the sexual and health behaviors of 1,014 adults between the ages of 18 and 45 who resided in Baltimore City. During the interview, respondents were asked if they had ever been diagnosed with gonorrhea or

chlamydial infection. In addition, 18 to 35 year old participants were asked to provide a urine specimen for gonorrhea and chlamydia testing.

The inclusion of both self-reported STDs and diagnostic tests to identify currently infected individuals makes the BSBS dataset unique. Field-friendly, urine-based diagnostic assays for gonorrhea and chlamydial infection were developed very recently. Only one other population-based survey has included them (National Survey of Adolescent Males), but in a more restricted sample. Until recently, population-based studies, which permit making inferences to a larger defined population, were restricted to self-reported information on STDs. It was impossible to use invasive diagnostic procedures in surveys conducted outside clinical settings. And studies conducted in clinics have been hampered by sampling bias. The incorporation of diagnostic tests for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in the BSBS provides population-based prevalence estimates of current gonorrhea and chlamydia infection among adult residents of the city. It also provides a unique opportunity to look at the individual- and community-level correlates to current, known cases of infection.

In addition to the BSBS data at the individual level (level-1), community-level data (level-2) on the geographic and social characteristics of Baltimore's neighborhoods were obtained from 1990 Census data and the Baltimore City Department of Planning (1993). These data include indicators of poverty and community socioeconomic status, the racial composition of neighborhoods, unemployment, and family composition.

Baltimore is an appropriate site for this investigation for several reasons. First, rates of STDs are well above national averages. In 1997, for example, Baltimore had the highest reported rate of gonorrhea and the third highest rate of chlamydia among U.S. cities with populations of 200,000 or more. Rates of gonorrhea in Baltimore for men and

women were four times higher and rates of chlamydia were two and a half times higher than the national average (CDC, 1998). Second, this study makes use of a unique classification of 'neighborhood' as defined by the Baltimore City Department of Planning. Using geographic boundaries and social characteristic, city administrators and local neighborhood officials have divided the city into 49 communities. These established community areas are used as the level-two unit of analysis. Third, Baltimore's neighborhoods are diverse, and the racial composition and socioeconomic status vary considerably.

By taking a hierarchical approach, this study supports analyses of linkages between the levels of influence. By using a broad theoretical perspective and taking advantage of unique data sets that address individual and community level variables, this study will be able to address a number of new and important research questions: (1) What individual characteristics and behaviors are associated with an increased GC/CT risk among an urban adult population? (2) Are certain characteristics of inner-city communities associated with an increased risk for gonorrhea and chlamydial infection? If so, which characteristics are significant? (3) Do community characteristics moderate the relationship between individual behaviors and STD risk? That is, do neighborhood effects operate differently for individuals with different characteristics? (4) Finally, and perhaps most importantly, do the findings of this study suggest alternative ways to intervene to reduce the burden of infection in Baltimore City?

2. The Role of the Community in Influencing Social and Sexual Behaviors: The Social Context

Traditionally, ethnographic or participant-observer studies have examined how specific social settings affect variation in behaviors. Such studies typically investigate how environments constrain or shape behavior (Cook, Shagle, and Degirmencioglu, 1997; DiMauro, 1995). Ethnographic studies, for example, have indicated the importance of school and family environments on levels of crime, employment, and educational achievement among young, poor, urban populations (Furstenberg and Hughes, 1997; Stack, 1975; Wilson, 1987). Although qualitative research methods are often reproved due to their methodological weaknesses, ex., the use of non-representative samples or the lack of adequate controls, ethnography has provided an effective theoretical basis for further empirical investigations of the relationship between social structure and individual behavior (Hogan and Kitagawa, 1985; Jencks and Mayer, 1990).

Contextual analyses, or micro-macro studies, link individual behaviors to variation in properties of their social context (Huber, 1991). An essential feature of contextual effects models is the "allowance for macro processes that are presumed to have an impact on the individual actor over and above the effects of any individual-level variables that may be operating" (Blalock, 1984:384). These macro-level structural properties stratify individuals according to their distribution among socially defined positions -- locations which influence role relations and ultimately behaviors (Pearlin, 1992).

The relevance of the social context in the study of individual health behavior has gained increasing recognition among public health specialists and sociologists alike (Becker, 1993; Diez-Roux, 1998; Duncan, Jones, and Moon, 1998; O'Campo et al., 1995; Pearlin, 1992). Neighborhoods determine a number of factors crucial to individual well-being. Where we live not only determines the extent of our exposure to drugs and crime, the quality of our housing, the availability of jobs, and the caliber of health and other local social services, but also influences our perceptions of the acceptability of these conditions.

At the individual level, the distribution of sexually transmitted diseases (STDs) within society reflects the individual behaviors that have been demonstrated to transmit and sustain these infections over time, e.g., multiple sexual partners, frequent sexual contacts, earlier initiation of sexual intercourse, drug use, unprotected intercourse, contact with an infected partner, and disattachment from the health care system. Examination of the STD risk within a community context suggests that a community's socioeconomic status, levels of neighborhood unemployment, and quality of housing may influence individual social and health behaviors and hence the risk of STD acquisition and transmission (Anderson et al., 1988; Williams and Collins, 1995).

Most research on sexual behavior has generally ignored these macro-micro linkages, favoring a micro-level, or individual approach (see Chapter 3). Demographic research on sexual behavior has generally focused on reproductive and contraceptive behaviors, predominantly of female populations. With the advent of more recent surveys, largely prompted by the AIDS epidemic and the high incidence of STDs in recent years, the focus has broadened to include the sexual practices of adolescent men (National Survey of Adolescent Males, Sonenstein et al. (1989, 1991)) and adult men

and women (National Health and Social Life Survey, Laumann et al., (1994); National AIDS Behavioral Survey, Catania et al. (1990)). Yet most empirical studies tend to focus on the individual attributes (social, demographic, and physiologic) associated with the timing, frequency, and consequences of sexual activity. A micro-level approach, for example, would predict that for young women with similar family background characteristics, living in a poor inner-city area would have no more predictable difference on the risk of a nonmarital birth than living in an affluent neighborhood. Conversely, purely macro-level research methods neglect the effects of individual level variation on specific behavioral outcomes. Entwisle and Mason (1985) note, for example, that cross-national studies of contraceptive prevalence or effectiveness generally rely upon aggregate data.

Only within the last 10-15 years has empirical demographic research attempted to measure both individual and contextual influences on behaviors. Much of this research concentrates on the micro and macro linkages affecting fertility or contraceptive behaviors among adolescent or female populations (Billy et al., 1993; Brewster, 1993, 1994a, 1994b; Crane, 1991b; Entwisle, Casterline, and Sayed, 1989; Hogan and Kitagawa, 1985; Ku, Sonenstein, and Pleck, 1993; Mosher and McNally, 1991). Employing similar analytic strategies, these multilevel studies have attempted to separate social structural effects from individual effects. While differing in research methodologies, the populations studied, and in the measurement of neighborhood characteristics, these studies bridge an important theoretical gap in prior fertility and fertility-related research and provide useful guidelines for this investigation of community influences on STD-related risk behaviors. The impact of the social context on the initiation of sexual activity, on the use of contraceptives, particularly use of condoms, and

on the frequency of exposure to sexual intercourse, are not only important determinants of fertility, but also influence the risk of acquisition and transmission of sexually transmitted diseases. Key aspects of contextual studies which are relevant to the proposed research are summarized in the next section (see Table 1).

Early Approaches to Contextual Analyses

One of the earliest studies (Hogan and Kitagawa, 1985), which attempted to reconcile methodological differences between traditional demographic and ethnographic approaches, related previous ethnographic research on the role of neighborhood socioeconomic conditions on teen fertility behavior to demographic modeling procedures. Such analytic approaches were previously advocated by Presser (1978), Moore and Hofferth (1980) and Zelnik, Kantner, and Ford (1981). Prior ethnographic work on neighborhood characteristics, family structure, adolescent development and fertility (Stack 1975; Wilson 1987, 1991; Hollingshead 1961) attributed the high rates of premarital pregnancy among black teens to poor economic conditions, socialization effects (lack of role models), as well as to relaxed or "loosely defined" norms regarding sexual behavior. Hogan and Kitagawa (1985) used Chicago census tracts' racial composition, median family income, percent poor, male-female ratio, children per ever-married female, and juvenile police contacts to create composites of neighborhood quality (measured as high-, medium-, and low-socioeconomic status (SES)). A survival analysis suggested that unmarried black teens from high-risk social environments, specified as having a higher proportion of lower class residents, nonintact families, and highly segregated communities, had higher rates of premarital pregnancy than teens from low-risk, or less economically and socially depressed environments. No significant

differences in pregnancy rates were noted between teens in the high and middle quality neighborhoods, after controlling parents' fertility, marital status, and SES. Using the same data and measures of neighborhood quality, and similar analyses, Hogan, Astone, and Kitagawa (1985) investigated contraceptive use as an outcome. Females in low-quality neighborhoods were about half as likely to use contraception at first sexual intercourse than those in middle or high-quality neighborhoods, with family background controlled.

Much of the subsequent literature on neighborhood effects also focused on negative social outcomes associated with residing in poor, inner-city neighborhoods. Poverty, low education, inadequate access to health care, and social inequity are paramount within this context (Wilson 1987, 1991; Massey, Gross, and Eggers, 1992; Massey and Denton, 1993).

What theoretical constructs drove this body of research? How might the social composition of a neighborhood affect behavior? Various theoretical perspectives have been proposed to explain ways in which neighborhoods or community-level characteristics may influence individual attitudes and behavior (Duncan, 1993; Jencks and Mayer, 1990). In the late 1980s, Jencks and Mayer (1990) conducted a comprehensive review of the existing literature on neighborhood effects for a National Academy of Sciences' study on the consequences of inner city poverty. They organized theories of neighborhood effects into four broad categories — contagion or epidemic theories (in which negative behavior is spread throughout a neighborhood through peer influences), collective socialization (in which positive behavior is promoted through adult role models and high-status job occupations), institutional theories (in which the quality of community services influences individual performance), and social competition or

resource-competition theory (in which those from lower SES neighborhoods strive to "keep up" with those in higher SES neighborhoods). Jencks and Mayer (1990) concluded that the available empirical studies were inconclusive regarding the existence and strength of neighborhood effects on a variety of outcomes, ex., educational attainment, crime, teenage sexual behavior, cognitive skills, and labor market success. The studies they reviewed frequently failed to adequately control for family background or assumed that neighborhood effects were linearly associated with the outcome measured (i.e., neglected the notion of a threshold). Their conclusion was also based on the small number of studies available at that time. Since their review, additional analyses of community effects on sexual behavior have been conducted and different theoretical perspectives on the effects of neighborhood processes have been recognized. Numerous neighborhood measures have been investigated and nearly all of the more recent studies controlled for family background characteristics. Few studies, however, have investigated community influences on adult sexual behaviors and none have explicitly addressed neighborhood effects on the risk of STD acquisition.

In the next section, three theoretical mechanisms linking neighborhood social structure to individual behaviors are described: contagion theory, collective socialization or normative influences/opportunity costs, and social isolation (an integration of contagion and collective socialization posited by Wilson (1987, 1991)). Although each of these processes may operate as discrete mechanisms of neighborhood influence, they may also be viewed as complementary. Consequently, empirical tests of neighborhood models have generally been conducted within one or more of these theoretical contexts.

Recent Analyses of Neighborhood Effects: Theories and Methods

Contagion or Epidemic Theory Studies that have investigated community influences on individual sexual behaviors have typically focused on teen or young adult populations. Crane (1991b) examined the effects of neighborhood quality on childbearing and dropping out of school among a national sample of teens aged 16-19 years. His analysis tested whether social problems are contagious and spread through peer influence. Data were obtained from a 1970 Public Use Microdata Sample (PUMS) file in which information on 55 neighborhood characteristics was attached to individuals' records. Neighborhood quality was measured by a single indicator -- the percentage of workers in the neighborhood with professional or managerial jobs (15 other measures were examined, however, none of the other indices, ex., family poverty rate, male labor-force participation rate, proportion of families who had moved within the last five years, nor the proportion of female-headed households, explained nearly as much variation in the outcomes). After controlling for individual characteristics, the risk of dropping out of school and of having a child were greater for both black and white adolescents living in the worst inner-city neighborhoods. The probability of dropping out of school for black teen males, for example, was positively associated with the percentage of low-status workers in the neighborhood; approximately 8 percent dropped out in areas where three-fourths of the workers performed low-status jobs compared to one-third in areas where the percentage of low-status workers was at least 97 percent. Crane concluded his results supported the notion of a contagion effect. Furthermore, the contagion effect was contingent upon a critical level or threshold, whereby negative outcomes were most strongly associated with the lowest-SES neighborhoods (where about 4% of adults held professional or managerial jobs).

The basic assumption of contagion theory is that social problems are contagious

and that peer influences are responsible for the spread of negative or deviant behaviors. People living close to one another are likely to share the same attitudes and behaviors and adopt similar ways of doing things. An important component of Crane's theory is that the relationship between the incidence of a particular social phenomenon and neighborhood quality is nonlinear. That is, the negative effects of residing in poor or "ghetto" neighborhoods may occur at only a certain critical level. So for example, the incidence of teen childbearing may increase with decreasing neighborhood quality, but the rate of increase is not constant and may not be apparent until a certain critical level, or threshold, is met. A common criticism of epidemic models is the assumption that a "dominant norm" (to which everyone tries to conform) drives specific behaviors, thereby neglecting effects of individual and subgroup variation in behavior (Jencks and Mayer, 1990).

Collective Socialization Theory: Socialization theory has frequently been tested in studies of adolescents' behavior. Socialization theory posits that adolescent behaviors are learned from processes of socialization with family, friends, teachers, and role models. Socially approved behavior is reinforced and socially undesirable behaviors are discouraged by the presence of neighborhood and community role models. Accordingly, "acceptable" and "unacceptable" sexual behaviors are socially learned.

Several early empirical studies tied family structure to adolescent sexual behavior (Hogan and Kitagawa, 1985; Hogan, Astone, and Kitagawa, 1985; Jemmott and Jemmott, 1992). Socialization agents such as parental control and imposition of rules, communication between parents and children, as well as the child's perceived strictness of parental rules have been demonstrated to influence adolescent choices and behaviors. Collective socialization theory also emphasizes how neighborhood role

models influence socialization, behavior, and opportunities, e.g., ways in which successful adults influence achievement among others and between themselves (Bronfenbrenner, 1989; Brooks-Gunn et al, 1993; Jencks and Mayer, 1990).

Brooks-Gunn and colleagues (1993) used both census tract and zip code data from the 1980 Census to examine how the socioeconomic status of neighborhoods influences developmental outcomes during childhood and as young adults. Neighborhood characteristics measured included female headship, male joblessness, racial composition, receipt of public assistance, and two indicators of neighborhood poverty -- the percentage of 'low income' families, and the percentage of affluent families. Only the poverty indicators were significant predictors of the child and adolescent outcomes once family socioeconomic status was controlled. Childhood IQ was measured among a sample of low birthweight, preterm infants from the Infant Health and Development Program (IHDP). Teen nonmarital births and dropping out of high school were measured among women between the ages of 14 and 19 years in the Panel Study of Income Dynamics (PSID). (The PSID is a longitudinal survey. The authors' analysis was based on the incidence of out-of-wedlock teen age births and school leaving during the period 1968-1985. Therefore the oldest cohort in their sample was 14 in 1968 (and 19 in 1973) while the youngest cohort was 14 in 1980 (and 19 in 1985)).

When tract data were linked to individual data from the PSID in regression analyses, the researchers found that the absence of high SES neighbors had a greater effect on teen childbearing than the presence of low SES neighbors. Their findings also suggested that family influences (such as parent's education and income) had stronger effects on adolescents than neighborhood level characteristics and that community characteristics measured at the tract level were more powerful indicators than those

measured at the zip code level. The authors maintained that the presence of affluent, high occupational status families were "key dimensions of neighborhood economic and social structure" most likely to affect children (Brooks-Gunn et al., 1993:377). Their results therefore stressed the importance of role models and resources provided by affluent neighbors in influencing adolescent outcomes.

Normative Influences/Opportunity Costs Although conceptually distinct, very few studies have examined the separate effects of normative influences and opportunity costs associated with a particular neighborhood context; rather, they have been hypothesized to interact. In these studies (Billy and Moore, 1992; Brewster, 1994a, 1994b; Hogan and Kitagawa, 1985; Ku, Sonenstein, and Pleck, 1993) sexual behaviors with "potentially negative consequences" e.g., nonmarital sexual activity and teen pregnancy, have been examined in association with residence in neighborhoods with limited opportunities and normative environments which do not encourage or support "conventional models of economic or social success" (Brewster, 1994b:409; Duncan, 1993). From this perspective, communities create an opportunity structure (economic, demographic, and health) within which individuals make reproductive decisions, as well as create a system of normative influences which "define the boundaries of permissible or desirable behaviors" (Billy and Moore, 1992:980).

Billy and Moore (1992) examined a range of community characteristics -- community religiosity, socioeconomic status, social disorganization (measured by community divorce rates), female labor force participation (indicated by the percentage of adult women employed, the proportion working full-time, and the percentage of white-collar workers), local demography (defined by the sex ratio, proportion black, and age structure), availability of family planning/abortion services, and community rates of

nonmarital/marital births -- in investigating whether contextual factors may influence the risk of childbearing among married and non-married nonblack women. Individual-level data were obtained from the 1982 NSFG. A contextual database of tract-level measures specifically constructed for use with the 1982 NSFG provided the community-level data. Using a multivariate regression analysis, contexual variables were found to directly influence the risk of both marital and nonmarital births, independent of the woman's individual characteristics. The effects of the social context were different for married and unmarried women. For married women, high levels of female employment and a low proportion of divorced or separated women in the community were associated with a reduced risk of a birth. The number of contextual influences was greater for unmarried women. Higher levels of divorce and female unemployment, lower neighborhood housing values, and a higher prevalence of out-of-wedlock childbearing increased the individual risk of a nonmarital birth.

Brewster (1994a) tested a multilevel model of neighborhood effects on the sexual and contraceptive behavior of young black women also using data from the 1982 NSFG. Neighborhoods were operationalized as census tracts (see Billy and Moore, 1992). Contextual covariates measured neighborhood socioeconomic status (proportion of population aged 15 and over employed in white-collar positions), female labor force participation rates, family formation (defined by the proportion of the female population aged 15 years and over that was separated or divorced), proportion of population that was black, youth idleness (proportion of school dropouts among those aged 16-19 who were not in labor force or service), and the marriage pool (ratio of single males aged 18-24 to single females aged 15-19). Brewster posited that the neighborhood context defined the opportunity structure and the normative environment regarding the costs and

benefits of teen sexual activity and the timing of childbearing in relation to other social goals (completing school, marriage, and employment). Not all neighborhood characteristics in the multivariate hazard model analysis influenced the risk of nonmarital intercourse or contraceptive use at first sex among black teen women. However, lower neighborhood socioeconomic status and female labor force participation, and higher levels of youth idleness were associated with an earlier timing of first intercourse. Results also suggested these effects were more pronounced among young women living in urban (versus nonurban) areas.

Brewster, Billy, and Grady (1993) observed how community social and economic characteristics affect the timing and use of contraceptives at first intercourse among a nationally representative sample of young nonblack women 20 years of age and older. They based their analysis on the premise that the experiences and values of adults within the community defined the opportunity structure and engendered a normative environment of acceptable behaviors. Using 1982 NSFG data and the accompanying aggregate-level database (see Billy and Moore, 1992; Brewster, 1994a), a multivariate hazards analysis revealed that higher levels of community social disorganization (measured by the crime rate, rate of housing turnover, unemployment rate, and the proportion of women who were divorced or separated), were associated with less contraceptive use at first intercourse, even when controlling for individual- level characteristics.

Ku, Sonenstein, and Pleck (1993) examined neighborhood influences on premarital sexual behaviors among adolescent males. Neighborhood variables were measured at the tract level (using 1980 census data) and included the unemployment rate, proportion of families receiving public assistance, poverty levels, proportion of high

school dropouts, and the adult sex ratio. Individual level data were obtained from the 1988 National Survey of Adolescent Males, a nationally representative survey of males 15-19 years of age. The authors included pairs of variables that had both individual and neighborhood-level measures, e.g., individual and neighborhood employment rates, when such indicators were available. Logistic regression models of neighborhood and individual effects (neighborhood only, individual only, and a combined model) suggested that higher neighborhood unemployment rates and a higher neighborhood sex ratio were related to higher levels of sexual activity and teenage fatherhood.

While many of these studies separately analyzed either black or white populations, other analyses have investigated the association between racial segregation and poverty. This research suggests that neighborhood environments vary substantially by race, independent of individual socioeconomic status. Furthermore, because of social structural constraints, the negative social and economic effects of neighborhoods are greater for blacks than other groups. For example, Massey, Gross, and Eggers (1992) demonstrated that segregation and poverty interact to yield geographically concentrated poverty. In highly segregated urban areas, increases in the rate of black poverty markedly increased the concentration of poverty within black neighborhoods. In the absence of racial segregation, even substantial increases in black poverty did not markedly alter the welfare of individual blacks. As the concentration of poverty within black neighborhoods increased, the probability of joblessness among young black males and the likelihood of an out-of-wedlock birth among young black females also increased.

Using the 1988 NSFG data and a similar analytic strategy to an earlier study, Brewster (1994a,1994b) examined the effect of racially segregated neighborhood

environments on racial differences in the sexual activity of women aged 20 years and younger. Neighborhood socioeconomic status and the proportion of females employed full-time were found to affect racial differences in adolescent nonmarital sexual activity, even after controlling for individual-level and family background factors. Teens of both races responded similarly to structural constraints and opportunities. The author suggests that race differences in access to economic resources, adult supervision, and role models, rather than race-specific responses to these structural constraints explain the race differences in age at initiation of sexual activity.

An important question these models raise with regard to the influence of social context is whether traditional assumptions of societal norms regarding sexual and reproductive behaviors are relevant to minority or socioeconomically disadvantaged populations. These models suggest that the "calculus by which individuals evaluate the cost and benefits of behavioral alternatives varies across social settings, leading to patterns of behavior that reflect the prevailing community environment rather than universally shared societal norms" (Brewster, 1994b:409). From this perspective sexual activity is reframed as an adaptation to a community context in which behaviors, that are often characterized in the social science literature as deviant, have "clear social, psychological, and economic benefits and few costs" (Brewster, 1994:411). Wilson (1991) argues that patterns and norms of behavior tend to be shaped by those with whom one has most sustained contact and interaction. Accordingly, the less frequent the routine contact with those who have steady employment (and therefore the greater the degree of social isolation), the less likely that regular and full-time employment will be viewed as a desirable goal.

Both collective socialization and normative/opportunity cost theories stress the

importance of the environment in creating a structure of constraints, as well as opportunities, within which individual decision-making occurs. Whereas the normative approach emphasizes that the presence of deviant behaviors reinforces negative behaviors, socialization theory emphasizes how the lack of appropriate role models influences negative behaviors. Empirically, it is difficult to distinguish among these theoretical approaches. Opportunity costs vary depending on community of residence, but also vary from individual to individual (Duncan, 1993:178). Neighborhoods may influence behaviors, attitudes, values, as well as opportunities (Brooks-Gunn et al., 1993).

Social Isolation Theory: William Julius Wilson (1987, 1991) integrates contagion and collective socialization theory in his analysis of structural changes on the behaviors of inner-city, poor neighborhood residents, into what he defines as *social isolation theory*. Wilson suggests that the social problems of inner-city neighborhoods are "related to the structure of opportunities and constraints in American society" (1990:99). He argues that changes in the urban economy resulted in the loss of manufacturing jobs and the flight of more economically stable blacks (who served as role models) from the inner city. Without appropriate role models, the chances that those in poor neighborhoods will conform to mainstream norms and have mainstream aspirations are greatly reduced (Wilson 1987).

The effects of these structural economic changes are most evident among residents of impoverished inner-city neighborhoods (Wilson, 1987, 1991). As poverty has become more geographically concentrated within the past several decades, the constraints and (lack of) opportunities that the residents of inner-city ghetto neighborhoods face in terms of access to jobs and job networks, involvement in quality

schools, and exposure to conventional role models, are reflected in a range of outcomes from weak labor force attachment to teen pregnancy to female-headed households (Wilson, 1987, 1991; Jargowsky, 1996a). A concentration of persons detached from mainstream social institutions leads to lower expectations about achievement of socially ascribed goals. As Wilson notes (1990:100), the "social organization of inner-city neighborhoods disintegrates, further depleting the resources and limiting the life chances of those who remain".

Mosher and McNally (1991) examined contextual effects on contraceptive use at first nonmarital intercourse. They drew their data from the 1988 NSFG and from the 1980 census. Neighborhood data were measured at the level of minor civil divisions. Neighborhood characteristics included the proportion of households with income below the poverty level, the proportion of households on public assistance, the male unemployment rate, and the proportion of racial minorities. Results from multiple logistic regression analyses suggested that community socioeconomic status and employment opportunities were associated with the proportion of women using contraceptives (primarily partners' condom use) at first intercourse, even after controlling for individual characteristics such as race, religion, and mother's education. Their findings are generally consistent with other studies that found living in an "economically depressed area discourages the planning and deferral of gratification that use of contraceptives at first intercourse requires" (Mosher and McNally, 1991:115).

Whereas Wilson posits that concentrated poverty within the inner city arose from the economic dislocations of residents, Massey argues that residential segregation has been the driving force in creating a "structural niche within which a deleterious set of attitudes and behaviors" has arisen and flourished (Massey and Denton, 1993:8). In

concentrating poverty, segregation also concentrates other negative social and economic conditions — drug use, joblessness, welfare dependency, and teenage pregnancy — and produces a social context where these conditions are considered normative (Massey and Denton, 1989, 1993). The effect of segregation on behavior, Massey argues, is structural not individual. "Residential segregation lies beyond the ability of any individual to change; it constrains black life chances irrespective of personal traits, individual motivations, or private achievements" (Massey and Denton, 1993:3). By adapting to this environment, residents adopt a series of behaviors and values that are at odds with those common in mainstream society — spatial isolation leads to social isolation.

Summary

Contextual analyses suggest that sexual and reproductive behaviors are influenced not only by individual characteristics, but also by the social context in which those behaviors occur. The mechanisms by which neighborhoods are posited to effect individual behavior, e.g., the normative environment, social and economic opportunity structures, peer influences, the availability of neighborhood role models, have frequently been tested among adolescent or young adult populations. Outcomes such as adolescent childbearing or premarital intercourse have been investigated within this context. It has been posited that communities characterized by high levels of poverty and unemployment or unstable family structures provide fewer alternatives or opportunities and foster a normative environment in which appropriate sexual behaviors or paths to adulthood are not carefully prescribed. Residence in inner-city neighborhoods lacking in appropriate role models, for example, leads to lower

expectations for the future. Compared to earlier studies, individual and family characteristics were controlled in these studies and many of the neighborhood effects persisted.

Generalizing these neighborhood effects, however, is complicated by the variety of statistical, conceptual, and methodological strategies employed. For instance, studies varied in their choice of community characteristics and in their operationalization of these measures. Consequently, what neighborhood characteristics mattered most varied from study to study.

Community-level traits were generally measured at the census tract level. Questions have emerged as to how closely the tract, an administratively-defined geographic unit, approximates the 'social' environment of neighborhoods. Census tracts are formed by local committees of the Census Bureau to approximate 'real' neighborhood boundaries. On average they contain approximately 4,000 people (Brooks-Gunn et al., 1993). Tracts also tend to be the smallest geographic units available to gather neighborhood-level data. The use of these administratively-defined units as representations of neighborhoods, however, has been criticized on the grounds that they do not adequately measure patterns of interaction or social ties found within 'true' neighborhoods (Tienda, 1991). On the other hand, tracts are contiguous, relatively homogenous, and tract-level data are easy to obtain (Brewster, 1994b; Crane, 1991b). Crane (1991b:1246) notes that potential measurement error associated with tract-level data probably biases the estimated contextual effects downward since "overlap between true boundaries and operational boundaries make the operationally defined neighborhoods weighted averages of actual separate neighborhoods".

There are also differences in the categorization of the community-level variables.

In some studies, a composite index is applied, whereas in other analyses, one or more indicator variables of neighborhood composition are selected. Correlations among individual community-level measures were generally examined and if the variables were highly correlated with each other, an index was typically preferred to provide a more stable estimate. With highly correlated measures, however, it is impossible to determine which of the neighborhood characteristics makes the most difference. Levels of poverty, for example, may be correlated with levels of unemployment, levels of racial segregation, and the quality of social services. Composite indices may be more difficult to interpret, since you may not know which variable, if any, is having the primary effect. Hogan and Kitagawa (1985) chose an index of 'neighborhood quality' whereas Crane (1991b) ultimately selected a single index, the percentage of workers in the neighborhood who held professional or managerial jobs, among 15 other potential neighborhood characteristics for his analysis.

