MIGRATION, SOCIAL DISADVANTAGE, SEXUAL PARTNERSHIPS, AND HIV/STI
IN THE GARÍFUNA POPULATION OF HONDURAS

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ABSTRACT

Anisha D. Gandhi: Migration, Social Disadvantage, Sexual Partnerships,
and HIV/STI in the Garífuna Population of Honduras
(Under the direction of Audrey Pettifor)

This study examined the relationships between HIV/STI status and the social and behavioral factors that are posited to shape the risk of these outcomes in the Garífuna population of Honduras. The Garífuna are a people with African and indigenous origins among whom high rates of HIV and other STIs have been observed. Research from multiple disciplines suggests migration patterns, sexual behavior norms, and social marginalization as a racial/ethnic minority have contributed to this disease burden among the Garífuna. However, gaps in the public health literature pertaining to these relationships persist. Data were collected from a population-based sample of Garífuna men and women in 2012 (n=629) through a survey of sexual behavior and HIV/STI prevalence among key populations in Honduras. Participants completed surveys and provided samples for the diagnosis of HIV, HSV-2, and non-viral STIs. Weighted log-binomial regression models were used to produce prevalence ratios.

The first aim of this study assessed whether temporary migration was associated with multiple sexual partnerships and concurrent sexual partnerships in the last 12 months. Multiple sexual partnerships were more prevalent among migrant men and migrant women relative to non-migrant men and non-migrant women, respectively. Concurrent sexual partnerships were also more prevalent among men and women who migrated, relative to men and women who did not migrate.

The second aim assessed the relationships between HIV, HSV-2 and non-viral STI prevalence and the following measures of social status and social disadvantage: education, unemployment, lack of income or financial support, labor migration, and experience of discrimination. There were no cases of HIV among men or women who had migrated within the last 12 months. Relationships between markers of social disadvantage and disease status were largely not significant or were of small

magnitude. While HIV prevalence has declined in Honduras, the estimated prevalence in this sample of the Garifuna population was 4.1%; HSV-2 and non-viral STI prevalence likewise remained high in comparison to previous estimates. Future research on the social and structural determinants of HIV/STI vulnerability in the Honduran Garífuna population would benefit from continued investigation into the role of mobility and a more thorough assessment of social status.

ACKNOWLEDGMENTS

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APR	Adjusted Prevalence Ratio
CDC	Centers for Disease Control and Prevention, Atlanta
CI	Confidence Interval
ECVC-I	Encuesta Centroamericana de Vigilancia de Comportamiento Sexual y Prevalencia de VIH/ITS en Poblaciones Vulnerables de Honduras, 2006
ECVC-II	Encuesta de Vigilancia del Comportamiento Sexual y Prevalencias de Infecciones de Transmisión Sexual y Virus de la Inmunodeficiencia Humana en poblaciones clave de Honduras, 2012
ELISA	Enzyme-linked immuno-absorbent assay
HIV	Human Immunodeficiency Virus
HSV-2	Herpes Simplex Virus 2
IgG	Glycoprotein G antibody
LCGP	Laboratorio Conmemorativo Gorgas, Panama (Regional HIV/STI Reference Laboratory)
NAAT	Nucleic acid amplification test
NHIVL	National HIV Laboratory of Honduras
NRLH	National STI Reference Laboratory of Honduras
RT-PCR	Real-time polymerase chain reaction
RPR	Rapid plasma reagin
STI	Sexually transmitted infection
TPPA	*Treponema pallidum* particle agglutination assay
UPR	Unadjusted Prevalence Ratio

Chapter I: Specific Aims

This study examined the relationships between HIV and sexually transmitted infection (STI) status and the social and behavioral factors that are posited to shape the risk of these outcomes in the Garífuna population of Honduras. The Garífuna are a people with African and indigenous origins whose presence in modern-day Honduras dates to 1797. While much of the Garífuna population still exists in Honduras, large diasporas have since formed in Belize, Guatemala, Nicaragua, and the United States. In Central America, the Garífuna have fought to preserve a distinct cultural identity as they simultaneously adapt to modern social and economic realities. Since the late 1990s, surveillance has detected elevated rates of HIV in Garífuna communities in comparison to regional and national averages, spawning further research on the social, structural, and behavioral factors that shaped HIV risk within this population. Research from multiple arenas and disciplines asserted that migration patterns, sexual behavior norms -- specifically, the practice of having multiple sexual partners -- contributed to the disproportionate HIV burden, as did the diminished access to health resources that resulted from the low social status occupied by the Garífuna as a racial and ethnic minority.

Migration, having multiple partners or concurrent partners, and social marginalization have all been linked to increased HIV vulnerability. Temporary migration, during which individuals leave their home community, often to pursue better employment opportunities, and then return home periodically to their existing social and sexual networks, characterizes much of the Honduran Garífuna migration process. The presence and propagation of HIV within rural Garífuna communities is often attributed to migrants; narratives in qualitative work detail in particular how some migrant men engage in sexual relations with partners in other cities or countries, and then infect new or existing sexual partners when they return home. The transmission of HIV and other STIs in the Garífuna population may be enhanced through the increased frequency of having multiple sexual partners, and through the practice of concurrency, defined as having two or more sexual relationships that have a temporal

overlap. Whether migration is associated with sexual partnership patterns in the Garífuna has not yet been determined in the epidemiologic literature.

Aim 1, assessed the relationship between temporary migration and having multiple sexual partnerships or concurrent partnerships among Garífuna men and women. Data collected through a nationally representative survey of 629 Garífuna adults in Honduras were analyzed to assess whether temporary migration (defined as spending more than one month away from home) was associated with 1) having two or more sexual partners in the last 12 months; or 2) having concurrent sexual partners in the last 12 months. Concurrency was measured using the first and last dates of sexual contact with study participants' three most recent sexual partners, and then assessing whether temporal overlap was present in at least two of those partnerships. All analyses were conducted separately for men and women. It was hypothesized that having multiple partnerships and concurrent partnerships would be more common among men, and that temporary migration would be positively associated with both outcomes among both men and women.

Social marginalization has also been posited to contribute to the higher HIV and STI rates among the Garífuna in Honduras. Prior research indicates that low socioeconomic status and racial/ethnic discrimination contribute to less access to and utilization of health services, such as HIV/STI testing and treatment. These structural factors may also fuel labor migration, as Garífuna leave rural communities and even urban neighborhoods where they have limited educational and employment opportunities in order to access better wages in bigger cities, tourist destinations, and abroad.

