Understanding Concurrent Sexual Partnerships among US Men:

Examining Relationship Characteristics and Racial Differences

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ABSTRACT

EBONI MONIQUE TAYLOR: Understanding Concurrent Sexual Partnerships
among US Men: Relationship Characteristics and Racial Differences
(Under the direction of Frieda M. Behets, PhD, MPH)

Racial and ethnic minorities continue to be disproportionately affected by sexually transmitted infections (STIs), including Human Immunodeficiency Virus (HIV), in the United States. Concurrent sexual partnerships, those that overlap in time, have been associated with increased STI prevalence and increase the spread of infection through a network. Different patterns of concurrent partnerships may be associated with varying STI risk depending on the partnership type (primary vs. non-primary) and the likelihood of condom use with each concurrent partner. One pattern potentially associated with high STI risk involves concurrency in the context of a co-parenting relationship, one in which a man and woman are the joint biological parents of a child.

We examined the relationship between co-parenting and concurrency using data from 4,928 male respondents age 15-44 in the National Survey of Family Growth Cycle 6. Among men engaging in concurrency in the past 12 months, 18% included a co-parent as at least one of the concurrent sex partners. One third of black men involved in co-parenting concurrency were <25 years, compared to 23% of Hispanics and 6% of whites. Young black men (age 15-24) were more likely to engage in co-parenting concurrency than white men, adjusting for socio-demographic characteristics, sexual and other high-risk behaviors, and relationship

quality. The largest racial differences in co-parenting concurrency prevalence were observed among men age 15-24.

In the second aim, concurrent partnerships were further classified based on pattern of overlap. Compared to men engaging in non-co-parenting concurrency, men engaging in co-parenting concurrency were more likely to report inconsistent condom use during the last month and less likely to have used a condom with either concurrent partner at last sexual intercourse in bivariable analyses. In multivariable analyses, concurrency duration was longer for men engaging in co-parenting concurrency than for men engaging in non-co-parenting concurrency, but there were no differences in STI preventive/protective behaviors.

These findings show that co-parenting concurrency is more common among young black and Hispanic men and suggest that concurrency involving co-parents could be associated with a high risk of STI transmission. A comprehensive understanding of the types of concurrent sexual partnerships and the contexts in which they occur is necessary.

I dedicate this dissertation research to the memory of my
grandmother --Frances F. Taylor.

To Jazmyne, Anija, and Imani. Anything is possible with hard work and a little faith.
Don't ever let anyone tell you differently.

To my mom -- Sylvia B. Holloway-- the loudest and best cheerleader on my squad.

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ABBREVIATIONS

ACASI   Audio computer-assisted self-interviewing

AIDS   Acquired immune deficiency syndrome

CAPI   Computer-assisted personal interviewing

CDC   Centers for disease control and prevention

CI   Confidence interval

FFCWB   Fragile families and child wellbeing

GEE   Generalized estimating equation

HIV   Human immunodeficiency virus

MSM   Men who have sex with men

NSFG   National survey of family growth

NSFG 2002   Cycle 6, National survey of family growth

PR   Prevalence ratio

STI   Sexually transmitted infection

UNAIDS   Joint United Nations Programme on HIV/AIDS

US   United States

CHAPTER ONE: OVERVIEW

Racial and ethnic minorities in the United States (US) continue to be disproportionately affected by sexually transmitted infections (STIs), including Human Immunodeficiency Virus (HIV). People of color bear the highest burden and have the highest infection rates compared to other racial/ethnic groups. Sexual network dynamics have been identified as a potential explanation for racial/ethnic disparities in STI rates (1-3). Individual and social factors leading to unstable relationships among racial/ethnic minorities promote sexual network and partnership patterns, such as engaging in concurrent sexual partnerships.

Concurrent sexual partnerships are those that overlap in time. Compared to serially monogamous relationships, the time between STI acquisition and subsequent exposure is decreased in concurrent (4, 5). Concurrency also removes the protective effect of sequence present in serial monogamy because earlier partners are put at risk of acquiring STIs from subsequent partners (4, 5). As a result, concurrency permits the spread of infection through a sexual network faster than in a network in which partnerships are sequential (2, 6-8).

Black men and women have been found to report higher rates of concurrent sexual partnerships, suggesting that concurrency contributes to the higher rates of STIs among this group (6, 9-11). Qualitative analyses have revealed different patterns of concurrent partnerships that, due to their nature and context, may be associated with varying STI risk (12). One of the patterns included concurrency in the context of a co-parenting relationship, a

partnership in where the man and woman are the biological parents of at least one child. This form of concurrency involves sexual activity with a co-parent while in a different main partnership (12).

The prevalence and correlates of concurrent sexual partnerships have been estimated in several high-risk populations and in a nationally representative sample of US adults. Relatively little research has been done to describe the features of concurrent sexual partnerships. Social determinants of concurrency are likely to be a combination of factors including low marriage rates, economic factors, and community and cultural norms. Co-parenting relationships may comprise a portion of the background in which concurrency occurs among blacks in the US. Concurrent sexual partnerships are strongly associated with single marital status (6, 8, 10, 13), and a large proportion of births outside marriage occur to blacks (14-19). Thus, it is possible that the co-parenting relationship, particularly among unmarried black men, could impact the formation and persistence of concurrent sexual partnerships.

The goal of this research is to quantitatively explore the association between co-parenting relationships and concurrent sexual partnerships. Using a large, nationally representative survey of **US men, aged 15 through 44** – the National Survey of Family Growth Cycle 6 (NSFG 2002) –the following aims will be addressed:

1.1.   Aim 1
Specific Aim 1. Examine the prevalence and correlates of co-parenting concurrency among men in the United States by racial/ethnic group.

Hypothesis for Aim 1. Black men will be more likely to engage in co-parenting concurrency than will White and Hispanic men.

1.2. Aim 2

Specific Aim 2. Examine the association of co-parenting with concurrency duration.

Hypothesis for Aim 2. The duration of overlap among men who experience concurrency in co-parenting relationships will be longer compared to the duration of overlap among men who experience concurrency but not as a part of a co-parenting relationship.

1.3. Aim 3

Specific Aim 3. Examine differences in STI/HIV preventive/protective behaviors among men engaging in co-parenting concurrency compared to men engaging in non-co-parenting concurrency.

Hypothesis for Aim 3. Men engaging in co-parenting concurrency will be less likely to use STI/HIV preventive/protective measures compared to men engaging in other types of concurrency.

The proposed study expands the current body of concurrency research. Understanding the context in which different types of concurrent partnerships occur could provide further insight into the persistence of racial/ethnic disparities in STI rates and will provide a foundation on which to develop future research and build STI prevention messages and programs.

CHAPTER TWO: BACKGROUND AND SIGNIFICANCE

2.1.   The Epidemiology of STIs in the United States

Sexually transmitted infections (STIs) remain a significant public health problem with an estimated 19 million new infections occurring in the United States each year (20). The nationwide problem of STIs persists despite their preventable nature of STIs and progress in prevention, diagnosis, and treatment (20, 21). STIs include syphilis, gonorrhea, chlamydial infection, and human immunodeficiency virus/acquired immunodeficiency virus (HIV/AIDS) (21), and US rates for these diseases in the United States exceed those in all other countries in the industrialized world including countries in western and northern Europe, Canada, Japan, and Australia (21). These behavior-linked diseases result primarily from unprotected sexual encounters and may cause many harmful, often irreversible, and costly clinical complications (21, 22).

STIs continue to rank high among the most common reportable diseases in the United States and accounted for five of the top 10 infections reported by state health departments to the Centers for Disease Control and Prevention (CDC) (23). STIs also contribute economic strain in the United States. Nationwide, an estimated $17 billion annually is spent on the direct and indirect costs of diagnosing and treating STIs and their complications (22, 24).

There are marked racial/ethnic and gender disparities in STI rates for chlamydial infection, gonorrhea, syphilis, and HIV/AIDS. With the exception of Asian/Pacific Islanders,

rates of chlamydial and gonococcal infection increased during 2005 to 2006 in all racial and ethnic groups, while syphilis rates increased only among African Americans (25). African Americans comprise 12% of the population, yet in 2007, 48% of all chlamydia cases and 70% of all gonorrhea cases occurred among African Americans (26). Race-specific rates of chlamydial infection, gonorrhea, and syphilis are presented in Table 2.1. Overall, the rate of chlamydial infection among African Americans was more than eight times that for US whites.

The racial/ethnic disparity in chlamydial infection rates was also present across gender. The rate of chlamydial infection among African American women was more than seven times higher than the rate among white women (1,906.0 and 249.3 per 100,000 population, respectively), and the chlamydial infection rate among African American men was more than 11 times higher than that among white men (841.3 and 71.9 per 100,000 population, respectively) (26). During 2002 and 2006, gonorrhea rates decreased among African Americans and Asian/Pacific Islanders while increasing among American Indian/Alaska Natives, whites, and Hispanics (26). Despite these fluctuating trends, the overall rate of gonorrhea among African Americans in the United States was 18 times greater than that among whites (25, 26).

Gender disparities similar to those observed for chlamydial infection rates exist for gonorrhea. The 2006 gonorrhea rate among African American men was 25 times higher than that among white men; the gonorrhea rate among African American women was 14 times higher than that among white women (25). In 2006, the primary and secondary syphilis rate among African American men was more than five times higher than that among white men;

the rate among African American women was more than 16 times higher than that for white women (25).

A majority of HIV transmission research has focused on studying high risk populations including intravenous drug users, commercial sex workers, and men who have sex with men (MSM). Much less attention has focused on groups with the fastest growing HIV rates: African Americans and women acquiring HIV via heterosexual transmission (27). AIDS is the leading cause of death among African American women aged 25-34 years, living in the United States (28), and the rate of AIDS diagnoses for African American women was nearly 24 times the rate for white women (29). As a result, racial and ethnic minorities continue to be disproportionately affected by the HIV/AIDS epidemic in the United States (30). Highlighting racial/ethnic and gender disparities in STI rates is just one step in the process of increasing awareness of this problem among affected communities and the population in general and developing solutions to reduce their spread in the future (25).

TABLE 2.1 Chlamydial infection, gonorrhea, and primary and secondary syphilis – Rates per 100,000 population by race/ethnicity and sex: United States, 2007 (30)

		Chlamydial Infection	Gonorrhea	Primary and Secondary Syphilis
White, non-Hispanic	Total	162.3	34.7	2.0
	Male	71.9	26.6	3.7
	Female	249.3	42.6	0.4
Black, non-Hispanic	Total	1,398.7	662.9	14
	Male	841.3	694.6	23.2
	Female	1,906.0	634	5.6
Hispanic	Total	473.2	69.2	4.3
	Male	211.7	64.3	7.5
	Female	753.3	74.5	0.8
Asian/Pacific Islander	Total	139.5	18.8	1.2
	Male	66.3	17.9	2.4
	Female	208.8	19.7	0.1
American Indian/ Alaska Native	Total	732.9	107.1	3.4
	Male	293.8	69.5	4.3
	Female	1,158.2	143.4	2.6

(Source: Centers for Disease Control and Prevention 2007)

2.2. Social and Sexual Networks in STI Transmission

Understanding the role social and sexual networks play in the transmission of sexually transmitted infections could provide some insight into why racial/ethnic disparities in STI rates exist. Sexual networks are shaped by social networks and are vital to understanding the spread of STIs. These networks determine the degree to which sexually transmitted infections are disseminated throughout populations (31). Social, economic, and physical environments are fundamental determinants of population level health and these factors help shape patterns of exposure to STIs (9). Societal determinants of sexual networks, including social norms and physical spaces, impact the availability of sex partners and influence partnership choices and, as a result, affect the extent to which STIs spread (31).

Most modern epidemiologic methodological approaches assess the association between individual attributes and disease occurrence. Though the use of these models have substantially advanced knowledge about the epidemiology of STIs, they do not account for the complex patterns and structures of intimate contacts required for STI transmission (32, 33) and fail to recognize two fundamental network aspects of STI dynamics: 1) the potential for partner behavior to influence an individual's STI risk and 2) how sexual networks can bridge between socially distinct subpopulations (1). Mathematical models and social network analysis examine and predict STI transmission within and across different groups of people (34, 35). These tools have revealed that social and sexual network structure has consequences for the individuals that comprise them as well as for the network as a whole (35).

Highly dissortative and segregated partner choices (both within and between different racial/ethnic groups) are sexual network patterns that have been used to explain higher rates of STI infection among African Americans compared to other racial/ethnic groups (1, 36). Social and network analyses have been conducted to examine STI transmission within different groups. Based on these studies, researchers hypothesized that disparate STI rates are perpetuated by control programs which concentrate the reservoir of infection within marginalized, hard-to-reach subpopulations that have limited contact with the healthcare system (37). To significantly reduce the occurrence of STIs among African Americans and decrease the disparities, researchers must focus beyond individual factors and examine the relationship between socioeconomic context and sexual networks (2).

2.3.   Concurrent Sexual Partnerships

Increasing recognition of the importance of sexual networks in STI epidemiology has highlighted concurrent sexual partnerships as a means of explaining how STIs, including HIV, spread through a population. The spread of STIs throughout a population depends on the patterns of sexual contacts within the population (38). Concurrent sexual partnerships, those that overlap in time, are an important characteristic of sexual networks. In concurrent partnerships, at least one of the members has other subsequent sexual partners, with repeated sexual activity with the original partner (12). Compared to serial monogamy, in which one partnership ends before the next partnership begins, concurrent sexual partnerships are characterized by having less time between the end of one partnership and the beginning of another (38). Although the rate of partner acquisition may be similar in concurrent compared to serially monogamous partnerships, the overlap of sexual partnerships over time can substantially impact STI transmission (38).

Mathematical models of infectious disease transmission have been instrumental in demonstrating how concurrent partnerships could influence the spread of STIs. Watts and May (39) developed a deterministic model that accounted for partnership duration and overlap and demonstrated that the rate of spread of infection in populations with overlapping partnerships is faster than in the absence of concurrency (39). Other stochastic models extended the concept introduced by Watts and May to show that epidemic spread depends both on the number of partners an individual accumulates over time and whether those partnerships exist simultaneously or sequentially in time (38). Kretzchmar's model, for example, indicated that over 5 years, the number infected when half of the partnerships were concurrent reached 10 times the number reached under sequential monogamy, suggesting

that concurrency impacts the rate of spread and the total number of individuals within a population who acquire an STI (5, 38, 40).