Another issue concerns differences in the form of measurement of the community variables. Some studies treat the measures as categorical, whereas others present averages of continuous variables. Frequently such determinations are made after review of the individual data. Decisions may also be guided by considerations of sample size (Ku, Sonenstein, and Pleck, 1993). If Crane's (1991a, 1991b) hypothesis is true, that a critical level, or threshold, is required in order for certain independent variables to exert an effect on behavior than a categorical variable is required. Crane (1991b), for example, found nonlinear effects on teen childbearing, with the strongest effects in the low status neighborhoods. Similarly, Hogan and Kitagawa (1985) found neighborhood effects on first pregnancy in only the lower-class neighborhoods; no differences were observed in middle- and upper-class neighborhoods.

Studies also vary in their analytic approaches. Most studies employed traditional regression analyses, generally specifying individual-level, community-level, and aggregate (individual and community combined) models; other studies utilized multivariate hazard modeling. Hierarchical linear models were not used in any analyses.

Many studies examined both total and net effects of community characteristics; a few tested for cross-level or interaction effects. Examining only total or net effects may not provide a complete picture of the community influence on individual behavior as the influence of the community context may be structured by individual characteristics in a systematic way (Entwisle, Casterline, and Sayed, 1989). For example, community socioeconomic status and availability of role models (specified, for example, by the proportion of employed persons with professional or managerial jobs) may have differential effects by an individual's age, marital, or socioeconomic status. Brewster (1994b) found that neighborhood context had a greater effect on the probability of experiencing an adolescent birth among young black women from low socioeconomic backgrounds than young white women. Mosher and McNally (1991) observed interactions between race and their community variables, and ran regression models separately for blacks and whites.

Few empirical studies have specifically tested these assumptions in inner-city, poor neighborhoods. Until recently, these theories were more often tested among national samples of young men and women with urban residence as a covariate. The characteristics of urban poor areas and rural poor areas, however, are likely to be quite different and to be related to different casual structures.

While limited in its generalizability to one geographic locale, this research provides the opportunity to investigate variation in gonorrhea and/or chlamydial infection

and the risk behaviors associated with these infections across a representative sample of Baltimore City adults. Baltimore is one of the few cities to have established and maintained a defined system of neighborhoods and communities (see Chapter 5), whereas national population-based studies have only the choice of utilizing census tracts. By utilizing data from a single metropolitan area, it is also possible to draw upon local resources to refine characterizations of neighborhoods. To my knowledge, population-based studies of both men and women have not attempted to link individual and community-level factors in a multilevel analysis of the risk of acquiring an STD. The rationale for this study is to provide a more rich investigation of the community's geographic and social characteristics and hence, a more complete examination of the factors associated with the risk of gonorrhea and/or chlamydial infection.

3. Sexually Transmitted Diseases: The Risk to Individual and Public Health

Sexually transmitted diseases are frequently classified as either bacterial, viral, or protozoal, referring to the microbiological agent responsible for the disease (Jones and Wasserheit, 1991). Bacterial and protozoal STDs, such as chlamydia, gonorrhea, syphilis, and trichomoniasis usually cause either a discharge from the lower genital tract or ulcers. Specific diagnostic tests for these diseases are available and they are curable. Viral STDs, such as herpes or HIV, usually cannot be cured, and individuals who are infected generally remain so (Wasserheit, Aral, and Holmes, 1991).

This proposal focuses on two bacterial STDs, *Neisseria Gonorrhoeae* and *Chlamydia trachomatis*. Chlamydia is the most commonly reported bacterial STD in the U.S. (CDC, 1998). According to an Institute of Medicine (1996) report, both gonorrhea and chlamydia were among the top ten most frequently reported diseases in the U.S. in 1995. An estimated 4.8 million Americans are infected each year. Rates of STDs in the U.S. far exceed those of other industrialized nations. In 1995, for example, the reported incidence of gonorrhea was 150 cases per 100,000 persons in the U.S. compared to 3 cases per 100,000 in Sweden and 19 cases per 100,000 in Canada (Institute of Medicine, 1996).

Although infections with gonorrhea and/or chlamydia may initially appear asymptomatic and therefore difficult to detect, the long-term morbidity associated with an infection can be serious and potentially life threatening, particularly for women. Gonorrhea and chlamydial infections are a major cause of pelvic inflammatory disease

(PID), an upper genital tract infection in women. The consequences of PID include infertility, ectopic pregnancy, and chronic pelvic pain. These infections have also been shown to increase the risk of HIV (Cates, Rolf, and Aral, 1990; Institute of Medicine, 1996; Wasserheit et al., 1991). Reinfections with gonorrhea and chlamydia are common (Piot and Islam, 1994).

The success of efforts to control the spread of STDs within communities is influenced by the biological characteristics of the disease pathogens. These biological parameters include the incubation period (the time between acquisition of infection and the time at which an individual is infectious to a sex partner); the presence and severity of symptoms; the efficiency of transmission; and the responsiveness of the infection to therapy (Hook et al., 1992). Single-dose treatments for gonorrhea are available, however some newer isolates of *Neisseria Gonorrhoeae* are resistant to penicillin or tetracycline. An estimated 30 percent of gonorrhea infections in 1994 were antibiotic-resistant requiring increasingly expensive treatments as therapeutic options (Institute of Medicine, 1996). Treatment for uncomplicated chlamydia is usually effective, however compliance with the required week of therapy may be more difficult to sustain (Batteiger and Jones, 1987).

Estimates of STD Infection

Gonorrhea According to CDC (1998) surveillance data, rates of gonorrhea steadily declined among men in Baltimore from 1993 to 1996. Rates increased in women, from 910.3 to 1,169 per 100,000 during 1993-94, but have decreased somewhat since then (Figure 1). Overall rates for both men and women in 1997, however, were the highest in the nation and four times greater than the national average (CDC, 1998).

Determining the true prevalence of gonorrhea is complicated by high levels of asymptomatic infection. Without apparent indications of infection, individuals are unlikely to receive medical attention or get enumerated in surveillance statistics. Gonorrhea is more likely to be asymptomatic in women than in men; clinicians estimate that between 50 and 80 percent of women, but less than 5 percent of men infected with gonorrhea are asymptomatic (Wasserheit et al. 1991).

Women are also more likely than men to become infected if exposed to an infected partner. For example, the risk of a woman acquiring gonorrhea from a single act of intercourse with an infected man may be as high as 60 to 90 percent, whereas transmission from an infected woman to a man is about one-third as high (Wasserheit et al., 1991). Thus, it is not unreasonable to consider the CDC rates as lower bound estimates of true prevalence, particularly for women.

Chlamydia Chlamydial infection is the most commonly reported bacterial STD in the U.S. (CDC, 1995, 1998). According to CDC (1995, 1997, 1998) national estimates, reported rates of chlamydia increased from 3.2 cases per 100,000 persons in 1984 to 207.0 per 100,000 in 1997. In Baltimore City, chlamydia rates among women nearly doubled from 1993 to 1997, increasing from 851.8 to 1,554.7 per 100,000. Rates for men in Baltimore decreased from 1991 to 1993, but have remained steady since 1993. The 1997 rate for men, 145.8 per 100,000, was less than one-tenth the reported rate for women. (Figure 2).

Like gonorrhea, chlamydia is often asymptomatic in women and may only be identified through screening (Aral et al. 1991; Jones and Wasserheit 1991). Research suggests that asymptomatic chlamydia infection occurs in 90 percent of infected women and over 50 percent of infected men (Aral and Holmes, 1990; Hillis et al., 1995). An

estimated two in three women and one in three men with infected partners are themselves infected (Batteiger and Jones, 1987).

Estimates of the distribution of STDs from clinical studies, nonprobability samples, or from CDC STD surveillance statistics are limited in their generalizability. Reporting of gonorrhea and chlamydia are required by the Public Health Service. This means that physicians and laboratories are required to report to the CDC all incident cases of gonorrhea and chlamydia. The CDC estimates include the number of new cases in a given area and period of time only. It is impossible to determine from the data the number of people who are infected or the patterns of transmission of infection from one individual to another (Laumann et al., 1994). At best, the case reporting system generates lower-bound estimates of STD prevalence. Undiagnosed cases are omitted. In addition, population subgroups with limited options for seeking health care and treatment, predominantly poorer or younger populations are excluded. These statistics are flawed for several additional reasons. First, they tend to over-represent the populations served by those health facilities. Second, changes in surveillance and screening rates will be reflected in yearly estimates. For example, declines in incidence could be due to decreases in screening high-risk women, declines in numbers of women screened, or real decreases in incidence (Laumann et al. 1994). Moreover, considerable geographic variation exists in the completeness of reporting (particularly by age and race/ethnicity), in case definitions, and in national and state policies and systems for collecting surveillance data (CDC, 1997; Laumann et al., 1994). Rates from the CDC are also reported per 100,000 population. Ideally, rates would be calculated among the sexually active population. Likewise, trend data are equally difficult to interpret. Increases in reported rates may reflect increased routine screening, improved reporting,

better diagnostic techniques, targeted public health efforts to enhance recognition of symptoms, as well as true increases in infection.

Population-based estimates of STD infection are provided by a few national surveys. The National Survey of Family Growth (NSFG) surveys a nationally representative sample of American women ages 15 to 44 years, focusing on their reproductive, contraceptive, and fertility behaviors. In 1988, self-reported information on STD histories was collected; 4.6 percent of sexually active women reported a history of gonorrhea or chlamydia (tabulations from 1988 NSFG). An analysis of the 1995 NSFG revealed that 6.3 percent of sexually active women reported a prior infection with gonorrhea or chlamydia (Miller et al., 1998). Overall, reports of STDs were higher among black women (compared to nonblack women), among those 15 years of age or younger at the time of their first intercourse, among women less than 35 years, and among women reporting more than 5 lifetime partners (compared to women reporting monogamy).

The 1991 National Survey of Men surveyed a probability sample of U.S. men ages 20-39 years (Billy et al, 1992, 1993). In this survey, 9.7 percent of adult men reported ever having a STD (Billy et al., 1993). In a nationally representative sample of adolescent males aged 15-19 years in 1988 (National Survey of Adolescent Males), 1.9 percent reported they had ever had gonorrhea, syphilis, herpes, or venereal warts (Sonenstein, Pleck, and Ku, 1991). The 1993 National Health and Social Life Survey provided self-reported estimates of both the incidence of risky behaviors and STDs among the U.S. adult population aged 18 to 59 years of age. The reported lifetime rate of gonorrhea among sexually active adults was 6.6 percent and 3.2 percent for chlamydia (Laumann et al., 1994). Rates for both of these infections were higher among

younger cohorts (under age 30), among those with a greater number of sexual partners since age 18 and within the past 12 months, and among blacks (compared to Whites and Hispanics). Among all age groups, rates of gonorrhea were higher among males, whereas chlamydia was higher among females.

Self reports of STD infection may be biased in several respects. First, given the social stigma attached to sexual behaviors and sexually transmitted diseases, some individuals may be reluctant to report a prior STD infection. Furthermore, many STDs are asymptomatic or produce symptoms that may be misdiagnosed or mild enough to go untreated (women with a vaginal discharge, for example, may misdiagnose the discharge as a yeast infection). And because of the high levels of asymptomatic infection, particularly associated with chlamydia, individuals who do report STDs are generally those who received treatment and are in closer contact with the health system.

A 1996 Institute of Medicine report on the public health risks presented by STDs in the U.S. noted that knowledge and awareness of STDs is generally poor among Americans (IOM, 1996). The study cited a 1993 national survey of adult women conducted by EDK Associates which indicated that almost two-thirds knew nothing or very little about STDs other than HIV/AIDS and only one in ten were aware that STDs can be more harmful to women than to men. Another survey conducted in 1994 by the American Social Health Association found that one-third of respondents could not name any STD other than HIV/AIDS; of those who did know another, 44 percent named syphilis and 37 percent named gonorrhea; few named any other STD (Institute of Medicine, 1996). The study also noted that increased knowledge and awareness of STDs was associated with greater use of condoms and an increased propensity to seek health care.

There are several important reasons for generating more precise estimates of the distribution of gonorrhea and chlamydia across different age and at-risk groups, including targeting limited health care resources and tailoring new intervention strategies. In addition, more precise changes in infection rates over time will be critical to improved evaluation of these interventions. Thus, it is important to develop the capacity to conduct population-based surveys of both the behaviors that transmit these infections as well as the prevalence of the infections themselves. Because we don't have accurate information on the dimension and distribution of these infections in the population, important opportunities to prevent infection and their sequella are lost.

At the individual level, the absence of specific symptoms can repress health seeking behavior. In addition, health care providers often don't screen for these infections since in general, patients are misperceived to be at low risk (Institute of Medicine, 1996; NY Times, 1998). Health care plans do not routinely include STD screening as part of their primary health care programs (Holmes et al., 1999; Institute of Medicine, 1996). Untreated infection with gonorrhea or chlamydia risks the development of serious sequella as well as continued transmission of infections to sexual partners. If left untreated, the spread of gonorrhea and/or chlamydia infection from the lower to the upper female reproductive tract can result in pelvic inflammatory disease (PID), infertility, ectopic pregnancy, and chronic pelvic pain (Jones and Wasserheit 1991; NIAID 1993). More than 20 percent of cases of acute PID in the U.S. are attributable to chlamydial infections (Jones and Wasserheit 1991).

Symptoms of chlamydia are similar to those of gonorrhea, however infections are generally less acute and produce milder symptoms. Since symptoms are milder, however, individuals with chlamydia may not seek medical care or if they do, it may not

be properly diagnosed. Consequently, a woman's first indication of a chlamydia infection may be when she has difficulty becoming pregnant or has an ectopic pregnancy (Jones and Wasserheit 1991). Perhaps the most important reason for monitoring these infections in the population is that, with timely diagnosis and appropriate treatment, antibiotics are now available to cure gonorrhea and chlamydial infections.

Individual Risk Behaviors for STD Infection

In addition to providing estimates of STD prevalence, population-based surveys can provide information on the factors and patterns of behaviors that affect the spread of sexually transmitted diseases. Only a few population-based surveys have focused explicitly on sexual behavior. Information has generally been gathered from large-scale national surveys which include a limited number of sexual activity questions or from studies of convenience samples, clinic populations, or other high-risk subgroups of the population.

The public use data files from the 1988 and 1995 NSFG contain information on female sexual activity, but are limited to age at first intercourse, contraceptive use, and reproductive histories (Forrest and Singh, 1990; Kost and Forrest, 1992). Women in the 1988 and 1995 surveys were asked about their number of sexual partners, prior gonorrhea and chlamydial infections, and the frequency of intercourse within the past 3 months. These data were not included in the public use file but are available by special request. The General Social Surveys, conducted annually by the National Opinion Research Center, ask about sexual activities within the last year and about the number of partners since age 18, but do not include questions on STDs (Anderson and Dahlberg, 1992; Davis and Smith 1991). (The General Social Survey (GSS) is an annual

population-based survey of U.S. men and women 18 years of age and older. Questions on sexual behavior are collected by self-administered questionnaire). The National AIDS Behavioral Surveys (NABS) were designed to describe the sexual practices and HIV correlates among U.S. adults between the ages of 18 and 75 years. Detailed behavior questions are asked only of those who report an HIV-related risk factor (Catania et al. 1990).

Several national surveys address behavioral factors associated with STD risk. The 1991 National Survey of Men (NSM) collected information on the sexual and health care behaviors of men between 20 and 39 years of age (Billy et al., 1992, 1993). The 1988 and 1995 National Survey of Adolescent Males (NSAM) gathered detailed sexual and contraceptive histories and information on STD acquisition and risk behaviors of young men ages 15 to 19 (Sonenstein, Pleck, and Ku, 1989, 1991; Turner et al., 1998). The most thorough survey to date on sexual activities of adult men *and* women is perhaps the 1992 National Health and Social Life Survey (NHSLS). Information from this national probability sample of U.S. adults between the ages of 18 and 59 "permits estimation of both the incidence of risky behavior and the incidence of sexually transmitted infections among those same individuals" (Laumann et al., 1994:376). Respondents received extensive questioning on sexual practices and preferences, number and characteristics of sexual partners, and STD history.

What are the major findings from population-based surveys and studies of clinic-based populations regarding the individual risk behaviors for STD infection? The data indicate that the majority of American adults are sexually experienced, most are currently sexually active, and the majority have had only one sexual partner in the previous year. This pattern of behavior suggests that most adults are not at high risk for exposure to

STDs. However, it is also apparent from these data that a substantial proportion of the population has had multiple or concurrent partners or unprotected sex with more than one partner. Kost and Forrest (1992:254), for example, note that "12 to 17 million women aged 15 to 44, and even more men, are at increased risk of STD infection because within a relatively short time (one year) they have had sex with more than one person or because their partner probably has had another partner". These individuals are more likely to be younger, never married, and nonwhite.

Age and gender are important predictors of the number of sexual partners and therefore indicators of STD risk (Aral and Holmes, 1990; Binson et al., 1993; Forrest and Singh, 1990; Laumann et al., 1994; Neu et al., 1998; Smith, 1991b). Men are more likely to report multiple sexual partners than women (Anderson and Dahlberg, 1992; Lauman et al., 1994). Young women report more frequent sex and more partners and are more likely to select sexual partners close to their own age than are older women (Kost and Forrest, 1992; Laumann et al., 1994).

Race is also associated with the incidence of STDs; overall, a higher incidence is observed among blacks and Hispanics than among whites. The relationship between race and STDs often persists after adjustments for socioeconomic differences (Ellen, Aral, and Madger, 1998; Ellen et al., 1995; Klausner et al., 1998; Rice et al., 1991). Racial differences in rates of STD infection may be attributed to differences in risk-taking behavior, differential access to health care services, or to biological differences in acquisition and transmission when exposed (Aral and Holmes, 1991). Some studies have noted a higher prevalence of chlamydia among white males and females than among blacks (Zimmerman, Potterat, and Duke, 1990).

Marital status also influences STD risk, differentiating men and women in terms of

their number of partners, and frequency of sex (Billy et al., 1993). Divorced and never married adults frequently engage in riskier sexual behaviors than those married (Anderson and Dahlberg, 1992; Kost and Forrest, 1992).

Specific sexual practices are associated with STD risk. The more sexual partners, the greater the risk of acquiring an STD through contact with an infected partner. The probability that a randomly selected partner is infected is, in turn, determined by the prevalence of infection within the community (Padian, Shiboski, and Hitchcock, 1991). Although an individual cannot directly change the prevalence of infection within the community, patterns of partner selection can be modified by individuals, which in turn affect the incidence of new infection. Multiple partners and frequent partner change increase the risk that at least one is infected (Hook et al, 1992; Laumann et al., 1994; Marrazzo et al., 1997).

The risk of infection also varies depending on the infectivity of the particular pathogen (Anderson, 1991). Gonorrhea has a relatively short period of infectiousness; consequently, having multiple partners during a brief period may result in greater risk of dissemination of infection than a series of monogamous relationships (Padian, Shiboski, and Hitchcock, 1991). Ideally we would like to determine the number of contacts that occurred after infection of the index case, however, for several reasons, including the prevalence of asymptomatic infection, this can rarely be determined.

The initiation of female sexual activity at an early age is associated with an increased number of subsequent sexual partners among women (Forrest and Singh, 1990). Anal intercourse, intercourse during the female menstrual period, or being paid for sex may also increase the risk of STD transmission. Other behaviors, such as consistent and effective condom use, are protective against STD risk (Catania et al.,

1995), although at least one study found no association between the consistency of self-reported condom use and the likelihood of STD infection (Zenilman et al., 1995).

An array of health-related factors are also associated with the probability of STD transmission, as well as the duration of infection once an individual is exposed. Such factors include health care-seeking behaviors, accessibility of health services, availability of screening programs, and compliance with prescribed therapy. Screening programs, for example, are particularly important in detection of asymptomatic infections (Padian, Shiboski, and Hitchcock, 1991). Recent clinical research suggests a lower prevalence of STD infection among adults due to a stronger influence of immunity from prior infections (Hook et al., 1992).

Drug and alcohol use have also been associated with an increased STD risk (Ericksen and Trocki, 1992, 1994). It is argued that drinking lowers inhibitions and may lead to irresponsible sexual behavior, including a decreased likelihood of condom use and less discrimination in the choice of partners.

Concluding Remarks

This chapter documents the public health dimension of sexually transmitted diseases. STDs affect men and women of all racial, ethnic, socioeconomic, and cultural backgrounds, although they disproportionately affect women, younger persons, and minorities (Jones and Wasserheit, 1991). Clinical and national studies demonstrate that young adults, for example, account for approximately two-thirds of all STDs in the U.S., have the highest age-specific rates of gonorrhea and chlamydia, and report the highest levels of risk-related behaviors (Binson et al., 1993; Hook et al., 1993). Blacks have disproportionately higher rates of infection than whites (Ellen et al., 1998).

In most clinic populations studied, infections due to chlamydia are twice as frequently reported as gonorrhea (Cates and Wasserheit, 1990; Hillis et al., 1995). Chlamydial infections are more common among the young and women (Zimmerman, Potterat, and Duke, 1990). In 1994, for every case of chlamydia detected and reported in males, more than five cases were detected and reported in females. This five-fold increase was reported despite the higher incidence of asymptomatic chlamydial infection among women. Clinicians estimate that as many as 85-90 percent of women and 40-50 percent of men clinically determined to be infected with chlamydia apparently report no symptoms (Wasserheit et al., 1991).

Gonorrhea, on the other hand, is more often clinically apparent as its signs and symptoms are more overt (Hook et al., 1992). Gonorrhea is more common among lower socioeconomic populations and minorities. According to CDC surveillance statistics, African-Americans accounted for 77 percent of total reported cases of gonorrhea in 1997 (CDC, 1998). Reported rates of gonorrhea have increased since the early 1990s, particularly among the female population. In 1997, eighty percent of cities with populations of 200,000 or more had rates of gonorrhea which exceeded the Healthy People Year 2000 objective (CDC, 1998).

The sheer number of individuals affected by these STDs underlies the importance of measuring the behaviors associated with their increased risk, yet our knowledge of the prevalence and patterns of spread of these infections is inadequate (Aral et al.1991; Jones and Wasserheit, 1991). Much more extensive information about the levels and types of sexual behavior at the population level are needed in order to develop, target, and monitor the effectiveness of interventions to prevent the acquisition and transmission of STDs (Kost and Forrest, 1991).

A complete listing of the individual-level variables to be considered in this research, as well as the operationalization and measurement of each of these variables is included in Chapter 4.

4. Theoretical Framework

A link between social structure and behavior is inherent to sociological theory. Structural effects, for example, are implicit in Marx's observation that groups with varying socioeconomic conditions have quite different social values and norms of behavior. In his writings on suicide, Durkheim demonstrates his view that "larger social forces exist which can account for a phenomenon that on the surface appears to be strictly a case of individual action" (Farganis 1993:73). He further suggests that such structural conditions constrain individual behaviors. Durkheim notes that social forces "have a reality outside the individual...Of course, the individual plays a role in their genesis [but] since this synthesis takes place outside each one of us, its necessary effect is to fix, to institute outside us, certain ways of acting and certain judgments which do not depend on each particular will taken separately. The individual yields to the slightest shock of circumstance because the state of society has made him a ready prey to suicide" (from Durkheim, Suicide: A Study in Sociology, translated by J. Spaulding and G. Simpson, 1951). The import of social control over individual behavior is further advanced by contemporary sociologists. Pearlin (1992:3) notes that the conditions that individuals regularly encounter as they participate in the stratified systems of society and in informal social relationships are "mirrored in the regularity of their experiences. That is, the structure of the contexts in which people lead their lives will tend to influence the structure of their experiences".

Contextual studies of individual behaviors posit that decisions regarding

acceptable and unacceptable behaviors are affected by the larger social and economic environment in which one lives. Brooks-Gunn and colleagues (1993) investigated how the percentage of residents employed in professional positions was related to individual behavior during adolescence. They concluded that living in a setting with a higher density of middle-class neighbors had a positive influence on individual development. To explain the link between environment and behavior, they assert that middle-class neighbors provide young adults with role models of conventional success — what it is and how it can be achieved. As such, the neighborhood demographic composition, defined as the percentage of adults employed in managerial or professional positions, is presumed to influence a social process, the density of role models, which then influences individual behavior (Cook, Shagle, and Degirmencioglu, 1997).

Recently, urban sociologists have focused our attention on the deteriorating neighborhood conditions in many inner-city areas. They illustrate the concentration of poverty, joblessness, out-of-wedlock births, school dropout, and poor health care found within these impoverished areas (Brooks-Gunn, Duncan, and Aber, 1997; Jencks and Mayer, 1990; Sampson and Morenoff, 1997). Studies of poor, inner-city neighborhoods have proposed a number of different social processes to explain the adverse effect of that environment on behavior.

Sociologist William Julius Wilson (1991:7) argues that the increasing geographical concentration of poverty and joblessness of the most disadvantaged urban black population has given rise to an urban underclass, a "heterogeneous grouping of inner-city families and individuals whose behavior contrasts sharply with that of mainstream America". The exodus of middle-class families from the inner-city during the 1970s and 1980s removed an important "social buffer", a source of urban viability and

core of support, leaving behind a highly vulnerable and socially isolated urban underclass with weakened connections to both formal and informal job networks.

Sampson and colleagues (1998) assert that the concentration of poverty enhances social disorganization by reducing social control and social cohesion among neighborhood residents. They demonstrated that the social organization of residents within Chicago's neighborhoods explained variation in crime rates that could not be attributed to individual demographic characteristics alone. Massey and Denton (1993:167) propose that isolation from 'mainstream' society leads to the evolution of an alternative value system which "explains and legitimizes the social and economic shortcomings of ghetto blacks...attaching value and meaning to a way of life that the broader society would label deviant".

While inherent to social science, the systematic study of social structure and behavior, specifically health behaviors, has remained the exception rather than the rule (Blau, 1962; Diez-Roux, 1998; Duncan, Jones, and Moon, 1998; Ericksen and Trocki, 1992; Institute of Medicine, 1996; Jaynes and Williams, 1991; Kiecolt, 1988; Williams and Collins, 1995). Typically, inadequate attention is given to the ways in which the social distribution of risk factors and resources for health are constrained by societal norms and structures (Williams and Collins, 1995:372). More often, STD research has focused on the individual as the unit of analysis. Theories to explain STD risk behaviors have tended to ignore social and environmental characteristics as influences on individual actions (Institute of Medicine, 1996). Yet individual behavior occurs in a complex social context, and analyses that remove behavior from its broader social setting ignore essential determinants.

The contextual model to be tested in this proposed research is informed by

theoretical writings of the "social isolation" among poor, inner-city, minority neighborhoods. This project draws upon Wilson's social isolation theory and Massey's segregation theory to identify characteristics of individuals residing in Baltimore City who are at high risk of STD infection and to link those characteristics to community qualities.

Poverty and Social Disadvantage

Attempts to reconcile the persistent economic and social inequities in American society have challenged U.S. policy for centuries. More recently, attention has centered on the social ills associated with poor, inner-city neighborhoods in older industrial cities (Sampson and Morenoff, 1997; Shaw and McKay, 1969; Wilson, 1987). In particular, researchers and policy-makers have sought explanations and solutions for the "growing entanglement in urban areas of neighborhood poverty with other social dislocations such as violent crime, joblessness, family disruption, high rates of infant mortality, and a host of other factors detrimental to social development, for example, school dropout, poor health care" (Brooks-Gunn, Duncan, and Aber, 1997:1). The association between urban poverty and various social 'dislocations' such as joblessness, drug use, teen pregnancy, and crime have been well documented (Brooks-Gunn et al., 1993; Duncan, 1993; O'Campo et al., 1995; Hogan and Kitagawa, 1985; Sampson, Raudenbush, and Earls, 1997).

Scholarly examinations of the context of neighborhood poverty and the problems associated with the inner-city 'underclass' have debated whether poverty is culturally or structurally determined (Brooks-Gunn, Duncan, and Aber, 1997; Kasarda, 1985; Massey and Eggers, 1990; Massey and Denton, 1993; Sampson and Groves, 1989; Shaw and McKay, 1969; Wilson, 1987). Those who seek structural solutions, primarily urban

sociologists, argue that the concentration of urban poverty deprives residents of resources, conventional role models, and cultural learning from mainstream social networks that equip individuals with the skills necessary for social and economic advancement in contemporary society (Jencks and Mayer, 1990; Wilson, 1991). Cultural arguments, in contrast, deny that changes in environment could modify individual behavior, since behaviors are learned and transmitted inter-generationally. In essence, the debate focuses on adaptations to constraints and opportunities afforded by inner-city life versus the internalization of normative behaviors.