Aim 2 examined whether socioeconomic status, experience of discrimination, and labor migration were associated with current HIV/STI status among Garífuna men and women. This aim used self-reported survey data and laboratory-confirmed diagnoses of 1) HIV; 2) Herpes Simplex Virus 2; and 3) non-viral STIs including *Chlamydia trachomatis*, *Treponoma pallidum*, *Trichomonas vaginalis*, and *Mycoplasma genitalium* from the same nationally representative study described in Aim 1. Socioeconomic status was measured by three separate self-reported indicators, including: highest level of education completed, current unemployment, and lack of income or financial support.

Discrimination was defined as a composite variable combining self-report of recent and lifetime exposure to various manifestations of discrimination for being Garífuna. Labor migration was defined as having migrated for work and spending more than one month away from the home community in the last 12 months, and was assessed among participants and their partners. It was hypothesized that each measure of social disadvantage, as well as labor migration, would be positively associated with disease status, but that the magnitude of association would differ between men and women.

These aims will help determine whether relationships between multiple social and structural risk factors, sexual risk behaviors, and current disease status exist in a large, representative sample of the Garífuna population as they have been posited in prior qualitative literature. Identifying segments of the population with greater HIV/STI vulnerability will help more effectively target existing treatment and prevention programming to those with the greatest need.

Chapter II: Background

1. Significance

The Burden of HIV and Sexually Transmitted Infections in Honduras

An estimated 1.5 million people in Latin America and the Caribbean are living with HIV (1). Within this region, Honduras has historically been one of the most heavily afflicted nations, with an estimated 26,000 people living with HIV as of 2012 (2). The most recent estimates place the national prevalence at 0.5% (1,2), which represents a decrease from estimates between 1-2% in the 1990s and early 2000s (3,4). The HIV epidemic in Honduras is primarily fueled through heterosexual transmission, with concentrated epidemics occurring among men who have sex with men, female sex workers, and within the Garífuna population (5). National prevalence estimates for diagnosed STIs are not available, but the 2011-2012 wave of the Honduras Demographic and Health Surveys indicated that 12% of women and 2% of men had been diagnosed with or experienced symptoms of a sexually transmitted infection within the last 12 months (6). HIV/AIDS is the seventh highest contributor to years of life lost and disability-affected life years in Honduras; both figures experienced over a 200% increase from 1990-2010 (7).

The National Strategic Plan against HIV/AIDS Honduras includes free provision of voluntary testing and counseling, prevention of mother-to-child transmission services, and antiretroviral therapy (8). However, the coverage of these services remains low. Less than 13% of adults nationally reported being tested for HIV in the last 12 months and receiving their results (6); less than 63% of HIV-positive women received ART for the prevention of vertical transmission, and only 49% of those with advanced HIV and in need of ART are receiving it (5).

HIV and STI Epidemics among the Garífuna in Honduras

Despite a nationwide decline in HIV prevalence, Northern Honduras continues to face a generalized epidemic, with about 1% of the total population living with HIV (8). This is also the region in Honduras

with the most concentrated population of Garífuna. The Garífuna are an ethnic minority descended from Black Caribs, a group that emerged on the Caribbean island of St. Vincent through the mixture of West African and indigenous Carib and Arawak populations (9). In 1797, the Black Caribs were deported from St. Vincent to Honduras after surrendering to British forces following defeat in the Carib War (9). Further mixing with the African and Creole populations already present in Honduras led to the creation of the Garífuna as a distinct group in the 1800s (10). With a population between 46,000 and 250,000 (11–13), the Garífuna comprise one of the largest ethnic minorities in Honduras; the wide range in the reported size of the group reflects discrepancies in estimates between national census data and reports from civil society organizations representing the Garífuna and other autochthonous communities in Honduras. Sizeable Garífuna diasporas also exist near the Caribbean coasts of Belize, Guatemala, and Nicaragua, and in a number of US cities (10,14–16).

In Honduras, the Garífuna have been identified as a priority population for HIV prevention (8,17). A study conducted across four established Garífuna communities in 1997-1998 documented an average HIV prevalence of 8.4% (8.5% among women and 8.2% among men), which was comparable to prevalence estimates obtained contemporaneously from men who had sex with men (8.0%) and ambulatory sex workers (9.0%) (18). Of 305 Garífuna participants surveyed in that sample, 18% of men and 13% of women reported having symptoms or being diagnosed with another STI in the past year. In a 2006 bio-behavioral surveillance study among a representative sample of Garífuna adults across eight Garífuna communities in both rural and urban areas, HIV seroprevalence was estimated at 4.5% (5.1% among women and 3.8% among men). Thus, the HIV prevalence among the Garífuna population was more than three times the estimated national average at the time. The burden of STIs was also high, with 10.5%, 6.8% and 7.1% testing positive for *Trichomonas vaginalis*, *Chlamydia trachomatis*, and *Mycoplasma genitalium*, respectively. Fifty-one percent of participants were infected with HSV-2 (19), which was notably higher than what has been reported elsewhere in Latin America (20,21). HSV-2 now accounts for the largest share of genital ulcer disease in developing countries, and augments HIV transmission and acquisition (21).

HIV awareness is high within the Honduran Garífuna population (10,22), and prevention programs are ongoing that specifically address relevant contextual factors (23) and market safer sexual practices (24–26). While such programs receive material and technical support through national and international agencies, only 17% of the national AIDS prevention budget was allotted to most-at-risk populations including the Garífuna, based on a 2012 evaluation (5). While the WHO recommends syndromic antiviral treatment with acyclovir when HSV-2 prevalence exceeds 30% (27), this therapy is not routinely available in primary care facilities in Honduras, and access is not guaranteed per national treatment guidelines.

2. Social and structural context of the HIV/STI epidemics among the Honduran Garífuna
The role of migration in HIV/STI risk among the Honduran Garífuna

The Garífuna of Honduras have, throughout their existence, been characterized as a highly mobile population, such that migration has been deemed central to their existence (28). While both women and men migrate, men are more likely to migrate and to migrate for longer duration (29), often taking jobs in the agricultural or fishing industries (10,16,28,29), or in urban centers that offer superior training and employment opportunities compared to those available within Garífuna communities (22,30). While large numbers of Garífuna have emigrated permanently to other countries, short-term mobility within Honduras is still common (8,29).