Not all researchers accept the theory that concurrent sexual partnerships play a substantial role in the dissemination of STIs throughout populations. While some researchers suggest that concurrency can increase the size of an epidemic and the speed at which it infects a population (2, 5, 41), others argue that empirical evidence is lacking and that concurrency should not be the target of prevention methods (42, 43). Those who oppose developing interventions to reduce concurrency believe that more research should be conducted due to weak associations and contradicting study results (44). The counter argument is that methodological limitations should not prohibit research and intervention development (44).

A wide range of concurrency prevalences have been estimated among population subgroups and for the general population in different regions of the United States and the world. Sub-Saharan Africa accounts for three percent of the global population yet, in 2007, accounted for 68% of new HIV cases 76% of AIDS deaths worldwide (45). Though the numbers are not nearly as high overall for the United States, the HIV/AIDS epidemic in some populations, specifically among blacks, mimics that seen in some developing nations (46). High rates of sex partner acquisition, sexual behaviors of certain core groups, lack of male circumcision, and the presence of other STIs have been given as potential explanations for differences in the timing and intensity of HIV epidemics across the globe (5).

Differences in the prevalence of concurrent partnerships in specific regions have also been estimated. One-year concurrency prevalence in sub-Saharan African countries ranges from 36% to 55% and are among the highest for developing countries (41). Additionally,

13% of young people in South Africa reported concurrency during their last sexual partnership (47). In the United States, published estimates of the prevalence of concurrent partnerships range from 20% to 54% over 6 months among adolescents (48-50) and 11% to 40% over one year among adults (6, 8, 10, 51).

Several demographic and behavioral factors are associated with concurrency prevalence. The prevalence of concurrency is usually higher for men than for women (6, 8, 10, 48, 52-54). Among blacks in the rural south, both the 1- and 5-year concurrency prevalence estimates were higher for men than for women [1-year concurrency prevalence: men 40% (95% CI: 29%-51%); women 19% (95% CI: 13-25%); 5-year concurrency prevalence: men 53% (95% CI: 41-64%); women 31% (95% CI: 24-39)%] (8).

The prevalence of concurrency also differs by race/ethnicity. Among women in the United States, the concurrency prevalence was highest among black women (21%), lowest among Asian American and Pacific Islanders (6%) and Hispanics (8%), and intermediate among whites (11%) (10). Even among women reporting the same number of sexual partners over the 5 year period, concurrency prevalence for black women was considerably higher than for the other ethnic groups (10). For men, concurrency was three and two times as likely for non-Hispanic black and Hispanic men, respectively, compared to non-Hispanic white men (6). Black men who have sex with men (MSM) had three times the odds of engaging in concurrency than non-black MSM, despite having fewer overall sexual partners (55).

The higher concurrency prevalence observed among black and Hispanic men likely is a contributing factor to the high rates of heterosexually transmitted HIV infection among non-Hispanic black and Hispanic women in the United States (6). Marital status has also been associated with concurrency for both men and women with unmarried individuals being

much more likely to engage in concurrent partnerships than those who are married (6, 10). Among Hispanic women concurrency was associated with an increased likelihood of human papillomavirus strains that increase the risk of cervical cancer. However, concurrency was associated with a decreased likelihood of high-risk human papillomavirus among black women (56). Behavioral factors like substance abuse and history of incarceration are other factors that have been associated with engaging in concurrent sexual partnerships (6, 8, 57). These findings suggest that population demography along with social and structural contexts are needed to better understand and assess concurrency (54).

A population-based sample of young adult men and women residing in census tracks with high STI rates, showed that the socio-demographic factors generally thought to be associated with STI risk (i.e. age, race, socioeconomic status, and education) did not predict individual concurrency (54). Substance abuse and history of incarceration are markers of structural context and have been associated with engaging in concurrent sexual partnerships (6, 8, 57). These findings suggest that population demography and social and structural contexts merit further research to better understand social determinants of concurrency (54). However, at the individual level, concurrency puts one's partner at higher risk for acquiring STIs (58). The impact of concurrency on the individual is the increased risk for transmitting infection (58).

Concurrency has been variably defined and measured in the literature making the comparison of reported concurrency prevalence across studies difficult. Until recently, there was no consensus concurrency definition or universally accepted measurement method (41). The most common methods used to assess concurrency include: a direct method in which individuals are specifically asked whether they had two or more sexual partnerships during a

specified period of time (54, 59-61), an indirect method that involves constructing concurrency by gathering information about the start and end dates of sexual partnerships (6, 8, 10, 33, 61, 62), and asking individuals to keep coital diaries (63).

The Joint United Nations Programme on HIV/AIDS (UNAIDS) reference group on estimates, modeling, and projections recently convened to establish a standard definition of concurrent sexual partnerships and recommend methods for measuring concurrency in a population (4). The proposed definition, "overlapping sexual partnerships where sexual intercourse with one partner occurs between two acts of intercourse with another partner (4)," is similar to definitions currently used in the concurrency literature. The Reference Group recommends using the point prevalence, which is defined as the proportion of the population having more than one ongoing sexual partnership at a time, as the main indicator for concurrency. The point prevalence of concurrency gives a picture or the proportion of the population maintaining ongoing concurrency but does not distinguish between different concurrency types (4). The UNAIDS Reference Group also recommended the cumulative prevalence of concurrent partnerships for studies examining different configurations of and reasons for concurrency. The cumulative prevalence is constructed based on overlapping relationships during the past year and gives a more complete picture of concurrency (4).

Qualitative data has provided a nuanced picture of concurrency. In-depth qualitative interviews with 131 men and women about sexual partnerships identified six main types of concurrent partnerships (experimental, separational, transitional, reciprocal, reactive, and compensatory) and several notable types (group sex, co-parenting, and survival sex), each of which is potentially associated with a different STI risk (Table 2.2) (12). The different types of concurrency were characterized by the contexts in which the partnerships occurred, and

the associated STI risk was determined by considering the type of partnership as well as the

likelihood of condom use with each partner.

TABLE 2.2. Concurrency Types and Proposed STI Risk [9]

Concurrency Pattern	Description	STI Risk[*]
Experimental	Sexual relationships with more than one partner for short periods of time, ranging from one or two nights to up to a few months with each partner; none of the partnerships are intimate and most are new partners	Low
Separational	Multiple sexual partnerships developing during physical separations from a main partner (e.g., by geography, jail, boats, or college)	Medium
Transitional	Occurs when individuals are transitioning between two main partners; not fully terminating one partnership until another is clearly established	High
Reciprocal	Occurs when both partners agree to an "open partnership"	Medium
Reactive	A type of mutual non-monogamy that arises when one member of an ongoing partnership finds another partner and the other member responds in turn	High
Compensatory	One partnership member may have other partners to compensate for perceived deficiencies in the main partnership, and hide the infidelity from the main partner.	High
Group Sex	Similar to experimental concurrency but consists of sexual activity with more than one partner on the same occasion	High
Co-parenting	Sexual activity with a co-parent, often while in a different main partnership	High
Survival Sex	Involves one main partnership, or many short-term partnerships (some involving sexual activity more than once) but exchanged sex for either money or drugs, including both crack cocaine and injectable drugs such as heroin	High

*Represents the effect of condom use if STIs are present; based on conclusions drawn from qualitative interviews; STI=Sexually Transmitted Infection

Another qualitative study aimed to inform public health interventions by asking black, heterosexual men to share their thoughts about concurrency (53). In this study, men were asked specifically if: 1) they thought men should restrict themselves to one sexual partner, 2) they thought women should restrict themselves to one sexual partner, and 3) their relationship would change if they found out their partner had other sexual partners. The men in the study indicated that they often had concurrent partnerships and believed this behavior to be normative (53). Some of the men also voiced a sexual double standard indicating that sexual activity was more acceptable for men than women, thus women should not have multiple partners (53). Furthermore, most of the men described negative consequences of concurrency as they related to themselves (i.e. guilt), but few mentioned the negative

consequences to their female partners. Men in the study also reported that, despite having concurrent partnerships themselves, they would end their current relationship if they discovered their partner had other partners (53).

These two qualitative studies highlight how much about the determinants and implications of concurrency is still unknown. For women, concurrency could represent a sexual strategy to help meet emotional or economic needs; while for men it could reflect a perceived social norm or a belief that concurrency equates to masculinity (12, 53). Lacking is an understanding of the range of social, economic and cultural conditions under which concurrent partnerships are established, and the factors that favor concurrency over long-term monogamy (10, 64).

2.4.   Unmarried Parents and Co-Parenting Relationships

Births to unmarried women in the US in 2007 reached historic highs. Approximately 40% of all births were to unmarried women (65). The proportion of births to unmarried non-Hispanic black women was approximately 2.5 times as high than the proportion of births to non-Hispanic white women (71.6% versus 27.8%), and the proportions increased for all racial/ethnic groups from 2006-2007 (65).The 2007 estimate for the total number of births to unmarried women was 26% higher than in 2002 when steep increases in non-marital births began (65). The numbers of non-marital births increased by six percent or more from 2006 to 2007 with the largest increases occurring among women aged 25 to 39 years (65). Sixty percent of births to women aged 20–24 years and almost one-third of births to women aged 25–29 years were to unmarried women (65).

Racial/ethnic differences in non-marital unions contribute to differences in non-marital births. Social and cultural norms regarding sex, fertility, and acceptable types of romantic unions in the US have evolved over the past half century (66). Documentation of profound racial and ethnic differences in family formation date back as early as 1965 (67), and the family formation processes in the United States are heavily influenced by society and culture (16). Compared to non-Hispanic whites, non-Hispanic black women are more likely to engage in non-marital cohabitation (68, 69). Also, within cohabiting relationships, non-Hispanic black and Hispanic women are much more likely to have children than non-Hispanic white women (19, 70). Among whites, legal marriage is typically the most common setting for childbearing, and cohabitation does not generally function as a long-term alternative to marriage. In contrast, extended family ties, cohabitation for extended periods of time, and unmarried parenthood are more prevalent among blacks (69). Unmarried parents in black communities tend to experience less stigma and social disapproval than their white counterparts (16).

Research about the nature of relationships between unmarried parents is limited. The term "fragile families" has been used to describe unmarried parents and their children, and is used to emphasize the higher risk of poverty and family dissolution faced by these families compared to traditional families (i.e. married parents and their children) (71). Most of what is known about relationships among unmarried parents comes from the Fragile Families and Child Wellbeing Study (FFCWB) which is the first national study of unmarried parents, their relationships to each other, and the wellbeing of their children (71). The typical unmarried parents are in their mid to late twenties, and an overwhelming majority of new, unmarried mothers are minorities (44% non-Hispanic black; 33%, Hispanic) (71). Four and six percent

of unmarried mothers and fathers, respectively, reported a drug or alcohol problem in the preceding year (71). Mental health and behavioral problems are also reported more often by unmarried compared to married parents (72).

Pregnancies among unmarried parents are typically not explicitly planned and often occur among couples who have been in a relationship for less than one year (15). At the time of the child's birth, 82% of unmarried parents are romantically involved (51% are living together and 31% have a romantic relationship but are not living together) (73). A majority of unmarried parents have high hopes about the future of their relationships, but there is a substantial gap between marital intentions and actual marriage among these couples (71, 74).

Relationships among unmarried parents are often characterized by repeated break-ups and reunions, and mothers and fathers identify money, infidelity, and lack of quality time as the main sources of disagreement (15, 71). An additional source of strain for fragile families is whether the parents have children from other partners. Among unmarried parents in the FFCWB study, 59% have children by more than one partner (multiple partner fertility) (14, 75). It is estimated that the prevalence of multiple partner fertility among US men and women ranges from eight to 13% (76, 77), and these estimates are predicted to increase over time (78). The consequences of multiple partner fertility on children, families, or the parental relationships are not well understood (76).

A conceptual model can help explain how (non-marital) co-parenting relationships can impact STI risk (Figure 2.1). The presence of a child maintains contact between the child's parents though their committed romantic relationship may have ended. Each individual may have other sexual relationships (and thus a different main sexual partner), yet continue to have sex with each other; they are engaging in co-parenting concurrency.

Because the couple knows with each other and have had a relationship in the past, co-parents may be less likely to use condoms. Furthermore, depending on the relationship with their new, main partner, they may also be less likely to use condoms with the main partner. The increased likelihood of concurrency and decreased likelihood of condom use could potentially lead to increased STI risk for the individuals involved in the co-parenting relationship as well as for their partners.

FIGURE 2.1Conceptual framework describing how co-parenting relationships could lead to an increased risk for STIs.
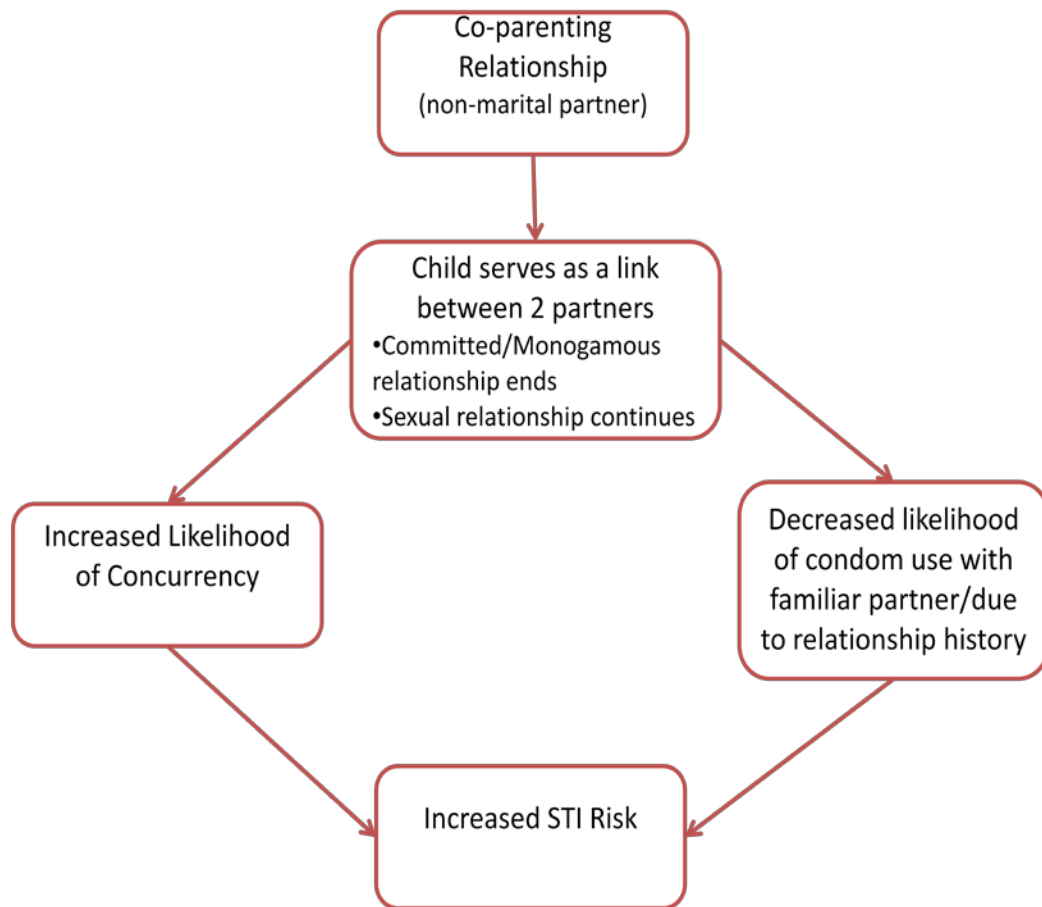
CHAPTER THREE: RESEARCH PLAN AND METHODS

3.1. Study Design Overview

To examine the relationship between co-parenting relationships and concurrent sexual partnerships, we conducted a secondary data analysis of data from male respondents to the National Survey of Family Growth Cycle 6 (NSFG 2002). Questions about dates of sexual intercourse, condom and contraception use, and fertility in the NSFG 2002 male dataset were asked in the context of specific sexual partners allowing for the exploration of co-parenting and concurrency.