Wilson (1987), in *The Truly Disadvantaged,* drew our attention to the increasing concentration of poverty and social disorganization in inner-city neighborhoods. He attributes the rise in inner-city social dislocations since the 1970s to changes in the national economy. He argues that persistent poverty is established and perpetuated by social, economic, and cultural conditions — external conditions which create specialized and localized pockets of disadvantage within inner-city populations. Changes in the overall economy during the 1970s resulted in a decentralization of employment from cities to the suburbs and to decreases in manufacturing employment (Wilson, 1987,1991). This "industrial restructuring" pulled the more highly educated to the suburbs in search of better wages and opportunities and further diminished opportunities for the least educated inner-city residents (Wilson, 1991). One consequence of these economic and demographic shifts, according to Wilson, is the removal of middle-class role models. "[T]he declining presence of working and middle class blacks deprives ghetto neighborhoods of key resources, including structural resources such as a social buffer to minimize the effects of growing joblessness and cultural resources such as conventional role models" (Wilson 1991:9).

Wilson argues that with the loss of manufacturing jobs and the middle-class exodus from the city to the suburbs, minorities were isolated from informal job networks, deprived of exposure to the behavior patterns of the steadily employed, and denied access to effective education. In the face of increasing unemployment, the exodus of higher-income families from inner-city neighborhoods made it more difficult for inner-city residents to sustain the basic institutions in the neighborhood such as schools, stores, health clinics, and churches. The subsequent social and geographic concentration of disadvantage brings about changes in behavior -- the lack of a sense of community, the lack of norms against aberrant behavior, the lack of a positive neighborhood identification — what Wilson (1987,1991) terms "concentration effects". The concentration of social and economic disadvantage influences individual-level outcomes independent of individual-level characteristics.

While largely agreeing with Wilson's structural thesis, Massey and Denton (1993:2) argue that an additional factor, residential segregation, concentrates poverty within the inner city, creating a social environment "where poverty and joblessness are the norm, where a majority of children are born out of wedlock, where most families are on welfare, where educational failure prevails, and where social and physical deterioration abound". They argue that the damaging effects of segregation lie beyond any individual's ability to change; '[segregation] constrains black life chances irrespective of personal traits, individual motivations, or private achievements' (Massey and Denton, 1993:3). While not dismissing Wilson's structural transformation argument, Massey and Denton (1993:8) assert that residential segregation was instrumental in:

> 'confining the increased deprivation to a small number of densely settled, tightly packed, and geographically isolated areas', areas in which a "deleterious set of attitudes and behaviors — a culture of segregation —

> has arisen and flourished. Segregation created the structural conditions for the emergence of an oppositional culture that devalues work, schooling, and marriage and that stresses attitudes and behaviors that are antithetical and often hostile to success in the larger economy. Although poor black neighborhoods still contain many people who lead conventional, productive lives, their example has been overshadowed in recent years by a growing concentration of poor, welfare-dependent families that is an inevitable result of residential segregation".

In response to the impoverished and isolated conditions, Massey argues that a segment of the urban black population has evolved a set of behaviors, attitudes, and values that are increasingly in opposition to the basic ideals of mainstream society. "Although these adaptations represent rational accommodation to social and economic conditions within the ghetto, they are not widely accepted or understood outside of it, and in fact are negatively evaluated by most of American society" (Massey and Denton, 1993:166). The interaction of poverty and segregation creates an environment where joblessness, out-of-wedlock childbirth, dropping out of school, prostitution, crime, and drug use are common or even normative (Massey and Denton, 1993). Furthermore, Massey argues, the origins of concentrated disadvantage within our inner-cities was not unique to the 1970s. Rather, racially segregated cities have existed throughout this century (Massey and Denton, 1993).

Whereas Wilson argues that social isolation is the primary mechanism for explaining the social transformation of the inner city, Massey cites the effects of racial segregation. According to Massey and Denton (1993:9), "focusing on the flight of the black middle class deflects attention from the real issue, which is the limitation of black residential options through segregation". Both, however, contend the result is increasing poverty and inequality among neighborhoods which in turn, is associated with deleterious social conditions and aberrant behavior.

A Theoretical Model

Demographic research on adult sexual behavior has typically focused on the individual social and demographic correlates. Ethnographic studies and a growing body of quantitative research suggest however that critical aspects of the neighborhood environment may influence individual rates of nonmarital fertility, contraceptive use, and teen sexual behavior (Cook, Shagle, and Degirmencioglu, 1997; Hogan and Kitagawa, 1993; Ku, Sonenstein, and Pleck, 1993). These studies demonstrate the need to study individual behaviors within the social context in which they occur (see for example, Brooks-Gunn et al., 1993).

This research is based upon the premise that neighborhoods matter, and that the economic and social environment of neighborhoods may actually have an influence on the life course of those who reside in them.

The proposed relationship between individual behaviors, community-level characteristics, and the risk of STD infection is illustrated in Figure 3. The research draws primarily upon Wilson's social isolation theory, also capturing critical elements of Massey's segregation thesis. Within this theoretical context, the risk of acquiring a sexually transmitted disease reflects a complex interaction of individual and community-level demographic characteristics, the individual's social environment, and individual sexual and health-care behaviors. In this model, demographic and behavioral characteristics of individuals, including, age, gender, race, marital status, socioeconomic status, education, and use of health services are believed to influence sexual behaviors and hence the risk of STD infection. In addition, the model proposes that the effects of individual sexual and health behaviors on STD risk are moderated by the characteristics of the community in which one resides. The neighborhood environment, in particular, the

conditions associated with poor, socially isolated areas, are expected to reinforce the negative impact of low income, low education, and high sexual risk-taking behaviors.

Community Influences on Individual Behaviors Community-level factors may influence behaviors in several ways. The community in which one lives provides the context in which behaviors are shaped and conducted. The opportunity structure, the available role models, the evaluation of the costs and benefits of behavioral alternatives, and the social norms perceived are, for the most part, influenced by one's social environment. Consequently, certain patterns of behavior may be more closely associated with the community environment rather than universally prescribed societal norms (Brewster 1994:409; Burton, 1990; Geronimus and Korenman, 1992; Hamburg 1986). Anderson's (1994) sex codes describe an oppositional culture of urban black youth which entraps them in a cycle of failure, conflict and alienation from mainstream views. He describes two urban cultures, the 'decent' culture and the 'street' culture.

Wilson (1987) argues that poor neighborhoods are unique, not only because they are the lowest in income, but also because of their social isolation which compounds whatever inherent problems the poor have (Berry, Portney, and Thomson, 1991). Residents of socially isolated neighborhoods are not sufficiently exposed to the norms of mainstream society. They are particularly disadvantaged because they live in areas of core poverty isolated from middle-class role models and institutional support.

If neighborhoods have an independent effect on how residents view themselves in relation to the broader society, one would expect to find, for example, that residents of poor neighborhoods are less likely to utilize health care (either because of lack of knowledge or access to services) and more likely to engage in riskier sexual practices such as multiple partners (either because of less restrictive norms regarding

monogamous relationships or the perceived opportunities) than poor people who do not live in poor areas.

Social structural conditions, such as enduring poverty and persistent segregation, compound and reinforce certain patterns of behavior, an idea central to Wilson's work on concentration effects and Massey's racial and residential segregation thesis. Limited economic and social opportunities engender different norms of acceptable sexual behavior and exert external constraints on individual behavior that may be at odds with achieving mainstream goals (Brewster 1994a, 1994b; Wilson, 1987). Limited opportunities can foster an 'anti-achievement ethic' and rejection of mainstream norms and values, prompting engagement in riskier sexual practices, ex., unprotected intercourse or sex with an IV drug user.

Communities characterized by high proportions of unmarried mothers or high levels of welfare dependency may reflect the communities values towards out-of-wedlock births, or the difficulty in finding stable employment. Facing a dearth of opportunities for gainful employment, or for forming a marriage partnership, it is not unrealistic that individuals adopt different values towards marriage, childrearing, and sexuality.

The labor market experiences of adults may influence the behaviors of others within the community, providing motivation to avoid behaviors that might risk their own employment opportunities, as well as providing support for behaviors that influence individual aspirations toward regular employment as a desired goal. Such reasoning is central to Wilson's (1987) theory of social isolation. According to collective socialization/social isolation theory, impoverished neighborhoods with more unemployed adults and single parent households provide role models that eschew conventional emphases on school achievement, family formation, work skills, and individual health

(Wilson, 1987, 1991). Conversely, neighborhoods characterized with more working adults and two-parent families provide support for conventional roles in the workplace, family, and home, and foster individual health.

The physical characteristics of a neighborhood provide the physical context in which social life and interaction occur (Furstenberg and Hughes, 1997). The types and quality of housing, the level of deterioration, and the extent of vacant buildings provide indices of community infrastructure and may also represent important constraints to social relationships (Williams and Kornblum, 1994). For example, an area of rental apartments may have a different character than an area of mostly owner-occupied single-family row houses. The social relationships among neighbors in each of these areas may be related to the characteristics of the people who choose to live in each area as well as to how the physical arrangement of these living arrangements foster or constrain social exchange.

Institutional resources may also serve as mechanisms of social influence. The accessibility to health care, schools, community parks, and local policing influence residents' perceptions of safety and available opportunities. Home ownership, as compared to the presence of rental units, may also be an important positive feature of the community, signifying permanence and commitment (Korbin and Coulton, 1997).

Research Hypotheses

The analysis will test various explanatory models to investigate hypothesized relationships at the individual level and the neighborhood level. The contextual or cross-level relationships will investigate how variables measured at the neighborhood level affect relationships at the individual level. Within this neighborhood framework is posited

the presence of a neighborhood context that influences individual outcomes, independent of individual-level characteristics. At the individual level, it is hypothesized that:

H1-1: Minority race, young age, female gender, and lower socioeconomic status are positively associated with the risk of STD infection.

H1-2: Individual behavioral characteristics such as young age at first sex and multiple sexual partners are positively associated with the risk of STD infection.

Individual-level demographic and behavioral attributes, such as race, gender, and social class are necessary but not sufficient conditions for explaining the variance in sexual and health-related behaviors and the risk of acquiring a sexually transmitted disease.

At the community level, it is hypothesized that:

H2-1: The distribution of STD infection varies across neighborhoods.

H2-2: Levels of STD infection will be higher in neighborhoods characterized by low socioeconomic status, high levels of social disorganization (ex., racial segregation, poverty) and limited opportunities (ex., high levels of unemployment, low rates of labor force participation).

A series of hypotheses will test relationships at the combined level. These hypotheses will consider the influence of neighborhood characteristics on level-1, or individual relationships. A basic premise of this research is that the social and organizational characteristics of neighborhoods will explain variation in STD rates that are not solely attributed to variation in individual characteristics. Hypotheses to be tested are:

H3-1: Neighborhood variation in STDs is influenced by levels of segregation, i.e., neighborhoods with a higher proportion of black residents will experience higher levels of STD infection, net of variation in individual characteristics.

H3-2: High levels of neighborhood poverty are also positively associated with STD infection, even after controlling for individual characteristics.

H3-3: Segregation and poverty form "concentrations of disadvantage", socially isolating lower-income and minority residents from key resources and role models, which in turn, is associated with an increased risk of STDs.

H3-4: Neighborhoods lacking in community resources, i.e., characterized by high levels of unemployment and single-parent families will experience higher rates of STDs, after controlling for differences in individual characteristics.

The next chapter reviews the data to be used in testing these hypotheses and defines the dependent and independent variables of interest.

5. Data and Methods

This chapter describes the data, the dependent and independent variables of interest, and outlines the methods for the data analysis. Data were derived from multiple sources. Individual-level demographic and behavioral data were drawn from a 1997-1998 household health survey of 1,014 adults ages 18-45 in Baltimore, Maryland. The Baltimore STD and Behavior Survey (BSBS) was conducted by Research Triangle Institute and data were collected from January, 1997 through September, 1998. Neighborhood-level data were gathered from the 1990 Census and the Baltimore City Department of Planning.

Study Design: Baltimore STD and Behavior Survey

The objective of the Baltimore STD and Behavior Survey (BSBS) was to collect health and sexual behavior data, including urine samples for laboratory analysis of gonorrhea and chlamydia. The target population was defined as all persons 18 to 45 years of age living in households in the city of Baltimore. Institutional and group quarters populations were excluded. All persons sampled from this population were asked to complete the study questionnaire. A subgroup of persons ages 18 to 35 years were also asked to provide a urine sample for laboratory testing for gonorrhea and chlamydia.

The sampling frame consisted of a listing of properties generated from the Real Estate Property Index. This city-wide listing of all residential and commercial properties is collected annually by the City's Department of Housing. Because this listing is used for

tax collection purposes, it is considered to be complete and reliable.

The household survey was based on a stratified probability sample design. Strata with the lowest concentrations of blacks were sampled more heavily as proportional allocation would have yielded many more blacks than others. Sample supplements of black males and white males and females aged 18 to 35 were implemented to balance the respondent sample by race and gender and improve the precision of the laboratory-based GC/CT measures in the white population. Census tracts with a high proportion of black adults were selected for the black supplemental sample. External measures of GC and CT prevalence at the census tract level were obtained from local STD clinics and tracts with the highest external measure of GC/CT prevalence were selected for the supplement white sample.

Approximately 3,182 households were eligible for screening. Households were sent a lead letter in the mail prior to being contacted by an interviewer. The lead letter described the purpose of the study and requested subjects' cooperation. Interviewers successfully screened 2,727 households for age-eligible respondents. Only one eligible person was selected per household. A total of 1,224 adults between the ages of 18 and 45 were identified as eligible for interviewing.

Of the 1,224 eligible adults, 1,014 respondents consented to participate and complete a detailed survey on sexual behavior, prior STD history, STD symptoms, use of medical care, social attitudes, drug and alcohol use, and individual background characteristics. Data were collected by a trained interviewer in the respondent's home. Respondents were randomly assigned to receive either an audio computer assisted self interview (audio-CASI) or computer assisted personal interview (CAPI). Respondents assigned to the CAPI mode responded directly to the survey interviewer for

approximately one-half of the questionnaire items; the interviewer then entered the responses directly into the computer. The remaining items were completed by a self-administered questionnaire. Respondents assigned to the audio-CASI mode received the entire questionnaire in audio-CASI; all responses were entered by the respondent directly into the computer. The entire survey was designed to take approximately 20-25 minutes to complete.

Following completion of the interview, respondents received a $10 co-payment. Respondents between 18 and 35 years of age were then asked to provide a urine specimen. Participants were told that the urine would be screened for *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. (The age restriction for the urine testing was based on financial reasons. The urine ligase chain reaction (LCR) tests used for the diagnosis of gonorrhea and chlamydia in this study are a relatively new technology and the cost for laboratory diagnosis was approximately $5 per specimen). Ligase chain reaction tests can detect minute quantities of genetic material of both gonorrhea and chlamydia in urine. The recent FDA-approval of these urine-based diagnostic tests for gonorrhea and chlamydial infection now make it possible to incorporate measures of these infections under standard field survey conditions. Prior to the development of these tests, diagnostics for these STDs required a cervical swab for women or a urethral swab for men. A two-stage consent procedure was used for these respondents. The first stage involved consent to complete the interview. The second stage involved consent to provide the urine specimen. Participants who agreed to provide a urine sample received an additional $10 co-payment. The informed consent process made explicit that the urine was ***not*** to be used for drug testing and that, in compliance with state laws, specimens found positive for gonorrhea and/or chlamydial were to be reported to the

individual and to the Baltimore City Public Health Department. Once contacted, respondents were told they should visit their regular medical provider or one of the city's two public STD clinics for treatment.

Dependent Variables

The primary outcome of interest was gonorrhea and/or chlamydia infection. Whether the respondent *currently* had gonorrhea or chlamydia infection at the time of the survey was assessed from the urine laboratory diagnosis. Lifetime prevalence estimates of gonorrhea and/or chlamydia infection were determined from self-reported information gathered from the survey questionnaire. Specifically, respondents were asked, "Have you ever heard of a disease called gonorrhea" and if so, "Has a doctor or nurse EVER told you that you had gonorrhea, or 'clap'?". An identical set of questions was asked for chlamydia. For each infection affirmed, respondents were asked to provide information on when the last infection occurred, and whether medical treatment was obtained. From these responses, it was possible to generate self-reported estimates of a lifetime history of gonorrhea and/or chlamydial infection, as well as determine the recency of the last diagnosis (and hence treatment).

Individual-level Characteristics and Behaviors

Sexually transmitted diseases result from exposure to infectious agents via sexual contact with an infected individual (IOM, 1996). Numerous behavioral and sociodemographic factors are associated with an increased risk for STDs (see Chapter 3). These factors include multiple sexual partners; being of a racial/ethnicity minority, young age, and single; inconsistent or non-use of condoms; inadequate access to and

use of appropriate medical services; and noncompliance with treatment regimens. Individual physiological differences between men and women are also associated with the risk of STD infection (Jones and Wasserheit, 1991).

Individual demographic and behavioral factors to be investigated in this study are described below. The justification for inclusion of these measures and the operationalization of each concept are also specified.

Age: Teens and young adults are more likely than older adults to become infected with a STD; two-thirds of all sexually transmitted infections each year occur among those aged 25 years or less (CDC, 1995, 1998). The increased risk is related to the number of partners, the frequency of partner change, and enhanced biologic susceptibility. Young people are also less likely to seek health care or use health services (Donovan, 1993). The age of respondents in this analysis ranges from 18 to 35 years.

Race/ethnicity: Race and ethnicity are associated with the incidence of STDs. Clinical studies indicate that the incidence of gonorrhea and chlamydia is higher among blacks and Hispanics than among whites (Aral et al., 1991; Washington et al., 1991). Aral and colleagues (1991) suggest that the disproportionate representation of STDs among certain racial/ethnic groups may be associated with more frequent risk-taking behaviors and/or differential access to or use of health services. Studies of patients from STD or public health clinics suggest that blacks are less likely to receive early diagnosis and treatment (Collier, 1990; Quinn et al., 1988). Race/ethnicity in this survey was based on self reports and categorized as black and nonblack.

Marital status: Single people engage in riskier sexual behaviors than married persons. The risk of acquiring an STD in a monogamous relationship is lower than in

one characterized by frequent partner change. Since there is a lower perception of risk in a monogamous relationship, married men, for example, are less likely than single men to use condoms but are more likely than younger men to seek health care (Billy et al., 1993). Respondents were asked to indicate whether they were married or living with a partner, divorced, widowed, separated, or never married.

Socioeconomic status: Socioeconomic status (SES) is a multidimensional concept encompassing indices of income, levels of poverty, educational attainment, and/or labor force attachment. Socioeconomic status is also a predictor of variation in health outcomes, largely due to the disparity in income (Williams and Collins, 1995). Each of these measures, taken individually as a measure of SES, has its own advantages and limitations. Income alone, for example, is generally an unstable measure of SES, as it varies throughout the life cycle, and is subject to reporting biases. Education is generally a more reliable measure. A composite measure of socioeconomic disadvantage was calculated for this study, using the indicators of education and income. 'Socioeconomic disadvantage' measured low education (did not complete high school) and low income (reported household income of $20,000 or less).

Measures of individual behaviors associated with an increased risk of STD infection are classified into six categories: partner selection, condom use, frequency of sex and sexual practices, alcohol and drug use, health behaviors, and partner relationships.

Partner selection: A basic parameter of increased transmission risk is the number of sexual partners. The more partners, the greater the risk that at least one is infected. Laumann et al. (1994) suggest that, on average, persons with several partners may also select riskier partners. In this survey, information on the number of lifetime partners, the

number of partners within the past 12 months, and the number of partners within the past 30 days were collected. Respondents were also asked to report any *new* partners within the last year and/or the last five years. Composite measures of these partner variables, such as reporting of six or more lifetime partners or two or more partners last year (multiple partners), or reporting of multiple partners and one or more new partners last year, were calculated as indicators of high risk partner selection behaviors.

Condom use: Condoms, used effectively and consistently, can inhibit STD transmission (Laumann et al., 1994; NIAID, 1992; Stone, 1986). Laboratory tests indicate that condoms are impermeable to STD infections (CDC, 1988). In this survey, respondents were asked whether a condom was used at last intercourse and the frequency of condom use within the last 12 months. Attitudes toward condom use were measured by responses to the questions, "Was there ever a time when you thought you or a partner should use a condom even though one wasn't used?" and "How often in the past year have you told a new sex partner that you won't have sex unless a condom (rubber) is used?".

Frequency of sex and sexual practices: Frequency of intercourse may also be positively related to the risk of infection with gonorrhea and chlamydia (Padian, Shiboski, and Hitchcock, 1991). Respondents were asked to report on their frequency of intercourse during the last 7 days. Respondents were also asked to report how old they were the first time they had sexual intercourse. Since the age of first intercourse affects the amount of time a person is sexually active, earlier onset of sexual initiation extends the period of possible STD exposure (Greenberg, Magder, and Aral, 1992). Earlier age at intercourse may also serve as a predictive marker for a variety of other sexual risk factors, such as the number of lifetime partners. Survey data suggest that blacks initiate

sexual activity at an earlier age than whites (Kost and Forrest, 1991; Brewster, 1994; Miller et al., 1998).

Clinical data indicate that certain risky sexual practices, such as anal intercourse (Billy et al., 1995), oral sex, or being paid for sex (Pabst et al., 1992) are also likely to increase the risk of STD transmission. Questions on other sexual practices in this survey included whether the respondent had paid for or been paid for sex (including sex with a prostitute); whether they had been ever forced to have sex against their will or forced someone to have sex with them; when, if ever, they last had anal sex; and, when, if ever, they last had a one-night stand, that is, engaged in casual sex with someone whom they did not expect to have sexual contact with again.

Alcohol and other drug use: Persons who use illicit drugs are more likely to acquire STDs (Anderson and Dahlberg, 1992; Shafer and Moscicki, 1993). Possible explanations propose that social and economic factors, such as poverty, lack of educational opportunities, and weak community infrastructure, may contribute to both higher rates of STDs and greater use of drugs (Institute of Medicine, 1996). Individual risk-taking and low self-efficacy are also presumed to affect both outcomes (Marx et al., 1991). Alcohol and drug use may lower inhibitions, so that a person under the influence, for example, has sex with a stranger or forgets to use a condom. Individuals were asked if they ever injected drugs and when drugs were last injected. Information on the frequency of alcohol use and the respondent's perceptions of their own alcohol use behaviors were collected. For example, respondents were asked if they ever felt they should cut down on drinking or if they had been criticized for their drinking.

Health behaviors: Health behaviors leading to an increased transmission of STDs include "failure to recognize symptoms, delay in seeking treatment after onset of

symptoms, continued sexual activity following onset of symptoms, delay or failure to notify partners of infection, nonuse of barrier contraceptives, and noncompliance with therapy" (Rice et al., 1991). Several survey questions were included on STD symptoms. Classic symptoms of gonorrhea include vaginal discharge and dysuria (pain or burning during urination) in women, although infection extending to the upper genital tract may cause lower abdominal pain and fever. In men, the common symptoms are dysuria and urethral discharge. Chlamydial infections usually produce milder but similar symptoms.

Respondents were asked if they had ever experienced the following symptoms: " a burning feeling when you urinate", "dripping or oozing or a discharge from your sex organs that had a strange color or smell", "painful sores or blisters on your sex organs", or "warts on your sex organs". (Genital ulcers are typically associated with herpes and/or syphilis infection whereas genital warts may be a common symptom of papillomavirus). If the respondent reported they had experienced a symptom, they were subsequently asked when was the last time they had the symptom, and whether they sought medical attention ("a doctor or a nurse") for treatment of the symptom at that time.

Other health behavior information pertained only to women. Women were asked about douching, whether they ever had an abortion, and whether they ever had pelvic inflammatory disease (PID). PID is a major complication of gonorrhea and/or chlamydia infection. Survey data suggest that the incidence of PID is related to douching behaviors; douching may actually increase the risk of PID and its sequelae (Aral, 1998). Although abortion has not been linked either directly or indirectly to STD infection, a history of abortion and a history of STD infection may reflect characteristics of individual sexual and health-care seeking behaviors.

Partner relationships: Having sexual intercourse with a partner who has had

multiple partners or has previously had an STD increases the risk of acquiring an STD from that partner. Partner information was limited in this survey. Respondents were asked whether their current partner ever had an STD, how often they discussed their sexual relationship with that partner, and whether they ever avoided sex with that partner to protect STD infection.

Ideally, information on when the partner was infected would be available, however, this is difficult to determine unless the partner was recently screened or tested. Some behaviors carry different levels of risk of transmission depending on the likelihood of STD infection within the population from which the partner is chosen. It has also been suggested that the discrepancy between increased risk for STDs and the lack of increased risk behavior among black females may be related to the higher prevalence of STDs among black men (Aral and Cates, 1989). If black women are at increased risk because of their partners' increased likelihood of infection, those who engage in intercourse at an early age or engage in unprotected intercourse are at heightened risk of infection.

In addition to asking respondents about the number of *new* sex partners during the last year, the survey included questions on whether they asked new partner(s) about their previous sexual partners, and if they discussed using condoms with new partners. These measures provide indicators of partner change and levels of communication between the respondent and more casual partners. Finally, respondents were asked how many other partners they were sexually involved with during the most recent time they were married or living together with a partner in a committed relationship (concurrent sexual relationships).

Community level Data

While individual characteristics and behaviors are important in determining the risk of gonorrhea and chlamydia infection, this study posits that they are not sufficient to explain the variation in GC/CT rates. Neighborhood characteristics influence risk behaviors through providing the environment or context in which these behaviors are shaped and conducted. Being a resident of a certain neighborhood, or having social ties to a certain community, can explain an individual's risk of STD, independent of the individual's own specific risk behaviors. Hence, individuals with similar educations and frequency of sexual activity may experience different levels of GC/CT risk depending upon the neighborhood in which they reside.

The Baltimore City Department of Planning publishes Census data on city socioeconomic and demographic characteristics at the neighborhood level. Neighborhoods are defined by city administrators, local neighborhood officials and community leaders based on contiguous geographic boundaries (generally census blocks) and sociodemographic similarities. These data were first published in 1983 based on 1980 Census information. Minor changes to the 1980 neighborhood definitions were made in 1993 based on changes in 1990 census tract boundaries. These data were published by the Department of Planning in 1993. Under current definitions, Baltimore is comprised of 49 neighborhoods (and 185 subunits within these neighborhoods). This classification of neighborhoods provides the neighborhood unit of analysis for this study.

Aggregate-level data on demographic and socioeconomic characteristics of the respondent's resident neighborhood that were measured at the neighborhood level and included in this analysis are:

Economic status: One of the key hypotheses of this research is that poverty, particularly extreme levels of neighborhood poverty, imposes structural constraints on the behavior of residents. The economic characteristics of neighborhoods may adversely affect behavior through the inferiority of public services (e.g., schools, health clinics) and indirectly through the lack of positive role models and peer influences, or informal job networks (Brooks-Gunn et al., 1993; Wilson, 1991).

Various measures were available for comparing neighborhoods' economic status — median household income, per capita income, and the neighborhood poverty rate. Poverty levels were defined according to federal poverty guidelines. Persons were defined as below the poverty level if their total household income in 1989 was below the following poverty thresholds by size and age of household: one person, $6,451; two persons, $8,343; three persons, $9,885; four persons, $12,674; five persons, $14,990; and six persons, $16,921.

The neighborhood poverty rate was calculated by dividing the number of poor persons in the neighborhood by the total number of persons, both poor and nonpoor. Consequently the neighborhood poverty rate (level of neighborhood poverty) represents the percentage of the city's total population that resides in high-poverty census tracts or neighborhoods. (Just as the overall poverty rate is the proportion of individuals in a given area who live in poor households or families, the neighborhood poverty rate is the proportion of persons who live in high-poverty neighborhoods).

The percent of the population below the poverty level is a rough indication of the economic resources that are available to individuals and their exposure to other "successful" individuals. Extreme poverty neighborhoods are characterized as tracts with at least 40 percent of residents in poverty (Wilson, 1987; Jargowsky and Bane,

1990). Although neighborhood poverty rates and areas of concentrated, or extreme poverty are correlated, they measure different aspects of neighborhood poverty. Two neighborhoods may have similar poverty rates, for example, but different concentrations of poverty. Likewise, a neighborhood may have a low poverty rate, but the few people who are poor may be highly clustered in a few high-poverty areas. The neighborhood poverty rate measures poverty relative to the size of the total population, whereas the concentration of poverty is useful when analyzing the constraints and opportunities faced by poor persons — it indicates the percentage of the poor who not only have to cope with their own poverty, but also of their neighbors around them (Jargowsky, 1997). Both measures of poverty and both measures of income will be used in this analysis.

Segregation: Wilson (1987) and Massey and Denton (1993) argue that the residential segregation of poor and middle-class Blacks has deleterious consequences for poor Blacks and that this situation has increased over the past several decades. The geographic segregation of racial and economic groups has negative consequences for poor Blacks because they no longer have middle-class neighbors to serve as role models, to provide economic viability to local institutions, and to embody mainstream normative values (Farley, 1991; Wilson, 1987). The lack of neighborhood material resources and the relative absence of conventional models of success produces negative outcomes, or concentration effects, that restrict social mobility. Some of these effects are structural, reflected in rates of unemployment, and others are psychosocial and related to limited aspirations, casual work habits, and alternative family structures (Wilson, 1991b).