Migrants have long been recognized as a population with increased vulnerability to sexually transmitted infections, including HIV (31–33). Cassels *et al* highlight three pathways through which migration can affect HIV risk: the intrinsic risk pathway, the bridging pathway, and the community displacement pathway (34). In summary, migrants may have an intrinsically different risk profile than non-migrants; those who are willing to migrate may be more adventurous and more likely to engage in higher-risk sexual behavior. Conversely, the act of migrating, may enable the uptake of risk behaviors -- such as increased drug and alcohol use, engaging in transactional sex, or simply engaging in relations with new sexual partners -- beyond what occur when confined to one's social environment at home (i.e. the bridging pathway, 35–43). Temporary migrants' acquisition of new

sexual partners at a new destination also bridges distinct sexual networks, and can facilitate HIV/STI transmission if migrants subsequently engage in sexual relations with a different partner upon their return. Finally, risk behaviors at home may alter as a result of high rates of out-migration, such that partners of migrants may be more likely to acquire additional partners or engage in transactional sex during periods of separation (44,45).

Among the Garífuna, mobility has consistently been implicated as a major driver of the HIV epidemic (10,19,22,29,46–48). In 2011, a formative study was conducted among populations prioritized for HIV/STI prevention in Honduras, in preparation for the national surveillance study used for the following analyses. Focus groups and in-depth interviews were conducted to better characterize key factors related to HIV/STI risk within those populations. In that assessment, Garífuna community leaders described the general pattern believed to be contributing to the HIV/AIDS problem:

> "Our youth, and often our adults, men and women have to leave our communities to go to the cities, we're talking about San Pedro Sula and Tegucigalpa or they go to the Bay Islands, or out of the country... When they're back in the country periodically, they come to our communities, to find their partner or to visit their family and they have sex and later they again leave the community and this has brought us serious, serious problems because most of our population that's gone away…they come from San Pedro Sula infected with HIV/AIDS."

> "When he goes away, if a man leaves his family… he always goes to find another family… And yes, it affects us in terms of sexuality because a man has one, two, or three women, or the woman will have another partner too." (27, translated)

A rural community member also described the changed relationship of partners who are separated by migration, even when they are reunited:

> "When one…returns already you won't have the same trust with the woman, because maybe the woman had another lover or he had a lover [out] there and it's not the same, and then comes the break-up." (27, translated)

Similar narratives are echoed elsewhere (10,22,47), usually describing circumstances in which males leave rural or semi-rural Garífuna communities for larger cities or international destinations, engage in unprotected sexual relations while away, and then return home and infect new or existing female partners who are unwilling to use condoms or unable to negotiate their use (22,29,47). Thus, the association between migration and HIV risk among the Garífuna may occur through all three

pathways described -- the **enabling** of higher-risk behaviors such as increased numbers of partners, the **bridging** of Garífuna communities with sexual networks that have greater HIV/STI prevalence, such as urban centers in Honduras and elsewhere with well-established sex work industries, and the **disruption** of sexual partnership patterns in home communities.

Migrants who leave economically-depressed areas to pursue better employment opportunities may also be at greater risk for HIV/STI due to social and economic vulnerability. Migrants from Mexico and Central America often face discrimination, poorer wages, and diminished access to health and social services due to their migrant status, whether they migrate within the region or to other destinations such as the United States (42,49,50). Migrants may have less knowledge of or resources to access health providers or prevention services in transit or at their destination; those that migrate without sufficient documentation may be particularly vulnerable, if they avoid contact with safety net health providers for fear of identification and deportation (33,44,50,51). Thus, access to health information, prevention, testing and treatment services for HIV and other STIs may be limited.

The role of multiple and concurrent sexual partnerships in the Garífuna HIV/STI epidemics

Prior research underscores that migration, and specifically temporary migration, leads to an increase in sexual partners, and enables the practice of sexual concurrency -- defined as having two or more sexual relationships that have a temporal overlap. Both multiple serial partners and concurrent partnerships have been implicated as risk factors for HIV transmission. The role of concurrency in fueling HIV/STI epidemics has been contentious (52–55), but continues to be a focus of investigation in describing potential risk factors for HIV/STI transmission. Concurrent partnerships, and even serial partnerships with short intervals between them, may allow a secondary transfer of infection to the partners of the individual engaging in concurrency (52,56). Thus, concurrency is linked to facilitating *transmission* of infection, rather than acquisition—the individual practicing concurrency may not be at increased risk themselves. However, empirically concurrency has also been linked to STI acquisition (57), which suggests that individuals engaging in concurrency may be more likely to form partnerships with others who likewise have concurrent partnerships. However, the impact of

concurrency on HIV/STI epidemics is dependent on a number of other factors including the stage of the epidemic, types and duration of sexual partnerships, coital frequency, and sexual mixing patterns (52,55).

Several studies have indicated that multiple sexual partnerships are common among the Garífuna, irrespective of migration (10,19,22,58). In the most recent national survey of the Garífuna in Honduras (ECVC-I, the prior wave of the national surveillance study used for this analysis), 57% of men and 44% of women reported having more than one sexual partner in the last 12 months (19). A study of Garífuna men and women living in Trujillo, Honduras found that 38% of men and 22% reported multiple regular sex partners, though the sample was small (n=55) (10). Of note, estimates of multiple partnerships in the latter study were at least twice those reported among Garífuna men and women who had migrated to New York (10). Among 531 Garífuna living in Belize, 59% of men and 33% of women reported having more than one sexual partner in the last 30 days (58). These figures suggest that either multiple partnerships may be more common in men (47), or that there may be differential reporting of such behaviors by gender, as has been found elsewhere (59–61). Regardless, the frequency of multiple recent sexual partnerships occurring among Garífuna men and women appear to be much higher than those reported in the general Honduran population, which averaged only 16% among men and 1% among women nationwide (6,62). The practice of having multiple partners across a lifetime is not in and of itself broadly stigmatized within Garífuna culture (9,63,64), but it is reproached in women to the extent that it impacts their ability to support their children (64). Among men, having multiple partners may be expected; Grieb writes:

> "Men's desire for more than one sexual partner is considered natural, and in the past a man's fidelity was often thought to be the result of sorcery. Although it is acknowledged that women experience great sexual urges as well, their sexual infidelities are not generally acceptable." (10)

In a small sample of Garífuna individuals in Trujillo, Honduras, 54% of men and 74% of women agreed that it was socially acceptable for men to have many sex partners, 60% of men and 69% of women believed it was acceptable for men could have sex outside of a relationship. In contrast, a minority (35% of men and 12% of women) acknowledged the acceptability of women having multiple

sex partners or having sex outside of a relationship (47% of men and 18% of women). However, modernization and the importation of attitudes and experiences of US-bound migrants into Garífuna communities has decreased the tolerance for male infidelity and potentially increased the practice of female infidelity (10). In summary, Garífuna culture may sanction having multiple sexual partners and, to a lesser extent, having overlapping sexual partnerships. Still, condom use remains inconsistent (10,19,22,29,47); only 11% of participants in ECVC-I reported always using condoms with stable partners, and 41% reported always using condoms with casual partners (19). In concert, these norms increase HIV/STI risk.

Social disadvantage in the Garífuna population

As an ethnic minority with both African and indigenous heritage and a language and culture distinct from the *mestizo* mainstream, the Garífuna occupy a distinct social space in Honduras (15,65). While much of the population continues to reside in one of the 40+ nearly-exclusively Garífuna communities situated along the Caribbean coast, significant segments of the population are also found in the largest towns and cities in Northern Honduras (10,12). The Garífuna have encountered social adversity throughout their history; much of the population was decimated by European colonial forces prior to their deportation to Honduras (9), and through the early 20th century, were considered unequal to their *mestizo* counterparts (persons of European and indigenous ancestry):

> "Together with indigenous groups in the region, the garinagu [Garífuna] occupied the
> lowest position on the social hierarchy that was based on class and race, which was
> dominated by white foreigners and the local ladino elites. During the first half of the
> 20th century, the garinagu (Garífuna) continued to occupy the lowest position in a
> country that officially defined itself as "mestizo." (12, translated)

Civil rights movements beginning in the 1950s led to an official recognition of the rights of Garífuna and other racial/ethnic minority groups in Honduras, and their cultural contributions are now celebrated as part of the rich and diverse heritage of the Honduran people (16,65). However, the Garífuna continue to face social marginalization that is both personal and institutionalized (12,15,16,47,48,66). At the institutional level, Garífuna land rights have been challenged such that access to both traditional livelihoods and tourism-based income are under threat (48,66), and rural Garífuna communities have experienced inequitable access to public services, including electricity,

water, and health services (48). Socially, Garífuna continue to be "othered" as both racial and ethnic minorities; reports of racial slurs and stereotypes are not uncommon (12,48), and individuals are denied educational and vocational advancement that is instead offered to their mestizo peers (48).

Traditional Garífuna communities offer limited educational and employment opportunities, such that socioeconomic advancement is challenging for those who remain permanently within them. Nationally, 45% of Garífuna households surveyed had at least one basic need unmet (such as food, non-crowded housing, and sanitation) (11). Recent ecological disasters have demolished agricultural endeavors in some communities, forcing relocation or shifts to other forms of subsistence (67). Educational resources may be especially limited in rural areas, where illiteracy rates among Garífuna are twice as high compared to Garífuna residing in urban areas (12% vs. 6%) (11). Secondary and post-baccalaureate education is not available in some of the most isolated and impoverished communities, so youth desiring advanced education are required to migrate (30). These factors contribute to the longstanding culture of migration among the Garífuna.

The role of social disadvantage in HIV/STI risk

In Aim 2, the following factors are explored in their relationship to HIV, HSV-2 and STI status: temporary migration of individuals and their partners; education; unemployment; lack of financial resources; and discrimination. The role of migration in shaping HIV/STI vulnerability is described above in relation to Aim 1; the remaining factors are discussed below.

Education

Jukes *et al* highlight the pathways through which education affects HIV risk (Figure 2.1). Education may alter the knowledge, attitudes, and perceived control of sexual behavior and HIV prevention, the social and sexual networks to which individuals are exposed, and subsequent socioeconomic status (68). A systematic review of findings from sub-Saharan Africa suggest that in later stages of epidemics, when awareness of mechanisms of HIV transmission and prevention were more widespread, more educated individuals had a lower risk of infection, while inversely, in some contexts, prevalence rose among groups with less education (69). In a large behavioral surveillance

study in the United States, having less than a high school education was highly predictive of new HIV infections (70). Data are largely lacking that quantify the relationship between education and HIV status in Latin America and the Caribbean, but a combined analysis of data from Demographic and Health Surveys across eight countries in the region suggested that less education was associated with earlier sexual debut and higher rates of sexual violence, both of which increase HIV risk (71).

Figure 2.1. Pathways for the effect of educational attainment on HIV infection

(From Jukes *et al,* (68))
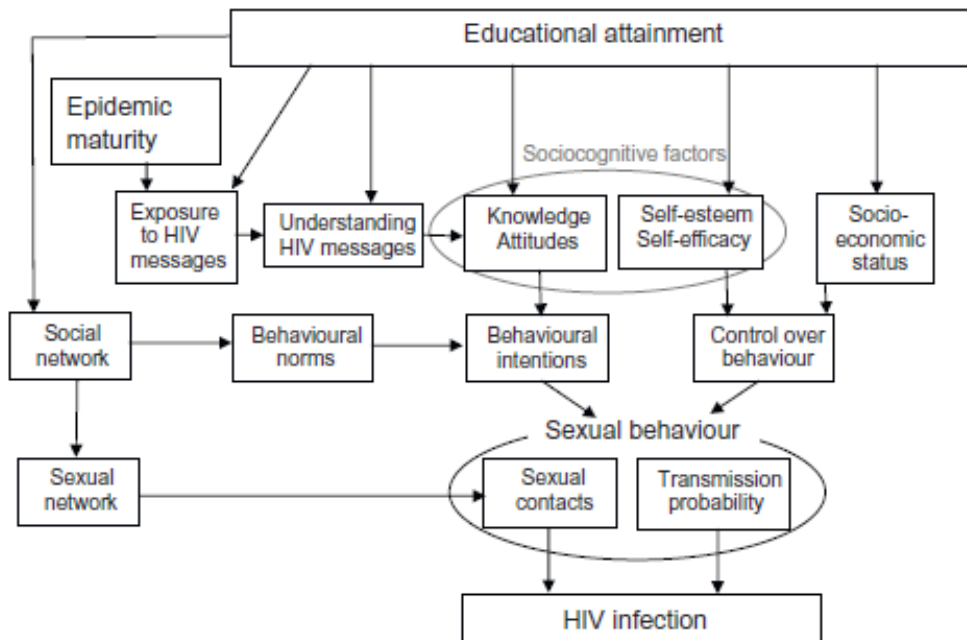
Poverty and Unemployment