3.2. Study Setting

The National Survey of Family Growth (NSFG) was initially constructed to be the national fertility survey of the United States. The survey was designed to collect data from national samples of women to help explain trends and group differences in birth and pregnancy rates including data on: contraception, infertility, sexual activity, marriage, divorce, miscarriage and stillbirth, and use of medical services for family planning and infertility (79). The first five NSFG cycles were based on samples of women aged 15 to 44 years and were conducted in 1973 (NSFG Cycle 1), 1976 (NSFG Cycle 2), 1982 (NSFG Cycle 3), 1988 (NSFG Cycle 4), and 1995 (NSFG Cycle 5). Only women who had ever been married were included in the first two cycles, but Cycle 3 was expanded to include all women aged 15 to 44 years, regardless of marital status (80, 81). This expansion allowed

researchers to study the desired outcomes in both married and unmarried women and teenagers. The topics of cohabitation, adoption, and sexually transmitted infections were introduced in NSFG Cycle 4, and respondents were asked questions regarding their knowledge of chlamydial infection, genital herpes, and AIDS (82). A contextual data file for examining associations between place of residence and individual behavior; additional questions about sexual partners, wantedness of pregnancies, consistency of contraception use, and the circumstances surrounding first intercourse; and Computer-Assisted Personal Interviewing (CAPI) and Audio Computer Assisted Interviewing (ACASI) were introduced in NSFG Cycle 5 (79).

When the survey was expanded to include men in NSFG Cycle 6, more data on behaviors that affect the risk of HIV and other sexually transmitted infections were collected, and questions on fathers' involvement with children, and men's and women's attitudes toward marriage, children, and sexual activity were added (79). For men, NSG Cycle 6 covers topics related to reproductive health, and family formation. Fertility topics, similar to those covered by the women's survey including contraceptive use; biological and adopted children; marriage, cohabitation, and other sexual relationships; infertility; expectations for future children; and use of health care were also included. In addition, men were asked about their activities with children and support of children with whom they do not live. In addition to the objectives of the other surveys, NSFG Cycle 6 also sought to produce national estimates of men's roles in raising and supporting their children and men's and women's attitudes about marriage, children, and families (79).

Men and women aged 15-44 years in the household population of the US were targeted for NSFG Cycle 6. Eligible participants were sampled using a stratified, multistage

probability sample of households (83). Individuals were selected using a four stage selection process selecting teens age 15 to 19 years, African Americans, and Hispanics at higher rates (79). As in NSFG Cycle 5, in-person interviews were conducted by trained, female interviewers using CAPI, and answers to more sensitive questions were obtained using ACASI. All interviews were voluntary and confidential. The interview for males averaged about 60 minutes in length, while the female interview averaged about 80 minutes. NSFG Cycle 6 participants were given $40 as compensation for their time and participation (79).

3.3.   Study Population

The study population was drawn from respondents to NSFG 2002. Respondents for NSFG 2002 were sampled to be representative of adults 15-44 years old in the civilian non-institutionalized US population (including all 50 states and the District of Columbia) (83). Men and women aged 15-44 years in the household population of the US were targeted for Cycle 6, and data collection took place from March 2002 through February 2003. NSFG 2002 included a total of 12,571 respondents 15-44 years of age--7,643 females and 4,928 males. The response rate was 79 percent overall--80 percent for females and 78 percent for males. Only data from the male file was used for these analyses.

3.4.   Data Collection

Male Questionnaire (79)

The male questionnaire consisted of 11 sections. The first section (Section A) gathered background information including demographics and data on marriage and cohabitation. The next section (Section B) consisted of questions about sex education, vasectomy, infertility, sexual intercourse, and sex partner information (including number of

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sex partners in life and the last 12 months and a listing of up to three of the most recent

sexual partners). The three subsequent sections gathered information about relationship

characteristics, sexual activity, and fertility in the context of specific relationships.

Information about the current wife or cohabiting partner was asked in Section C, the three

most recent partners in Section D, and former wives and the first cohabiting partner in

Section E.

Section F and section G gathered information on other biological children, adoptions,

and other pregnancies and fathering, respectively. Desires and intentions for future births

were included in Section H, while Section I included questions on health conditions and

utilization of different types of health services. Additional background information

(residence, place of birth, military experience, etc.) and psychosocial questions were included

in Section J, and the final section (Section K) was the ACASI portion of the questionnaire

(79). The questionnaire design (asking questions about sexual activity and fertility in the

context of specific partnerships) makes it possible to link a child to a specific partnership,

thus making it possible to determine whether concurrency occurs between partners with

which the respondent also had a child.

<u>Data Acquisition</u>

Most of the data for this study was available through public-use data files from the

National Center for Health Statistics and can be obtained from

http://www.cdc.gov/nchs/about/major/nsfg/nsfgcycle6datadoccodebooks.htm. More sensitive

data providing a comprehensive description of current and past behavior related to the risk of

acquiring sexually transmitted infections and contextual/geographic data is available from the

NSFG staff upon request and free of charge. To gain access to this data, researchers

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submitted a research proposal to the National Center for Health Statistic's Research Data

Center (RDC), signed confidentiality agreements and observed strict confidentiality

protocols.

3.5. Sample Weights

The NCHS-provided sample weights (finalwgt) which adjust for sub sampling, non-

location, nonresponse, and strata (sest) and cluster (secu_r) variables, which account for the

full complexity of the sample design, were applied to all univariable, bivariable and

multivariable analyses (83) (StataCorp. 2007. *Stata Statistical Software: Release 10*. College

Station, TX: StataCorp LP.).

3.6. Analytic Methods

3.6.1. Co-parenting and Sexual Partner Concurrency among White, Black, and Hispanic Men in the United States (Specific Aim 1)

Measurements

Outcome: Co-parenting concurrent sexual partnerships in the past 12 months. The main

outcome of interest was co-parenting concurrency in the past 12 months. We defined co-

parents as a man and woman who are the joint biological parents of a child. A concurrent

partnership pair was classified as co-parenting concurrency if the respondent had a biological

child with at least one concurrent partner.

Concurrency was measured by examining dates of first and last intercourse as it was

in previous research (6, 10). Reported dates of first sexual intercourse with the respondents'

current wife/partner and three most recent partners were ordered. The dates of first and last

sex for all partnerships were compared for men providing information on two or more sexual

partners. (A man could have reported dates for a maximum of four sexual partners equating to six possible partnership combinations.) For each partnership pair, the date of first sexual intercourse with the second partner was compared with the date of last sexual intercourse with the first partner. If the date of first sex with the most recent partner occurred before the date of last sex with the earlier partner, the partnership was considered concurrent. Sexual partnerships ending more than 12 months prior to the month of interview were excluded from this analysis. If the date of first or last sexual intercourse was missing, substitute values were used based on the respondents' reported age at first or last intercourse or by using dates of marriage, cohabitation, and separation.

Additional covariates: Additional covariates were selected from a conceptual model (Figure 3.1) included demographic characteristics (i.e. age, race, socio-economic status), relationship duration, relationship commitment/stability at the time of the child's birth (marital status, intention to marry) and sexual risk behavior information. A description of each covariate of interest is provided in Table 3.1. All variables were coded as dichotomous or nominal categorical variables.

FIGURE 3.1. Conceptual Framework for the Association between Co-parenting and Concurrent Sexual Partnerships
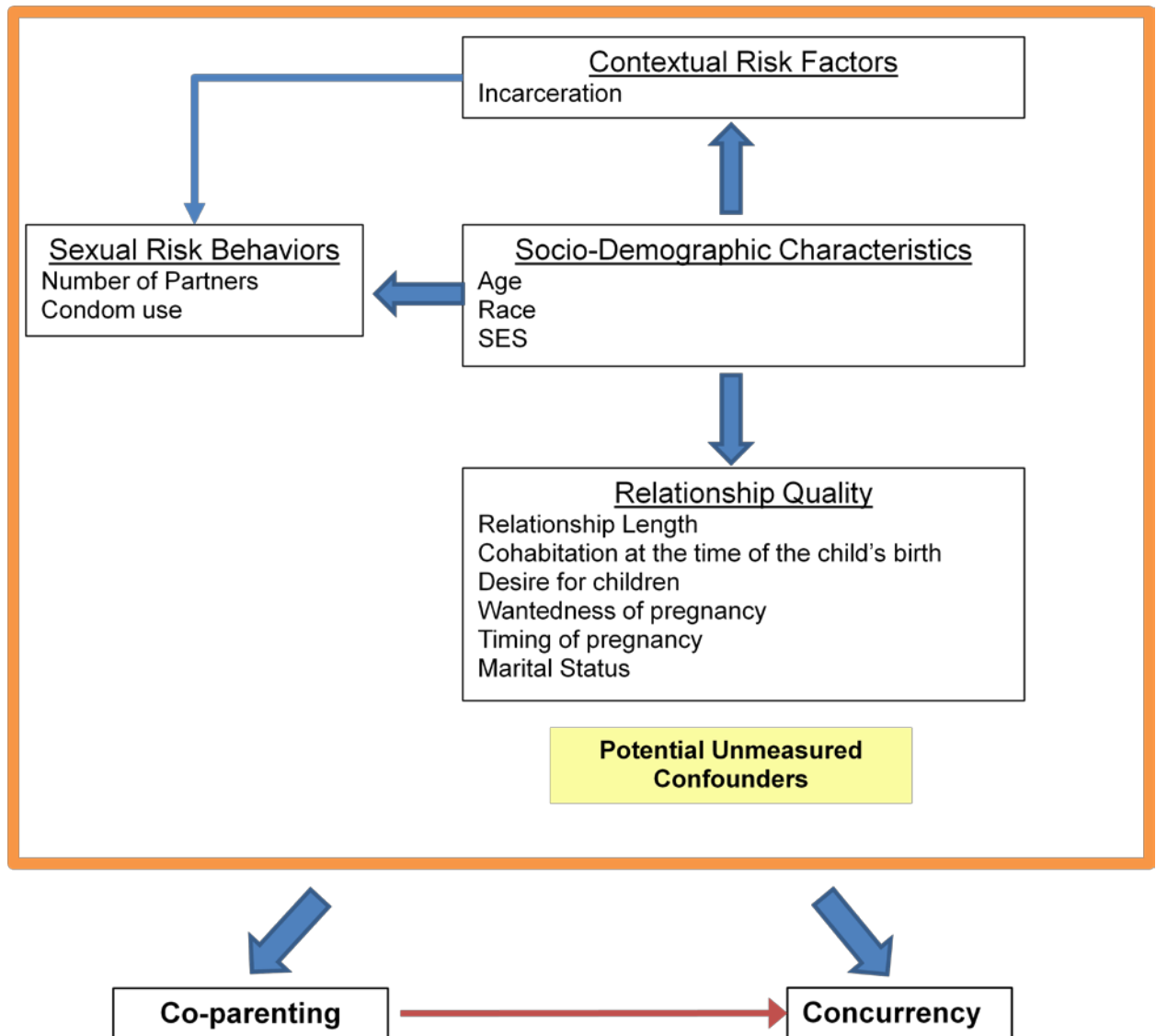
TABLE 3.1. Demographic characteristics, relationship duration, relationships commitment/stability, and sexual risk behavior covariates of interest: NSFG 2002.

Covariate	NSFG variable	Description
Age	ager	Respondent's age; continuous
Race	hisprace	Respondent's race; collected separately for race and ethnicity
Marital status	fmarital	Formal (legal) marital status
	rmarital	Informal marital status (includes cohabitation)
Socioeconomic status	hieduc	Highest level of education completed
	poverty	Poverty level income as a % of 2000 poverty line
Relationship duration	cmfsxp; cmlsxp	Century month of first and last sex; subtract dates to obtain duration
Incarceration	jailed	Jail, prison past 12 mos.
	jailed2	Jail, prison ever
# Partners in past year	parts1yr	# Partners during past 12 mos.
# Lifetime partners	lifprtnr	# Lifetime partners
Age at first sexual intercourse	vry1stag	Age at first sexual intercourse
Perception of partner's monogamy	nonmonog	Non-monogamous partners
Relationship quality	pxcxres	Living with partner at the time of birth
	pxcxmarb	Married at the time of birth
	pxcxever	Ever lived with mother of child
	pxwant	Did respondent want children in the future
	pxsoon	Did the pregnancy come too soon, on time, or later than respondent wanted
	pxhpypg	Happiness about the pregnancy

Data Analysis

Prevalence of co-parenting concurrency. The prevalence of co-parenting concurrency was

computed using the formula $\dfrac{A}{N}$, where A refers to the number of individuals with the

outcome (co-parenting concurrency) and N represents the total number of men who engaged

in concurrency in the past 12 months. The 95% confidence interval (95% CI) for the

prevalence was estimated using the svy command in STATA to incorporate survey weights

and account for the complex sampling design. The prevalence and 95% CIs were calculated

for the total study population and by race/ethnicity.

Bivariable associations. Tabular analyses and Wald chi-square p-values were used to

determine the prevalence and distribution of co-parenting concurrency in relation to the

demographic and relationship characteristics and sexual risk behaviors listed in Table 3.1

above.