Research suggests that levels of racial segregation are strong predictors of variation in health outcomes. Racial segregation can restrict access to "the quantity and

quality of health-related desirable services, such as public education, health care, housing, and recreational facilities" (Williams and Collins, 1995:367). Segregation in this study was defined as the proportion of neighborhood residents that were black.

Adult labor force: Wilson (1991) observes that when unemployment rates are high, opportunities to observe models of economic success or alternatives to welfare are greatly reduced. One indicator of adult labor force status, consistent with social isolation theory, is the proportion of employed black males in the neighborhood. Male joblessness may reveal isolation from job opportunities or networks (Brooks-Gunn et al., 1993). Wilson (1987) and others have linked trends in joblessness among young black males to increases in the proportion of households headed by single women and marital instability.

Theory is ambiguous regarding how employment opportunities may affect women's sexual behavior. On the one hand, employment may increase the opportunity costs associated with STD acquisition and the potential health outcomes. On the other hand, higher earnings may also be associated with better access to health services and therefore pose less of a potential health risk.

Wilson (1987, 1991b) contends that the negative social consequences demonstrated by weak labor force attachment, out of wedlock births, "self-limiting social dispositions" are far more likely in areas of concentrated poverty than in areas that are less poor. The neighborhood environment, by influencing the availability of opportunities and role models, help define individual attributes and behaviors. According to Wilson (1991b:474), what "distinguishes members of the underclass from those of economically disadvantaged groups is that their marginal economic position or weak attachment to the labor force is uniquely reinforced by the neighborhood or social milieu". This definition

captures the marginal economic position and social isolation of residents in impoverished neighborhoods. Neighborhood-level data on occupational status and the proportion of adults in the labor force measure elements of Wilson's social isolation thesis.

Educational attainment: A neighborhood's economic and educational status are indicative of the resources, economic and human capital, available to neighborhood residents. Measures of neighborhood educational attainment include the proportion of residents who did not complete high school, the proportion of residents who attended or completed college, and the proportion of residents aged 16 to 19 who are not in high school (dropouts).

Social welfare: Wilson (1987, 1991) and Massey and Denton (1993) point to the effects of concentrated disadvantage and segregation on individual behaviors and community norms and attitudes. Within this environment, joblessness, out-of-wedlock births, welfare dependency, and educational failure, may be common or even normative. The proportion of single parent households and the proportion of households receiving public assistance are measures of social inequality between neighborhoods.

Concluding Remarks on Study Methods

A household survey of adults residing in Baltimore, Maryland and 1990 Census data defined at the neighborhood level were used to investigate the individual behaviors and community characteristics associated with gonorrhea and chlamydial infection. The target area for study, Baltimore City, was an appropriate site for this investigation for several reasons. According to the CDC, rates of gonorrhea and chlamydia were well above national average. Baltimore had the highest reported rate of gonorrhea in 1997 among U.S. cities with populations of 200,000 or more (CDC, 1998). The Baltimore STD

and Behavior Study collected detailed information about individual sexual and health behaviors, focusing on factors identified in the literature as associated with an increased the risk of gonorrhea and chlamydia acquisition and transmission. Estimates of infection were derived from two sources: urine LCR assays provided estimates of current infection and self-reported STD histories provided estimates of the lifetime prevalence. The study also drew upon a unique source of neighborhood level data from the Baltimore City Department of Planning.

This study offers several methodologic advantages over previous studies. One of the major contributions of this research over prior studies of STD infection which relied solely upon self-reported infection is the clinical testing of urine samples for gonorrhea and chlamydia. The biases associated in obtaining measures of self-reported sexual and other sensitive behaviors have been reviewed in the literature (Bradburn and Sudman, 1979; Turner, Miller, and Moses, 1989; Turner, Danella, and Rogers, 1995; Turner et al., 1998). There is likely over-reporting of some normative behaviors and under-reporting of sensitive ones. That is, respondents may be less likely to disclose stigmatized or illicit behaviors (such as STD infection or injecting drug use), but may be more likely to report desirable or normative behaviors (such as compliance with prescribed medical treatment). Some error may also be related to problems of respondent recall.

A multilevel approach, including community level characteristics in the analysis, adds to the policy relevance of the findings by defining an appropriate level for implementation of interventions within the Baltimore population (O'Campo et al., 1995; Tanfer, 1993). This strategy of linking individual behaviors with community characteristics combined with the collection of biomarkers for STD infection, it is argued,

provides a more comprehensive view of the population at risk of STD infection, the types of behaviors that place individuals at risk, and the characteristics of the community which moderate individual risk. The benefits of a multilevel analysis over traditional multivariate regression techniques are described in the next section.

Analytic Methods

Nearly all studies which have examined the contribution of both micro- and macro-level factors to models of fertility-related behaviors have employed similar statistical approaches. In these studies, individual-level factors, such as age, race, education, and employment status are entered simultaneously into models with neighborhood characteristics, such as the percentage of residents on public assistance, the median household income, or the percentage of adults in professional or managerial positions, to explain individual variation in fertility or sexual behaviors. Conventional logistic regression techniques, in which contextual variables are entered into the analyses along with individual-level variables, however, ignore the implicit hierarchy found in the data: individuals clustered within neighborhoods.

Given the multilevel structure of the data being analyzed, the independence assumption implicit to standard regression techniques is violated. That is, independence implies that individuals differ in their characteristics in a random or unsystematic way. If individuals are clustered within larger geographic units, ex., neighborhoods, it is likely that they are more similar to the other individuals within their neighborhood than to individuals in different neighborhoods. Estimating cross-level relationships using conventional regression techniques leads to misspecified conclusions regarding individual- and contextual-level effects (Blalock, 1984; Bryk, Raudenbush, and Congdon,

1996). Typically, the variances of the estimated coefficients are underestimated when the hierarchical nature of the data is ignored.

The analysis for this study addresses the multilevel relationships between individual characteristics and behaviors and community-level factors on the risk of gonorrhea and/or chlamydia infection. Results from a series of logistic regression and hierarchical logistic regression models are presented in the next chapter. Hierarchical linear and loglinear regression modeling procedures (HLM) (Bryk, Raudenbush, and Congdon, 1996; Wong and Mason, 1985) correct for the inadequacies of traditional regression techniques for modeling hierarchy in multilevel analyses. With HLM, each of the levels within the nested structure, ex., individuals nested within neighborhoods, is represented by its own submodel. These submodels express relationships among variables within a given level, and can help explain how variables at one level influence relationships occurring at another (Bryk and Raudenbush, 1992).

The analysis proceeds in two main stages -- a descriptive analysis and statistical modeling. The descriptive analysis: 1) identifies the individual demographic and behavioral and community-level correlates of current and self-reported gonorrhea and chlamydial infection; and 2) describes variation in the estimated prevalence of GC and CT by each of the individual characteristics, individual behaviors, and community characteristics.

Traditional regression models are estimated using SUDAAN. This statistical software allows the user to include paramaters of the sample design in the calculations of variance estimates and test statistics. This is an advantage when complex sampling strategies have been incorporated into the survey design. Hierarchical loglinear models examine the independent effects of community-level factors on rates of GC/CT infection

and their interaction with individual characteristics and behaviors.

One methodological concern with contextual analyses is multicollinearity between the individual-level and neighborhood variables (if measuring similar concepts at different levels) or between neighborhood variables (see Ku, 1993:487). High inter-item correlations, for example, preclude specifying a model comprised of multiple measures of correlated neighborhood characteristics. Although the possibility of multicollinearity is minimized by use of separate data sources of macro and micro-level data (Tsui, 1985), appropriate measures will be selected by examining correlations (Pearson's *r*) and a series of preliminary models. It may be the case that many independent variables are significantly associated with the dependent variable in zero-order correlations, but become nonsignificant in multivariate models.

6. Results: Descriptive Statistics and Bivariate Relationships

This chapter presents the results of the descriptive and bivariate analyses outlined in Chapter 5. Two dependent variables are used in the analyses presented here. The first is current infection with gonorrhea and/or chlamydia. The data for this variable were generated by ligase chain reaction (LCR) tests of urine specimens provided by survey respondents. The second dependent variable is a self-reported, lifetime history of gonorrhea and/or chlamydial infection. The data for this measure were provided by respondents during the survey interview.

The independent variables are based on associations reported in the scientific literature between sexually transmitted diseases and demographic and behavioral characteristics of infected individuals. In general, these data have been generated from two types of studies: clinic-based and population-based studies. Clinic-based studies have described the sociodemographic and behavioral histories of patients seeking care in those settings. Until very recently, population-based studies have had to rely on self-reported histories of gonorrhea and chlamydial infection to probe the associations between these diseases and the characteristics of individuals reporting them. The advent of new, field-friendly, urine-based diagnostic tests permitted investigators conducting the BSBS to merge population-based sampling and interviewing techniques with pathogen-specific diagnoses of current infection that used to be available only in clinical settings.

The BSBS dataset affords a new and unique opportunity to examine the

correlates of both self-reported history of these STDs and current infection. Analyses that focus on self-reported history afford the opportunity to make comparisons to other studies. Analyses that focus on current infection allow us to learn for the first time about similarities and differences between the currently infected and the historically infected. As these data suggest, the characteristics and behaviors of respondents with a treated or symptomatic infection (and hence self-reported infection) differed from those with an undetected, asymptomatic infection (as determined by the urine assay). Many of the associations with individual behaviors that were significant when examining self-reported infection as the outcome were not significant when examining current infection as the dependent variable.

The analyses presented in this chapter proceed in several phases. The first phase provides descriptive statistics of the final sample. Characteristics of the neighborhoods in which these respondents resided are based on data from the 1990 Census. Weighted estimates of current and self-reported infection as determined from the urine LCR assays and the survey questionnaire are also presented.

The next phase of analyses examines the bivariate relationships between the two dependent variables and three categories of independent variables: sociodemographic, behavioral, and neighborhood characteristics of respondents. Results are presented separately for each dependent variable. These analyses begin with an examination of bivariate relationships using self-reported infection as the dependent variable, thus providing information about how BSBS data correspond with the larger literature on STDs. Then, I conduct a parallel set of analyses using current infection as the outcome measure. This is where new and unique information begins. To further investigate the absence of a relationship between current infection and many of the STD-related

behaviors and symptoms, additional tabulations, separately by race and gender, are also presented.

Bivariate and multivariate analyses were used to select variables for hierarchical log linear models (HLM), which is the third and final phase of analysis. These analyses are presented in the next chapter. Separate HLM models were constructed for each dependent variable, once again beginning with self-reported infection as the outcome. A series of models test the interrelationships between individual and neighborhood level characteristics and GC/CT infection.

Sample weights were used to adjust for the different probabilities of sample selection and nonresponse (see Chapter 5). Poststratification adjustments were applied to the sample weights to align the survey estimates with the 1997 population estimates for Baltimore from the Bureau of the Census (1998). To accurately represent the effect of sample weighting and the stratified design used in drawing the sample, statistical software was used that adjusts variances for the sample estimates to reflect the sample design (SUDAAN). Unless stated otherwise, estimates reported in the following analyses are generalizable to the household population of Baltimore adults ages 18 to 35.

Sample Characteristics

The target population for the Baltimore STD and Behavior Survey (BSBS) was all persons ages 18 to 45 years living in households in Baltimore City. Households were selected for screening using a multistage probability sampling design. Two supplemental samples were added after the first 10 months of data collection to improve the precision of the urine-based gonorrhea and chlamydia measures: a sample of black males ages

18 to 35 residing in predominantly black census tracts and a sample of white males and females ages 18 to 35 living in predominantly white census tracts. The white census tracts were also identified by STD surveillance statistics as areas with a high prevalence of STDs. To obtain the final sample, 2,727 of the 3,182 households that were eligible for screening were successfully screened. A total of 1,224 adults between the ages of 18 and 45 were identified as eligible for interviewing.

Interviews were completed with 1,014 respondents, for an overall screening and response rate of 71 percent. The characteristics of the 1,014 respondents are shown in Table 2. Percentages were weighted to represent the age, race, and sex distribution of Baltimore residents in 1997. The majority of respondents (66 percent) were black; 52.5 percent were female and 40.5 percent were currently married or cohabitating with a partner. Most respondents had at least a high school education (78.8 percent). One in five (21.1 percent) reported an average household income of less than $10,000 and the majority of respondents (58.9 percent) reported household incomes of $30,000 or less. Less than one in 20 (5.5 percent) reported a total household income greater than $75,000. Most households included more than one adult (79.6 percent) and 61 percent of households included children.

The survey protocol specified that only respondents between the ages of 18 and 35 years be eligible to provide urine for GC and CT testing. Of the 1,014 respondents interviewed, 745 matched this age criteria. Due to errors in the field, 20 of the 745 age-eligible respondents were not asked to provide urine specimens for GC and CT testing. There were age discrepancies in 15 of these 20 cases with household screenings indicating the respondent's age to be greater than 35 years, but the interview data indicating the respondent to be 35 or younger. In four instances, the interviewer did not

ask the age-eligible respondent to provide a sample, and in one case, the interview was only partially completed and the interviewer did not proceed to the second stage of consent. I compared the demographic characteristics of all respondents ages 18 to 35 (N=745) with the 725 respondents ages 18 to 35 who were given the option to participate in the urine testing. These data are shown in the first two columns of Table 3. The two groups were nearly identical with respect to race, gender, age, marital status, education, income, and household structure.

Among the 725 age-eligible respondents who were asked to provide a urine specimen for GC and CT testing, 579 (79.9 percent) did so. Approximately one sixth of age-eligibles (16.1 percent, N=117) refused to provide a urine specimen; an additional 29 respondents consented, but were not able to urinate at that time. Column 3 of Table 3 provides the percentage of age eligibles providing urine by the demographic characteristics of the respondents. There were few differences with respect to race, gender, age, or marital status. Respondents with lower education (less than high school) and lower household incomes (less than $10,000) were more likely to provide a specimen than those with higher education and incomes. (I also compared the demographic characteristics of the three following groups: respondents who provided a urine specimen, those who refused to provide urine, and those who consented but could not urinate. I found that respondents who could not urinate were more similar to those who consented and provided a sample than to respondents who refused.) The increased participation among poorer and less educated respondents in this phase of the survey may be tied to the two-stage consent process. That is, respondents who consented to participate in the survey and completed the interview were paid an initial monetary incentive for their participation in phase one of the survey. Age-eligible

respondents were then asked to provide a urine specimen for gonorrhea and chlamydia testing and paid an additional incentive if they agreed to participate in the second phase.

The sample for this analysis was further restricted to sexually active age-eligible respondents who provided urine specimens. Respondents who had never had sex were not considered to be at risk for gonorrhea or chlamydial infection. The analyses presented in this study are based on data from 560 age-eligible sexually active respondents. The characteristics of this sample, classified by gender and race, are shown in Table 4. There were few gender differences, although more females than males reported at least some college education and more females than males lived in households with children. Female respondents were also more likely than male respondents to report a lower household income, e.g., incomes of $10,000 or less. Racial differences, on the other hand, were noted for nearly every demographic measure. Compared with nonblacks, fewer blacks reported being currently married or cohabitating with a partner and fewer completed college. Twice as many blacks as nonblacks reported household incomes of less than $10,000 (30.5 percent and 14.5 percent, respectively). The household composition of blacks and nonblacks also differed with more blacks living in households with a single adult and in households with one or more children.

In the next step of the analysis, I examined data from the 1990 Census to describe the characteristics of the neighborhoods in which these 560 respondents resided.

Neighborhood Characteristics

In 1997, an estimated 657,256 people resided in Baltimore City; 43.2 percent

were adults between the ages of 18 to 45. Nearly two-thirds of these adults were black (65.7 percent). Like many other northern industrial cities whose economies have been negatively affected by the loss of manufacturing and skilled-labor jobs, the population of Baltimore has declined over the past two decades. Whereas in 1970, the total population of Baltimore was 905,759, by 1995 the population had decreased to 692,830, a loss of approximately one in four residents (Maryland Office of Planning, 1998). For whites, the change in population was -48.4 percent; for nonwhites, the population increased by 4.6 percent. Wilson (1987, 1991a, 1991b) argues that changes in the urban economy resulted in the flight of the more economically stable from the inner city, further diminishing the economic opportunities, the tax base, and consequently, the resources for the least educated and less skilled inner-city minority residents. Massey and Denton (1993), agreeing largely with Wilson's structural thesis, argue that segregation has led to the growing social inequalities in metropolitan areas. Both contend that changing patterns of resource distribution and racial segregation within the inner city context have led to an increasing concentration of poverty and social disadvantage.

Currently, unemployment rates hover around 20 percent and an estimated 22 percent of residents have incomes below federally defined poverty levels (Baltimore City Department of Planning, 1998). Most of the city's communities are racially, economically, and culturally diverse. Yet, many areas within the city remain racially segregated and rich and poor are separated into spatially segregated neighborhoods. The upper northwestern part of the city is primarily white, middle and upper class, although working class homeowners have moved into recently gentrified areas. West Baltimore is home to mostly poorer African Americans. The northern and eastern

sections of the city are mixed socioeconomically, including working-class neighborhoods intermixed with areas of poor and near-poor black and nonblack residents and areas of heavy industry. South Baltimore is racially and economically diverse, and most neighborhoods in this area have remained working class. Streets of renovated housing, newly constructed homes, libraries, and recreation centers define some areas, while other sections of South Baltimore include blocks of abandoned and boarded-up public housing.

The Baltimore City Department of Planning, first using data from the 1980 Census, has divided the city into neighborhoods and publishes the census data by neighborhood characteristics, as well as by census tracts. Neighborhood borders are based on contiguous geographic boundaries (generally census blocks) and sociodemographic similarities. The 1980 neighborhoods definitions were revised and published by the Department of Planning in 1993 based on minor administrative changes to 1990 census tract boundaries. Under current definitions, Baltimore City comprises 49 neighborhoods. (These neighborhoods are further divided into 185 smaller administrative units which resemble census blocks.) This classification of neighborhoods developed by the Baltimore City Department of Planning is the unit of analysis for neighborhoods in this study.

Respondents in the BSBS were drawn from 47 residential neighborhoods within the city. Two neighborhoods were defined by the Baltimore City of Planning (1993) as areas of heavy industry -- the 1990 Census indicated only 251 residents in the Pulaski Industrial Area and 73 in the Canton Industrial Area surrounding the Harbor Tunnel thruway area, and no interviews were attempted in these areas. A third neighborhood, Hollander Ridge, was also not included in these analyses as none of the respondents

were age-eligible for the urine component of the study. Hollander Ridge is physically adjacent to the Pulaski Industrial Area on the far eastern side of the city. According to census data, only 534 families resided there in 1990.

The 560 sexually active respondents who provided urine assays resided in 46 neighborhoods. The average neighborhood sample size was 12, with a range of 10 to 38. To avoid the omission of neighborhoods from HLM analyses due to insufficient sample size, a larger neighborhood sample *N* was required to run many of the multilevel models described in the next chapter. Therefore, it was necessary to group the neighborhoods into a smaller number of discrete categories. Based on geographic proximity and similarities in neighborhood compositional factors, the neighborhoods were reclassified into 25 community units. This reclassification yielded, on average, 22 respondents per neighborhood.

Measures of the characteristics of these neighborhoods using data from the 1990 census are presented in Table 5. The means and standard deviations of the characteristics of the 46 neighborhoods are compared to the means and standard deviations for the 25 reclassified neighborhoods. On average, the means were similar between the two classifications.

Table 5 also illustrates significant socioeconomic and demographic diversity across neighborhoods. Within neighborhoods, the mean proportion black was 0.49, with a range of 0.01 to 0.99; the mean proportion white was 0.49, with a range of 0 to 0.98. (Over one-fifth of Baltimore's communities (22 percent) were at least 95 percent black; approximately 10 percent were predominantly (95 percent or more) white (data not shown, separate tabulations of 1990 Census data). The mean proportion of residents ages 25 years and older who were not high school graduates was 0.42, ranging from

0.13 to 0.60. On average, per capita income within neighborhoods was $16,757 with a range of $6,017 to $54,349. The proportion in poverty, as defined by federal poverty guidelines, ranged from 0.04 to 0.51, with an average of 0.19. The mean proportion of single-parent households was 0.31, with a range of 0.07 to 0.58; and the mean proportion of males 16 years of age and older who were in the labor force was 0.69, with a range of 0.52 to 0.78.

Estimates of GC and CT Infection

The primary objective of the BSBS was to obtain population-based estimates of gonorrhea and chlamydial infection among adults residing in households in Baltimore City. Estimates of current infection were based on LCR tests of urine specimens collected during face-to-face interviews. Lifetime prevalence estimates of gonorrhea and/or chlamydial infection were determined from self-reported data. Respondents were asked, "Have you ever heard of a disease called gonorrhea?". Respondents who responded in the affirmative were subsequently asked, "Has a doctor or nurse EVER told you that you had gonorrhea or 'clap'?". An identical set of questions was asked for chlamydia, genital phlemoria (a fictitious disease), syphilis, genital herpes, and pelvic inflammatory disease (PID). Respondents who recorded a history of each infection were asked when the last infection occurred, whether medical treatment was obtained, and whether they had informed their sexual partners of their infection. From these responses, it was possible to generate lifetime prevalence estimates of gonorrhea and/or chlamydial infection, to determine the recency of the last diagnosis (and hence treatment), and to ascertain whether the respondent's sexual partners were told about their exposure to infection.

Current GC/CT Infection Forty-nine of the 560 respondents who provided a urine specimen tested positive for gonorrhea and/or chlamydia, yielding an overall weighted prevalence estimate of 8.3 percent. This estimate suggests that among 18 to 35 year old adults residing in households in Baltimore in 1997-98, approximately one in 12 had a current gonorrhea and/or chlamydial infection. Of the 49 positive test results, 33 were positive for gonorrhea (5.6 percent), 19 were positive for chlamydia (3.4 percent), and 3 (0.7 percent) were positive for both gonorrhea and chlamydia.

Twelve respondents with current infection (22.5 percent) also reported prior infection(s) with gonorrhea and/or chlamydia. Repeat infections were more common among those currently infected with gonorrhea (25.3 percent) than those with current chlamydial infections (13.2 percent).

Estimates of current infection were higher among blacks than nonblacks (11.5 percent and 2.1 percent, respectively) and among females than males (11 percent and 5.4 percent, respectively). Table 6 presents estimates of current infection by race and gender. Black females had the highest rate of current infection (15.6 percent). Among blacks, the prevalence of infection was higher among females than males (15.6 percent versus 6.8 percent); however, among whites the opposite was true. Estimates among nonblack males (3.0 percent) were more than twice that of nonblack females (1.3 percent).

Table 6 also presents separate estimates of gonorrhea and chlamydial infection by race and gender. Weighted estimates of current infection with gonorrhea were 9.7 percent among black females and 5.6 percent among black males. Gender-specific estimates for gonorrhea were similar among nonblacks — 1.3 percent for nonblack females and 1.4 percent for nonblack males. Infection with chlamydia, on the other

hand, distributed differently across gender and race. Whereas estimates of current chlamydial infection were highest among black females (6.6 percent), nonblack males had slightly higher rates (2.5 percent) than black males (2.2 percent). No chlamydial infection was detected among nonblack females.

Self-reported History of GC/CT Infection Lifetime prevalence estimates of gonorrhea and chlamydial infection were based on weighted data from self-reported STD histories provided during the interview. A total of 126 respondents (26.1 percent) reported being told at least once by a doctor or a nurse that they had gonorrhea and/or chlamydia (Table 7). Blacks were more likely to report, hence had been previously treated for an infection (32.8 percent among black females and 39.2 percent among black males) than nonblacks (11.6 percent among nonblack females and 4.5 percent among nonblack males).

Overall estimates of self-reported infection with gonorrhea (15.6 percent) were similar to self-reports of chlamydial infection (15.0 percent). Self-reports varied, however, by gender and race. Self-reported gonorrhea was highest among black males (34.5 percent), lower among black females (12.9 percent), and lowest among nonblacks (2.1 for nonblack females and 1.9 for nonblack males). More females than males, both black (26.1 percent) and nonblack (10.5 percent), reported prior treatment for chlamydial infection. Among males, 11.6 percent of blacks and 2.6 percent of nonblacks reported a prior history of infection with chlamydia.

Self-reported measures of prior gonorrhea and/or chlamydial infection are subject to reporting bias. It is possible that some respondents may have misreported their prior infection, either because of the social stigma associated with STDs, or because their infection remained asymptomatic and therefore undetected. Others may not have

remembered the name of the disease if they had been previously diagnosed. Under any of these conditions, self-reported estimates for the household population would underestimate the true prevalence of infection.

The next phase of analyses examines the bivariate relationships between the demographic, behavioral, and neighborhood characteristics of respondents and self-reported infection.

Self-reported Infection: Variation by Demographic Characteristics

Information on STDs has typically been generated from studies of patients seeking treatment in a clinical setting. Studies that have used population-based samples had to rely on self-reported histories. Only with the recent development of urine-based diagnostic tests for GC/CT have researchers been able to link population-based sampling with biologic measures of current infection. Based on the findings of clinic-based studies and population-based surveys, a number of demographic characteristics have been identified as important predictors, or risk markers of STDs, including age, race, and gender. Individuals who are younger, nonwhite, and male are more likely to have multiple partners, for example, and are therefore at increased risk.

Estimates of self-reported gonorrhea and chlamydial infection by individual characteristics are shown in Table 8. Levels of significance are presented for tests of the two-way association between individual characteristics and self-reported infection. The prevalence of self-reported infection was higher among blacks (35.7 percent) than nonblacks (8.0 percent). Males were just as likely as females to report a prior infection, 26.3 percent and 25.9 percent, respectively and reporting showed a linear increase with age. Reports of a previous infection with gonorrhea and/or chlamydia decreased as

education increased (p <0.001). The combined measure, lower education and lower income, which is an indicator of socioeconomic disadvantage, was significantly associated with self-reported infection. Among respondents who did not complete high school and whose annual household income was less than $20,000, the rate of self-reported infection was 44.3 percent. These data support previous studies which have found an association between self-reported gonorrhea and/or chlamydia infection and individual demographic and socioeconomic characteristics.

Self-reported Infection: Behavioral Characteristics

Specific sexual practices are also associated with an increased STD risk. Frequent partner change, initiation of sexual activity at an early age, anal intercourse, having been paid or paid for sex, and unprotected intercourse are associated with an increased probability of infection. Health-care seeking behaviors and compliance with treatment and condom use may reduce the risk of transmission. Drug and alcohol use have been associated with an increased, although indirect, STD risk.

Individual behavioral characteristics measured in the BSBS are shown in Table 9. Measures are classified into seven categories of behaviors: partner selection, condom use, frequency of sex and sexual practices, alcohol and drug use, health behaviors, STD symptoms, and partner relationships. Partner selection variables include measures of the number of lifetime partners, the number of partners within the last year and the last month, and the recent acquisition of new partners. Condom related variables include measures of use within the past year as well as measures of attitudes towards condom use. Measures of the frequency of sex and sexual practices include the frequency of intercourse within the past week, age at first intercourse, and a history of certain risky

sexual practices, such as anal intercourse in the past six months, oral sex within the past week, and ever having sex with a prostitute, forced sex, or paid sex. Illicit and licit drug use are also examined and include measures of ever injecting drugs, alcohol use, and excessive alcohol use. Individual health behavior measures include prior diagnoses with STD infection and for females, abortion and douching. STD symptoms include reports of dysuria, or painful urination, and genital discharge. These two symptoms are commonly associated with gonorrhea and chlamydial infection in clinical studies. The partner relationship variables consist of several measures, such as discussions about sexual activities, avoiding sex to prevent STD infection, and engaging in concurrent sexual relationships, i.e., having a sexual relationship with another person while involved in a committed relationship with another.

Table 9 presents estimates of lifetime infection by individual behavioral characteristics. The column percentages represent the estimated prevalence of infection among respondents reporting that behavior and those not reporting that behavior. As confirmed by other research, respondents with a history of self-reported gonorrhea and/or chlamydia infection were also more likely to report 'classic' STD risk behaviors. Among the partner selection variables, estimates of self-reported infection were significantly higher among respondents reporting multiple lifetime partners and one or more new partners within the last year than among those who did not report these behaviors. Among respondents reporting 11 or more lifetime partners, the rate of self-reported GC/CT infection was 35.5 percent, compared to 22.3 percent among those reporting fewer lifetime partners ($p = 0.02$). Similarly, the estimate of self-reported infection among respondents reporting six or more lifetime partners or two or more partners last year (32.7 percent) was nearly twice the estimated prevalence among

those who did not report these behaviors (16.9 percent, $p < 0.001$).