Poverty reduces access to health services, including testing and treatment for STIs that may increase the risk of HIV infection (44). Particularly among women, having low or no income may increase exposure to higher-risk sexual encounters, through engagement in transactional or survival sex, diminished power within partnerships to negotiate condom use, and increased risk of intimate partner violence or sexual violence (44,51,72). Though difficult to separate its effects from poverty, unemployment has been linked to increased HIV/STI risk through increased drug and alcohol use

(47,73), engagement in transactional sex (73), and increased sexual activity due to lack of other recreational outlets (73,74). In the United States, household poverty was associated with individual HIV infection (70), while the concentration of poverty and unemployment was associated with HIV incidence in an ecological analysis of 80 cities (75). Recent research underscores that socioeconomic inequality may be an even more salient predictor of HIV infection than individual or area-level measures of income, education, and employment alone (51,71,75).

Discrimination

A recent meta-analysis found that perceived discrimination was associated with worse physical and mental health, a decrease in healthy behaviors, and an increase in unhealthy behaviors (76). Discrimination's effect on physical health may be mediated by post-traumatic stress, changes in immune and inflammatory responses, along with altered health-related behaviors (76–81). At the population level, racial discrimination may increase HIV/STI vulnerability through the segregation of communities into social networks in which poverty is more abundant, and sexual networks in which infections are more prevalent (72,82,83). Individual experience of discrimination can lower self-worth and the perceived control over one's health (79,84), thus diminishing the likelihood of engaging in protective behaviors. In African American and Latinos in the United States, experience of racial discrimination has been linked to unprotected intercourse, a greater number of sexual partners, and engagement in transactional sex (80,84–87). Discrimination can also result in diminished access to health services including testing and treatment for HIV/STIs. Garífuna community members have reported neglect in health care settings when there are non-Garífuna patients that need attending (48) and a lack of STI diagnostic and treatment resources in village clinics (88); full-scale health facilities can be difficult to access from the more remote communities and often have long wait times.

3. Innovation of following analyses

Aim 1

While qualitative literature has linked migration and the practice of having multiple or concurrent sexual partnerships among the Garífuna, the association between these structural and behavioral

factors has not been rigorously assessed in the epidemiologic literature. The prevalence of concurrent partnerships within the Garífuna population remains unmeasured. The high proportion of multiple partners within the last 30 days (50.4%) among Belizean Garífuna suggests a high proportion of concurrency (58), but it is unknown whether these partnerships were serial or overlapping. In ECVC-I, migration among Honduran Garífuna was defined by whether individuals had worked outside their city or country in the last 12 months (19), but did not incorporate the duration of time away or information regarding migration of participants' partners. In that study, the association between migration and the number of sexual partners or HIV/HSV-2/STI status was not reported, and having multiple sexual partners was not associated with increased HSV-2 prevalence (19). It is possible that the high HIV/STI rates and a high frequency of multiple and possibly concurrent partnerships within Garífuna communities, temporary migration of individuals or their partners may not confer additional risk of infection. Assessing the HIV/STI risk behavior associated with mobility among the Garífuna will enhance the specificity of prevention messaging for both migrants and non-migrants in this population.

Aim 2

The association between HIV/STI status and socioeconomic status or individual experience of discrimination has not been assessed in a large sample of heterosexual adults in Latin America outside of the context of commercial sex work. The relationship between labor migration and HIV/STI has not been well-characterized in the Latin American context, and has not been substantiated with epidemiologic evidence within the Garífuna population. Research has highlighted the intersecting effects and sequelae of undereducation, poverty, unemployment, discrimination, and labor migration, but the individual and joint effects of these factors may differ in the Garífuna context. This study will allow us not only to identify whether increased prevalence of HIV, HSV-2, and other non-viral STIs are associated with a number of markers of social disadvantage, but will enable us to determine whether these effects differ between men and women. Identifying segments of the population with the highest burden of infection will improve targeting of testing and treatment services in a setting where access to these resources is limited.

Chapter III: Methods

1. Data source and study population

The analyses conducted for Aims 1 and 2 utilized data derived from the same study and population; that study and population will be described here prior to addressing the analytic methods employed for each individual aim. In 2012 and 2013, the Honduran Ministry of Health conducted the second survey of sexual behavior and HIV/STI prevalence among key populations in Honduras (ECVC-II), implemented by TEPHINET Inc. and in collaboration with the CDC Global AIDS Program for Central America and the Universidad del Valle, Guatemala. The first such surveillance study (ECVC-1) was conducted in 2006 (19). This second cross-sectional study was conducted in accordance with national and global recommendations to monitor HIV/STI prevalence and relevant risk behaviors in order to guide and influence the design, implementation and assessment of national HIV and STI control programs. Four key populations were sampled separately for this study, including: female sex workers, men who have sex with men, persons living with HIV/AIDS, and persons identified as Garífuna. As the sole focus of this work is the Garífuna population in Honduras, the subsequent description will pertain only to that arm of the parent surveillance study.

Formative research

In 2011, a formative assessment was conducted in order to explore key themes that would be addressed and the terminology used in the questionnaire that would be administered to the Garífuna population in ECVC-II. Four focus groups were convened to capture different segments of the Garífuna population: urban men, urban women, rural men, and rural women (total n=30). Five in-depth interviews were also conducted with leaders of Garífuna community organizations in Tela and La Ceiba, two cities with large Garífuna populations. Field work was conducted by technical experts from the STI/HIV/AIDS Department of the Honduras Ministry of Health, from TEPHINET, Inc, public health graduate students working as TEPHINET, Inc interns, and volunteers from a Garífuna

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organization of the town of Corozal. Field staff attended a two-day training workshop prior to conducting the focus groups and interviews. All individuals provided informed consent prior to participation, and were audio-recorded during data collection. Interviews were transcribed, summarized, and coded to identify and ultimately summarize response categories and emergent themes.