Multivariable associations. Poisson regression models were used to determine correlates of

co-parenting concurrency. The Poisson model takes the form

$$\ln(Y_i) = \beta_0 + \beta_1 X_i \ldots + \beta_k X_k$$

where Y is the dependent variable (outcome) at level i of predictor variable X and β_0 is the

intercept parameter or baseline log risk. The model parameters, β_1- β_k, are log relative risks,

and the prevalence ratio is directly estimated by the model (84). Effect measure modification

by race/ethnicity and age was examined using a product interaction model and a Wald test at

the p<0.20 significance level.

3.6.2. Sexual Partner Concurrency and Co-parenting among US Men: STI Prevention Behaviors and Concurrency Duration (Specific Aim 2)

Measurements

<u>Outcome: Concurrency duration (duration of overlap).</u> Concurrency duration was reported in month long increments because respondents were only asked to give the month and year when answering questions about dates of first and last sexual intercourse. Duration of overlap was determined by taking the difference between the date of first sex with the current or most recent partner and the date of last sex with a previous partner (51). If dates of first and last intercourse for a previous partner fell within the dates of first and last intercourse for a previous partner, duration of overlap equaled the duration of the sexual relationship for the previous partner (85).

<u>Exposure: Co-parenting concurrent sexual partnerships in the past 12 months.</u> The main outcome of interest was co-parenting concurrency in the past 12 months. We defined co-parents as a man and woman who are the joint biological parents of a child. A concurrent partnership pair was classified as co-parenting concurrency if the respondent had a biological child with at least one concurrent partner.

Concurrency was measured by examining dates of first and last intercourse as it was in previous research (6, 10). Reported dates of first sexual intercourse with the respondents' current wife/partner and three most recent partners were ordered. The dates of first and last sex for all partnerships were compared for men providing information on two or more sexual partners. (A man could have reported dates for a maximum of four sexual partners equating to six possible partnership combinations.) For each partnership pair, the date of first sexual intercourse with the second partner was compared with the date of last sexual intercourse

with the first partner. If the date of first sex with the most recent partner occurred before the

date of last sex with the earlier partner, the partnership was considered concurrent. Sexual

partnerships ending more than 12 months prior to the month of interview were excluded from

this analysis. If the date of first or last sexual intercourse was missing, substitute values were

used based on the respondents' reported age at first or last intercourse or by using dates of

marriage, cohabitation, and separation.

<u>Additional covariables.</u> Additional covariables of interest included demographic and

concurrent partnership characteristics and were obtained during the CAPI portion of the

interview. Respondent's age at interview was categorized into 5-year groups while

race/ethnicity, educational attainment, and household income as a percent of 2000 poverty

(income) were categorized to match those used in previous analyses of this dataset (6, 86).

Partnership characteristics included concurrency type, condom use at last sexual

intercourse and whether or not the current wife or partner was included in a concurrent pair.

For men with co-parenting concurrency, we also examined marital status and cohabitation at

the time of the child's birth and whether the respondent ever lived with the child. Men were

asked to provide information about relationship characteristics, sexual activity, and fertility

in the context of relationships with specific sexual partners including: their current wife or

cohabiting partner, their three most recent sexual partners in the past 12 months, and their

former wives and first ever partner. Only relationship information about a respondents'

current wife/cohabiting partner and three most recent partners was included in this analysis.

Data Analysis

Basic descriptive analyses were used to determine the distribution of concurrency

duration including the mean, median, standard deviation, and range. Bivariable analyses were

conducted to examine the distribution of concurrency duration with concurrency type and

with the demographic and relationship covariates of interest.

A linear regression model with generalized estimating equations (GEE) was used to

examine the effect of co-parenting concurrency on overlap duration. The model takes the

form:

$$g(E(\boldsymbol{y}i)) = g(\mu i) = \boldsymbol{x}i'\,\beta$$

where $\boldsymbol{y}i$ is a response variable ($i = 1, \ldots, n$), $\boldsymbol{\mu}i = E(\boldsymbol{y}i)$, g is a link function, $\boldsymbol{x}i$ is a vector of

independent variables, and $\mathbf{b}$ is a vector of regression parameters to be estimated. The

variance of yi is $vi = vi(\mu i)$ and is a specified function of its mean μi. Yi is a continuous

response whose mean is related to the covariates by an identity link function. Survey

commands in STATA were used to account for unequal sampling probabilities and the

complex survey design.

Effect measure modification by race/ethnicity and age was examined for all outcomes

by creating a product-interaction term and testing the significance of that term using Wald p-

values. We found no effect measure modification by race/ethnicity and age using p-value $\leq$

0.20.

Potential confounders were identified as a confounder on the causal diagram

presented in Figure 3.2 and included socio-demographic characteristics (e.g. age, race, SES)

and relationship characteristics (e.g. relationship duration, plans to marry, living with or

married to partner at time of birth). The fact that information on relationship characteristics

was only asked of a small proportion of fathers precluded us from adjusting for relationship

characteristics in multivariable models. Differences in relationship characteristics were

examined using tabular analyses and descriptive statistics.

FIGURE 3.2. Causal diagram of the relationship between co-parenting concurrency and duration of overlap.
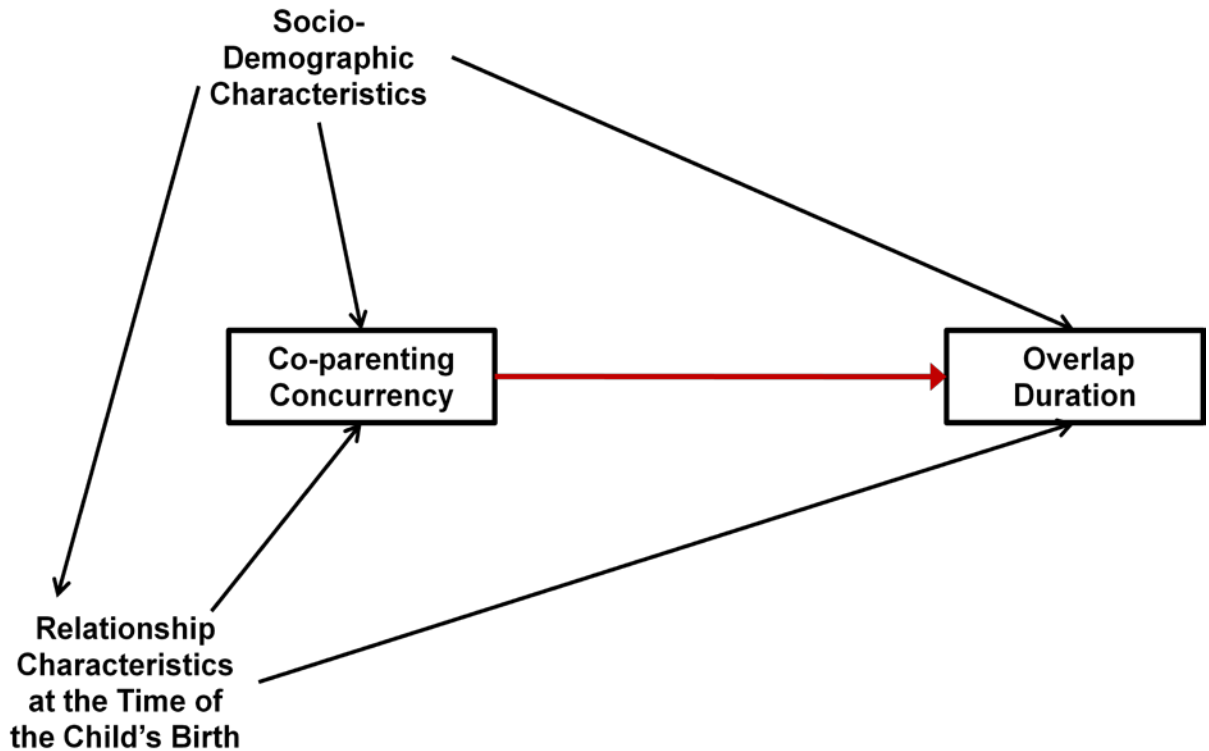
3.6.3. Sexual Partner Concurrency and Co-parenting among US Men: STI Prevention Behaviors and Concurrency Duration (Specific Aim 3)

Outcomes: Preventive/ protective sexual behaviors. The main outcomes of interest included: condom use (use at last sex and frequency of use) and STI testing and treatment in the past 12 months. Condom use at last vaginal intercourse with a female, receipt of an STI test in the past 12 months, and treatment for an STI in the past 12 months were reported in the ACASI questionnaire (1=Yes, 0=No).

Exposure: Co-parenting concurrent sexual partnerships in the past 12 months. The main outcome of interest was co-parenting concurrency in the past 12 months. We defined co-parents as a man and woman who are the joint biological parents of a child. A concurrent

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partnership pair was classified as co-parenting concurrency if the respondent had a biological child with at least one concurrent partner.

Concurrency was measured by examining dates of first and last intercourse as it was in previous research (6, 10). Reported dates of first sexual intercourse with the respondents' current wife/partner and three most recent partners were ordered. The dates of first and last sex for all partnerships were compared for men providing information on two or more sexual partners. (A man could have reported dates for a maximum of four sexual partners equating to six possible partnership combinations.) For each partnership pair, the date of first sexual intercourse with the second partner was compared with the date of last sexual intercourse with the first partner. If the date of first sex with the most recent partner occurred before the date of last sex with the earlier partner, the partnership was considered concurrent. Sexual partnerships ending more than 12 months prior to the month of interview were excluded from this analysis. If the date of first or last sexual intercourse was missing, substitute values were used based on the respondents' reported age at first or last intercourse or by using dates of marriage, cohabitation, and separation.

Additional covariates: Additional covariates of interest include demographic characteristics (i.e. age, race, socio-economic status), relationship commitment/stability (marital status, intention to marry) and sexual risk behavior information.

Data Analysis

Bivariable analyses were conducted to examine the associations between co-parenting concurrency and each outcome, separately, and with the demographic and relationship covariates of interest. We used Poisson regression for survey to fit separate bivariable and

multivariable models for STI testing, treatment and history. Men who reported more than two sexual partners could have more than one concurrent partnership. Therefore, a Poisson model using GEE was fit used for condom use at last sexual intercourse. For Poisson regression, the link and variance functions are: $g(\mu) = \log(\mu)$ and $v(\mu) = \mu$. The same potential confounders adjusted for in Section 3.6.2 were included as adjustment variables for this analysis.

CHAPTER FOUR: CO-PARENTING AND SEXUAL PARTNER CONCURRENCY AMONG WHITE, BLACK AND HISPANIC MEN IN THE UNITED STATES

4.1. Abstract

Objectives: To evaluate co-parenting concurrency, overlapping partnerships in which at least one concurrent partner is a co-parent with the respondent, which may promote the spread of sexually transmitted infections (STIs).

Methods: We examined sexual partnership dates and fertility history of 4928 male respondents in the 2002 National Survey of Family Growth. We calculated co-parenting concurrency prevalence and examined correlates using Poisson regression to estimate prevalence ratios.

Results: Among men with ≥1 pair of concurrent partnerships, 18% involved a co-parent. 33% of black men involved in co-parenting concurrency were < 25 years, compared to 23% of Hispanics and 6% of whites. Young black men (age 15-24) were more likely to engage in co-parenting concurrency than white men, adjusting for socio-demographic characteristics,

sexual and other high-risk behaviors, and relationship quality. Compared to white men age 15-24, black and Hispanic men were 4.60 (95% CI 1.10, 19.25) and 3.45 (95% CI 0.64, 18.43) times as likely to engage in co-parenting concurrency.

Conclusion: Almost one in five men engaging in concurrent sexual partnerships in the past year was a co-parent with at least one of the concurrent partners. Understanding the context in which different types of concurrency occur will provide a foundation on which to develop interventions to prevent STIs.

4.2. Background

Concurrent sexual partnerships (relationships that overlap in time), have been associated with the transmission of sexually transmitted infections (STI) including syphilis (62), chlamydial infection (87), and heterosexually acquired HIV infection (88). While the rate of partner acquisition may be similar in concurrent compared to serially monogamous partnerships, the overlap of sexual partnerships can lead to faster spread and establishment of STIs in a population (38, 39, 89, 90).

An estimated 11% of US men had concurrent partnerships during the previous 12 months and 12% of US women (past five years) (6, 10) and is associated with several demographic and behavioral characteristics. The prevalence of concurrency is higher among black men and women in the US than among other racial/ethnic groups (6, 10). Unmarried individuals are much more likely to engage in concurrent partnerships than those who are married (6, 10). Additionally, younger age at first sexual intercourse and high risk sexual behaviors including exchanging sex for money or drugs, and using marijuana or crack cocaine have been positively associated with concurrency among women while having a non-monogamous female sexual partner, incarceration, and a history of sexual intercourse with a man have been positively associated with concurrency among men (6, 10, 13, 50, 54, 57).

Research into the socio-cultural factors that likely influence the occurrence and types of concurrency has begun to emerge for some populations, such as the relationship between acculturation and sexual behavior among Hispanic youth (48, 91, 92). In addition, qualitative research has identified different patterns of concurrency that may be associated with varying STI risk depending on the partnership type (primary vs. non-primary) and the likelihood of condom use with each concurrent partner (12). One pattern potentially associated with high

STI risk involves concurrency in the context of a co-parenting relationship (12). Co-parenting concurrency involves engaging in sexual intercourse with a co-parent while in another committed partnership. Black, unmarried fathers report that it is more difficult to end a sexual relationship with the mother of their children despite not being in a committed/mutually monogamous relationship with her. Women in main partnerships with unmarried fathers' tend to view sexual activity outside the relationship as more acceptable if it is with a co-parent compared to some other woman (12, 53).

To date, no study has quantitatively examined co-parenting in the context of concurrent sexual partnerships. We used data from male respondents in Cycle 6 of the National Survey of Family Growth (NSFG) to: (1) calculate the overall and race-specific-prevalence of co-parenting concurrency; (2) describe co-parenting concurrency patterns, and (3) determine demographic and behavioral correlates of co-parenting concurrency.

4.3.   Methods

The NSFG is a cross-sectional survey conducted by the National Center for Health Statistics designed to examine trends in contraception, marriage, divorce, sexual activity and fertility(79). Cycle 6 of the NSFG was the first cycle to include men and also obtained richer data on behaviors that affect the risk of HIV and other STIs than had been collected in previous cycles (79). Men and women aged 15-44 years in the US household population were targeted for NSFG Cycle 6, and teens (aged 15-19), African Americans, and Hispanics were oversampled (83). The survey collected data about demographic, socio-economic, and behavioral characteristics and was administered by female interviewers using computer-

assisted personal interviewing (CAPI). Respondents answered sensitive questions using audio computer-assisted self-interviewing (ACASI) (83). Data collection took place from March 2002 through February 2003. Seventy-eight percent of males sampled completed the interview, yielding a total of 4928 male respondents (83). We excluded 274 men who reported a race/ethnicity other than white, non-Hispanic black or Hispanic from all analyses because only 12 men in this group engaged in concurrency resulting in a final sample of 4654 men.