Moreover, self-reported infection was associated positively with frequency of sex and a number of risky sexual practices. Estimates of self-reported infection were 42.9 percent among respondents whose first sex occurred at age 14 or younger, compared to 18.9 percent among those who initiated sexual activity at an older age ($p < 0.001$). (It is noted that 17.5 percent of cases were missing values for this question). Similarly, respondents who reported having anal sex within the past 6 months, ever having a one-night stand, and having forced sex or paid sex were significantly more likely to also report a prior infection with gonorrhea or chlamydia than those who did not report these behaviors.

Use of alcohol did not appear to be associated with self-reported infection. The estimated prevalence of self-reported GC/CT infection was similar between those who reported they drank excessively and those who reported they did not. However, respondents who reported injecting drugs were more likely to report a prior infection than those who never injected drugs ($p = 0.09$).

Female health behaviors were also positively associated with self-reported gonorrhea and/or chlamydia. Estimates of lifetime infection were higher among women who douched after sex, had an abortion, and had pelvic inflammatory disease (PID) than women who did not report such a history.

In addition to collecting information on respondents' risk-taking behaviors, several survey questions were included on symptoms. Symptoms of gonorrhea include vaginal discharge and dysuria in women, although infection extending to the upper genital tract may cause lower abdominal pain and fever. In men, the common symptoms are dysuria and urethral discharge. Chlamydial infections usually produce milder but similar

symptoms to gonorrhea. Respondents were asked if they had ever experienced any of these symptoms. If the respondent reported they had, they were subsequently asked when was the last time and whether they sought medical attention ("a doctor or a nurse") for the symptom at that time.

Respondents with a self-reported gonorrhea and/or chlamydial infection were significantly more likely to report a history of dysuria and discharge than those without a history of infection. The estimated prevalence of self-reported infection, for example, was 58.2 percent among those reporting a genital discharge in comparison to 14.9 percent among those who did not ($p < 0.001$).

Among the partner relationship measures, the prevalence of self-reported GC/CT infection was estimated as 61.8 percent among respondents whose main partner had a history of an STD compared to 23.1 percent among those whose partner did not ($p = 0.002$). Reports of concurrent sexual relationships, i.e., having another sexual relationship while involved in a relationship with a primary partner, were also significantly associated with increased rates of self-reported infection ($p = 0.03$). Respondents who reported avoiding sex to prevent an STD infection were significantly less likely to report a history of gonorrhea or chlamydia (19.3 percent) than respondents who did not report this behavior (30.2 percent).

These data indicate that self-reported gonorrhea and/or chlamydial infections were associated with a host of STD-related risk factors. Respondents with a self-reported history of GC/CT were more likely to report a history of multiple sexual partners, acquisition of new partners (within the last year), a one-night stand, forced sex, paid sex, having a partner with an STD, STD-related symptoms, and engaging in concurrent sexual relationships.

I next examine the characteristics of the neighborhoods in which these respondents reside.

Self-reported Infection: Neighborhood Characteristics

A primary research question to be addressed is whether and how community characteristics explain individual variability in rates of gonorrhea and chlamydial infection. It is hypothesized that rates of infection will be higher in neighborhoods characterized by higher levels of poverty, racial segregation, and 'social disorganization' (Wilson, 1987, 1991; Massey and Denton, 1991). The lack of opportunities within these neighborhood settings and the structural disadvantages of segregation impact negatively on individual health behaviors and engender different norms of sexual and risk-taking behaviors. Using the theoretical framework proposed in Chapter 4 as a guide, twelve neighborhood characteristics were initially selected for further investigation - three measures of economic status: the proportion in poverty, median household income, and per capita income; the percentage black and the percentage white (estimates of racial segregation); and several measures identified by Wilson's social isolation thesis: male and female employment; the percentage employed as professionals; the percentage aged 25 years and older who did not complete high school and the percentage of neighborhood residents aged 16 to 19 years who were high school dropouts; the proportion of families receiving public assistance; and the proportion of single parent families.

Once the neighborhood measures were selected, it was necessary to determine an appropriate form for the variables. Previous analyses suggested that the neighborhood effects may be nonlinear (Crane, 1991b) and the strongest effects might

occur in the 'worst' neighborhoods. Other research, in which neighborhoods were classified as high-, middle- and lower-class (Hogan and Kitagawa, 1985) demonstrated differences in outcomes only in the lower-class neighborhoods. Other investigations of neighborhood effects have focused on outcomes associated with the "underclass" (Ricketts and Sawhill, 1988), defined as residents of neighborhoods in which the proportion of female-headed families, households receiving welfare, school drop-outs, and adult male unemployment were more than one standard deviation above the mean. Differences in behavioral outcomes were associated with whether or not the individual resided in these areas of 'concentrated poverty'.

Continuous and categorical measures of neighborhood characteristics were explored. Continuous measures were used in the multivariate analyses. Categorical variables were created for each of the neighborhood measures to test for nonlinear effects. Each neighborhood measure was divided into four categories of approximately equal numbers of neighborhoods (approximately 6-7 neighborhoods each). Tests for an association between these quartiles and a self-reported history of infection are summarized in Table 10. Self-reports of prior GC/CT infection were significantly associated with several neighborhood characteristics. All of the economic indicators were significantly associated with lifetime reporting of GC/CT infection. The racial composition of the neighborhood was also significant; as the proportion of blacks within the neighborhood increased, reporting of prior infection also tended to increase ($p < 0.001$). The opposite effect was observed as the proportion of white residents increased. Neighborhoods with a higher concentration of white residents were associated with lower rates of self-reported infection ($p < 0.001$). Finally, both measures of social welfare were significant predictors of self-reported infection. The neighborhood

measures of female employment, employed professionals, and the indicators of educational attainment were not significantly associated with self-reported GC/CT infection.

Since many of the neighborhood variables measure neighborhood social class, tests for multicollinearity between the measures were conducted. Correlation coefficients among the neighborhood measures ranged from .09 to .88. The proportion of households receiving public assistance was positively associated with the proportion in poverty (.88) and the proportion of single parent households (.81). Median household income was positively associated with the proportion of employed professionals in the neighborhood (.68) as well as average per capita income (.84). Finally the proportion of blacks in the neighborhood was positively associated with the proportion of single parent households (.78). Correlations between these measures were considered in the selection of neighborhood variables for the multivariate analyses.

Having described the individual demographic and behavioral characteristics and the neighborhood characteristics associated with self-reported GC/CT infection, I now present the results of a parallel analysis using current estimates of gonorrhea and/or chlamydial infection as my outcome measure.

Current Infection: Variation by Individual Characteristics and Behaviors

Estimates of current gonorrhea and/or chlamydial infection by individual sociodemographic and behavioral characteristics are shown in Tables 11 and 12. The first column of each table presents overall estimates for the entire sample. The analyses presented below revealed very few significant associations between the overall estimate and individual behaviors. Race (black, nonblack) and gender-specific differences in

characteristics and behaviors were also explored (columns two through five). Levels of significance are presented for tests of bivariate associations between individual characteristics and current infection (overall and for males, females, blacks, and nonblacks separately).

Current Infection: Demographic Characteristics Rates of current infection were significantly higher among blacks than nonblacks (11.5 percent versus 2.1 percent, $p < 0.001$) and among females than males (11 percent versus 5.4 percent, $p = 0.05$). Estimates of current infection did not differ by age, income, or household composition (Table 11). Current infections were detected among married respondents (8.7 percent) nearly as frequently as among those never married (9.1 percent). Education was negatively associated with the prevalence of current infection. Only 1.4 percent of respondents who completed college were currently infected compared to 11.4 percent of those who had not completed high school. The combined measure of lower education (less than high school) and lower income (household income less than $20,000), an indicator of socioeconomic disadvantage, was significantly associated with current infection. An estimated prevalence of 16.8 percent was calculated for non-high school graduates with household incomes of less than $20,000 ($p = 0.04$).

There were few significant differences in the estimated prevalence of current infection by individual characteristics when examining males and females, blacks and nonblacks separately. As noted previously, being black and female was associated with a significantly higher risk of current infection ($p < 0.001$). Education was significantly associated with current infection among females but not among males. For socioeconomically disadvantaged females the estimate of current infection was 25.3 percent ($p = 0.02$). Among nonblack respondents, increased education was associated

with a decreased likelihood of current infection. Blacks residing in households without children were significantly more likely to be currently infected with gonorrhea and/or chlamydia than blacks in households with children. These data suggest that race, gender, and socioeconomic status are important individual characteristics associated with the risk of current infection with gonorrhea and/or chlamydia.

Current Infection: Behavioral Characteristics A striking and unexpected finding in column 1 of Table 12 is the lack of significant differences in estimates of current infection by reported individual risk behaviors. Most of the risk behaviors that have historically been associated with an increased risk of STD infection, namely, multiple partners, new partners, anal sex, inconsistent condom use, paid sex, and concurrent sexual partnerships were not associated with current GC/CT infection. The exception was the reporting of one or more new partners in the last year (and measures combining this behavior with other risk behaviors). The reporting of new partners was associated with a statistically significant *de*crease in the risk of current infection (5.2 percent, $p = 0.03$). Having multiple lifetime partners, never using a condom, initiating sexual activity at age 14 or younger, having anal sex, paid sex, sex with a prostitute, or forced sex, for example, showed no association with current gonorrhea or chlamydial infection in bivariate analyses.

For females, frequent douching was associated with a higher rate of current infection. Compared with those who douched less regularly, females who reported douching at least once a month were more likely to have an infection with gonorrhea or chlamydia ($p = 0.005$). This positive association between douching and STD risk is consistent with reports from other studies. Estimates of current infection were lower among women reporting an abortion than women with no history of abortion ($p < 0.001$).

Although the link between these two behaviors is unclear, they both may be indicative of individual health-care seeking behavior and sexual risk-taking.

Reporting of dysuria was significantly and negatively associated with current GC/CT infection (4.5 percent, $p < 0.05$). Reporting of this symptom within the past 6 months, which may suggest a current or recent infection, was also associated with a reduced likelihood of current infection. None of the partner relationship variables were significantly associated with current infection.

The lack of an association between risky behaviors and current infection persists when examining the behavior of females and males separately. Likewise, very few race-specific differences in behaviors were associated with an increased risk of GC/CT infection. Blacks reporting multiple partners (6 or more lifetime partners or 2 or more partners last year) and one or more new partners last year had a lower prevalence of current infection, 4.5 percent, than the overall estimate of 11.5 percent among all black respondents ($p = 0.02$).

Based on these bivariate associations, it appears that respondents currently infected with gonorrhea and/or chlamydia were not at a higher risk of infection because they were more likely to engage in high-risk sexual behaviors, nor were there gender or race-specific behaviors related to a higher STD risk. On the contrary, respondents with a current GC or CT diagnosis were less likely than respondents not currently infected to report many of the 'classic' behaviors associated with an increased STD risk. Given a substantial literature linking these risk behaviors with a self-reported history of STDs, it was somewhat surprising to find very limited associations between diagnostic evidence of current infection and reporting of risk behaviors.

Current Infection: Neighborhood Characteristics

Previous research suggests that transmission of STDs may be concentrated among 'core' groups of individuals, or "small, stable [groups] composed of a sufficient number of infected persons who successfully transmit their infection to others so that STD perpetuation is assured" (Potterat et al., 1992:16). These 'core groups' have also been demonstrated to reside in 'core' census tracts; that is, infected individuals have been shown to reside in geographically adjacent clusters of census tracts.

City maps of Baltimore identifying neighborhood boundaries were obtained from the Baltimore City of Planning. Individual cases of current gonorrhea and chlamydial infection were plotted by neighborhood of residence (Figure 4). Eighteen of the city's 25 neighborhoods included at least one case of current infection. Eleven cases were reported in one neighborhood, although this neighborhood was among one of the census tracts purposively selected for the study's white oversample (surveillance data indicated higher levels of infection among whites in these census tracts). Overall, weighted cases of current infection did not appear to be geographically concentrated within any particular area or neighborhoods within the city.

As in the previous analysis of self-reported infection, the use of continuous and categorical measures of neighborhood characteristics was explored. There was limited evidence of non-linear effects (Table 13). Estimates of current infection were positively associated with the proportion of females in the labor force ($p = 0.10$). Neighborhoods with a lower proportion of single parent families (1st quartile) were also associated with a lower estimate of current infection ($p = 0.08$). There appeared to be no significant association between current infection and indicators of neighborhood economic status, educational attainment, or social welfare.

Concluding Remarks

Most of what we know about the distribution of gonorrhea and chlamydia and the behaviors associated with an increased risk of their transmission comes from two sources. Studies of clinic populations provide information on the characteristics and behaviors of those who seek treatment for symptomatic infection. Population-based surveys provide self-reports of previous GC/CT infections and related risk behaviors. Neither of these sources of information, however, is well-suited to informing us about current infections in the general population. Thus, the epidemiology of undiagnosed and/or untreated gonorrhea and/or chlamydial infection in the population at large is not well understood.

Unlike previous population-based studies, the BSBS collected urine assays of current infection in addition to collecting information on self-reported histories of infection. (To my knowledge, only one large-scale population based survey, the 1995 National Survey of Adolescent Males, collected urine biomarkers for detecting gonorrhea and chlamydia. The results of that study have not been published to date). In analyses of BSBS data, risk-taking behaviors and reporting of symptoms associated with these infections differed dramatically between respondents with a current infection and those with a self-reported infection. Respondents with a self-reported history of infection were more likely than respondents without a past infection to report STD-related risk behaviors, a pattern consistent with the STD literature. This pattern was not observed among currently infected respondents. Respondents with a current infection were <u>not</u> more likely than those without a positive urine assay, for example, to report multiple sexual partners, new partners, concurrent relationships, or having paid (or been paid) for sex. Furthermore, the majority of currently infected respondents did not report

symptoms associated with an increased likelihood of infection. These results suggest that the behaviors predicting a self-reported infection may not predict current infection.

To probe this finding, I compared the reporting of symptoms among respondents with a current infection and no prior history of infection (N=37) to those with a self-reported history of infection (Table 14). Over three-fourths (76.5 percent) of respondents with a prior infection reported ever having dysuria or discharge, compared to 20.8 percent of respondents with a current infection only. Reporting of symptoms was higher among respondents with a current gonorrhea infection (28.1 percent) than those with a current chlamydial infection (5.5 percent). When restricting the reporting of symptoms to 6 months prior to interview, the pattern of results was the same. One in five respondents with a history of infection (21.2 percent) reported dysuria or discharge within the past 6 months, compared to only 2.5 percent of respondents who tested positive for GC/CT. None of the males who tested positive for gonorrhea or chlamydia reported symptoms during the past 6 months nor did any of the respondents who tested positive for chlamydia.

These data imply that the current infections detected by the urine assay were predominately asymptomatic infections. Furthermore, unlike individuals with a self-reported infection, currently infected individuals were not more likely to exhibit the sexual risk behaviors associated with STD infection. From these analyses, it appears that the sexual and health behaviors predicting a self-reported infection do not predicit current infection. Previous estimates for gonorrhea and chlamydia which rely upon individuals' reporting treatment for infection are likely to underestimate the true prevalence. Without an apparent indication or symptoms of infection, individuals are unlikely to seek or receive treatment.

The next chapter describes the multivariate analyses. Logistic regresssion and hierarchical loglinear models explore the interrelationships between individual and neighborhood level characteristics and self-reported and current GC/CT infection.

7. Results: Multivariate Analyses

The multivariate analyses proceeded in a series of steps beginning with the testing of logistic regression equations and leading to the formulation and testing of more complex hierarchical models. The hypotheses guiding these analyses were based on the analyses presented in the preceeding chapter and relate to the inter-relationships between individual and neighborhood characteristics and the risk of gonorrhea and/or chlamydial infection. Measures of individual and community characteristics that were statistically significant in bivariate analyes and of theoretical interest to the two outcomes being measured were selected for inclusion in regresssion and hierarchical models. The operationalization of variables used in the multivariate analyses, the variable means, and their standard deviations are presented in Appendix Table 1.

Estimates of the effects of individual and neighborhood characteristics on gonorrhea and chlamydial infection were first modeled using logistic regression analyses. Models were estimated for the two dichotomous outcomes, self-reported GC/CT infection and current infection. The model fitting involved a four-stage approach to address the direct effects of individual and neighborhood characteristics, and the extent to which neighborhood characteristics are moderated by individual-level attributes. I begin modeling at the individual level. The second stage considered the effects of neighborhood characteristics. The third stage combined the individual and neighborhood-level models. Comparison of this model with the previous model suggests

which neighborhood characteristics act independently of individual characteristics in affecting each of the outcomes. Finally, the fourth stage tested interactions between individual and neighborhood measures. It may be, for example, that the effects of neighborhood variables on GC/CT infection operate differently for individuals with different characteristics or behaviors.

The presentation of the regression results follows the stages of model fitting described above and begins with self-reported GC/CT infection as the outcome (Table 15). Each column in Table 15 represents a separate logistic regression model. Model 1 measures the influence of individual characteristics and behaviors on self-reported GC/CT infection. Race and the measure of socioeconomic disadvantage were significantly associated with a prior history of gonorrhea and/or chlamydia, controlling for the other individual-level measures. Taking the antilog of the race coefficient suggests that blacks were 5.98 times as likely to report a prior infection than nonblacks. Several behavioral characteristics were also significant. Having multiple sex partners, having been paid for sex, and having had a one-night stand were positively and significantly associated with self-reported GC/CT infection.

Model 2 considers the effects of two neighborhood characteristics, the level of racial segregation (defined as the proportion of the population that is black) and neighborhood poverty. Additional models, testing other neighborhood characteristics were formulated and tested. This 'final' model considered the theoretical constructs to be tested as well as the level of collinearity among several of the neighborhood measures. Since both neighborhood characteristics were continuous variables with a potential range from zero (i.e., no families in poverty) to one (i.e., all families in poverty), their coefficients in Table 15 can be interpreted, for example, as the change in the log

odds of self-reported infection associated with a change from zero to all poor neighbors. This discussion focuses on the statistical significance of the neighborhood coefficients and how these coefficients change based on the addition of individual-level variables and interaction terms. Only the measure of racial segregation (the proportion black) was significantly associated with self-reported infection in Model 2.

Model 3 specifies a cross-level model, indicating the effects of the neighborhood characteristics, controlling for the individual-level covariates. Comparison of this model with Model 1 illustrates small changes in the individual-level effects, once neighborhood characteristics are controlled. (The race effect reduces from 1.8 to 1.38, but remains significant. Most of the other individual attributes remained unchanged). The effects of neighborhood racial composition persisted even after adjusting for individual-level differences. The attenuation of the neighborhood racial segregation effect (the proportion black) suggests that this neighborhood characteristic may act indirectly on self-reported GC/CT infection through individual-level characteristics.

Models 4 and 5 add interaction terms for individual race and socioeconomic disadvantage and the proportion of the neighborhood that is black. (Interactions were also tested for several individual behavioral characteristics. The results for these models yielded no significant interactions.) These interactions produce coefficients on the neighborhood measures that show neighborhood effects for nonblacks (Model 4) and non-socioeconomically disadvantaged (Model 5). The coefficients of the interaction variables reflect the unit change to these neighborhood effects associated with being black or socioeconomically disadvantaged.

None of the interactions were significant after controlling for the effects of the other covariates. These results suggest that the effects of neighborhoods' racial

composition and individual characteristics on self-reported GC/CT infection did not differentially affect blacks or nonblacks, or individuals who were or were not socioeconomically disadvantaged.

Table 16 presents results from similar logistic regressions modeling current GC/CT infection as the outcome. Race, socioeconomic disadvantage, and having a one-night stand were significantly associated with current infection in Model 1. Controlling for the other individual-level variables, having a one-night stand was negatively associated with the likelihood of a current infection.

The proportion of neighborhood residents who were black was also significantly and positively associated with current infection, controlling for neighborhood poverty (Model 2). However, once individual-level characteristics and levels of neighborhood poverty were controlled in Model 3, the proportion of black residents was not significant. Neighborhood poverty, on the other hand became significant. The *negative* effect of poverty on current infection was moderate (odds ratio = 0.96, $p = 0.07$), suggesting small decreases in the likelihood of current infection per unit increase in poverty. Adding interactions between individual race and socioeconomic disadvantage and neighborhood poverty to Model 3 yielded a marginally significant interaction between neighborhood poverty and race (see Model 4), but again the effect was not large (O.R. = 0.95, $p = 0.10$).

Results from these logistic regressions suggest that several individual-level measures were associated with the risk of self-reported and current GC/CT infection. Race and socioeconomic disadvanatage were significantly and positively associated with both outcomes, even after controlling for other individual characteristics and neighborhood racial composition (proportion black) and poverty. Several behavioral

characteristics, e.g., multiple sex partners, been paid for sex, having a one-night stand were also significantly associated with self-reported infection. Including neighborhood measures improved the explanatory model for self-reported infection as evidenced by the statistically significant relationship of the proportion of black residents in the multilevel model. On the other hand, neighborhood poverty was marginally significant in the model of current infection, controlling for the proportion of black residents. Interactions between neighborhood and individual-level characteristics were not significant ($p<0.05$) in models of self-reported or current infection.

The next step in the multivariate analysis was to test the inter-relationships between the level-1 and level-2 predictors and GC/CT infection using hierarchical logistic regression models.

Effects of Neighborhood Characteristics on GC/CT Infection

HLM methods are preferred over traditional regression techniques when analyzing hierarchical data for several reasons. The limitations of conventional regression techniques in estimating models with nested structures have generated concerns about "aggregation bias, misestimated precision (of coefficients and variance estimates), and the 'unit of analysis' problem. They have also fostered an impoverished conceptualization, discouraging the formulation of explicit multilevel models with hypotheses about effects occurring at each level and across levels" (Bryk and Raudenbush, 1992:3).

Specifically, HLM analyses formally test 1) whether neighborhood characteristics are associated with individual gonorrhea and chlamydial infection (current and self-reported) and if so, which neighborhood characteristics explain variation in rates of

infection across neighborhoods; and 2) whether there are cross-level effects. For example, do levels of neighborhood poverty influence the relationship between individual characteristics and GC/CT infection within neighborhoods? Results of these analyses are presented for both outcome measures — self-reported and current GC/CT infection.

Testing of the HLM models began with an examination of the effects of neighborhood characteristics on the mean log odds of self-reported gonorrhea and/or chlamydial infection. In this initial model no predictors were specified at the individual level. The likelihood of infection in each neighborhood is characterized by the intercept, β_{0j}, which in this case is the mean. The level-1 model for individual *i* living in neighborhood *j* was specified as:

$$\log\frac{P_{ij}}{1-P_{ij}} = \beta_{0j} + r_{ij}$$

Only the intercept in the level-1 model, β_{0j}, or the mean log odds of GC/CT infection, varied at level-2. At the level-2 or neighborhood level, each neighborhood's mean log odds of self-reported infection, β_{0j}, was represented by :

$$\beta_{0j} = \gamma_{00} + \mu_{0j}$$

where γ_{00} represents the overall population mean, plus a random error μ_{0j}. Neighborhood level predictors entered into the level-2 model were: neighborhood poverty, mean per capita income, the proportion of black residents, proportion of employed professionals, proportion of single-parent families, and the proportion of families receiving public assistance. The independent effects of each level-2 variable

and various combinations of level-2 predictors were tested. Table 17 illustrates the results of seven of these models. Only the measure of the percentage of black residents was positively related to self-reported GC/CT infection, alone and after controlling for the effects of other neighborhood measures. Poverty was marginally associated with self-reported infection (Model 3). The effects of the other level-2 predictors were small in absolute terms and in relation to their estimated standard errors.

A parallel set of analyses testing the same variables, but predicting the outcome of current GC/CT infection was conducted. None of the neighborhood variables, either alone or in combination, were significantly associated with current GC/CT infection (results not shown).

Differentiating Effects of Neighborhoods on Self-Reported GC/CT Infection

In the HLM models presented above, only the level-1 intercept coefficient, β_{0j}, was random. There were no level-1 predictors. No attempt was made to adjust the level-2 effect estimates for the different characteristics of individuals within the neighborhood. As a next step, models were formulated to test the direct and indirect effects of neighborhood context on individuals' infection with gonorrhea and/or chlamydia (indirect effects referring to interactions of individual characteristics with neighborhood characteristics).

The results reported below describe a final set of models consistent with the research hypotheses being tested. The final models tested four individual level predictors: race, gender, the measure of socioeconomic disadvantage (did not graduate from high school and a household income of less than $20,000), and whether the respondent reported multiple sex partners, that is, 6 or more lifetime partners or 2 or

more new partners within the past year. (Models including the predictor, been paid for sex, were also tested. Having been paid for sex remained a significant predictor of self-reported infection, however the model estimates were based on only 17 of the 25 neighborhood units. When this variable was added to the model, eight neighborhoods had limited information on these predictors to detect the hypothesized contextual effects. Models were also tested which added having a one-night stand as an explanatory variable. Results of these models were similar to those presented using multiple sex partners as a behavioral predictor. Data are not shown for those models). Two neighborhood characteristics of primary theoretical interest to this research were included as level-2 predictors. One variable was a measure of racial segregation (proportion black) and the second was a measure of neighborhood poverty. Additional models with different level-1 and level-2 predictors were formulated and tested. None of the other level-2 predictors remained significant once the proportion of black residents was controlled.

Table 18 presents the results of a random coefficients model of self-reported GC/CT infection. The random coefficients logistic regression model examines whether the mean log odds of GC/CT infection (the intercept) varies significantly across neighborhoods. It also tests the hypothesis that the effects of individual characteristics on self-reported GC/CT infection differ by neighborhood, e.g., variation in slopes. For theoretical reasons, I test whether the intercept and the effects of individual characteristics/behaviors (slopes) randomly vary across neighborhoods.

Level 1 model: The individual-level or level-1 model for individual *i* living in neighborhood *j*, is specified as:

$$\log\frac{P_{ij}}{1-P_{ij}} = \beta_{0j} + \beta_{1j}X(RACE) + \beta_{2j}X(GENDER) + \beta_{3j}X(SES) + \beta_{4j}X(MULTPART) + r_{ij}$$

where the X(RACE) represents being black, X(GENDER) being female, X(SES) is a measure of socioeconomic disadvantage, and X(MULTPART) represents having multiple sex partners. Each of the predictors is centered around its respective mean to obtain a convenient interpretation of the variables. Bryk and Raudenbush (1992) refer to the coefficients as distributive effects since they indicate how the outcome is distributed in neighborhood *j* as a function of individual characteristics, X_{qj}. Each of the distributive effects, $\beta_{0j} \ldots \beta_{4j,}$ is net of the others. For example, β_{1j} is the adjusted mean of the log odds of GC/CT infection between blacks and nonblacks in neighborhood *j* after controlling for the effects of gender, low SES, and multiple partners. This level-1 model of the random coefficient model introduces a set of 25 possible values for the intercept (one for each neighborhood grouping) and each of the other K (k=4) coefficients in the logistic regresssion model.

The parameters, β_{0j} and each of the β_{qj}'s, vary (are specified as random) across neighborhoods in the level-2 model of the random coefficients logistic regression:

$$\beta_{0j} = \gamma_{00} + \mu_{0j} \qquad \text{for q = 0 thru 4}$$

where γ_{q0} is the mean value for each neighborhood effect. The combined level-1 and level-2 equations test the hypothesis that the distribution of gonorrhea and chlamydial infection across neighborhoods varies by the distribution of the individual characteristics and behaviors within neighborhoods.

The results are displayed in Table 18. The intercept (γ_{00}) represents the neighborhood mean log odds of a lifetime history of GC/CT infection. The exponentiated value of the estimated coefficient is more easily interpreted in terms of odds ratios or probabilities. Converting the coefficient, -1.258, to its exponentiated value of 0.284, indicates that at the centers of all explanatory variables in the model, the neighborhood mean probability of GC/CT infection, on average, was 22.1 percent. This estimate is similar to the unweighted overall sample estimate of 22.7, not controlling for any individual or neighborhood factors.

Being female, being black, having less than a high school education and a household income of less than $20,000, and having multiple partners were, on average, all positively associated with the mean log odds of a self-reported GC/CT infection. The average race effect, for example, was 1.100. This means that in the average neighborhood, blacks were more likely to report a prior GC/CT infection than their nonblack neighbors of the same gender, socioeconomic status, and with a similar number of sexual partners. After controlling for the other individual characteristics, being female (γ_{02} = 0.508, t ratio = 1.85) was marginally associated with self-reported infection.

Table 18 also provides estimates of the variances of the random effects. The estimated variance between the neighborhood means is 0.583, with a χ^2 of 47.82 and 19 degrees of freedom (based on information from 20 of the 25 neighborhoods). It is inferred that there were significant differences between the neighborhood means ($p <$ 0.001), i.e., that the mean log odds of GC/CT infection vary across neighborhoods. The estimated variance of the race-GC/CT slope was 0.011, with a χ^2 of 7.64 and d.f.=19. In this case, although race was positively associated with the mean log odds of self-reported gonorrhea and/or chlamydial infection, the estimated variance was not

significantly different from zero, indicating that the race effect on the outcome may not vary across neighborhoods. In this case, the null hypothesis that the relationship between race and self-reported GC/CT infection does not vary across neighborhoods can not be rejected. Similarly, the *p* values for the estimated variability in the remaining coefficients were also not significant.