Key findings included the substantial effect migration was perceived to have on the concentration of HIV within Garífuna communities, and that Garífuna people experienced several types of both social and institutional discrimination related to their racial/ethnic identity. Additionally, field staff confirmed the appropriate terminology to use when probing survey participants about different types of sexual partners (stable/regular; casual; and commercial). These findings were detailed in a final report (48) that informed the planning and questionnaire finalization for ECVC-II.

Sample design of Garífuna population in ECVC-II

The study population was intended to be a representative sample of the Garífuna population of Honduras. The intended sample size was 800 participants (400 men and 400 women), with half of the sample being recruited from urban areas, and half of the sample being recruited from rural Garífuna communities. The sample size of 800 was designated based on the desired statistical power of being able to detect a 5% change in key indicators such as HIV prevalence across the entire sample, or an 8% change within the urban or rural subsample. It was anticipated that the study would have the statistical power to detect a 10% change in key behavioral indicators such as drug use.

The Garífuna population of Honduras was enumerated in a 2001 national census, which indicated that 84% of the total Garífuna population of Honduras resided in Atlántida, Colón, and Cortés, three contiguous departments in Northern Honduras along the Caribbean coast. The sampling frame for the study was thus limited to these three departments. Within the 20 municipalities with the densest Garífuna populations across these departments, five urban districts and five rural communities were selected with probability proportional to size of the Garífuna population. In 2012, a second census was conducted in the ten selected areas to identify and locate individuals who were at least 18 years

old and who self-identified as Garífuna. Households were entered into the study sampling frame if they had at least one Garífuna man or woman residing there; probability of selection into the sample was proportional to the number of eligible Garífuna adults within the household. Ultimately, the projected sample included 335 men and 465 women, as proportional to the imbalanced sex ratio in the Garífuna population captured by the 2001 census (11).

Coordinating and field staff

Study implementation was directed by technical experts of TEPHINET, Inc. and the Universidad del Valle, Guatemala, with additional managerial and laboratory support from the Honduras Ministry of Health and CDC. Prior to implementation, a four-day training workshop was held in September 2012. The workshop took place in La Ceiba, a large city in Honduras with reasonable proximity to most of the field sites than the capitol, where trainings for the other arms of the study had been held. All field staff from all sites were strongly encouraged to attend, though some interviewers that were subsequently hired were trained at their respective study sites as data collection was initiated. Each site had a designated physician, microbiologist, and interviewers, as well as a nurse and/or counselor. The workshop reviewed in detail the objectives of the study and the procedures involved. The entire survey instrument was reviewed with workshop participants, and particular attention was given to how to assess sexual partnership concurrency. Time was provided for questions and concerns to be addressed, and for modifications to be made to the study protocol and survey instrument as necessary. Teams from each site were also given time to rehearse the flow of study procedures and practice survey administration. The field teams were primarily recruited from the staff already posted at the study sites as regular clinical staff, but additional personnel were appointed (such as interviewers) specifically for the purpose of the study. Staff comprised both Garífuna and non-Garífuna individuals. Given the small size and interconnectedness of some of the Garífuna communities in which the study was implemented, the importance of obtaining informed consent and preserving confidentiality and privacy during data collection was emphasized in training.

Subject recruitment and eligibility

Field staff were provided the name, age and address of each individual selected to participate. Small teams visited the household of each prospective participant to briefly describe the study and them to take part. Participants were considered eligible for the study if they were at least 18 years of age, self-identified as Garífuna, and either lived or regularly visited the area in which they were sampled. Willing and eligible individuals were given a written invitation to visit the designated study site for that area, where they would complete all study procedures. If the selected individual was not available at the time of the visit, the study staff obtained permission from other household residents to make up to three additional visits to recruit the individual. If the selected individual was again not available or refused to participate, field staff approached the next household to the right that had at least one Garífuna person residing there of the same gender as the original recruit.

Data collection procedures

Data collection occurred at seven public health centers that were situated near or within the communities and neighborhoods sampled in the study. The sites were generally well-known by the local population, and in some cases were the sole health facility in the area. All study procedures were conducted in Spanish. Previous work has demonstrated that while the Garífuna maintain an indigenous language, Spanish is universally spoken and its exclusive use would not undermine the representativeness of the study population.

Upon arrival to the study site, a staff member would review the informed consent form and obtain written consent. The staff nurse or counselor would then administer HIV pre-test counseling, after which a trained professional (often the physician or microbiologist/laboratory scientist) would collect a serum sample to conduct a rapid HIV test and other diagnostic tests (described below). A rapid syphilis test was also conducted using serum of women who reported they were pregnant. An interviewer, counselor or other trained staff member would then initiate the survey administration in a private setting inside or within close proximity to the clinic.

Following the interview, the participant would receive a clinical pelvic/genital examination from the staff physician, who would also record a brief medical history in regards to current symptoms of STIs. Male participants then provided a urine sample, while female participants provided a vaginal swab sample collected by clinical study staff. Participants who presented with a history or symptoms of one or more STIs were provided a prescription or treatment, based on national guidelines for syndromic management of the infection(s) in question. Participants were also given a small card with their study identification number and the expected time frame in which they could return to the study site to claim their final STI results. Upon completion of the clinical examination, subjects then returned to the nurse/counselor to receive the results of their HIV test (and syphilis rapid test, when applicable) as well as post-test counseling. Participants receiving a positive HIV test result were referred to a local health center for follow-up and to receive antiretroviral therapy as indicated per national guidelines. Subjects completing the survey and/or providing biological specimens were given a small gift (a recharge card for one of the major national cellular telephone companies, and a purse or shoulder bag) valued around $4 USD in compensation for their time and cost of transport. The data collection period ran from September-December 2012.