Concurrent Sexual Partnerships

Concurrency with female partners was determined, as in previous research (6, 10, 86), by examining dates of first and last intercourse. Reported dates of first sexual intercourse with the respondents' current wife/partner and three most recent partners were ordered sequentially. Partnerships that ended 12 months before the interview were excluded. The dates of first and last sex for all partnerships were compared for men who provided information on two or more sexual partners. (A respondent could have reported dates for a maximum of four sexual partners resulting in six possible partnership combinations.)

For each partnership pair, the month of first sexual intercourse with the later partner was compared with the month of last sexual intercourse with the earlier partner. If the month of first sex with the later partner occurred before the month of last sex with the earlier partner, the partnership was considered concurrent. Co-parents were defined as a man and woman who are the joint biological parents of a child. For each sexual partner, a respondent was asked questions about children he co-parented with his partner, including biological, foster, adopted, and step children. Only biological children were included in our definition, and biological children from other partnerships that ended more than 12 months before the

interview were excluded from the definition. A concurrent partnership pair was classified as co-parenting concurrency if the respondent had a biological child with at least one of the concurrent sexual partners.

<u>Additional Measures</u>

A conceptual model for the association between co-parenting and concurrency was used to identify potential correlates of co-parenting concurrency. Socio-demographic characteristics (including age, race, educational attainment, and household income as a percent of the 2000 US poverty line) were obtained during the CAPI portion of the interview. Sexual behaviors that increase the risk of STIs included the respondent's number of sexual partners, frequency of condom use, and age at first sexual intercourse. Each respondent was asked about relationship characteristics, sexual activity, and fertility in relation to his current wife or cohabiting partner and each of his three most recent sexual partners in the past 12 months. The ACASI section asked respondents about their incarceration history. We categorized incarceration for at least 24 hours as never, within the past 12 months and greater than 12 months ago.

Cohabitation status at the time of the child's birth and average relationship duration were used as proxy measurements for relationship quality. A father was categorized as having children born only in cohabiting relationships (meaning he was married to or living with their partner at the time of the child's birth), having children born only in non-cohabiting relationships (not married to or living with the mother at the time of the child's birth), or having children born in both cohabiting and non-cohabiting relationships. We subtracted the date of last sexual intercourse from the date of first sexual intercourse with

each partner to determine relationship duration and used those values to calculate the average relationship duration for each respondent.

Analysis

All variables were coded as dichotomous or nominal categorical variables. All analyses were conducted using Stata version 10 (StataCorp. 2007. *Stata Statistical Software: Release 10*. College Station, TX: StataCorp LP.) and incorporated the NCHS-provided sample weights (which adjust for sub-sampling, non-location, and non-response) and sampling design variables (83). We examined demographic, socio-economic, fertility, and sexual behavior characteristics among all male respondents (N=4654), all fathers (N=1653), and all men with overlapping partnerships with women in the past 12 months (N=430). We calculated the prevalence of co-parenting concurrency, with 95% confidence intervals (95% CI), among all men engaging in concurrency in the past 12 months, overall and by racial/ethnic group. We calculated chi-square statistics for bivariable associations of co-parenting concurrency with socio-demographic and behavioral and relationship characteristics. Effect measure modification by race/ethnicity and age was examined using a product interaction model and a Wald test at the p<0.20 significance level. Prevalence ratios and 95% CIs were calculated using a multivariable Poisson regression model including all covariates of interest and a race by age interaction term.

4.4.   Results

Differences between men engaging in concurrent partnerships and the entire NSFG sample have been described in detail in previous analyses (6). Approximately 18.0% of

concurrent sexual partnerships among US men involved a co-parent, and the overall prevalence varied slightly by race/ethnicity (Table 4.1). Co-parenting prevalence among concurrent men was similar across the three racial/ethnic groups. However, black and Hispanic men who had engaged in co-parenting concurrency were considerably younger than white men who had engaged in co-parenting concurrency. Slightly more than a third of black men involved in co-parenting concurrency were younger than 25 years, compared to 23% of Hispanic men and only 6% of white men (Figure 4.1). The Wald p-value for the interaction between race/ethnicity was 0.06 indicating PR modification by race/ethnicity and age.

In our previous analyses of these data, we estimated that 11% (weighted) of the men had concurrent partnerships (6). Among this subset of 430 men (unweighted number), the prevalence of co-parenting concurrency was highest among men with less than a high school education and decreased with increasing education (Table 4.1). The prevalence of co-parenting concurrency among men with the lowest household incomes (<150% of the 2000 poverty line) was almost five times the prevalence among men with the highest household incomes (≥400% of the 2000 poverty line) (39.7% vs. 8.4%). Co-parenting concurrency prevalence was slightly higher among men who had children born outside marriage compared to men who did not but did not vary depending on the number of children born outside marriage (Table 4.1). Co-parenting concurrency was more prevalent among fathers who had children with multiple partners (51.8%) than among fathers who did not have multiple partner fertility (12.5%).

On the basis of the unadjusted prevalence ratios (PR) and Wald tests (Table 4.2) age at interview, education, household income, condom use during the last month, cohabitation at the time of the child's birth, and average relationship duration were associated with co-

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parenting concurrency. Higher levels of education and increased household income were associated with a decreased likelihood of co-parenting concurrency. Among men who had engaged in concurrent partnerships, those whose average relationship duration was 3-5 years were 5 times as likely to be involved in co-parenting concurrency [PR 5.23 (1.98, 18.83)] as those whose average relationship lasted less than 1 year. The association was even stronger for average relationship duration of 6 years or more compared to less than 1 year [PR 13.79 (5.58, 34.10)].

The associations of co-parenting concurrency with poverty, condom use, average relationship duration, and incarceration history persisted in the final, multivariable model (Table 4.2). Lower household income and increased relationship duration were associated with an increased likelihood of co-parenting concurrency, with PRs increasing as household income decreased. Men who used a condom none of the time were more likely to have engaged in co-parenting concurrency in the past 12 months compared to men who used a condom all of the time [PR 1.88 (1.13, 3.12)]. Having a history of incarceration, particularly incarceration within the past 12 months, was associated with a decreased likelihood of co-parenting concurrency [PR 0.54 (0.34, 0.85)].

Young black men (age 15-24) were more likely to engage in co-parenting concurrency than white men, adjusting for socio-demographic characteristics, sexual and other high-risk behaviors, and relationship quality (Table 4.3). The largest racial differences in co-parenting concurrency prevalence were observed among men age 15-24. Compared to white men age 15-24, black and Hispanic men were 4.60 (95% CI 1.10, 19.25) and 3.45 (95% CI 0.64, 18.43) times as likely to engage in co-parenting concurrency. White men age

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≥35 slightly more likely than black and Hispanic men to engage in co-parenting concurrency (Table 4.3).

4.5.   Discussion

This study is the first to explore quantitatively the role of co-parenting relationships in concurrent sexual partnerships. Almost one in five men engaging in concurrent sexual partnerships with women in the past 12 months had a biological child with at least one of his concurrent partners. Although he prevalence of co-parenting concurrency did not differ markedly by race/ethnicity overall, the largest racial/ethnic disparities in occurred among men age 15-24; blacks and Hispanics were almost 5 and 4 times as likely to engage in co-parenting concurrency as whites , respectively. In bivariable analyses, decreased household income, decreased condom use, and increased average relationship duration increased the likelihood of co-parenting concurrency, whereas a history of incarceration was associated with a decreased likelihood of co-parenting concurrency.

Despite qualitative research suggesting that different patterns of concurrency occur in varying contexts (12, 53), the concurrency literature about sexual behavior in the United States tends to assess the prevalence and correlates of concurrency over different periods of time and in various populations at risk of STI. We used these data to examine patterns of timing of and condom use within concurrent partnerships (86, 93) and also to explore the interrelationships between incarceration, substance abuse and concurrency (94). Studies of couples have documented that risk of STIs increases for persons unaware of their partner's non-monogamy (59). The likelihood of concurrency increases with acculturation among

Latinos, the fastest growing population in many regions of the United States. How concurrency itself is defined and measured has received scrutiny (4, 57, 58, 95).

We extend this body of knowledge with analysis of co-parenting; approximately 18% of male respondents from a representative sample who had concurrent sexual partners engaged in co-parenting concurrency. Co-parenting establishes a relationship that, regardless of the level of commitment to the co-parent, increases the potential for sexual intercourse with the co-parent. Because the parents know each other and have had at least one unprotected sexual encounter in the past, co-parents may be less likely to use condoms. The increased likelihood of concurrency and decreased likelihood of condom use increase STI risk for the individuals involved in the co-parenting relationship as well as for their other partners.

Research among US men estimated concurrency was three and two times as likely among non-Hispanic blacks and Hispanics, respectively, compared to non-Hispanic whites (96). Data from our analyses do not suggest racial/ethnic differences in the overall prevalence of co-parenting among men engaging in concurrency, though co-parenting concurrency did vary considerably when examined jointly by race/ethnicity and age. Black men who engaged in co-parenting concurrency were most likely to be under 25 years of age, while white men who engaged in co-parenting concurrency were most likely to be 35 years or older. Among black men, the co-parenting concurrency prevalence was highest among 15-24 year olds, for white men, it was highest among 25-34 year olds, and Hispanics co-parenting concurrency prevalence was highest among men >35 years of age. The largest racial/ethnic disparities in co-parenting concurrency prevalence were observed among men aged 15-24 with blacks and

Hispanics being four to five timesas likely to engage in co-parenting concurrency than their white counterparts.

Young people (age 15-24), including young parents, have been found to engage in a variety of risk behaviors, such as having multiple and concurrent sexual partners, unprotected intercourse, drug or alcohol use, and needle sharing (97-99). Inconsistent condom use was almost four times as likely among adolescent couples with a child compared to those without a child (100). Furthermore, young parents in relationships were generally unaware of their intimate partner's HIV testing history (101).

Co-parenting is generally discussed in the context of married couples, though it can occur via a number of different scenarios (102). Approximately 40% of all births in the US in 2007 were to unmarried women, and the proportion of births to unmarried non-Hispanic black women (71.6%) was approximately 2.5 times as high as the proportion of births to non-Hispanic white women (27.8%) (65). Relationships between unmarried parents are often unstable and characterized by repeated break-ups and reunions, (15, 71) creating an environment conducive to concurrency. In our study, births outside marriage were reported by over three quarters (76.3%) of men engaging in co-parenting concurrent partnerships supporting the idea of increased concurrency among unmarried parents. A study showed that at the time of the child's birth, 82% of unmarried parents were romantically involved, 31% had a romantic relationship but were not living together (73).

The term *nonresident father* includes a wide variety of men (e.g. divorced men who may or may not be remarried) but has more recently been used in research targeting non-resident fathers, regardless of marital status (103-105). Nonresident fathers' involvement with their children differs by race/ethnicity, and this difference can be partially explained by

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the status of the mother-father relationship (103). Specifically, minority nonresident fathers were more likely to maintain romantic relationships with their child's mother than white fathers, while mothers who had children with white men were more likely to re-partner (103). Thus, it is possible that the co-parenting relationship, particularly among unmarried racial/ethnic minorities, could impact the formation and persistence of concurrent sexual partnerships.

A major limitation of this study is the cross-sectional nature of the data. Because the information on co-parenting relationships and sexual partnership dates were ascertained simultaneously, we were unable to draw causal inferences. Although comparison of children's birth dates with partnership dates enabled us to identify instances of co-parenting concurrency, we did not have the data to assess directly whether past partnerships in which a child was born were more likely to persist and become concurrent. We were also not able to examine the contexts surrounding transitions into and out of sexual partnerships. Despite these limitations, the results from this study can serve as the basis for additional analyses on the impact of co-parenting on concurrency.

An additional limitation is that information on partnerships and children conceived in them was available for at most four sexual partners and only partnerships active during the past year. Men who had other partners could have had concurrent partnerships and children that were undetected. Additionally, since only month and year of first and last intercourse were reported for each sexual partnership, a sexual partnership that appeared to continue over two years could actually have consisted of one sexual act with a woman during one month and a second sexual act with the same woman two years later. Though the NSFG 2002 is comprised of a large, nationally representative sample that over-samples blacks and

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Hispanics, co-parenting concurrency was a relatively infrequent occurrence. The limited number of outcomes and a significant age by race/ethnicity interaction resulted in small cell counts which decreased the precision of our effect estimates.

We defined co-parents as a man and woman who are the joint biological parents of a child. This definition was more restrictive than that proposed in the sociology and child development literature, which includes co-parents regardless of their sexual orientation or biological linkage to the child (102). Though some instances of co-parenting could have been missed by our more specific definition, the significance of a biological child as a continuing manifestation of earlier sexual intimacy argues for differentiating adoptive and biological children in examining co-parenting concurrency.

All data were self-reported and were subject to recall bias and social desirability bias (106). Accuracy of self-report in this study depends on both recall and willingness to disclose sensitive information. The NSFG 2002 utilizes a life calendar approach to assist respondents in recalling information, but the potential for misreporting partnerships and/or dates remains. Social desirability bias is of concern because answers to some sexual and other risk behavior questions could require respondents admit they violated a social norm (107). Self-report of sexual behaviors varies depending on the mode in which the survey is administered (107), and the use of ACASI likely improved the completeness of self reported sensitive and high-risk behaviors (108-110). We have no evidence that reporting of sexual behaviors differed according to concurrency status.

Concurrent sexual partnerships can speed the spread of STIs throughout a population and may contribute to observed racial/ethnic disparities in STI rates. Although the factors that lead to concurrency are still being established, it is likely to be a combination of

imbalanced sex ratios, low marriage rates, economic differentials, media influences, and community and cultural norms. Our results show that the prevalence of co-parenting concurrency differs by race/ethnicity and age and that this concurrency pattern is most prevalent among young black and Hispanic men. A comprehensive understanding of the types of concurrent sexual partnerships and the contexts in which they occur should provide a basis for more effective prevention interventions and public messages. Co-parenting relationships are complex and have profound implications for child health and development. Concurrent sexual partnerships add an additional layer of complexity to co-parenting relationships, which can affect the health of the co-parents, their partners and their community.