Reliability estimates for each of the level-2 random effects are also shown in Table 18. These indices provide information on how reliable, on average, were estimates of each neighborhood's intercept and slope based on computing separate logistic regressions for each neighborhood. They also provide additional guidance on the appropriate specification of the level-1 coefficients, e.g., random or fixed (Byrk and Raudenbush, 1992). The precision of the estimation of the intercept (the mean log odds of self-reported infection) relies on the sample N within each neighborhood. The precision of the slope estimate depends on the sample N as well as the variability of the race, gender, and socioeconomic composition within the neighborhood. The results indicate that the intercept is quite reliable (0.700) based on an average of 22 observations per neighborhood. Only the race slope is less than 0.05 and may be considered as having a fixed effect. Bryk and Raudenbush (1992) explain that a primary reason for the lack of reliability of slopes is that the true slope variance across neighborhoods may be smaller than the variance of the true means. In addition, the slopes may be estimated with less precision than the means because many neighborhoods may be racially homogeneous.

The results of this random coefficient logistic regresssion model indicated that, on average, only gender was not significantly associated with GC/CT infection across neighborhoods, controlling for the other individual-level characteristics. Contrary to my

expectations, examination of the estimated level-2 variances and reliability estimates revealed that there was not significant variation among neighborhoods in each of the level-1 coefficients to treat them as random. The theoretical basis for this research, however, would suggest otherwise. Because the variances of the effects did not differ significantly from zero does not mean that they cannot vary across neighborhoods (Bryk and Raudenbush, 1992). The χ^2 tests are univariate tests and do not take into account the effects of the other variables in the model. It could be that the effects could differ when examining a particular context, for example, the effect of socioeconomic disadvantage on self-reported infection in a highly segregated versus less segregated neighborhood.

Table 19 presents a final hierarchical logistic regression model of self-reported GC/CT infection. Bryk and Raudenbush (1996) refer to this model as an intercept- and slopes-as-outcomes model. This model goes one step beyond the random coefficient model and models the variability in the regression coefficients (intercepts and slopes) across neighborhoods. It tests for cross-level interactions between neighborhood and individual-level characteristics. Specifically, this model examines how neighborhood differences - in terms of the joint effects of racial composition and poverty — might influence the relationships between individual attributes and self-reported GC/CT infection within neighborhoods.

The level-1 model specified is similar to the level-1 model for the random coefficients model. For the level-2 model, I tested the following:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(propBlack) + \gamma_{02}(poverty) + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(propBlack) + \gamma_{12}(poverty) + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(propBlack) + \gamma_{22}(poverty) + \mu_{2j}$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}(propBlack) + \gamma_{32}(poverty) + \mu_{3j}$$

$$\beta_{4j} = \gamma_{40} + \gamma_{41}(propBlack) + \gamma_{42}(poverty) + \mu_{4j}$$

Combining the level-1 and level-2 models illustrates that the outcome, the mean log odds of self-reported GC/CT infection, may be viewed as a function of: the overall intercept (γ_{00}); the main effect of the proportion black (γ_{01}); the main effect of poverty (γ_{02}); the main effects of race (γ_{10}), gender (γ_{20}), socioeconomic disadvantage (γ_{30}), and multiple partners (γ_{40}); four cross-level interactions of the proportion black with race (γ_{11}), gender (γ_{21}), socioeconomic disadvantage (γ_{31}), and multiple partners (γ_{41}); and four cross-level interactions of poverty with race (γ_{12}), gender (γ_{22}), socioeconomic disadvantage (γ_{32}), and multiple partners (γ_{42}); plus random error. Gender was included in the final model presented here. In a model excluding this variable, coefficients varied somewhat, yet results were similar.

As indicated in Table 19, the proportion of black neighborhood residents was positively associated with reporting of GC/CT infection. The mean log odds of self-reported infection was higher in neighborhoods with a higher proportion of black residents (γ_{02} = 0.016, t = 3.47). These results suggest that, on average, and controlling for individuals' race, gender, SES, and multiple sex partners, neighborhoods with a higher proportion of blacks were also more likely to exhibit higher reporting of prior

GC/CT infection than neighborhoods with a smaller proportion of blacks. The other contextual variable, the measure of poverty, had no significant impact.

There was no evidence of significant crosslevel effects between neighborhood context and individual characteristics. That is, differences between neighborhoods (in terms of their levels of poverty and racial composition) did not influence the association between self-reported GC/CT infection and individual characteristics within neighborhoods after adjusting for individuals' race, gender, SES, and reporting of multiple partners.

The bottom panel of Table 19 reports the estimated variances for this model. These are conditional variances compared to the unconditional variances (in which no level-2 predictors were specified) associated with the random coefficient model in Table 18. Comparison of the conditional and unconditional variances indicates a substantial reduction in variation once the proportion of black residents and neighborhood poverty were taken into account. Specifically, the unconditional variance of the intercepts had been 0.583, whereas the conditional variance was 0.234. This suggests that 59.9 percent [(0.583 - 0.234)/0.583] of the variation in the mean log odds of self-reported infection could be explained by addition of the proportion black and poverty.

Differentiating Effects of Neighborhoods on Current GC/CT Infection

Similar models using different combinations of variables were formulated and tested with current GC/CT infection as the outcome. Previous bivariate and multivariate analyses of the relationship between current infection and individual behaviors and characteristics indicated that only a few relationships were significant. Having a one-night stand was associated with a decreased risk of current infection in logistic

regression analyses. The inclusion of this measure in the models did not significantly change the effect of the other variables. A final set of models is discussed and reviewed below.

Results of the random coefficients model are shown in Table 20. The model is analogous to the model presented in Table 18 with self-reported GC/CT infection as the outcome. The intercept, -2.312, represents the mean log odds of current infection. Controlling for the mean effects of race, gender, and socioeconomic disadvantage, the probability of a current infection, on average, was 9.01 percent. Being black and socioeconomically disadvantaged were positively associated with current GC/CT infection. After controlling for the effects of the other individual characteristics, gender was not associated with current infection.

Review of the estimated variances indicated that neighborhoods varied in the distribution of current infection, controlling for race, gender, and socioeconomic disadvantage within them. In terms of the univariate χ^2 tests, approximate p values associated with the race, gender, and socioeconomic disadvantage coefficients are not significant. Therefore, the null hypothesis that the slopes are homogeneous can not be rejected. Reliability estimates from the random coefficients model also suggest that the effects of race and gender on the distribution of current infection among neighborhoods might be treated as fixed.

The next model of current infection, the slopes- and intercepts-as-outcomes model, examined the crosslevel interaction effects between neighborhood and individual characteristics (Table 21). Neither the main effect of poverty nor the main effect of the proportion black was significantly associated with the mean log odds of current infection. Neigbhorhoods with a higher proportion of black residents did not differ from

neighborhoods with less blacks in current infection, controlling for neighborhood poverty. Furthermore, none of the interactions were significant. Racial composition and poverty differences between neighborhoods did not influence the mean log odds of current GC/CT infection within neighborhoods after adjusting for individual race, gender, and SES. For example, there was no difference between neighborhoods with a high proportion of black residents and neighborhoods with fewer blacks in terms of the strength of the association between gender (or race or SES) and current infection within them (controlling for neighborhood poverty).

In an additional set of models estimating current infection, I examined whether the relationship between individual characteristics and current GC/CT infection might be influenced by levels of the proportion black alone or levels of poverty alone. My overall conclusions remained unchanged, that is, the neighborhood characteristics examined did not appear to moderate the relationship between individual behavior and the risk of current GC/CT infection.

8. Conclusions

The analyses presented here utilized a unique and rich data source for understanding the scope and distribution of gonorrhea and chlamydial infection within an urban adult population. The Baltimore STD and Behavior Study (BSBS) combined use of urine-based diagnostic tests for gonorrhea and chlamydial infection with a population-based survey of health and STD-related risk behaviors. This strategy provided a new perspective on the burden of current infection within the general population and on the relationship of infection to the individual behaviors and characteristics associated with their transmission. Case reporting systems which rely upon physicians and laboratories to report cases of infection frequently describe the demographic and behavioral histories of patients seeking care in those settings. Individuals with asymptomatic infection or those with limited options for obtaining health care are underrepresented by these reporting systems. The inclusion of diagnostic assays in a population-based survey provides a new model for understanding the dimensions and distribution of symptomatic and asymptomatic infection within the general population.

This study also examined the individual demographic and behavioral characteristics associated with the risk of GC/CT infection. Unlike other studies, this study investigated how the neighborhood composition may influence individual behaviors and therefore STD risk. Hierarchical loglinear modeling procedures were used to estimate the interrelationships between the individual-level and neighborhood-level data and the risk of GC/CT infection.

Estimates of GC/CT Infection

Results from the BSBS suggest that it is possible, using in-field survey procedures, to obtain urine specimens for testing of gonorrhea and chlamydia from a household population. Eight in ten (79.9 percent) eligible study participants who completed the household interview also provided a urine specimen. Results from the LCR assays revealed that nearly one in twelve adults between the ages of 18 and 35 (8.3 percent) were currently infected with gonorrhea and/or chlamydia. An estimated 5.6 percent were currently infected with gonorrhea, 3.4 percent were infected with chlamydia, and 0.7 percent were positive for gonorrhea and chlamydia. Current infections were highest among black females (15.6 percent). Among nonblacks, males (3.0 percent) were more likely than females (1.3 percent) to be currently infected.

A self-reported history of GC/CT infection was assessed from data provided during the BSBS interview. Approximately one in four respondents (26.1 percent) reported previous treatment for gonorrhea or chlamydia. Black males were most likely to report a prior infection (39.2 percent) and three times as likely to report a history of gonorrhea (34.5 percent) than chlamydia (11.6 percent). Females and nonblack males, on the other hand, were more likely to report a prior history of chlamydial infection than of gonorrhea. Consistent with other studies, self-reports of GC and CT were also associated with lower levels of education and income.

Among the respondents with a current infection, 22.5 percent reported a prior history of infection. These estimates of repeat infection were higher among those reporting a history of gonorrhea (25.3 percent) than chlamydia (13.1 percent).

Self-reported estimates of gonorrhea and chlamydia in the BSBS were substantially higher than estimates derived from other population-based studies. Ten

percent of adults between the ages of 18 and 35 reported treatment for gonorrhea and/or chlamydia in the 1992 National Health and Social Life Survey. Results from the 1991 National Survey of Men indicated that 6.2 percent of males 20 to 39 years of age had ever had gonorrhea and 1.2 percent had had chlamydia (Tanfer, Cubbins, and Billy, 1993). The 1995 National Survey of Family Growth and the 1991 National Survey of Women provided estimates of infection among U.S. adult women. Estimates of a prior gonorrhea or chlamydial infection derived from these surveys ranged from 1.7 to 7 percent. Overall, gonorrhea was more frequently reported than chlamydia and blacks were more likely than nonblacks to report a history of infection. The estimated prevalence of gonorrhea, for example, was 23.5 percent among blacks in the 1992 NHSLS compared to 3.2 percent among nonblacks. Estimates of chlamydia in that survey were 6.9 percent and 4.4 percent for blacks and nonblacks, respectively.

There are a number of reasons to suspect that self-reported infection may underestimate the true prevalence of infection. Respondents may be hesitant to report a previous history of gonorrhea or chlamydia because of the social stigma surrounding STDs. Both gonorrhea and chlamydia may be asymptomatic or produce symptoms that may be misdiagnosed or mild enough to go untreated (women with a vaginal discharge, for example, may misdiagnose the discharge as a yeast infection). Respondents may not adequately recall a previous diagnosis or may mistake the name of the infection. For example, when respondents in the BSBS were asked if they had ever heard of specific STDs (gonorrhea, chlamydia, syphilis, pelvic inflammatory disease (PID), genital phlemoria, and herpes), 17.3 percent of respondents reported they had heard of genital phlemoria, a fictitious disease.

An important feature of these data is the ability to differentiate currently infected

individuals from individuals with a symptomatic or treated infection. Previous studies have identified a host of sexual and health-care seeking behaviors associated with an increased risk of STD infection. This information has primarily been drawn from clinical studies of STD patients who were treated for symptomatic infection. Population-based surveys have also collected information on the demographic characteristics and behaviors of individuals with a self-reported history of infection. Individuals with multiple sexual partners, frequent partner change, and individuals who practice anal sex and inconsistent condom use, for example, are considered at high-risk for STD infection.

As predicted by the STD literature, bivariate and logistic regression analyses suggested that self-reported infections were significantly associated with a range of individual and behavioral risk factors. However, the lack of STD-related risk behaviors among respondents testing positive for current GC/CT infection in the BSBS was somewhat unexpected. Compared with uninfected participants, respondents with a current infection, for example, were actually less likely to report multiple sex partners, new partners within the last year, anal sex within the past six months, sex with a prostitute, paid sex, or having sex three or more times within the past week. Individuals reporting a history of GC/CT infection, on the other hand, were more likely to report these risky behaviors than those without a prior GC/CT history; this is consistent with the existing literature. I did not anticipate that the sexual risk-taking behaviors between the currently infected and those reporting a history of infection would be different. The analyses presented above suggest that the behaviors predicting self-reported infection do not predict current infection. The lack of an association persisted when examining the behavior of males and females separately. Likewise, very few race-specific differences in behavior were associated with an increased GC/CT risk.

To probe this issue a bit further, I investigated reports of STD-related symptoms in two subsamples: 1) respondents with a history of prior infection but no current infection, and 2) those with a current infection but no prior history of infection. (As noted earlier, twelve respondents with a current infection also reported being treated for a prior infection.) Nearly one-half (44.6 percent) of all respondents reported ever having dysuria or genital discharge. Reporting of these symptoms was higher among respondents with a prior history of infection (76.5 percent) in comparison to 20.8 percent of respondents with a current infection. Restricting the reporting of symptoms to within the past 6 months, which is more suggestive of current or recent infection, produced a similar pattern in symptom reporting. That is, one in five respondents with a prior infection (21.2 percent) reported dysuria or dripping within the past 6 months, compared to only 2.5 percent of respondents with a current and no prior GC/CT infection. Furthermore, males and respondents whose urine assay tested positive for chlamydia reported no symptoms within the past 6 months.

These data imply that 1) the sexual risk-taking behaviors of respondents with a current infection differ from those with a prior history of GC/CT, 2) the currently infected experienced less STD-related symptoms, and 3) untreated asymptomatic infections appear to be common among both men and women in Baltimore. Prevalence estimates for GC/CT which rely upon individuals receiving treatment for infection are likely to underestimate the true prevalence. Without an apparent indication or symptoms of infection, individuals are unlikely to seek or receive medical attention or to get enumerated in surveillance statistics.

Influence of Neighborhoods on GC/CT Infection

This study utilized the unique strategy of linking urine assays for GC/CT infection and information on individual behaviors with community characteristics. Hierarchichal logistic regression models indicated that the racial and socioeconomic composition within neighborhoods was significantly associated with variation in levels of self-reported GC/CT infection between neighborhoods. When neighborhood characteristics were added to the models, only racial segregation (as measured by the proportion of the neighborhood population that was black) was positively and significantly associated with self-reported GC/CT infection, on average, after controlling for individual- and community-level characteristics.

However, multilevel analyses did not detect an association between neighborhood characteristics and *current* infection. Neighborhood characteristics did not seem to matter when examining differences in the distribution of current infection in Baltimore. Estimates of current GC/CT infection were not differentially distributed across neighborhoods based on the characteristics examined here – neighborhood economic status, proportion of adults active in the labor force, education, proportion of families receiving public assistance, or the percentage of single-parent families. Moreover, maps of current infection by neighborhood of residence did not identify geographic 'cores' of infection, or contiguous geographic concentrations of gonorrhea or chlamydial infection.

Collective socialization and normative/opportunity cost theories stress the importance of the environment in creating a structure of constraints, as well as opportunities, within which individual decision-making occurs. Socially approved behavior is reinforced and socially undesirable behaviors are discouraged by the presence of neighborhood and community role models. According to this perspective,

neighborhoods create an opportunity structure, as well as a system of normative influences, in which permissible behaviors are defined. Wilson (1991) and Massey (1993) suggest that negative behaviors may be reinforced by residing in neighborhoods with particularly high concentrations of poor, unemployed, single-parent, and minority residents, or socially isolated environments. The dual problem of marginal economic position plus the social isolation of residents within poor neighborhoods is Wilson's central theoretical construct. Massey and Denton (1989) suggest that segregation also contributes to the concentration of disadvantage. Both Wilson (1987) and Massey (1993) posit that the concentration of social and economic disadvantage influences individual outcomes independent of individual characteristics (Jargowsky, 1997; Jencks and Mayer, 1990).

These data provide mixed support for neighborhood social isolation theory or for the notion of 'concentration effects'. Consistent with Wilson's and Massey's positions, at the individual level, being black and socioeconomically disadvantaged were significantly and positively associated with GC/CT infection (for both current and self-reported infection). At the neighborhood level, several neighborhood measures were significantly associated with self-reported infection. However, only one measure, the proportion of the population that was black, was associated with GC/CT infection after controlling for other neighborhood characteristics. Furthermore, multilevel analyses suggested that the effects of neighborhood racial composition on the likelihood of self-reported infection were independent of individual characteristics. Regardless of whether one was black or nonblack, socioeconomically disadvantaged or not socioeconomically disadvantaged, male or female, or whether one had multiple sexual partners or not, living in a predominantly black neighborhood in Baltimore was associated with a higher risk of a

lifetime history of gonorrhea and/or chlamydial infection.

Inconsistent with the theory, this analysis found no evidence that variation in neighborhood poverty differentially influenced the relationship between individual characteristics and self-reported infection within neighborhoods. Controlling for the proportion of the neighborhood that was black and individual-level characteristics, none of the other neighborhood measures -- economic status, social welfare, education, or adult labor market status -- were associated with the likelihood of self-reported infection. There was no convincing evidence of interaction effects between the proportion of black residents and neighborhood poverty. For example, it was not apparent from these data that the likelihood of a self-reported infection was greater in poor black neighborhoods than in nonpoor black neighborhoods.

Differences in sexual and social networks may reflect one dimension of the local opportunity structure that characterizes highly segregated and less segregated neighborhoods. A substantial literature has documented racial differences in the age of initiation of sexual activity, teen pregnancy, contraceptive practices, and patterns of family formation. Race-ethnicity is an important predictor of where a person circulates and with whom a person has sex (Laumann et al., 1994; Wilson, 1987). Because the risk of acquiring gonorrhea or chlamydia depends upon the prevalence of infection within the pool of potential partners, the risk of acquistion and transmission of infection varies within and between sexual networks. Differences in the prevalence of infection (and risk behaviors) between racially segregated sexual networks can result in large differences in STD morbidity between these groups.

Unfortunately the BSBS dataset does not contain data to investigate sexual and social networks. Other structural differences between racially segregated and non-

segregated neighborhoods with potential implications for STD risk, such as neighborhood variation in screening practices within local (public and private) health care facilities and the quality of care also could not be investigated in this study.

Similarly, differences in norms and values between segregated and less segregated neighborhoods may also influence behaviors. Anderson's (1991:388) ethnographic work in black neighborhoods in Chicago and Philadelphia suggests that a young woman's proximity to and degree of integration with certain peer groups can significantly influence her likelihood of a teen pregnancy. Wilson (1991b:474) argues that patterns and norms of behavior tend to be shaped by those with whom one has most sustained contact and interaction, i.e. "by the neighborhood or social milieu". If these behavioral differences reflect variations in norms regarding sexuality and sexual relationships, then the community's racial composition may affect individuals' sexual choices through its influence on the local normative environment. For example, if predominantly black neighborhoods are characterized by less restrictive norms regarding condom use, than nonblacks living in that neighborhood (and exposed to the normative environment of that neighborhood) would be expected to have a lower likelihood of condom use (and hence an increased likelihood of contracting a sexually transmitted disease) than their counterparts in less segregated neighborhoods.

Unfortunately very little is known about the relative importance of contextual characteristics in explaining racial differences in STD prevalence. The analyses presented here represent a first step in probing the relationship between social context and STD-related risk behaviors. The effect of neighborhood racial composition on self-reported infection persisted after controlling for other neighborhood and individual-level characteristics. These data suggest that while these other characteristics are important,

there may be additional unmeasured factors contributing to the race differential. Future research should further explore the effects of segregation in sexual networks as a possible explanation for the racial disparities in GC/CT prevalence.

There are limitations to the BSBS data. The study collected data in only one city, Baltimore, and the results may not be generalizable to other urban populations. Baltimore has one of the highest rates of gonorrhea and chlamydial infection among U.S. cities with populations of 200,000 or more (CDC, 1995,1998). Whether these results may be replicated in other populations with different levels of infection remains to be studied. Of interest is whether the neighborhood effects, or lack thereof, in Baltimore may be found in other locations, and whether similar patterns between individual and neighborhood characteristics and GC/CT infection may be observed. Given a larger sample size, it may have been possible to investigate individual and neighborhood differences in rates of infection for gonorrhea and chlamydia separately. At least one previous study of patients attending STD clinics in Baltimore suggested that there are behavioral differences associated with gonorrhea and chlamydial infection (Hook et al., 1992). Hook and colleagues, for example, found that among both males and females the risk of gonorrhea but not chlamydia was positively associated with the number of recent sexual partners.

The size of the sample may also not have been adequate for detecting differentiating (level-1 and level-2 interaction) effects. The sample *N* for this analysis was 560. Respondents in the HLM analysis were distributed among 25 'neighborhoods', with an average of 22 respondents per neighborhood. Reliability estimates from the random coefficient logistic regression model indicated these data were adequate for examining hypotheses about effects of neighborhood characteristics on neighborhood mean levels

of self-reported infection. However, the data may not have been as useful in investigating, for example, how neighborhood characteristics influence the prevalence of infection among socioeconomically disadvantaged and non-socioeconomically disadvantaged individuals.

The neighborhood-level characteristics may not have reliably measured the theoretical constructs to be tested. It was hypothesized, for example, that neighborhood demography (the level of poverty, the proportion of college graduates, the proportion of families receiving welfare, etc) influenced the local opportunity structure and the availability of community role models, which then affected individual behavior and the likelihood of GC/CT infection. While there may be individual level processes intervening between community characteristics and individual level outcomes, this study may not have adequately measured these mechanisms. The neighborhood measures employed described the neighborhood in terms of aggregates of individual demographic or compositional differences. Individual-level data on respondents' perceptions of the community, e.g., the availability of role models within the community, or the local opportunity structure were not obtained. Consequently, the neighborhood-level variables employed in this study may have provided better measures of the neighborhood's physical attributes (in 1990) than its internal social dynamics.

The BSBS collected limited information on respondents' sexual partners. While information was obtained on the number of partners and the respondent's relationship with the most recent partner, survey data did not indicate whether the respondents' partner(s) were currently or recently infected with gonorrhea or chlamydia, nor did it inquire about the partners' sexual activities. Asking a respondent to report on their partner's sexual activities, however, is fraught with measurement problems. When a

woman or man has a new partner, or even a continuing partner, he or she may not know about that person's other partners or whether that person has an STD (Kost and Forrest, 1992). In some cases, as this research suggests, without apparent symptoms the infected person may not even realize their own infection. Ideally, urine specimens and behavioral information would have been collected from the partner(s) on their own sexual and STD history.

In concluding, it is important to note that very few Americans perceive of themselves as being at risk of gonorrhea and chlamydial infection (Institute of Medicine, 1996). The results presented here suggest that the profile of the at-risk population as generated by studies of clinic populations may not be generalizable to the larger population. Studies of clinic populations may overrepresent the populations they serve. Adults residing in Baltimore who were currently infected with GC and/or CT were not more likely than those not currently infected to report multiple partners, recently new partners, concurrent sexual relationships, a one-night stand, or paying for sex. They also were not more likely to report behaviors that may have protected them from STD risk, such as avoiding sex to prevent STD infection, discussing their prior sexual relationships with new partners, or using a condom. Finally, they were not more likely than those without an infection to report symptoms associated with gonorrhea or chlamydial infection.

What do these data suggest for the design of public health interventions aimed at reducing the frequency and spread of gonorrhea and chlamydial infections in Baltimore? The response rate from the urine testing component of the study suggests that in-field collection of urine specimens was acceptable by the majority of eligible study participants. Eighty percent of respondents ages 18 to 35 who were eligible for the urine

testing provided urine specimens. The advent of urine-based assays for gonorrhea and chlamydial infection (combined with the availability of oral single-dose therapies) suggests that efforts to detect and treat infection may extend successfully beyond clinical settings (see also Burstein et al., 1998; Gunn et al., 1998; Marrazzo et al., 1997).

Several results infer that expansion of STD screening programs may reduce gonorrhea and chlamydial infection within Baltimore. Laboratory results from the urine tests indicated that nearly one in twelve (8.3 percent) adults were currently infected with gonorrhea and/or chlamydia. This estimate represents more than twice the number of adults who reported they were diagnosed with gonorrhea or chlamydia during the previous 6 months (3.8 percent). Furthermore, one in five (22.5 percent) of current infections were detected among respondents who also reported a prior GC/CT infection. Treated GC and CT infections may therefore be a fraction of the total infections that occur in the Baltimore population. Although the currently infected were predominantly younger, black, and female, infections were detected among both married and unmarrried, men and women, those under 20 and over 30 years of age, those who reported monogamous sexual relationships and those who reported having numerous sexual partners. One common behavioral characteristic of those currently infected, however, was the absence of STD-related symptoms. Only 2.5 percent of respondents with a positive urine assay for gonorrhea and/or chlamydia and no history of a prior infection reported dysuria or discharge in the 6 months preceeding their diagnosis.

The combination of asymptomatic and untreated infection and the apparent lack of risk behaviors among individuals who were currently infected suggests that efforts to reduce rates of GC and CT infection within Baltimore might focus on strengthening and expanding screening programs. The absence of specific symptoms can fail to stimulate

health seeking behavior. This may be especially problematic for women, although these data suggest that a substantial number of men may also be asymptomatic for gonorrhea and chlamydia. Typically, patients considered to be at high-risk for STDs may be screened during routine health exams. Yet screening programs may be particularly important for detecting infections among patients who do not match the high-risk demographic or behavioral profile. Consequently, undetected and untreated infection risks the continued transmission of infection to sexual partners, and particularly for women, the development of serious health consequences. Expansion of screening programs, therefore, may be considered an important component of health care programs to reduce rates of GC/CT acquisition and transmission in cities such as Baltimore with a high prevalence of infection.

The U.S. Preventive Services Task Force (of the U.S. Department of Health and Human Services) currently recommends screening of all pregnant women and screening of 'high-risk' female populations for gonorrhea and chlamydia (Morse, Beck-Sague, and Mardh, 1999). Determining who is at 'high-risk' however, has certain drawbacks. Clinicians often do not elicit complete sexual histories from patients, particularly those who are asymptomatic (Institute of Medicine, 1996). Patients may be hesitant to disclose their own sexual behaviors and may be unaware of their partners' sexual risk-taking. The call for enhanced chlamydia screening in Baltimore was recommended last year by researchers from Johns Hopkins University (Burstein et al., 1998; The Washington Post, 1998). In their study, 3,202 girls between the ages of 12 and 19 who attended Baltimore health clinics (STD, public, private, school-based) from 1994 to 1996 were screened for chlamydia. Approximately one-third of the girls tested positive at least once during this period. More than one-half of those with an initial negative diagnosis tested positive for

chlamyida within the next seven months. Based on their findings, the study's authors recommended screening for chlamydia among all sexually active adolescent girls in Baltimore twice a year.

Data from these analyses acknowledge the role of the individual *and* the community in preventing gonorrhea and chlamydial infection. The community serves an important function in defining social norms and patterns of healthy behaviors. The community also provides resources needed for behavior change to occur through access to education and health services. Community-based programs to enhance awareness of symptoms and the consequences of STD infection can be useful strategies in preventing the spread and acquisition of GC and CT infection (Zenilman et al., 1999). These data suggest that individual neighborhoods vary in terms of their levels of infection and that they also may vary in their opportunity structures, hence interventions to prevent gonorrhea, chlamydia, and other STDs should be tailored to address local needs and conditions.

Finally, these data point to the need to collect behavioral information and biomarkers of infection from partners. Unlike individuals with a self-reported infection, currently infected individuals in the BSBS were not more likely to report high-risk sexual behaviors. One plausible explanation for this finding is that the partners of these 'low-risk' individuals may have engaged in 'high-risk' behaviors. However, without collecting data from these partners or testing them for infection, it is impossible to fully understand the dynamics of infection within local sexual networks. These data urge further exploration of the social context of gonorrhea and chlamydial infection conducted in conjuction with an investigation of partners' relationships and the interactions between individuals and their sexual partners.