Survey Instrument

 The survey instrument addressed participant sociodemographic characteristics; recent migration history; drug and alcohol use; sexual history and behavior; HIV/STI knowledge, attitudes and practices; and experience of discrimination as a member of the Garífuna community. The introductory section of the survey (registration of participant identification code; verification of eligibility; sociodemographic characteristics; and migration history) was administered by the staff member, after which willing subjects with sufficient literacy self-administered the remainder of the questionnaire. Subjects who self-administered the questionnaire were instructed to notify the staff member when they arrived at the survey section regarding concurrent partnerships, which was to be administered by the staff member. This was done to help increase the proportion of complete responses, given the documented difficulty in obtaining accurate data on the dates of first and last sex with recent partners (60,89). However, reasonably high data quality was expected based on the data collected regarding

concurrent partnerships from female sex workers in an earlier round of study implementation, even in the context of a high number of recent sexual partnerships. However, the interviewer was often crucial in prompting recall of specific dates of sexual contact. Questionnaire responses were recorded either on electronic tablets, or on paper. If the participant chose to self-administer the majority of the interview, the interviewer provided a tutorial on how to enter responses electronically or on paper, and remained in the same private area as the participant for the duration of the interview in case additional assistance was needed. Paper surveys were subsequently entered into the electronic tablet by study staff. All surveys stored on tablets were then wirelessly uploaded into a central database, after which data were reviewed and cleaned by TEPHINET technical staff.

Diagnostic tests

 Specimens were collected to test for the following infections: HIV; HSV-2; Syphilis (*T. pallidum)*; Chlamydia (*Chlamydia trachomatis)*; gonorrhea (*N. gonorrhoeae*); trichomoniasis (*T. vaginalis)*; *Mycoplasma genitalium*; and bacterial vaginosis. Details regarding bacterial vaginosis testing, estimation of HIV incidence, and HIV genotyping have been omitted as they are not included in the analysis. Details regarding specific assays used, laboratory sites and quality control sites can be found in Table 3.1. Both serum and urogenital specimens were re-tested at the National Reference Laboratory of Honduras and/or at CDC-Atlanta for quality control.

Ethical considerations

All study procedures were approved by the Biomedical Research Ethics Committee of the National Autonomous University of Honduras, and the statistical analyses described in this dissertation were approved by the Office of Human Research Ethics at the University of North Carolina at Chapel Hill. In order to protect confidentiality, neither participants' names nor personal identifying information were attached to any of the survey forms or biological samples. All forms and samples were identified only by a unique personal numeric code.

2. Analytic methods common to Aims 1 and 2

Analytic sample

Of the 800 participants (335 men and 465 women) selected to participate, survey data was collected from 629 individuals (overall response rate 79%). Of the 171 missing observations, 18 were due to surveys that were completed but lost before data could be recorded in the master study database. It is unknown whether the remaining 153 persons selected to participate declined or could not be located and/or replaced. However, the vast majority of non-responses occurred at two of the most remote rural sites of Cusuna and Punta Piedra, from which survey data are available for only 16% and 6% of the proposed sample, respectively. During mid-implementation evaluation, it was found that these study sites were not consistently equipped with field staff that was willing and able to recruit and matriculate participants; interviews at these two sites were only conducted on four dates in the final weeks of the study. In contrast, data were available for 82-100% of the projected samples from each of the other eight sites. Participation was thus lower than expected in rural areas (61%) and lower among men (69%) compared to women (86%), based on the available survey data.

Analytic methods

All analyses were conducted using Stata 12.1 (90), and employed the *svy* prefix to adjust parameter estimates and standard errors to account for the complex sampling design. The weighted results thus account for the stratification (rural or urban) and clustering (by neighborhood/community sampled) of the observations. The primary sampling unit was defined as the community or district from which the participant was selected (n=10), and each sampling unit grouped into either the urban or rural stratum (n=2). Probability weights were constructed by multiplying the inverse of the total individual probability of selection by the non-response factor based on the fraction of the expected sample who participated:

probability weight= (1/[(probability of community selection)*(probability of individual selection)])*(total expected sample/total realized sample)

such that the probability weights across the 10 sites ranged from 40.7-139.0. These weights were constructed by the TEPHINET technical staff in consultation with the National Statistics Institute of Honduras, such that the weighted population estimates of the survey would most accurately reflect the status of the Garífuna population as measured by the 2001 national census. Unaltered weights were used in so that analyses would remain consistent and comparable to those conducted by collaborators in Central America.

The difference in the distributions of parameters between weighted and unweighted data were typically not substantial, except that the proportion of the sample classified as residing in "rural" increased in the weighted analysis, which was expected. As expected, confidence intervals widened and hypothesis tests were less likely to indicate significant differences between groups in the weighted data due to the decrease in precision produced by the clustered sampling design.

3. Aim 1 Methods

Aim 1 examined the association between temporary migration and the outcomes of 1) multiple sexual partnerships and 2) concurrent sexual partnerships.

Exposure measures

In the survey instrument, participants were asked several questions regarding their mobility in the prior 12 months, including the following: whether they left their community in the last 12 months; where they traveled within and outside of Honduras; the cumulative amount of time they spent away from their community; the frequency and duration of their return trips home; and whether and where they worked outside of their community. Participants were also asked if their spouse or partner had worked outside the community where the participant lived in the last 12 months; where they had worked; the cumulative time spent away; and the frequency and duration of the partner's return trips. Questions regarding partner migrant were not restricted to a current partner. We explored the distribution of each of these measures and noted the poor validity and response rate of the questions regarding the frequency and duration of trips home. These questions may have been misinterpreted or caused confusion, particularly for participants who worked outside of their community but returned

home on a daily basis. Supporting literature was reviewed when choosing the definition of migration for this aim; previous studies do not use a consistent unit to define migrant or mobile persons (34,91–93), but several studies assessing the relationship between migration and HIV risk defined migrants as those who had spent at least one month away from home in the past 12 months (91,94,95). This was an appropriate measure for this study context, as it was a sufficient amount of time to undertake both domestic and international travel patterns described in prior research on the Garífuna culture (9,10,16) and to form sexual partnerships while away from home; but was sensitive enough to capture shorter-term or seasonal mobility. The definition used allowed for more flexibility in multivariable regression analyses than had the definition of migrant been restricted to those who spent more cumulative time away. For this aim, the definition of mobility was not restricted to labor-related migration, as multiple and/or concurrent partnerships occurring among migrants would not be restricted to those traveling for work.