TABLE 4.1 Co-parenting Concurrency Prevalence among US Men Reporting Concurrency in the Past 12 Months (N=430), 2002 National Survey of Family Growth

	Co-Parenting Concurrency	
	Unweighted N	Weighted % [*]
Overall	59	18.0
Age at Interview (Years)		
15-19	7	7.6
20-24	10	5.8
25-29	12	25.6
30-34	12	22.6
35-39	11	19.7
40-45	7	29.5
Race/Ethnicity		
White	13	14.7
Black	30	17.8
Hispanic	16	18.2
Education[§]		
< High School	17	47.1
High School / GED	18	16.9
Some College	10	13.4
Bachelor's Degree or Higher	4	5.3
Household income as a percent of 2000 poverty line[§]		
<150%	22	39.7
150%-249%	5	28.7
250-399%	12	17.4
≥400%	10	8.4
Current Marital Status		
Married	18	76.9
Cohabiting	9	36.7
Previously Married[†]	8	7.1
Never Married	24	6.9
Number of Biological Children[#]		
0	0	0
1	28	42.6
2	12	44.1
3	13	72.1
≥4	6	61.6
Number of Children Born Outside Marriage[#‡]		
0	13	41.9
1	27	55.1
2	11	59.6

	Co-Parenting Concurrency	
	Unweighted N	Weighted % [*]
≥3	8	56.6
Cohabitation at Child's Birth[‡]		
Non-Cohabiting Only	16	35.2
Cohabiting Only	31	51.5
Both Cohabiting and non-Cohabiting	12	70.5
Multiple Partner Fertility[‡§]		
No	41	12.5
Yes	18	51.8
Age at First Sexual Intercourse (Years)		
≥18	10	25.2
16-17	8	8.2
14-15	22	36.4
≤13	19	19.5
Number of Lifetime Sexual Partners		
0	0	0
1-2	0	0
3-5	9	12.6
6-10	14	10.9
≥11	36	15.0
Number of Sexual Partners in the Past 12 Months		
0	0	0
1	0	0
2	29	28.9
3	19	13.1
≥4	11	4.8
Condom Use During the Last Month		
None of the time	21	23.4
Some of the time	13	24.6
All of the time	18	7.3
Incarceration for ≥24 hours		
Never	38	18.9
>12 months ago	14	11.8
Within past 12 months	7	14.3

* Weighted to account for stratification, clustering, and unequal selection probabilities yielding nationally representative estimates. Percents may not sum to zero due to rounding.
§ Among men aged 22 years and older (n=309)
† Includes separated, divorced, and widowed
# Includes children fathered with the respondent's current wife/cohabiting partner or 3 most recent partners in the 12 months prior to the interview
‡ Among men who have a biological child (n=136)

§ Includes children fathered with the respondent's current wife/cohabiting partner, 3 most recent partners in the 12 months prior to the interview, former wives, first premarital cohabiting partner, or other biological children fathered with women who were not discussed in other sections of the interview

FIGURE 4.1. Age Distribution of Co-parenting Concurrency by and Race/Ethnicity[^]
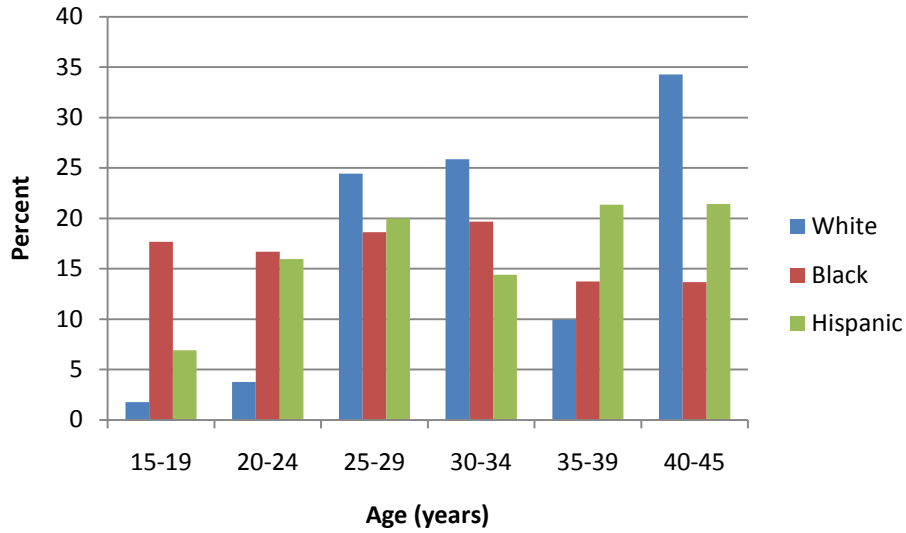
^N=430 white, non-Hispanic black, and Hispanic men reporting concurrency in the past 12 months

TABLE 4.2 Correlates of Co-parenting Concurrency among Men Who Had Concurrent Partnerships in the Past 12 Months[^]

	Co-parenting Concurrency in the past 12 months						
	Yes		No		Bivariable Model	Wald	Multivariable Model
	N	%	N	%	PR (95% CI)	p-value	PR (95% CI)
Total	59	16.3	371	83.7			
Age at Interview (Years)							
15-24	17	18.0	176	50.9	0.26 (0.11, 0.57)		3.51 (1.86 6.62)
25-34	24	43.1	98	26.6	0.95 (0.41, 2.21)	0.0002	1.60 (0.84 3.03)
≥35	18	39.0	97	22.6	1.0		1.0
Education							
< High School	22	47.7	78	19.9	1.0		1.0
High School / GED	20	24.2	120	30.0	0.43 (0.20, 0.93)	0.01	0.74 (0.45 1.23)
Some College	13	23.7	115	35.2	0.56 (0.28, 1.15)		0.81 (0.41 1.62)
Bachelor's Degree or Higher	4	4.4	58	15.4	0.16 (0.04, 0.58)		0.27 (0.12 0.58)
Household income as a percent of 2000 poverty line							
<150	25	38.7	70	17.4	4.00 (1.97, 8.14)		2.36 (1.30 4.28)
150-249	7	21.7	72	17.2	2.14 (0.58, 7.81)	0.007	0.90 (0.49 1.64)
250-399	14	18.1	76	22.7	1.43 (0.50, 4.05)		2.14 (1.20 3.83)
≥400	13	25.6	153	42.8	1.0		1.0
Age at First Sexual Intercourse (Years)							
≥18	10	26.4	47	15.2	1.0		1.0
16-17	8	13.9	104	29.1	0.37 (0.10, 1.32)	0.4	0.66 (0.31 1.39)
14-15	22	36.4	148	36.9	0.83 (0.32, 2.20)		0.49 (0.28 0.86)
<14	19	23.3	72	18.8	0.78 (0.27, 2.24)		0.59 (0.28 1.24)
Race/Ethnicity							
White	13	47.5	152	53.4	1.0		1.0
Black	30	29.1	136	26.2	1.21 (0.52, 2.80)	0.9	1.21 (0.65 2.23)
Hispanic	16	23.4	83	20.5	1.23 (0.49, 3.09)		1.22 (0.74 2.02)
Condom Use During the Last Month							
None of the time	21	60.1	101	39.0	2.50 (1.14, 5.48)		1.88 (1.13 3.12)
Some of the time	13	20.9	41	12.7	2.59 (1.14, 5.87)	0.002	1.65 (0.90 3.02)
All of the time	18	19.0	166	48.3	1.0		1.0
Cohabitation at Child's Birth [*]							
Non-Cohabiting Only	16	19.2	28	38.7	0.62 (0.34, 1.12)		0.86 (0.46 1.59)
Cohabiting Only	31	42.7	34	43.9	1.0	0.07	1.0
Both Cohabiting and non-Cohabiting	12	38.1	15	17.4	1.29 (0.85, 1.98)		0.89 (0.55 1.45)
Average Relationship Duration							

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	Co-parenting Concurrency in the past 12 months									
	Yes		No							
	N	%	N	%	Bivariable Model PR (95% CI)			Wald p-value	Multivariable Model PR (95% CI)		
<1 year	7	8.3	141	36.4	1.0				1.0		
1-2 years	8	12.4	109	27.3	1.96	(0.52 ,	7.39)	<0.001	0.67	(0.31	1.45)
3-5 years	20	28.5	89	27.8	5.23	(1.98 ,	13.84)		1.85	(0.95	3.60)
≥6 years	24	50.9	32	8.4	13.79	(5.58 ,	34.10)		3.43	(1.86	6.31)
Incarceration for ≥24 hours											
Never	38	65.8	209	54.8	1.0				1.0		
>12 months ago	14	18.2	99	26.5	1.07	(0.54 ,	2.09)	0.5	0.60	(0.35	1.03)
Within past 12 months	7	16.1	63	18.7	0.75	(0.27 ,	2.06)		0.54	(0.34	0.85)

^N=430 men reporting concurrency in the past 12 months
*Among men who have a biological child (n=139)

TABLE 4.3 Adjusted Prevalence Ratios (PR) and 95% Confidence Intervals (95% CI) for Co-Parenting Concurrency by Age and Race/Ethnicity, 2002 National Survey of Family Growth [*]

Age at Interview (Years)	Co-Parenting Concurrency			Prevalence	PR	95% CI	
	No	Yes	Total	weighted %			
15-24							
White	76	3	79	1.8	1.0		
Black	55	9	64	14.3	4.60	(1.10,	19.25)
Hispanic	45	5	50	8.5	3.45	(0.64,	18.43)
25-34							
White	30	6	36	28.9	1.0		
Black	40	13	53	22.1	0.99	(0.37,	2.65)
Hispanic	28	5	33	17.2	1.83	(0.69,	4.87)
≥35							
White	46	4	50	22.2	1.0		
Black	41	8	49	18.3	0.86	(0.36,	2.10)
Hispanic	10	6	16	53.0	0.90	(0.49,	1.66)

*Estimates calculated using multivariable Poisson regression for survey data adjusted for socio-demographic characteristics (age, education, household income as a % of the 2000 US poverty line), sexual behaviors (age at first sexual intercourse, condom use), relationship quality (average relationship duration, cohabitation at the time of the child's birth), and other high-risk behaviors (incarceration history); N=430 men who engaged in concurrent sexual partnerships in the past 12 months

CHAPTER FIVE: SEXUAL PARTNER CONCURRENCY AND CO-PARENTING AMONG US MEN: STI PREVENTION BEHAVIORS AND CONCURRENCY DURATION

5.1.   Abstract

Objectives: We sought to examine differences in STI/HIV prevention/protective behaviors by co-parenting status and the association of co-parenting with concurrency duration.

Methods: We examined sexual partnership dates and fertility history of 4928 male respondents in the 2002 National Survey of Family Growth. We defined co-parents as a man and woman who are the joint, biological parents of a child. A concurrent partnership was classified as co-parenting if the respondent was a co-parent with at least one concurrent partner. Concurrent partnerships were further classified based on pattern of overlap (Experimental: concurrent pairs where the only sex with one partner occurred within the same month of another partnership; Contained: partnerships lasting for at least one month and beginning and ending during the course of a second partnership; Transitional: concurrent partnerships in which a later partnership began during a prior partnership and continued after the prior partnership ended). We used Poisson regression to examine associations between co-parenting and STI preventive/protective behaviors. Linear and Poisson regression models with GEE were used to determine the association of co-parenting concurrency with concurrency duration and condom use at last sexual intercourse.

Results: Co-parenting concurrent partnerships were more likely than non-co-parenting concurrent partnerships to be transitional (31.5% vs. 21.2%). Compared to men engaging in non-co-parenting concurrency, men engaging in co-parenting concurrency were more likely to report inconsistent condom use during the last month (51.7% vs. 81.0%) and to not have used a condom with either concurrent partner at last sexual intercourse (26.0% vs. 46.1%). Concurrency duration was 2.3 months longer for men engaging in co-parenting concurrency than for men engaging in non-co-parenting concurrency (p=0.02) after adjusting for age, race/ethnicity, education and income. There were no differences in STI preventive/protective behaviors by co-parenting status.

Conclusion: Co-parenting relationships are part of the complex context in which concurrency occurs, but the nature of co-parenting concurrent partnerships and the extent to which they impact STI transmission is not known. Studies of partnership dyads among high-risk individuals and among men and women in the general population are needed to determine if the longer duration and decreased condom use associated with co-parenting concurrency translates into an increased STI risk for co-parents and their partners.

5.2. Background

Sexually transmitted infections (STIs) are a significant public health problem with an estimated 19 million new infections occurring in the United States each year (20). People of color bear a disproportionate amount of the STI burden, and infection rates of gonorrhea, chlamydial infection, and syphilis are higher for blacks than for all other racial/ethnic groups (111). Observed racial/ethnic differences in STI rates correlate with other fundamental determinants of health status, such as poverty, limited or no access to or use of quality health care, fewer attempts to get medical treatment, illicit drug use, and living in communities with a high STI incidence and prevalence (21).

Individual and social factors leading to unstable relationships among racial/ethnic minorities promote sexual network and partnership patterns such as concurrent sexual partnerships (more than one partner during the same period of time). Compared to serial monogamy, in which an individual has one sexual partner at a time, concurrent sexual partnerships are characterized by having a negative between the end of one partnership and the beginning of another (38). Compared to monogamy, concurrent sexual partnerships over time can substantially impact STI transmission (38).

Concurrency has been reported as being more common among men than women and among blacks and Hispanics than whites (6, 8, 10, 12, 13). Features of concurrent sexual partnerships have been investigated among men in high risk subpopulations including youth in impoverished urban areas (93), young adults seeking care in sexually transmitted disease (STD) and family planning clinics (59), young alcohol and/or drug users (112). Among men in the general US population, over half of concurrent sexual partnerships overlapped three months or less, and men reporting long term concurrency were less likely to use condoms

with both concurrent partners (86). Understanding the determinants and implications of concurrency could lead to more effective interventions to prevent population-level STI transmission and reduce racial/ethnic disparities in STI rates.

Co-parenting concurrency has been characterized as having a high STI risk based on the decreased likelihood of condom use with a co-parent compared to a sexual partner who is not a co-parent (12). To date, a quantitative exploration of concurrency involving co-parents has not been conducted. We used data from men reporting concurrent sexual partnerships in the 2002 National Survey of Family Growth (NSFG) to 1) examine differences in STI/HIV prevention/protective behaviors by co-parenting status and 2) examine the association of co-parenting with concurrency duration.