Table 1. Studies of Neighborhood Effects on Fertility-related Behaviors

Author, year	Population sampled	Outcome measured	Sources of data	Measures of neighborhood
Hogan & Kitagawa, 1985	Unmarried black sexually active females 13-19, Chicago N=1,071	nonmarital adolescent pregnancy	1979 survey of Chicago teens, 1970 census tract	Quartiles: racial comp., median family income, sex ratio, % poor, children per ever-married female, % single females
Hogan, Astone, & Kitagawa, 1985	Unmarried black sexually active females 13-19, Chicago N=1,071	contraceptive use at first intercourse	1979 survey of Chicago teens, census tract	Quartiles: racial comp., median family income, sex ratio, % poor, children per ever-married female, % single females
Crane, 1991	National sample 16-19 N=92,512 (HS analysis) and N=44,666 (female teen birth analysis)	nonmarital births and high school drop-out	1970 census PUMS	% professional workers *
Mosher & McNally, 1991	National sample of women aged 15-44	contraceptive use at first intercourse	1988 NSFG & 1980 minor civil divisions data	poverty rate, % receiving public assistance, male unemp., % Hispanic
Billy & Moore, 1992	National sample of women aged 15-44 N=3,487 married N=3,244 unmarried	marital and nonmarital live births	1982 NSFG & 1980 tract data	SES, female divorce rates, female LFP, sex ratio, racial comp., age struc., avail. FP, median housing value,
Brewster et al., 1993	National sample of nonblack women 20+ N=8368	timing of and contraceptive use at first intercourse	1982 NSFG & 1980 tract and/or county data	SES,comm.religiosity, racial comp., female LFP, median income, occupational status
Brooks-Gunn et al., 1993	National sample of females 14-19 N=2,346	school dropout; teen birth	PSID 1968-85 & 1970-80 census tract, zip code	SES, male professional workers, racial comp., female hh, public assistance, unemp. males
Grady et al., 1993	National sample of women 15-44 N=1,258	contraceptive effectiveness	1982 NSFG & 1980 census tract data	SES, comm. religiosity, voting patterns, unemp., pop. growth, female LFP, racial comp.,
Ku et al., 1993	National sample of males 15-19 N=1,880	male premarital sexual activity and teenage fatherhood	1988 NSAM & 1980 census tract data	unempl. rate, public assis., prop hs dropouts, sex ratio,female hh,urban resid.
Billy et al., 1994	National sample of women 15-44 N=1,852	adolescent sexual activity	1982 NSFG & tract/county data	SES, female LFP, comm. religiosity, social disorg., racial comp., sex ratio, family planning service availability'
Brewster, 1994	National sample of young black women N=698	adolescent nonmarital sexual activity	1982 NSFG & tract data	racial conc., youth idleness, SES, unemployment, female LFP, family formation, marriage pool
Brewster, 1994	National sample of adolescent women 15-19 N=2,210	age at first intercourse	1982 NSFG & tract data	SES, adult employment, female full-time employment, racial composition, youth idleness

Note: * Crane (1991b) examined 15 other measures, however, none of these indices, ex. family poverty rate, male labor-force participation rate, proportion of families who moved within the last five years, proportion of female-headed households, explained nearly as much variation in outcomes.

Table 2: Sociodemographic Characteristics of Sample Respondents: 1997-98 Baltimore STD and Behavior Survey

Characteristics	RESPONDENTS AGES 18-44 %	N
Race		
Black	66.0	(578)
White	28.0	(362)
Asian	2.0	(15)
American Indian	0.9	(13)
Hispanic/other	3.2	(29)
Gender		
Female	52.5	(598)
Male	47.5	(402)
Age		
18-24	22.8	(231)
25-29	19.9	(202)
30-35	30.7	(311)
36-45	26.6	(270)
Marital status		
Married/cohab	40.5	(365)
W/D/S	16.4	(177)
Never married	43.1	(459)
Education		
< high school	21.1	(229)
Completed high school	32.3	(299)
Some college	30.4	(294)
Completed college	16.1	(176)
Household income		
<$10,000	21.1	(218)
$10,001-$20,000	18.8	(177)
$20,001-$30,000	18.9	(192)
$30,001-$40,000	13.6	(131)
$40,001-$50,000	11.0	(87)
$50,001-$75,000	11.1	(96)
>$75,000	5.5	(50)
Total adults in household		
1	20.4	(287)
2+	79.6	(638)
No. of children		
None	39.4	(407)
1+	60.6	(594)
N of respondents	**1,014**	

Notes: Percentages are weighted to account for unequal probability of selection and nonresponse. Unweighted Ns.

Table 3: Sociodemographic Characteristics of Respondents Ages 18 to 35: 1997-98 Baltimore STD and Behavior Survey

Characteristics	Respondents 18-35		Respondents ages 18-35 eligible for urine testing [a]		Eligibles providing urine [b]	
	%	N	%	N	%	N
Race						
Black	66.3	(413)	65.9	(403)	79.2	(319)
White	28.7	(284)	28.9	(278)	79.5	(221)
Other	5.0	(44)	5.2	(44)	88.6	(39)
Gender						
Female	52.5	(428)	52.0	(417)	80.5	(335)
Male	47.5	(317)	48.0	(308)	79.2	(244)
Age						
18-24	33.5	(232)	33.9	(228)	81.6	(186)
25-29	26.8	(202)	27.3	(199)	80.4	(160)
30-35	39.6	(311)	38.8	(298)	78.2	(233)
Marital status						
Married/cohab	38.5	(268)	38.3	(260)	78.1	(203)
W/D/S	10.3	(93)	10.2	(89)	79.8	(71)
Never married	51.2	(384)	51.5	(376)	81.8	(305)
Education						
< high school	20.3	(171)	20.5	(168)	86.9	(146)
Completed high school	35.6	(232)	36.0	(229)	79.9	(183)
Some college	29.5	(216)	29.1	(208)	76.0	(158)
College +	14.6	(123)	14.4	(117)	76.9	(90)
Household income						
<$10,000	22.0	(162)	22.2	(159)	88.8	(145)
$10,001-$20,000	21.6	(143)	22.1	(143)	80.4	(117)
$20,001-$30,000	18.7	(140)	18.4	(136)	73.8	(106)
$30,000-$40,000	14.5	(101)	14.4	(98)	79.4	78
>$40,000	23.3	(156)	22.8	(147)	67.6	106
Total adults in household						
1	19.5	(200)	19.5	(196)	80.1	(157)
2+	80.5	(478)	80.5	(467)	79.4	(371)
No. of children						
None	44.8	(324)	44.9	(315)	76.8	(242)
1+	55.2	(421)	55.1	(410)	82.2	(337)
N of respondents	745		725		579	

Notes: Percentages are weighted. Unweighted Ns.

[a] Due to interviewer error, 20 respondents ages 18-35 who were eligible for urine testing were not asked to provide urine samples. See text for details.

[b] Of the 725 eligible cases, 579 provided urines, 117 refused, and 29 consented but were unable to provide specimens for testing.

Table 4: Sociodemographic Characteristics of Respondents 18-35 who Provided a Urine Specimen for GC and CT Testing: 1997-98 Baltimore STD and Behavior Survey

Characteristics	Sexually active respondents 18-35 who provided urine specimen [a]								
	TOTAL	Female		Male		Black		Nonblack	
	%	%	N	%	N	%	N	%	N
Race									
Black	**65.5**	67.6	(187)	63.1	(121)				
Nonblack	**34.5**	32.4	(138)	36.9	(114)				
Gender									
Female	**52.3**					54.0	(187)	49.1	(138)
Male	**47.7**					46.0	(121)	50.9	(114)
Age									
18-24	**34.5**	34.9	(96)	34.1	(81)	37.2	(107)	29.4	(70)
25-29	**27.1**	25.1	(87)	29.3	(66)	22.2	(69)	36.3	(84)
30-35	**38.4**	40.0	(142)	36.6	(88)	40.5	(132)	34.3	(98)
Marital status									
Married/cohab	**37.6**	39.6	(126)	35.4	(74)	30.7	(89)	50.6	(111)
W/D/S	**9.8**	10.2	(48)	9.4	(22)	10.2	(39)	9.2	(31)
Never married	**52.6**	50.2	(151)	55.2	(139)	59.1	(180)	40.2	(110)
Education									
< high school	**22.4**	22.7	(87)	22	(55)	24.0	(86)	19.3	(56)
Completed high school	**36.4**	30.8	(97)	42.5	(80)	43.8	(116)	22.4	(61)
Some college	**27.4**	31.4	(93)	23.1	(60)	27.2	(87)	27.8	(66)
College +	**13.8**	15.1	(47)	12.3	(40)	4.9	(18)	30.5	(69)
Household income									
<$10,000	**24.8**	28.4	(98)	20.8	(42)	30.5	(101)	14.5	(39)
$10,001-$20,000	**22.7**	22.5	(67)	23.1	(47)	26.7	(69)	15.6	(45)
$20,001-$30,000	**17.5**	15.1	(52)	20.3	(50)	17.4	(50)	17.7	(52)
$30,000-$40,000	**14.9**	15.9	(44)	13.2	(32)	13.4	(35)	17.0	(41)
>$40,000	**20.1**	18.1	(56)	22.6	(48)	11.9	(34)	35.3	(70)
Total adults in household									
1	**20.7**	22.0	(96)	19.1	(56)	23.9	(96)	15.1	(56)
2+	**79.3**	78.0	(205)	80.9	(155)	76.1	(179)	84.9	(181)
No. of children									
None	**43.0**	27.2	(77)	60.3	(151)	36.5	(103)	55.2	(125)
1+	**57.0**	72.8	(248)	39.7	(84)	63.5	(205)	44.8	(127)
N of respondents	**560**		**325**		**235**		**308**		**252**

Notes: Percentages are weighted. Unweighted Ns.

[a] Excludes 19 cases from the age-eligibles who reported they were not sexually active.

Table 5. Demographic and Social Characteristics of Neighborhoods: Baltimore City

Neighborhood characteristic from 1990 Census	Initial classification [a]		Reclassification of neighborhoods [b]			
	Mean	S.D.	Mean	S.D.	Minimum	Maximum
Demographic characteristics						
Population	15,935	(10067)	29,321	(15352)	8,460	69,489
No. of households	5,629	(3711)	10,358	(4717)	1,797	17,748
Prop. black	0.53	(0.37)	0.49	(0.37)	0.01	0.99
Prop. white	0.43	(0.40)	0.49	(0.37)	0.00	0.98
Male:female ratio	0.90	(0.17)	0.88	(0.07)	0.78	1.06
Prop. ages 25+ not HS graduate	0.44	(0.15)	0.42	(0.13)	0.13	0.60
Prop. ages 16-19 high school dropouts	0.23	(0.12)	0.22	(0.11)	0.01	0.49
Economic status						
Median household income ($)	24,042	(7,640)	24,693	(7,030)	10,384	38,238
Per capita income ($)	15,986	(13,619)	16,757	(13,755)	6,017	54,349
Prop. poverty [c]	0.22	(0.13)	0.19	(0.10)	0.04	0.51
Labor force/occupation						
Prop. males aged 16+ in labor force	0.68	(0.11)	0.69	(0.06)	0.52	0.78
Prop. females aged 16+ in labor force	0.55	(0.09)	0.54	(0.07)	0.44	0.67
Prop. prof/managerial	0.23	(0.15)	0.24	(0.12)	0.11	0.59
Prop. employed within city	0.66	(0.11)	0.66	(0.08)	0.47	0.79
Social welfare indicators						
Prop. single-parent households	0.34	(0.17)	0.31	(0.14)	0.07	0.58
Prop. households receiving public assistance	0.17	(0.11)	0.16	(0.1)	0.03	0.37
Housing conditions						
Prop. housing units vacant	0.08	(0.05)	0.09	(0.05)	0.04	0.21
Prop. renter-occupied housing units	0.45	(0.17)	0.44	(0.13)	0.23	0.70

Source: 1990 Census data.

Notes: [a] Neighborhoods as defined by Baltimore City Dept. of Planning (1993). Data correspond to 46 residential neighborhoods.

[b] Reclassification of neighborhoods into 25 neighborhood units. See text for details.

[c] As defined according to federal poverty guidelines. Persons were defined as below the poverty level if their total household or family income in 1989 was below the following poverty thresholds by size and age of household: one person, $6,451; two persons, $8,343; three persons, $9,885; four persons, $12,674; five persons, $14,990; and six persons, $16,921.

Table 6. Crossclassification of Current Gonorrhea and/or Chlamydial Infection by Race and Gender: 1997-98 Baltimore STD and Behavior Survey

Race	Gender	Current GC/CT infection [a]		Estimated prevalence current infection		
		Yes	No	GC/CT %	GC %	CT %
Black	Female	21	166	15.6	9.7	6.6
	Male	14	107	6.8	5.6	2.2
Nonblack	Female	8	130	1.3	1.3	0.0
	Male	6	108	3.0	1.4	2.5
TOTAL		49	511	8.3	5.6	3.4

Notes: Estimates are weighted. Unweighted Ns.

[a] Determined from urine ligase chain reaction (LCR) assays.

Table 7. Crossclassification of Self-reported Gonorrhea and/or Chlamydial Infection by Race and Gender: 1997-98 Baltimore STD and Behavior Survey

Race	Gender	Self-reported GC/CT infection [a]		Estimated prevalence self-reported infection		
		Yes	No	GC/CT %	GC %	CT %
Black	Female	62	125	32.8	12.9	26.1
	Male	41	77	39.2	34.5	11.6
Nonblack	Female	18	120	11.6	2.1	10.5
	Male	5	108	4.5	1.9	2.6
TOTAL		126	430	26.1	15.6	15.0

Notes: Percentages are weighted. Unweighted Ns. Four cases were omitted due to missing information.

[a] Calculated from responses to the following questions, "Has a doctor or nurse ever told you that you had [chlamydia] [gonorrhea or 'clap']?".

Table 8: Estimates of Self-reported Infection with Gonorrhea and/or Chlamydia by Individual Characteristics: 1997-98 Baltimore STD and Behavior Survey

Characteristic	Estimated prevalence self-reported GC/CT infection [a] %
Total Estimate	**26.1**
Race	
Black	35.7 ***
Nonblack	8.0
Gender	
Male	26.3
Female	25.9
Age	
18-24	21.3
25-29	26.1
30-35	30.4
Marital status	
Married/cohab	21.5
W/D/S	26.6
Never married	29.2
Education	
< high school	40.1 ***
Completed high school	26.1
Some college	23.7
College +	7.9
Household income	
<$10,000	34.1
$10-20,000	32.4
$20,001-$30,000	25.1
$30,000-$50,000	21.7
>$50,000	17.8
Education & Income	
Socioeconomic disadvantage [b]	44.3 **
Total adults in household	
1	25.0
2+	27.5
No. of children	
None	29.3
1+	21.8

***Notes*:** Estimates are weighted.

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.001$

[a] Respondents reporting yes to either or both of the following questions, "Has a doctor or nurse EVER told you that you had [chlamydia] [gonorrhea or "clap"]?".

[b] Non high school graduate and household income < $20,000 (adjusted for number of household members).

Table 9: Estimates of Self-reported Infection with Gonorrhea and/or Chlamydia by Individual Behavioral Characteristics: 1997-98 Baltimore STD and Behavior Survey

Behavioral Characteristic	*Estimated prevelance of self-reported GC/CT infection* [a]		
	Respondents reporting behavior %	Respondents not reporting behavior %	
Partner selection			
6 or more lifetime partners	32.7	19.3	***
11 or more lifetime partners	35.5	22.3	**
3 or more partners last year	29.5	25.4	
2+ partners last year	31.9	23.7	
2+ partners last month	27.3	27.3	
11+ lifetime partners OR 2+ partners last year	33.9	19.9	***
6+ lifetime partners OR 2+ partners last year	32.7	16.9	***
One or more new partners last year	31.7	22.9	*
2+ new partners last year	33.3	30.3	
Multiple partners & new partners	32.4	23.6	*
Never married & multiple partners	33.8	23.4	*
Condom use			
Never used condom last year	29.1	23.8	
Ever thought should use condom and didn't	30.8	21.6	*
Never told new partner last yr, no condom no sex	23.5	27.1	
Frequency of sex and sexual practices			
Sex 3+ times last week	27.2	26.3	
Sex 3+ last week OR 1+ new partners	28.7	24.0	
Oral sex within past week	30.9	23.9	
Anal sex within past 6 months	41.0	24.3	*
First sex age 14 or younger	42.9	18.9	***
Ever one-night stand	35.3	19.8	**
Ever been forced to have sex	36.1	23.0	**
Ever forced someone to have sex	44.1	25.4	
Forced sex	37.3	22.1	**
Sex with a prostitute	42.1	23.1	*
Been paid for sex	58.9	22.3	***
Paid sex (paid for or been paid)	44.9	20.8	**
Alcohol and other drug use			
Ever drank alcohol	27.0	18.4	
Drank alcohol 5+ days last month	27.0	25.9	
Had sex while drinking last month	27.5	25.9	
Drank 5+ drinks on 5+ occasions last month	30.0	25.8	
Ever felt should cut down on drinking	31.4	24.3	
Ever injected drugs	45.4	25.1	*

Behavioral Characteristic	Estimated prevelance of self-reported GC/CT infection[a]		
	Respondents reporting behavior %	Respondents not reporting behavior %	
Health behaviors			
Ever had GC/CT	100.0	0.0	***
Ever had an STD	87.2	0.0	***
Females : douched last month	28.2	24.1	
Douche at least once/month	32.6	19.6	
Douche after sex	37.9	19.2	**
Females:ever abortion	33.0	21.5	*
Females:ever PID	50.9	25.1	*
STD symptoms			
Ever dysuria	43.1	15.6	***
Dysuria within the past 6 months	42.5	24.6	**
Ever dripping or discharge	58.2	14.9	***
Drips or discharge within the past 6 months	28.1	25.9	
Partner relationships			
Discussed sex with primary partner last year once/month or less	25.6	26.2	
At least 2: 6+lifetime partners, infrequent discussions of sex with main partner, 2+ partners last year	32.4	23.4	
At least 2: 11+ lifetime partners, never discussed sex with main partner, 2+ partners last year	32.4	23.9	
Never discuss sex & never/rarely used condom last yr	26.2	25.8	
Infrq discussion of sex & never/rarely used condom last yr	27.7	25.7	
Main partner ever had an STD	61.8	23.1	**
Difficulty having satisfying sex	34.6	24.0	**
Avoided sex to prevent STD infection	19.3	30.2	**
Always asked new prtnr re:other partners	24.3	27.2	
Never/sometimes told new partner re: # partners	27.8	25.2	
Concurrent sexual relationship	38.3	23.9	**
Fight w/ partner 10+ times last year	28.1	25.8	

Notes: Percentages are weighted.

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.001$

[a] Respondents reporting yes to either or both of the following questions, "Has a doctor or nurse EVER told you that you had [chlamydia] [gonorrhea or "clap"]?".

Table 10. Estimates of Self-reported GC/CT Infection by Neighborhood Characteristics: 1997-98 Baltimore STD and Behavior

NEIGHBORHOOD MEASUREMENT	Self-reported GC/CT infection [a]	
	%	*p*
All neighborhoods	**26.1**	
Economic status		
Poverty		
1st quartile	17.6	
2nd quartile	23.5	
3rd quartile	35.5	
4th quartile	29.6	0.09
Median household income ($)		
1st quartile	32.2	
2nd quartile	30.7	
3rd quartile	13.0	
4th quartile	23.0	0.01
Average per capita income ($)		
1st quartile	30.8	
2nd quartile	33.9	
3rd quartile	15.5	
4th quartile	17.8	0.02
Demographic composition		
Proportion Black		
1st quartile	12.7	
2nd quartile	17.3	
3rd quartile	26.5	
4th quartile	38.9	0.003
Proportion White		
1st quartile	38.9	
2nd quartile	26.5	
3rd quartile	17.8	
4th quartile	12.3	0.001
Adult Labor Market		
Male employment		
1st quartile	35.7	
2nd quartile	28.8	
3rd quartile	17.6	
4th quartile	27.1	0.07
Female employment		
1st quartile	24.7	
2nd quartile	21.8	
3rd quartile	24.1	
4th quartile	32.3	ns

NEIGHBORHOOD MEASUREMENT	Self-reported GC/CT infection [a]	
	%	p
Employed: professionals		
1st quartile	29.7	
2nd quartile	30.8	
3rd quartile	21.3	
4th quartile	22.1	ns
Educational Attainment		
Aged 25+ not HS grad		
1st quartile	23.0	
2nd quartile	31.0	
3rd quartile	22.1	
4th quartile	27.7	ns
Aged 16-19 HS dropout		
1st quartile	24.1	
2nd quartile	27.4	
3rd quartile	23.2	
4th quartile	29.9	ns
Social Welfare		
Families receiving public assistance		
1st quartile	19.0	
2nd quartile	13.7	
3rd quartile	30.3	
4th quartile	30.0	0.05
Single parent families		
1st quartile	9.1	
2nd quartile	25.1	
3rd quartile	35.6	
4th quartile	29.8	<0.001

Notes: ns, not significant, $p > 0.10$.

[a] Respondents reporting yes to either or both of the following questions, "Has a doctor or nurse EVER told you that you had [chlamydia] [gonorrhea or "clap"]?".

Table 11. Estimates of Current Infection with Gonorrhea and/or Chlamydia by Individual Sociodemographic Characteristics: 1997-98 Baltimore STD and Behavior

Characteristic	Estimated prevalence current GC/CT infection [a]				
	TOTAL %	Female %	Male %	Black %	Nonblack %
Overall Estimate	**8.3**	**11.0**	**5.4**	**11.5**	**2.1**
Race					
Black	**11.5** ***	15.6 ***	6.8		
Nonblack	**2.1**	1.3	3.0		
Gender					
Female	**11.0** **			15.6 *	1.3
Male	**5.4**			6.8	3.0
Age					
18-20	**12.4**	24.1	2.8	15.8	2.9
21-24	**7.9**	8.9	6.5	10.2	3.1
25-29	**4.3**	4.5	4.2	5.9	2.4
30-35	**9.6**	11.8	7.1	13.5	1.1
Marital status					
Married/cohab	**8.7** **	12.0	4.6 *	15.1	1.3
W/D/S	**2.6**	4.2	0.7	2.6	2.5
Never married	**9.1**	11.6	6.6	11.2	3.1
Education					
< high school	**11.4** **	18.6 **	3.2	13.7	5.9 **
Completed high school	**9.6**	11.7	7.9	11.1	3.7
Some college	**7.6**	10.1	3.9	11.5	0.3
College +	**1.4**	0.0	3.4	5.2	0.3
Household income					
<$10,000	**8.9**	11.5	4.9 *	10.7	2.2
$10-20,000	**11.4**	15.0	7.3	13.3	5.4
$20,001-$30,000	**11.7**	11.7	11.7	16.2	3.7
$30,000-$40,000	**5.1**	5.8	**4.1**	8.3	0.6
> $40,000	**3.3**	5.9	0.8	7.2	**0.8**
Education & income					
Socioeconomic disadvantage [b]	**16.8** **	25.3 **	4.7	20.5 *	6.3
Total adults in household					
1	**8.7**	4.9 *	13.7	11.3	1.3
2+	**8.1**	11.5	4.3	11.8	2.3
No. of children					
None	**9.5**	16.1	6.2	16.1 **	1.2
1+	**7.4**	9.1	4.1	8.9	3.3
N of respondents	**560**	**325**	**235**	**308**	**252**

***Notes:* Estimates are weighted.**

* p <0.1 ** p < 0.05 *** p < 0.001.

[a] Sexually active respondents ages 18-35 with a positive urine assay for gonorrhea and/or chlamydia.

[b] Non-high school graduate and household income < $20,000 (adjusted for number of household members).

Table 12. Estimates of Current Infection with Gonorrhea and/or Chlamydia by Gender, Race, and Individual Behavioral Characteristics: 1997-98 Baltimore STD and Behavior Survey

Behavioral Characteristic	*Estimated prevelance of current GC/CT infection* [a]				
	TOTAL %	Female %	Male %	Black %	Nonblack %
Overall Estimate	8.3	11.0	5.4	11.5	2.1
Partner selection					
6 or more lifetime partners	6.6	7.5	5.8	8.6	1.8
11 or more lifetime partners	8.6	10.3	7.4	11.5	0.7
3 or more partners last year	4.8	2.2 **	5.9	6.9	0.0
2+ partners last year	5.3	4.7 *	5.7	6.5	2.6
2+ partners last month	8.8	0.0	10.5	11.6	0.0
11+ lifetime partners OR 2+ partners last year	6.8	7.4	6.2	8.4	2.4
6+ lifetime partners OR 2+ partners last year	6.5	7.1	6.0	7.9	3.0
One or more new partners last year	5.2 **	6.8	4.0	6.3 *	2.8
2+ new partners last year	5.0	4.4	5.2	5.8	3.2
Multiple partners & new partners	4.2 **	4.6	4.0	4.5 **	3.6
Never married & multiple partners	9.9	11.9	8.3	12.5	1.3
Condom use					
Never used condom last year	9.3	12.7	4.2	14.9	1.5
Ever thought should use condom and didn't	6.0	6.6	5.4	8.5	1.1
Never told new partner last yr, no condom no sex	6.6	11.6	2.7 **	11.8	0.0
Frequency of sex and sexual practices					
Sex 3+ times last week	6.9	10.3	4.5	9.6	2.3
Sex 3+ last week OR 1+ new partners	6.1 *	8.7	4.0	7.9 *	2.4
Oral sex within past week	8.5	11.1	6.3	11.9	2.4
Anal sex within past 6 months	6.8	17.0	1.1 **	9.3	1.4
First sex age 14 or younger	5.0	2.9	6.1	5.3	4.2
Ever one-night stand	6.1	12.5	3.1	9.0	0.4
Ever been forced to have sex	6.0	7.7	0.5	8.6	0.8
Ever forced someone to have sex	4.2	10.2	1.1	4.5	0.0
Forced sex	5.4	7.4	0.4	7.5	0.8
Sex with a prostitute	6.0	0.0	6.4	6.7	3.6
Been paid for sex	9.1	14.0	3.6	10.9	0.0
Paid sex (paid for or been paid)	7.9	12.9	6.0	9.4	2.8
Alcohol and other drug use					
Ever drank alcohol	7.7	9.8	5.4	17.3	2.0
Drank alcohol 5+ days last month	7.2	15.4	2.7	11.2	2.6
Had sex while drinking last month	5.3	9.5	2.6 **	7.7	2.3
Drank 5+ drinks on 5+ occasions last month	4.4	5.0	4.2	7.5	1.2
Ever felt should cut down on drinking?	7.5	9.7	6.4	11.7	1.2
Ever injected drugs	15.1	25.3	5.9	22.5	0.0

Behavioral Characteristic	Estimated prevelance of current GC/CT infection [a]				
	TOTAL %	Female %	Male %	Black %	Nonblack %
Overall Estimate	**8.3**	**11.0**	**5.4**	**11.5**	**2.1**
Health behaviors					
Ever had GC/CT	7.2	10.5	3.6	7.9	1.1
Ever had an STD	8.3	10.3	6.0	9.1	2.7
Females : douched last month	12.3	12.3		13.7	4.6
Douche at least once/month	12.6 **	12.6 **		15.1 **	3.2
Douche after sex	11.2	11.2		13.4	2.5
Told had GC,CT or syphilis within past 6 mos	3.3	5.7	0.0	3.8	0.0
Females:ever abortion	7.6 ***	7.6 ***		8.7 **	1.8
Females:ever PID	14.7	14.7		14.4	17.7
STD symptoms					
Ever dysuria	4.5 **	7.6	0.3 **	6.5 **	1.0
Dysuria within the past 6 months	1.7 **	2.9 **	0 **	2.5 **	0.7
Ever dripping or discharge	8.1	9.5	0	11.1	2.1
Drips or discharge within the past 6 months	3.7	3.9 *	0	4.4 *	0.0
Partner relationships					
Discussed sex with primary partner last year once/month or less	9.2	11.4	6.7	12.0	3.1
At least 2: 6+lifetime partners, infrequent discussions of sex with main partner, 2+ partners last year	5.6	3.7 *	6.7	7.4	1.3
At least 2: 11+ lifetime partners, never discussed sex with main partner, 2+ partners last year	8.1	7.6	8.3	12.2	0.0
Never discused sex & never/rarely used condom last y	15.5	16.0	14.5	22.8	4.4
Infrequnt discussion of sex & never/rarely used condom	9.4	10.3	7.9	13.0	5.7
Main partner ever had an STD	4.4	7.7	1.9	3.9	7.1
Difficulty having satisfying sex	9.2	11.3	5.7	12.1	0.9
Avoided sex to prevent STD infection	8.1	11.9	4.7	14.4	3.1
Always asked new prtnr re:otr prtnrs	8.6	10.3	6.4	12.0	1.9
Never/sometimes told new partner re # partners	6.5	11.1	3.3 *	8.7	1.8
Concurrent sexual relationship	8.7	6.1	10.3	11.1	1.4
Fight w/ partner 10+ times last year	11.4	18.6	1.8	16.1	2.1

Notes: Estimates are weighted.

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.001$

[a] Sexually active respondents ages 18-35 with a positive urine assay for gonorrhea and/or chlamydia.

Table 13. Estimates of Current GC/CT Infection by Neighborhood Characteristics : 1997-98 Baltimore STD and Behavior Survey

NEIGHBORHOOD MEASUREMENT	Prevalence of current GC/CT infection [a]	
	%	p
All Neighborhoods	**8.3**	
Economic status		
Poverty		
1st quartile	10.1	
2nd quartile	2.8	
3rd quartile	14.8	
4th quartile	5.2	ns
Median household income ($)		
1st quartile	6.7	
2nd quartile	11.2	
3rd quartile	3.4	
4th quartile	10.6	ns
Average per capita income ($)		
1st quartile	7.2	
2nd quartile	8.3	
3rd quartile	7.4	
4th quartile	10.4	ns
Demographic composition		
Proportion Black		
1st quartile	5.4	
2nd quartile	3.6	
3rd quartile	14.9	
4th quartile	6.7	ns
Proportion White		
1st quartile	6.7	
2nd quartile	14.9	
3rd quartile	4.6	
4th quartile	3.6	ns
Adult Labor Market		
Male employment		
1st quartile	5.0	
2nd quartile	6.7	
3rd quartile	8.6	
4th quartile	15.5	ns
Female employment		
1st quartile	2.5	
2nd quartile	6.3	
3rd quartile	9.2	
4th quartile	14.8	0.1

NEIGHBORHOOD MEASUREMENT	Prevalence of current GC/CT infection [a]	
	%	*p*
Employed: professionals		
1st quartile	9.6	
2nd quartile	4.6	
3rd quartile	9.0	
4th quartile	11.4	ns
Educational Attainment		
Aged 25+ not HS grad		
1st quartile	10.6	
2nd quartile	11.1	
3rd quartile	6.8	
4th quartile	4.1	ns
Aged 16-19 HS dropout		
1st quartile	10.7	
2nd quartile	7.8	
3rd quartile	10.1	
4th quartile	4.2	ns
Social Welfare		
Families receiving public assistance		
1st quartile	8.4	
2nd quartile	9.0	
3rd quartile	8.2	
4th quartile	8.1	ns
Single parent families		
1st quartile	2.9	
2nd quartile	14.4	
3rd quartile	9.3	
4th quartile	6.4	0.08

Notes: ns, not significant, $p > 0.10$.

[a] Determined from urine LCR assays.

Table 14. Percent of Respondents Ever Reporting Symptoms and Within the Past 6 months by STD status:1997-98 Baltimore Health and Behavior Survey

STD infection status	% EVER reporting a symptom	% reporting symptom w/in past 6 mos
PRIOR GC/CT (N=126)	76.5	21.2
CURRENT GC/CT, no prior (N=37)	20.8	2.5
GC only, no prior (n=24)	28.1	3.9
CT only, no prior (n=16)	5.5	0.0
Never GC/CT (N=393)	34.6	13.9
TOTAL (n=556)	44.6	15.0

Note: [a] Reporting of dysuria and discharge.

Table 15. Logistic Regression Coefficients of Models of the Likelihood of Self-reported GC/CT Infection: 1997-98 Baltimore STD and Behavior Survey

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-3.43	-2.06	-3.71	-3.79	-3.64
INDIVIDUAL CHARACTERISTICS/BEHAVIORS					
Race	1.8 ***		1.38 ***	1.5 **	1.36 **
	(0.36)		(0.39)	(0.57)	(0.39)
Socioeconomic disadvantage	1.05 **		1.07 **	1.07 **	0.68
	(0.34)		(0.33)	(0.33)	(0.73)
Gender	0.22		0.22	0.22	0.22
	(0.34)		(0.36)	(0.36)	(0.36)
Multiple sex partners	0.54 *		0.61 *	0.61 *	0.63 *
	(0.31)		(0.30)	(0.30)	(0.30)
Ever been paid for sex	0.93 *		0.98 *	0.98 *	1.00 *
	(0.36)		(0.37)	(0.37)	(0.37)
Had a one-night stand	0.67 *		0.62 *	0.62 *	0.60 *
	(0.33)		(0.33)	(0.33)	(0.33)
Concurrent sexual relationship	0.11		0.11	0.11	0.12
	(0.35)		(0.37)	(0.37)	(0.37)
NEIGHBORHOOD CHARACTERISTICS					
Proportion black		1.76 ***	1.16 **	1.38	1.07
		(0.47)	(0.55)	(0.93)	(0.57)
Poverty		-0.01	-0.01	-0.01	-0.01
		(0.01)	(0.01)	(0.01)	(0.01)
INDIVIDUAL-NEIGHBORHOOD INTERACTIONS					
*Race * Proportion black*				-0.29	
				(1.05)	
*Socioec.disadvantage * Proportion black*					0.59
					(1.01)
Log-likelihood	496.84	605.68	489.82	489.73	489.43
N	515	556	515	515	515

Notes: Standard errors in parentheses.
* p < 0.1 ** p < 0.05 *** p < 0.001

Table 16. Logistic Regression Coefficients of Models of the Likelihood of Current GC/CT Infection: 1997-98 Baltimore STD and Behavior Survey

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-3.85	-2.85	-3.53	-4.16	-3.39
INDIVIDUAL CHARACTERISTICS/BEHAVIORS					
Race	1.59 **		1.57 **	2.29 **	1.56 **
	(0.73)		(0.73)	(0.92)	(0.73)
Socioeconomic disadvantage	0.78 *		0.97 **	0.96 **	0.33
	(0.46)		(0.45)	(0.45)	(1.00)
Gender	0.14		0.16	0.16	0.15
	(0.40)		(0.41)	(0.42)	(0.41)
Multiple sex partners	-0.03		-0.21	-0.22	-0.15
	(0.53)		(0.46)	(0.46)	(0.48)
Ever been paid for sex	0.30		0.38	0.37	0.41
	(0.53)		(0.55)	(0.55)	(0.56)
Had a one-night stand	-0.76 *		-0.69	-0.69	-0.74
	(0.46)		(0.49)	(0.50)	(0.51)
Concurrent sexual relationship	0.41		0.43	0.44	0.42
	(0.48)		(0.47)	(0.47)	(0.47)
NEIGHBORHOOD CHARACTERISTICS					
Proportion black		1.72 **	0.65	0.59	0.65
		(0.78)	(0.79)	(0.78)	(0.79)
Poverty		-0.04	-0.04 *	0.01	-0.05
		(0.02)	(0.02)	(0.03)	(0.03)
INDIVIDUAL-NEIGHBORHOOD INTERACTIONS					
*Race * poverty*				-0.05	
				(0.03)	
*Socioec.disadvantage * poverty*					0.03
					(0.04)
Log-likelihood	250.41	309.47	245.72	245.04	244.94
N	517	560	517	517	517

Notes: Standard errors in parentheses.
* p < 0.1 ** p < 0.05 *** p < 0.001

Table 17. Random intercept models: Self-reported GC/CT infection by neighborhood characteristics: 1997-98 Baltimore STD and Behavior Survey

Fixed Effect	Coefficient	s.e	t-ratio	p
Model 1				
Neighborhood mean log odds of GC/CT	-1.277	0.141	-9.077	0.000
Proportion black	0.015	0.004	3.994	0.001
Model 2				
Neighborhood mean log odds of GC/CT	-1.276	0.144	-8.827	0.000
Proportion black	0.015	0.004	3.819	0.001
Per capita income	0.000	0.000	0.022	0.983
Model 3				
Neighborhood mean log odds of GC/CT	-1.250	0.166	-7.539	0.000
Poverty	0.031	0.016	1.894	0.070
Model 4				
Neighborhood mean log odds of GC/CT	-1.283	0.144	-8.894	0.000
Proportion black	0.015	0.005	3.207	0.004
Poverty	0.006	0.016	0.377	0.709
Model 5				
Neighborhood mean log odds of GC/CT	-1.282	0.145	-8.837	0.000
Proportion black	0.014	0.005	2.857	0.010
Single-parent households	0.004	0.013	0.277	0.784
Model 6				
Neighborhood mean log odds of GC/CT	-1.303	0.130	-10.026	0.000
Proportion black	0.015	0.005	3.106	0.006
Employed professionals	-0.016	0.016	-0.957	0.350
Families receiving public assistance	-0.005	0.020	-0.243	0.811
Model 7				
Neighborhood mean log odds of GC/CT	-1.277	0.143	-8.616	0.000
Proportion black	0.015	0.005	3.014	0.007
Poverty	0.017	0.041	0.418	0.680
Families receiving public assistance	-0.014	0.047	-0.298	0.769

Notes: Individual models test the effects of neighborhood characteristics on the mean log odds of self-reported GC/CT infection. No level-1 predictors are included in these models.

Table 18. Random coefficient logistic regression model: self-reported GC/CT infection by individual characteristics: 1997-98 Baltimore STD and Behavior Survey

Fixed Effect	Coefficient	se	t ratio	p
Neighborhood mean log odds of GC/CT	-1.258	0.184	-6.84	0
Race	1.100	0.269	4.09	0.001
Gender	0.508	0.275	1.85	0.076
Socioeconomic disadvantage	0.815	0.293	2.79	0.011
Multiple partners	0.842	0.233	3.62	0.002

Random Effect	Variance component	df	X^2	p
Mean log odds of GC/CT	0.583	19	47.818	<.001
Race	0.011	19	7.643	ns
Gender	0.671	19	29.204	ns
Socioeconomic disadvantage	0.336	19	22.284	ns
Multiple partners	0.284	19	15.729	ns

Reliability of coefficient estimates	
Mean log odds of GC/CT	0.700
Race	0.006
Gender	0.343
Socioeconomic disadvantage	0.145
Multiple partners	0.193

Note: This model tests the hypotheses that: 1) the mean log odds of self-reported infection varies across neighborhoods and 2) the effects of individual characteristics (race, gender, socioeconomic disadvantage, and having multiple sexual partners) on the mean log odds of self-reported infection differ by neighborhood.

Table 19. Estimated effects of neighborhood racial composition and poverty on the relationship between individual characteristics and self-reported GC/CT infection: 1997-98 Baltimore STD and Behavior Survey

Fixed Effect	Coefficient	se	t ratio	p
Neighborhood mean log odds of GC/CT				
Grand mean	-1.417	0.151	-9.42	0.000
Poverty	0.009	0.016	0.57	0.572
Proportion black	0.016	0.005	3.47	0.003
Race				
Mean	1.109	0.319	3.47	0.002
Poverty	0.017	0.037	0.47	0.645
Proportion black	-0.012	0.011	-1.09	0.287
Gender				
Mean	0.594	0.318	1.87	0.075
Poverty	-0.023	0.036	-0.63	0.537
Proportion black	0.004	0.010	0.38	0.710
Socioeconomic disadvantage				
Mean	1.068	0.340	3.14	0.005
Poverty	-0.044	0.036	-1.24	0.229
Proportion black	0.009	0.010	0.91	0.375
Multiple partners				
Mean	1.084	0.266	4.01	0.001
Poverty	-0.039	0.029	-1.32	0.201
Proportion black	-0.002	0.008	-0.19	0.854

Random Effect	Variance component	df	X^2	p
Mean log odds of GC/CT	0.234	17	30.77	0.021
Race	0.031	17	6.63	ns
Gender	1.040	17	26.92	0.059
Socioeconomic disadvantage	0.435	17	18.72	0.344
Multiple partners	0.451	17	11.68	ns

Note: This model tests the hypothesis that neighborhood poverty and the proportion of black residents differentially effect the relationship between individual characteristics and self-reported GC/CT infection within neighborhoods.

Table 20. Random coefficient logistic regression model: current GC/CT infection by individual characteristics: 1997-98 Baltimore STD and Behavior Survey

Fixed Effect	Coefficient	se	t ratio	*p*
Neighborhood mean log odds of GC/CT	-2.312	0.188	-12.31	0
Race	0.960	0.344	2.79	0.011
Gender	-0.175	0.264	-0.07	0.948
Socioeconomic disadvantage	0.735	0.352	2.09	0.047
Random Effect	**Variance component**	**df**	**X^2**	***p***
Mean log odds of GC/CT	0.452	19	33.06	0.023
Race	0.125	19	23.24	0.226
Gender	0.040	19	9.37	>.5
Socioeconomic disadvantage	0.550	19	8.47	>.5
Reliability of coefficient estimates				
Mean log odds of GC/CT	0.373			
Race	0.028			
Gender	0.014			
Socioeconomic disadvantage	0.116			

Note: This model tests the hypotheses that: 1) the mean log odds of current infection varies across neighborhoods and 2) the effects of individual characteristics (race, gender, and socioeconomic disadvantage) on the mean log odds of current infection differ by neighborhood.

Table 21. Estimated effects of neighborhood racial composition and poverty on the relationship between individual characteristics and current GC/CT infection: 1997-98 Baltimore STD and Behavior Survey

Fixed Effect	Coefficient	se	t ratio	p
Neighborhood mean log odds of GC/CT				
Grand mean	-2.365	0.199	-11.83	0.000
Poverty	-0.011	0.023	-0.47	0.643
Proportion black	0.007	0.006	1.12	0.277
Race				
Mean	1.420	0.511	2.78	0.011
Poverty	-0.033	0.052	-0.64	0.530
Proportion black	0.021	0.017	1.18	0.253
Gender				
Mean	-0.014	0.269	-0.05	0.960
Poverty	-0.008	0.032	-0.26	0.795
Proportion black	0.007	0.008	0.84	0.413
Socioeconomic disadvantage				
Mean	0.544	0.379	1.44	0.165
Poverty	0.052	0.040	1.30	0.206
Proportion black	-0.007	0.011	-0.62	0.540

Random Effect	Variance component	df	X^2	p
Mean log odds of GC/CT	0.518	17	62.18	<.001
Race	0.078	17	90.29	<.001
Gender	0.051	17	8.47	>.5
Socioeconomic disadvantage	0.443	17	7.84	>.5

Note: This model tests the hypothesis that neighborhood poverty and the proportion of black residents differentially effect the relationship between individual characteristics and current GC/CT infection within neighborhoods.

Estimated rates of gonorrhea and chlamydia, Baltimore City 1993-1997

Figure 1. Gonorrhea

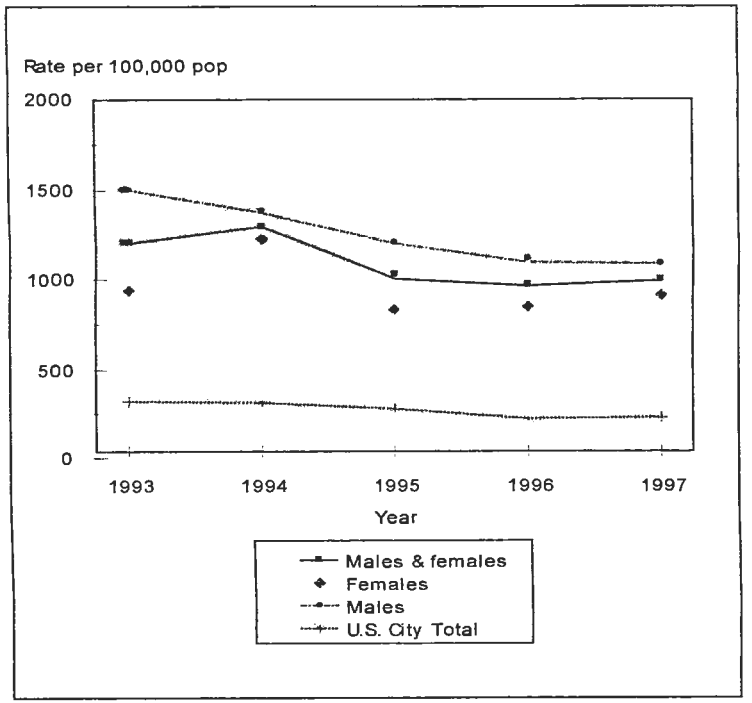
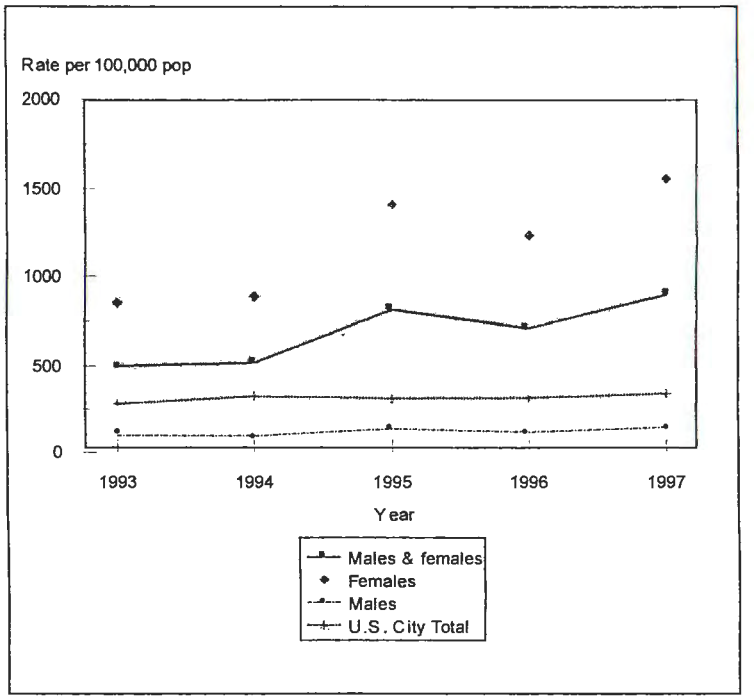


Figure 2. Chlamydia



Source: CDC STD Surveillance (1998).
***Note*:** U.S. city total reflects selected cities of >200,000 population.

Figure 3. Theoretical Model of Risk of Acquiring an STD Integrating Individual Behavioral and Community-level Characteristics

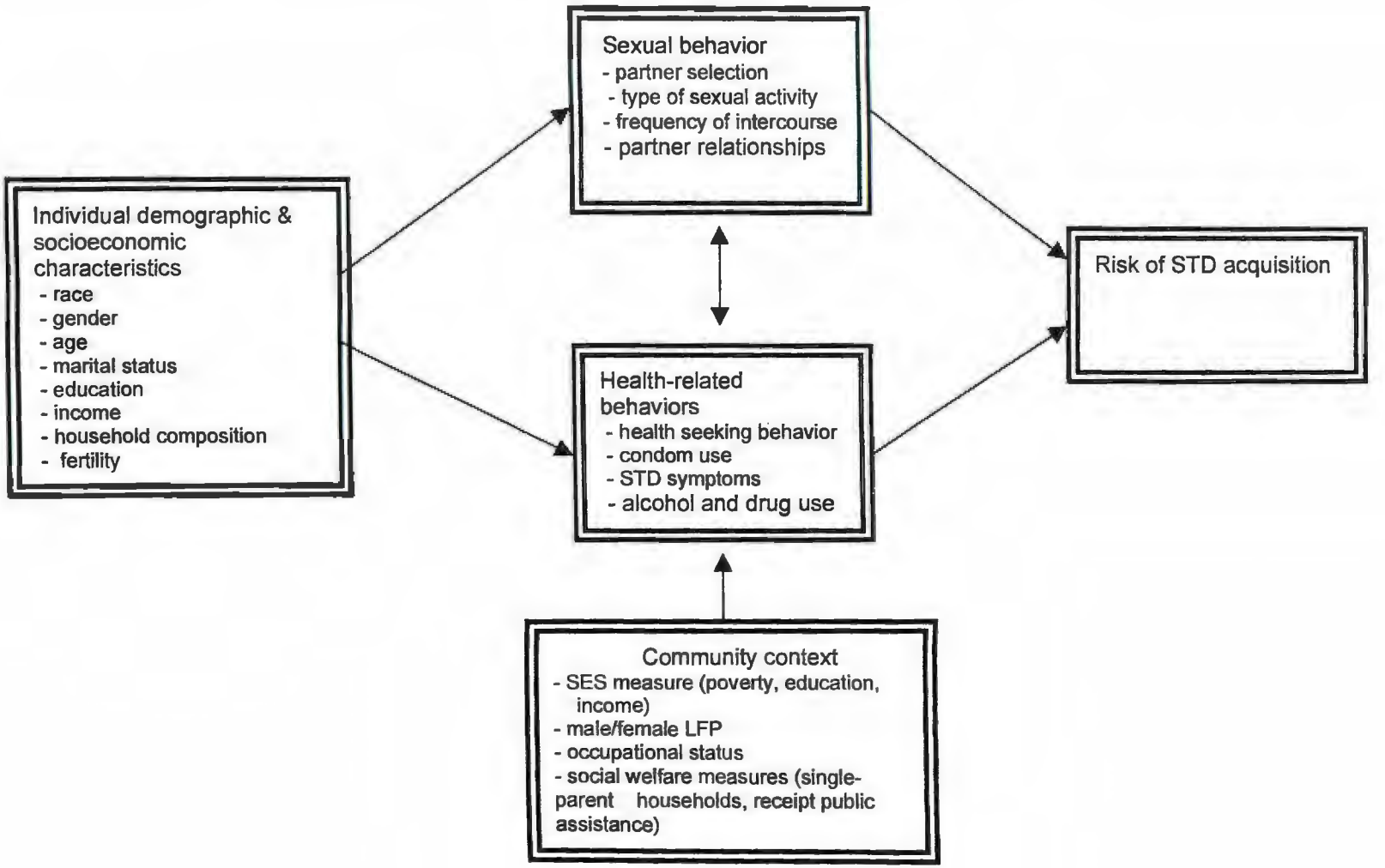
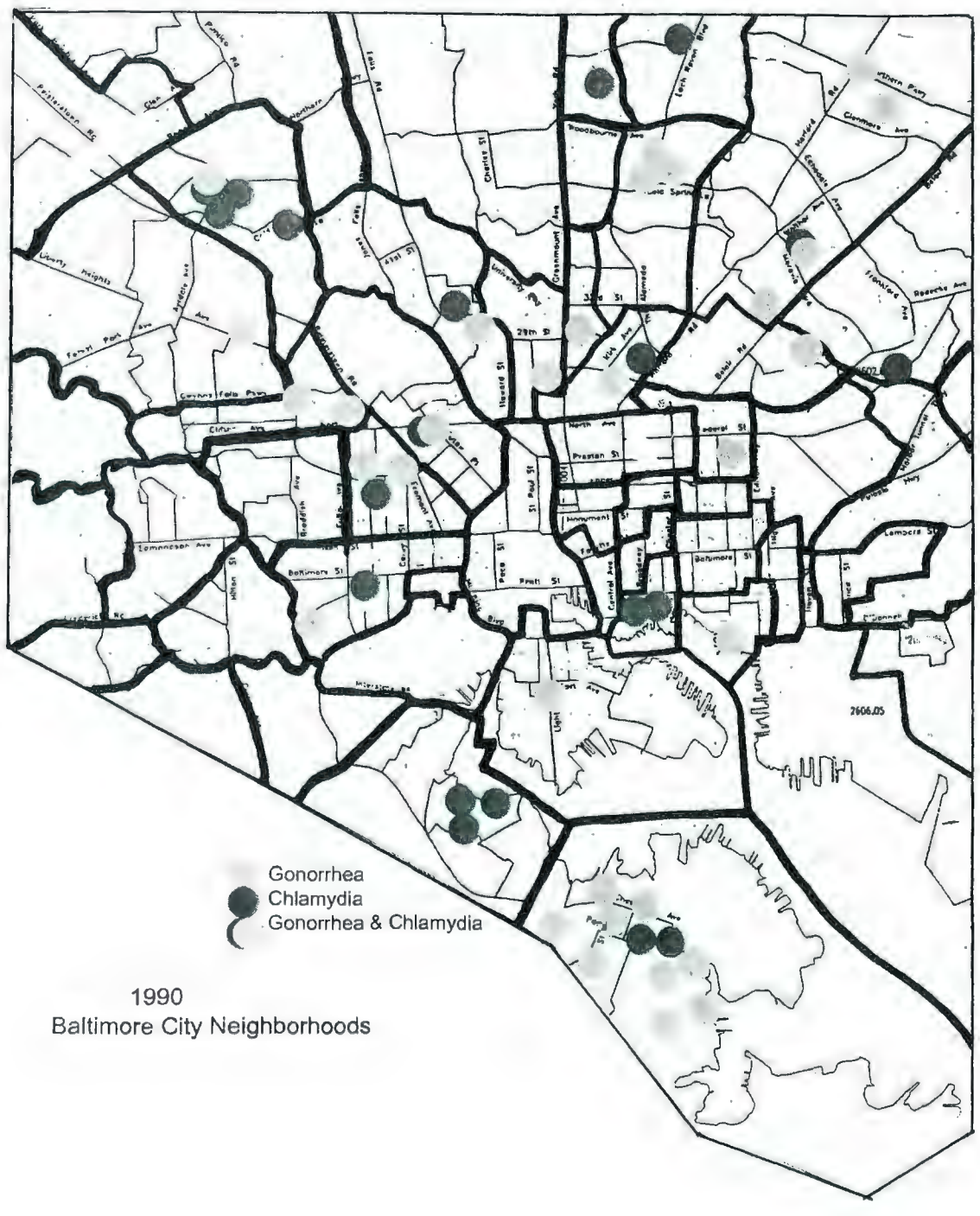


Figure 4. Geographic Location of Current Gonorrhea and Chlamydial Infection as Determined from Urine LCR Assays: 1997-98 Baltimore STD and Behavior Survey



Appendix Table 1: Means and Standard Deviations of Independent Variables used in Multivariate Analyses

Variable	Variable definition	Mean	(S.D.)
LEVEL-1	INDIVIDUAL DEMOGRAPHIC CHARACTERISTICS		
Race	1=Black	**0.65**	(0.48)
Gender	1=Female	**0.52**	(0.50)
Age	Reported age in completed years	**27.15**	(5.30)
Marital Status			
Married/cohab	Currently married or cohabitating	**0.38**	(0.48)
W/D/S	Widowed/divorced/separated	**0.10**	(0.30)
Never married	Never married	**0.53**	(0.50)
Socioeconomic disadvantage	1= did not complete HS and family income < $20,000	**0.14**	(0.35)
	BEHAVIORAL CHARACTERISTICS		
6+ lifetime partners	1 = 6 or more lifetime sexual partners	**0.52**	(0.50)
11+ lifetime partners	1 = 11 or more lifetime sexual partners	**0.30**	(0.46)
2+ new partners last year	1 = 2 or more new sex partners during the past 12 months	**0.31**	(0.46)
Multiple sex partners	1 = 6 or more lifetime partners OR 2 or more new partners last year	**0.59**	(0.49)
Multiple partners & new partners	1 = 6 or more lifetime partners OR 2 or more new partners last year AND 1+ new partners last year	**0.30**	(0.46)
Anal sex within past 6 months	1 = Insertive or receptive anal sex within the past 6 months	**0.12**	(0.33)
One-night stand	1 = Ever had sex with a total stranger	**0.42**	(0.49)
Forced sex	1 = Ever been forced or forced someone to have sex against their will	**0.26**	(0.44)
Sex with a prostitute	1 = Ever had sex with a prostitute or someone they paid for sex	**0.16**	(0.37)
Been paid for sex	1 = Ever been paid by someone for sex	**0.11**	(0.31)
Any STD symptom	1 = Ever dysuria or discharge	**0.43**	(0.49)
Main partner ever had an STD	1 = Main sex partner ever had any STD, such as herpes, GC, or syphilis	**0.08**	(0.27)
Avoided sex to prevent infection	1 = Ever avoided sex to prevent the possibility of disease or infection	**0.37**	(0.48)
Concurrent sexual relationships	1 = Had other sex partners during the most recent time married or living together with a partner in a committed relationship	**0.17**	(0.37)
LEVEL-2	NEIGHBORHOOD CHARACTERISTICS		
Poverty	Percent families in poverty as defined by 1989 poverty thresholds, by size and age of household (see text)	**0.19**	(0.10)
Per capita income	Average individual income, 1989, ($000s)	**16.76**	(13.70)
Proportion black	Percent of population that is black	**0.49**	(0.37)
Males in labor force	Percent of males age 16 and over employed or looking for or available for employment	**0.69**	(0.06)
Females in labor force	Percent females age 16 and over employed or looking for or available for employment	**0.54**	(0.07)
Professionals	Percent of adults age 16 and over employed in a professional occupation	**0.24**	(0.12)
Non-HS graduates	Percent of adults age 25 and over who did not graduate from high school	**0.42**	(0.13)
Single parent households	Percent of households occupied by a single adult and one or more related individuals	**0.31**	(0.14)
Families receiving public assistance	Percent of households receiving public assistance	**0.16**	(0.10)

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