5.3.   Methods

Data for this cross-sectional analysis come from Cycle 6 of the National Survey of Family Growth (NSFG). The NSFG gathers information on family life, marriage and divorce, pregnancy, infertility, use of contraception, and men's and women's health using Computer-Assisted Personal Interviewing (CAPI) and Audio Computer Assisted Interviewing (ACASI) (79). Eligible participants were sampled using a stratified, multistage probability sample of households (83). Men and women aged 15-44 years in the household population of the US were targeted for NSFG Cycle 6, with teens, African Americans, and Hispanics selected at higher rates (79). NSFG Cycle 6 included a total of 12,571 respondents 15-44 years of age--7,643 females and 4,928 males. The response rate was 79 percent overall--80 percent for females and 78 percent for males (83). The current study uses data from 4928 male NSFG Cycle 6 respondents.

Concurrency Definition

Concurrency with female partners was determined by comparing the calendar month and year of first and last intercourse for the respondent's current wife/partner and three most recent partners. For each pair of partnerships, the month/year of first sexual intercourse with the later partner was compared with the month/year of last sexual intercourse with the earlier partner. Overlapping dates were considered concurrent. Sexual partnerships ending more than 12 months prior to the month of interview were excluded from this analysis. If the date of first or last sexual intercourse was missing for a partnership, where possible a substitute value was used based on the respondents' reported age at first or last intercourse or dates of marriage, cohabitation, and separation.

Concurrent partnership pairs were further classified into three types based on the pattern of overlap: experimental, contained, and transitional (Figure 5.1) (86). Concurrent pairs where the only sex with one partner occurred within the same month of another partnership were classified as experimental. Partnerships lasting for at least one month and beginning and ending during the course of a second partnership were classified as contained. Transitional concurrent partnerships were those partnerships in which a later partnership began during a prior partnership and continued after the prior partnership ended (86).

Definition of co-parenting

Each respondent was asked questions about children he co-parented with his partner, including biological, foster, adopted, and step children. We defined as co-parents a man and woman who are the joint biological parents of a child. Only biological children were included in our definition, and biological children from partnerships ending more than 12 months before the interview were excluded. Characteristics of concurrent partnerships involving a co-parent were compared with those of other concurrent partnerships.

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Outcomes:

Concurrency duration

Concurrency duration (in months) was calculated based on concurrency type (86) and reported in month long increments. The duration for experimental concurrent partnerships was set at zero. Concurrency duration for transitional and contained concurrent partnerships was determined by taking the difference between the date of first sex with the current or most recent partner and the date of last sex with a previous partner. For contained concurrent partnerships, concurrency duration was equal to the duration of the sexual relationship for the shorter partnership. Concurrency duration was categorized as <1, 1-6, 7-12, 13-24, and ≥ 25 months for descriptive purposes.

Preventive/Protective sexual behaviors

The main preventive/protective sexual behaviors examined were: condom use at last sexual intercourse, STI testing and treatment in the past 12 months, and STI history. During the CAPI portion of the interview, men were asked which methods to prevent pregnancy or sexually transmitted disease, if any, were used at last sexual intercourse with each female sexual partner. Information about STI testing and treatment during the past 12 months was obtained during the ACASI portion of the interview. During the ACASI portion, men were also asked about lifetime diagnoses of herpes simplex virus (HSV), human papillomavirus (HPV), and syphilis. Men who had ever been diagnosed with HSV, HPV, or syphilis or who had been treated for a STI in the past 12 months were considered to have a history of STIs. All preventive/protective sexual behaviors were coded as dichotomous (yes/no) variables.

Additional Covariables

Additional covariables of interest included demographic and concurrent partnership characteristics and were obtained during the CAPI portion of the interview. Respondent's age at interview was categorized into 5-year groups while race/ethnicity, educational attainment, and household income as a percent of 2000 poverty (income) were categorized as was done in previous analyses of this dataset (6, 86).

Partnership characteristics included concurrency type, condom use at last sexual intercourse and whether or not the current wife or partner was included in a concurrent pair. For co-parenting men, we also examined marital status and cohabitation at the time of the child's birth and whether the respondent ever lived with the child. Men were asked to provide information about relationship characteristics, sexual activity, and fertility in the context of relationships with specific sexual partners including: their current wife or cohabiting partner, their three most recent sexual partners in the past 12 months, and their former wives and first ever partner. Only relationship information about a respondents' current wife/cohabiting partner and three most recent partners was included in this analysis.

Analysis

All analyses were conducted using Stata version 10 (StataCorp. 2007. *Stata Statistical Software: Release 10*. College Station, TX: StataCorp LP.) The NCHS-provided sample weights which adjust for sub sampling, non-location, non-response were applied to all analyses (83). Due to sparse data, 12 men who reported races/ethnicities other than white, black, or Hispanic were excluded from these analyses. We used basic descriptive statistics to examine demographic, socioeconomic, fertility history, and sexual behavior characteristics by co-parenting status among men reporting concurrency in the past 12 months;

characteristics of concurrent partnership pairs by co-parenting status; and to determine the distribution of concurrency duration with demographic and partnership characteristics.

Tabular analyses were also used to examine additional characteristics of men reporting co-parenting concurrency (desire for children and timing of and happiness about the pregnancy) and for co-parenting concurrent partnership pairs (cohabitation status at the child's birth, concurrency type, and reported condom use with each concurrent partner). For each biological child, men were asked whether they were married to or cohabiting with the mother at the time their child was born and whether they ever lived with the child. Men who had a child born within five years of the interview and were married to or living with their partner at the time of the child's birth or knew about the pregnancy before the child's birth were asked 1)whether they wanted children at some time in the future right before their partner became pregnant and 2)how they felt when they found out their partner was pregnant. Men who gave a positive response (definitely yes or probably yes) to wanting children at some time in the future were also asked if the pregnancy came sooner than they wanted, at about the right time, or later than they wanted. Within co-parenting concurrent partnership pairs we determined with which sexual partner the respondent reported condom use and compared the partnership duration for sexual partnerships involving co-parents to those not involving co-parents.

We used Poisson regression for survey data to fit separate bivariable and multivariable models for STI testing, treatment and history. Men who reported more than two sexual partners could have more than one concurrent partnership. We fit simple and multivariable linear and Poisson regression models with generalized estimating equations (GEE) specifying an exchangeable correlation structure and robust variance estimators to

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determine the association of co-parenting concurrency with overlap duration and condom use at last sexual intercourse, respectively. Natural logarithmic (ln) transformation of concurrency duration was used to correct for skewness and kurtosis. The ln transformation of duration+0.5 was used for respondents with duration = 0. Duration was then back-transformed to its natural unit (months). Effect measure modification by race/ethnicity and age was examined for all outcomes by creating a product-interaction term and testing the significance of that term using Wald p-values. We found no effect measure modification by race/ethnicity and age using p-value $\leq$ 0.20. All multivariable models adjusted for potential confounders (age, income, condom use, relationship duration, and incarceration history) determined a priori based on a review of the literature and a directed acyclic graph.

5.4.   Results

A total of 650 concurrent partnership pairs were reported by 430 male respondents, and slightly more than 12% of concurrent partnership pairs involved a co-parent (Table 5.1). The distribution of concurrency type differed by co-parenting status. Co-parenting concurrent partnership pairs were more likely to be transitional (31.5%) compared to non-co-parenting concurrent partnership pairs (21.2%). Not using a condom with either partner was much more common among co-parenting concurrent than non-co-parenting concurrent partnership pairs (46.1% vs. 26.0%) while condom use with both partners was much more common among non-co-parenting concurrent partnership pairs (48.8% vs. 18.1%).

Approximately 72% of co-parenting concurrent partnership pairs involved co-parents who were not married at the time of the child's birth, though men reported living with the child at some point in 87.4% of co-parenting concurrent partnerships. Most (89.4%) fathers gave a positive response when asked about their desire for children at some time in the

future, but men engaging in co-parenting concurrency were slightly less likely to give a positive response (87.4%) than men engaging in non-co-parenting concurrency(93.6%). Approximately 91% of fathers were happy when they found out about their partner's pregnancy, and this did not differ by co-parenting concurrency status.

Among fathers who desired children at some time in the future, those who engaged in co-parenting concurrency were much more likely to feel that the pregnancy occurred sooner than they wanted (53.6% vs. 27.0%). Condom use with the non-co-parenting partner was reported in 95.3% of co-parenting concurrent partnership pairs where condom use was reported with only one concurrent partner. The co-parenting sexual partnership was the longer of the partnership pairs in 93.2% of contained and 84.1% of transitional concurrent partnerships. The co-parenting partner was the experimental partner in approximately 19.6% of experimental co-parenting concurrent partnership pairs.

Average concurrency duration generally increased with increasing age, decreased with increasing education and household income, and did not greatly differ by race/ethnicity (Table 5.2). Compared to contained concurrency, the duration for transitional concurrency was about 10 months longer. Reported condom use with both partners was more common in concurrent partnerships with short duration overlap (11 months), whereas use with neither partner was more common in concurrent partnerships with long duration overlap (24 months).

Among men with concurrent partnerships, STI testing and treatment were less likely among men engaging in co-parenting concurrency, though the associations were not statistically significant, and there was no association between STI history and co-parenting concurrency (Table 5.3). Not using a condom with either partner was more likely among men

engaging in co-parenting concurrency compared to those engaging in non-co-parenting concurrency (PR 1.60; 95% CI 0.95, 2.69). Estimates for STI testing, treatment and history did not change after adjusting for potential confounders, and there was no association between condom use and co-parenting concurrency after adjustment (Table 5.3).

Co-parenting concurrency was associated with increased concurrency duration. Compared to non-co-parenting partnerships, concurrency duration for co-parenting partnerships was about 3.4 months longer. After adjusting for age, race/ethnicity, education, and income, the difference in concurrency duration between co-parenting and non-co-parenting concurrent partnerships decreased to about 2.3 months but remained statistically significant (p=0.02).

5.5.   Discussion

We examined 1)differences in STI/HIV prevention/protective behaviors by co-parenting status among men reporting concurrency and 2)the association of co-parenting with concurrency duration. Co-parenting concurrent partnerships were more likely than non-co-parenting concurrent partnerships to be transitional. Men engaging in co-parenting concurrency were more likely to report inconsistent condom use during the last month and less likely to have used a condom with either concurrent partner at last sexual intercourse compared to men engaging in non-co-parenting concurrency. Having ever lived with the child was common among co-parenting concurrent partnerships, though being married to the co-parent at the time of the child's birth was not. Concurrency duration was significantly longer for men reporting co-parenting concurrency than for men reporting non-co-parenting

concurrency, but there were no differences in STI preventive/protective behaviors by co-parenting status.

Approximately one in three co-parenting concurrent sexual partnerships were classified as transitional. This type of partnership pattern has been described as occurring among individuals transitioning between two main sexual partners and not fully terminating one partnership until another one is clearly established (12). Because both sexual partners in transitional concurrency are often considered main partners, individuals may completely avoid condoms, making this concurrency pattern particularly risky for STI acquisition and transmission (12). Results from the present study support this hypothesis and agree with results from a previous analysis of the NSFG data on condom use and concurrency duration (86). Not using a condom with either partner was reported in 46% of co-parenting concurrent partnerships in this study, compared to 30% of transitional concurrent partnership pairs in a published study (86), suggesting that different contextual and relationship characteristics within the same concurrency pattern could translate to an even greater STI risk.

Concurrency duration increased with age and was, on average, ten months longer for transitional compared to contained concurrent partnerships. Concurrency duration was about two months longer for co-parenting versus non-co-parenting concurrent partnerships. Low rates of condom use are common in long-term, steady partnerships and condom use generally decreases as relationship duration increases (113-115). Similar to results from a previous NSFG analysis (86), low rates of condom use were reported in long-term concurrent partnerships. The positive association observed between not using a condom with either partner and co-parenting concurrency was attenuated after adjusting for potential confounders including relationship duration. Thus, focusing efforts to reduce long-term

overlapping sexual relationships, regardless of co-parenting status, or promoting consistent condom use within these partnerships could be effective strategies for STI prevention.

Almost three quarters of co-parenting concurrent partnerships involved unmarried parents. The body of literature on relationship characteristics and health and well being of fragile families, a term that has been used to define unmarried couples who have a child together, is growing (14, 104, 116). Non-marital births in the US have increased from 6% of all births in 1960 to 40% in 2007 (65). Compared to married fathers, unmarried fathers are more likely to be younger, be less educated, have children by multiple partners, and have ever been incarcerated (116). These characteristics, coupled with the complexity and stress of managing both co-parenting and romantic relationships could lead to decreased relationship quality and stability among unmarried parents and provide an environment that is potentially more favorable to concurrent than mutually monogamous relationships.

Experimental concurrency was characterized as concurrent pairs where the only sexual intercourse with one partner occurred within the same month of another partnership. Experimental concurrency has been qualitatively described as occurring in nonbinding, nonexclusive partnerships in which condom use is common and acceptable and therefore associated with low STI risk (12). In this study, the co-parent served as the experimental partner in about 20% of experimental co-parenting concurrent sexual partnership pairs. Furthermore, in co-parenting concurrent partnerships where a condom was used with only one partner, the co-parent was the partner with whom a condom was used only 12% of the time.

Our examination of characteristics of the individual partnerships comprising a co-parenting concurrent partnership pair provided some support for the qualitative description of

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co-parenting concurrency as involving sexual activity with a co-parent while having a different, main sexual partner (12). Research among blacks has shown that unmarried men find it more difficult to end sexual relationships with the mothers of their children despite not being in a committed/mutually monogamous relationship with her (12, 53). Though their committed relationship may have ended, unmarried parents continue to interact because of the child. This interaction may serve as the basis for continuing a sexual relationship that otherwise may have ended. Thus, the increased likelihood of concurrency and decreased likelihood of condom use could potentially lead to increased STI risk among co-parents.

Though the NSFG 2002 comprised a large, nationally representative sample in which blacks and Hispanics were over-sampled, co-parenting concurrency was overall a rare occurrence. Small cell counts limited the use of multivariable models and decreased the precision of our effect estimates. In addition, as with other studies involving self-reporting of sensitive information, our results are subject to distortion from social desirability and imperfect recall. The use of ACASI may have reduced respondents' inhibitions about disclosing socially stigmatized behaviors. However, the accuracy of responses cannot be determined.

The design of the 2002 NSFG questionnaire, which asked about sexual activity and fertility in the context of specific partnerships, made it possible to link a child to a specific partnership, thus allowing us to determine whether concurrency occurred with a co-parent. There was no direct question about concurrency, but the overlapping date method we used to determine the cumulative prevalence of concurrency which is one of the measurement methods recommended by the UNAIDS Reference Group on Estimates, Modeling, and Projections (4). However, since first and last intercourse dates were recorded only as month

and year, it was not possible to detect concurrency between a partnership ending in the same calendar month as another partnership began. Additionally, respondents were asked about only a limited number of partnerships (current wife/cohabiting partner, three other most recent partners during the past 12 months, and first ever sexual partner), so co-parenting and/or concurrency with additional partners could not be detected.

Despite these limitations, this study provides some of the first data on co-parenting concurrency among U.S. men. Co-parenting relationships comprise a portion of the complex context in which concurrency occurs, particularly among unmarried men. To the extent that co-parenting outside stable monogamy influences formation and persistence of concurrent sexual partnerships, it could be a factor in STI dissemination, which may be sensitive to small changes in the level of concurrency. Studies designed specifically to collect data on concurrency could help 1) provide a more comprehensive understanding of the different types of concurrent sexual partnerships and the contexts in which they occur and 2) help inform STI prevention interventions and public health messages aimed at reducing concurrency.

FIGURE 5.1. Types of Concurrent Partnerships Reproduced from Doherty 2009(86)

Concurrency Type*	Partner	
Transitional	1	X X X X X X X X
	2	X X X X X X X
Contained	1	X X X X X X X X X X
	2	X X X X X
Experimental	1	X X X X X X X X X X
	2	X

***X** represents 1 month. Transitional: partnership 2 begins during partnership 1 and continues after partnership 1 ends. Contained: partnership 2 lasts for at least 1month, beginning and ending during the course of partnership 1. Experimental: the only sex with partner 2 occurs within the same month as sex with partner 1.

TABLE 5.1. Characteristics of Concurrent Partnership Pairs by Co-parenting Status among US Men, 2002 National Survey of Family Growth[*]

| | Co-parent | | | | | |
| | No | | Yes | | Total | |
	Unweighted N	Weighted %[*]	Unweighted N	Weighted %[*]	Unweighted N	Weighted %[*]
Total	579	87.7	71	12.4	650	100
Concurrency Type						
Experimental	174	31.5	16	21.2	190	30.2
Contained	275	46.7	31	46.5	306	46.7
Transitional	130	21.8	24	32.3	154	23.1
Concurrency Duration (months)						
<1	178	32.1	17	22.0	195	30.8
1-6	184	32.6	12	17.9	196	30.8
7-12	76	13.4	8	9.2	84	12.9
13-24	74	11.0	5	4.4	79	10.2
≥25	67	10.9	29	46.6	96	15.3
Condom Use at Last Sexual Intercourse						
Neither Partner	124	26.0	25	46.1	149	28.5
1 Partner	149	25.2	25	35.8	174	26.5
Both Partners	306	48.8	21	18.1	327	45.0
Current Wife/ Cohabiting Partner						
No	24	4.4	25	58.4	49	11.1
Yes	555	95.6	46	41.6	601	88.9

*N=650 concurrent partnership pairs among 430 White, non-Hispanic Black, and Hispanic men aged 15-45
§ Includes legally married
† Applicable if the child is ≤18, is not dead, adopted or in foster care, and does not currently live with the respondent

TABLE 5.2 Distribution of Concurrency Duration by Select Demographic and Partnership Characteristics, 2002 National Survey of Family Growth [*]

	N	Concurrency Duration		
		Median	Mean	Standard Error
Age at Interview (years)				
15-19	107	1	4.32	0.70
20-24	172	3	8.60	1.55
25-29	102	2	7.87	1.54
30-34	97	6	20.83	7.48
34-39	100	4	22.52	5.19
≥40	72	12	32.81	12.10
Race/ Ethnicity				
White	231	3	14.90	4.48
Black	265	5	16.00	2.05
Hispanic	154	3	11.84	2.74
Education				
< High School	150	4	28.32	8.46
High School / GED	206	5	12.71	1.45
Some College	198	2	7.23	0.99
Bachelor's Degree or		3		
Higher	96		11.64	1.97
Household income as a percent of 2000 poverty line				
<150%	131	5	23.97	7.28
150%-249%	126	5	18.96	8.96
250-399%	136	3	11.59	2.20
≥400%	257	3	9.69	1.32
Concurrency Type				
Experimental	190	0	0	0
Contained	306	6	17.59	3.12
Transitional	154	11	27.55	7.08
Condom Use at Last Sex				
Neither Partner	149	6	23.92	7.26
One Partner	179	2	11.23	2.11
Both Partners	327	3	10.63	1.48

*N=650 concurrent partnership pairs among 430 white, black, and Hispanic men engaging in concurrency in the past 12 months; Mean and standard error weighted to account for stratification, clustering, and unequal selection probabilities yielding nationally representative estimates.

TABLE 5.3 Crude and adjusted prevalence ratios (PR) and 95% confidence intervals (CI) for the association between co-parenting concurrency and STI/HIV preventive/protective behaviors, NSFG 2002[*]

	Co-parenting concurrency in the past 12 months									
	No		Yes		Crude PR (95% CI)			Adjusted PR (95% CI)[§]		
	n	%	n	%						
STI testing[†]										
No	256	82.3	39	17.7	1.0			1.0		
Yes	114	86.8	20	13.2	0.80	(0.44,	1.46)	0.81	(0.46,	1.44)
STI treatment[†]										
No	344	82.8	55	17.2	1.0			1.0		
Yes	25	93.2	4	6.8	0.74	(0.18,	3.02)	0.56	(0.18,	1.73)
STI history[#]										
No	344	83.5	54	16.5	1.0			1.0		
Yes	26	86.3	5	13.8	1.05	(0.38,	2.92)	0.98	(0.47,	2.13)
Condom use[‡]										
No	269	87.0	38	13.0	1.0			1.0		
Yes	102	77.6	21	22.4	1.60	(0.95	2.69)	0.95	(0.61	1.50)

*N=430 US white, black, and Hispanic men reporting concurrent sexual partnerships in the past 12 months; percents, PRs and 95% CI Weighted to account for stratification, clustering, and unequal selection probabilities yielding nationally representative estimates.

§Poisson regression model adjusted for age, income, condom use, relationship duration, and incarceration history

†STI testing or treatment for a sexually transmitted disease in the past 12 months; obtained during the ACASI

#Includes lifetime history of herpes simplex virus, human papillomavirus, or syphilis, and within the past 12 mo gonorrhea, chlamydial infection, or treatment for another STI

‡Condom use with neither partner at last sexual intercourse

CHAPTER SIX: DISCUSSION

6.1.   Overview

In 2007, blacks in the US represented only 13% of the population, and compared to whites, had higher rates of HIV/AIDS, gonorrhea, chlamydial infection, and syphilis(26) . By the end of 2006, blacks accounted for 46% of the estimated 1.1 million Americans living with HIV infection, with high-risk heterosexual contact (heterosexual contact with a person known to have or be at risk for HIV infection) ranking among the most common modes of transmission for both men and women(111, 117).

Individual and social factors leading to unstable relationships among racial/ethnic minorities promote sexual network and partnership patterns such as engaging in concurrent sexual partnerships. Different patterns of concurrent sexual partnerships may have different meanings for STI dissemination throughout a population. Despite advances in concurrency research in estimating prevalence and identifying correlates, information about the contexts in which concurrency occurs and exactly what promotes concurrent relationships is not well understood.

6.2.   Summary of Findings

This is the first study to quantitatively investigate co-parenting concurrent sexual partnerships. First, we calculated the prevalence, examined correlates of co-parenting concurrency, and explored the hypothesis that black men would be more likely to engage in

co-parenting concurrent sexual partnerships than white and Hispanic men. Second, we explored the association of co-parenting concurrency with concurrency duration and examined differences in STI preventive/protective behaviors among men engaging in co-parenting concurrency compared to men engaging in non-co-parenting concurrency.

In the first portion of this dissertation, we found the prevalence of co-parenting concurrency among men who engaged in concurrent sexual partnerships in the past 12 months was 18%. The prevalence of co-parenting concurrency differed by race/ethnicity and age, with young black and Hispanic men being most likely to engage in the behavior. Increased income, decreased condom use, and increased relationship duration were associated with an increased likelihood of co-parenting concurrency, whereas a history of incarceration was associated with a decreased likelihood of co-parenting concurrency in bivariable analyses.

The significant interaction of race/ethnicity and age shows co-parenting concurrency may be particularly important among young, minority fathers. Young people (age 15-24), including young parents, have been found to engage in a variety of risk behaviors, such as having multiple and concurrent sexual partners, unprotected intercourse, drug or alcohol use, and needle sharing (97-99). Inconsistent condom use is also high among adolescent couples with a child (100). Additionally, many of the co-parenting concurrent men in our study had children born outside marriage supporting the idea of increased concurrency among unmarried parents. Major limitations to this study included the cross-sectional nature of the data, limited information on sexual partners, and biases related to self-report of sexual behaviors.

In the second portion of this dissertation, we further explored the features of co-parenting concurrency and compared co-parenting concurrent partnerships to non-co-parenting ones. Co-parenting concurrent partnerships were more likely than non-co-parenting concurrent partnerships to be transitional, and inconsistent condom use was more common among men engaging in co-parenting concurrency than among men engaging in non-co-parenting concurrency. After adjusting for age, race/ethnicity, education and income, concurrency duration was significantly longer for men reporting co-parenting concurrency than for men reporting non-co-parenting concurrency. We found no differences in STI preventive/protective behaviors by co-parenting status.

Transitional concurrency has been qualitatively described as occurring among individuals transitioning between two main sexual partners and not fully terminating one partnership until another one is clearly established and is thought to be associated with decreased condom use (12). Results from this study support this discription and agree with results from a study on condom use and concurrency duration (86). Inconsistent condom use was common in our study, suggesting that different contextual and relationship characteristics, even within one category of concurrency, could translate to an even greater STI risk.

Concurrency duration was about two months longer for co-parenting versus non-co-parenting concurrent partnerships. Low rates of condom use are common in long-term, steady partnerships and condom use generally decreases as relationship duration increases (113-115). Consistent condom use has been effective in preventing HIV transmission and reduces the risk of other STIs (118), but young adults report that their condom use decisions focus more around preventing pregnancy than STIs (119-121). Focusing efforts to reduce

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long-term overlapping sexual relationships, or promoting consistent condom use within these partnerships, particularly among young co-parents, could be effective strategies for STI prevention.

6.3. Public Health Significance

Our examination of characteristics of the individual partnerships comprising a co-parenting concurrent partnership pair provided some support for the qualitative description of co-parenting concurrency as involving sexual activity with a co-parent while having a different, main sexual partner (12). Research among blacks has shown that unmarried men find it more difficult to end sexual relationships with the mothers of their children despite not being in a committed/mutually monogamous relationship with her (12, 53). Though their committed relationship may have ended, unmarried parents continue to interact because of the child. This interaction may serve as the basis for continuing a sexual relationship that otherwise may have ended. Thus, the increased likelihood of concurrency and decreased likelihood of condom use could potentially lead to increased STI risk among co-parents.

Concurrent sexual partnerships play a critical role in accelerating the spread of STIs, including HIV through populations. We have shown that co-parenting concurrent relationships are most prevalent among young black and Hispanic men in the US. Concurrent sexual partnerships are strongly associated with single marital status (6, 8, 10, 13), and a large proportion of births outside marriage occur to blacks (14-19). Thus, the co-parenting relationship, particularly among unmarried black men, could impact the formation and persistence of concurrent sexual partnerships.

6.4. Future Research Directions

A majority of the existing concurrency literature focuses on its presence or absence. However, the limited literature on different patterns of concurrent sexual partnerships shows that concurrency is much more complicated. This dissertation research has merely skimmed the surface of the complex issues related to one type of concurrency. There are many different types that are likely as complex and warrant further investigation.

To advance knowledge in this area, cohort studies of adolescents and young adults should be conducted to identify causal factors associated with co-parenting concurrency. Participants would need to be recruited as dyads, and data collection would need to include information on coital frequency, condom and other contraceptive use, fertility history, and relationship characteristics for each respondent. Each respondent would need to provide similar information for their other sexual partners. Implementing a study of this nature would require immense resources and a large sample. A more attainable research goal would be to incorporate studies of co-parenting concurrency into existing cohort studies.

One of the main findings of this dissertation was the interaction of age and race/ethnicity with co-parenting concurrency. Qualitative studies should be conducted to gain a better understanding of the reasons that men engage in co-parenting concurrency and whether there are social and/or structural factors that promote this type of concurrent partnership. Quantitative studies should also be conducted to determine if the results of this study can be replicated and to establish an empirical link between co-parenting concurrency and STI transmission. One way to accomplish this would be to incorporate co-parenting concurrency into studies designed to estimate HIV incidence and monitor sexual behaviors. This could be accomplished by including questions on fertility histories and dates of sexual

intercourse while collecting information for contact tracing studies and would incorporate a sexual network perspective to understanding co-parenting concurrency.

It is also worth noting that the research questions addressed in this dissertation are applicable to women, however the data did not allow the determination of co-parenting concurrency among women. Co-parenting concurrency could not be examined among women because we could not link a biological child to a specific partnership. Strong assumptions would be required to infer to which partnership a biological child belonged using the child's date of birth and the dates of first and last sex, but there would be no way to validate them. Future studies must examine the prevalence and correlates of co-parenting concurrency among women in order to obtain a complete understanding of this phenomenon.

In addition to focusing on co-parenting concurrency, future research should focus on improving overall methods for measuring concurrency and understanding the relationship between concurrency and STIs, particularly HIV (4). Measuring cumulative concurrency requires study participants to recall dates of first and last sex with previous partners. Research assessing the accuracy of date recall and new methods for improving date recall would be beneficial in advancing concurrency research.

Additional studies focusing on further exploration of specific types of concurrency and the STI risk associated with each type are also needed. Concurrent sexual partnerships occur in different patterns and for many different reasons. The behaviors associated with different types of concurrency are not the same and may have different risks associated with them. In order to fully understand the contexts in which concurrency occurs, more qualitative work (among both men and women) to define important types of concurrency and quantitative research to estimate the prevalence of the types is needed (4).

Research should also focus on social norms about concurrency and knowledge and perceived risk about concurrency (4). The factors driving concurrency likely include a combination of low marriage rates, economic factors, and community and cultural norms. Future research into the social and structural drivers of concurrency will provide even more context and insight into concurrency. We have shown that concurrency cannot be treated as a simple dichotomy. In order to develop and implement interventions to reduce concurrency, we must have a more complete understanding of factors that promote it and the associated risks.

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