The survey question used to define individual migration was "In the last 12 months, how much time did you spend outside the city or community where you currently live?" The response choices were: 1) I did not leave; 2) Less than one week; 3) Between one week and one month; 4) More than one month and up to three months; 5) More than three months and up to six months; 6) More than six months and up to nine months; and 7) More than 9 months. Responses were then grouped into a dichotomous variable**: non-migrants were those who did not leave or spent a maximum of one month away from their home city or community, whereas migrants were those who spent more than one month away.** Partner migration was defined similarly; participant had migrant partners if they reported that a partner spent more than one month away from where the participant lived in the last 12 months, whereas individuals without migrant partners either had partners who did not spend more than one month away, or reported not having a partner in the last 12 months. The change in results when migration was defined by more or less cumulative time was spent away from home was explored (Appendix Table A-1); a discussion of these findings follows in Chapter 6.

Outcome measures

Multiple sexual partnerships. Having **multiple sexual partnerships was defined as reporting two or more sexual partners in the past 12 months.** Details regarding recent sexual partnership history were captured in five sections of the survey. Participants were asked in successive sections to enumerate the number of stable, occasional, and commercial partners they had in the last 12 months, respectively, with a sexual partner defined as someone with whom the participant engaged in anal or vaginal sex. Clarifications for what signified "stable," "casual" and "commercial" partners were provided in written format or read by the interviewer to prevent double-reporting of the same sexual partner in multiple sections. Participants were then asked to report whether they had any partners from whom they received money in exchange for engaging in sexual relations in the past year, and to provide an average weekly and daily number of partners who provided money in exchange for sex. While a cumulative number of paying partners in the last 12 months was not collected, only three participants (<0.5%) reported receiving money for sex. The number of each type of partner was summed to provide an estimate of the total number of sexual partners in the last year.

This composite measure was then validated against a single item in a subsequent section of the survey, which asked: "In the last 12 months, in total, with how many people have you had sexual relations?" For this question, the participant was reminded to include all stable and casual partners with whom they had anal or vaginal sex in this count, but to restrict inclusion of partners whom they had paid or received payment from for sexual relations to those persons with whom they had engaged in transactional sex at least three times in the last 12 months. Thus, this summary item may have underestimated the total number of recent sexual partners among those who provided or received money for sex, but this affected only 6 participants (<1% of total sample) and did not result in misclassification of whether participants had multiple sexual partners. Additional data cleaning and validation improved consistency between the values of the composite measure and single-item count of the total number of sexual partners in the last 12 months, after which there was over 98%

agreement regarding whether participants had 0-1 sexual partners or 2+ sexual partners in the last 12 months, as defined by Cohen's kappa statistic (96). For the remaining inconsistencies in number of sexual partners that would have affected classification of whether the participant did or did not have multiple sexual partnerships, the value for the single-item question was used. As subjects had already been prompted to recall different types of partners and the number of each type of partner prior to the administration of this question, it was expected that this might have been a more comprehensive, accurate, and straightforward assessment of number of partners. Based on this final count of participants' total number of sexual partners in the last 12 months, having multiple sexual partnerships was defined as reporting 2 or more partners in the last 12 months, while those who reported having 0-1 partners in the last 12 months did not have multiple sexual partners.

Concurrent sexual partnerships. After reporting their total number of sexual partners in the last 12 months, participants were asked by the interviewer to recall their three most recent sexual partners, starting with the person with whom they most recently had anal or vaginal sex. For each of these three most recent partners, participants were asked to provide a number of details, including the dates of first and last sexual contact with that partner. The participant was encouraged to provide the exact date, rather than just the month or year of first and last sexual contact with each respective recent partner. When subjects could not recall the exact date of first or last sex, interviewers were trained to assist respondents in estimating the date by asking whether the sexual contact in question occurred before or after holidays, birthdays, etc. Subjects who reported having more than one partner in the last 12 months were at risk of having concurrent partnerships within that time period. The dates of first and last sex with each reported partner was individually reviewed for each of the 106 participants who reported at least two sexual partners in the last 12 months. **Participants were defined as having concurrent partnerships if they had at least one day of overlap between two or more sexual partnerships, and were defined as not having concurrent partnerships if there was not at least one day of temporal overlap between two concurrent partnerships. If it could not be determined whether at least two partnerships had temporal overlap, due to missing or imprecise values for dates of first or last sex, concurrency was defined as missing.** While a

conservative estimate was chosen as the default outcome definition, the change in results when all missing observations were defined as concurrent or non-concurrent was explored (Chapter 4).

Statistical Analysis

All analyses were conducted separately by sex. It was expected that the frequency of the exposure and outcomes would differ in men and women, and that a stratified analysis would allow for a more thorough description of the migration and sexual behavior patterns of Central American women, for which data are sparse in the existing public health literature. This also allowed for the evaluation of the presence of effect measure modification by gender, as it was hypothesized that the magnitude of association between migration and both outcomes may differ between men and women. No other variables were considered or evaluated as effect measure modifiers.

A number of variables were evaluated for their potential to confound the relationship between the exposure and outcomes, including age, education, marital status, rural residence, age at first sex, having financial dependents, and experiencing forced or transactional sex. The distribution of age was explored across exposure and outcome groups, and the predicted probabilities of each outcome were graphed in men and women within 5-year and 10-year age groups. Exponential transformations of age were also examined. Ultimately, age was incorporated into bivariate analyses and multivariable models as a binary variable (Age 18-24 vs Age 25+, and Age 18-34 vs Age 35+, respectively). These age brackets also allowed for greater comparability to national estimates of sexual behavior (6).

The variables characterizing education, marital status, and having financial dependents were each defined by evaluating the distribution of a single survey item and collapsing response categories to create binary variables that were meaningful and maximized statistical efficiency by reducing the risk of extremely small cell sizes that would hinder multivariable analyses. Rural residence (vs. urban) did not require any transformation as a variable. The distributions of age at first sex and its variations over sex, exposure and outcome categories were also evaluated. Age at first sex was included in

multivariable models as a binary variable. I used a cutpoint of the median age at first sex for men (17+ versus 16 and under) and women (18+ versus 17 and under) based on recent national data (6).

Crude and adjusted prevalence ratios were estimated using binomial regression models with a Poisson distribution. Full models began included all potential confounders that were significantly associated with the exposure, and with the outcome among the unexposed at a level of p<0.10, or that were strong predictors of the outcome (p<0.10 or OR≥2.0 or ≤0.5). In order to maximize the precision of effect estimates, covariates were successively dropped from the regression model if doing so did not result in more than a ten percent change in the main effect estimate or increase the standard error corresponding to that estimate.

4. Aim 2 Methods

Aim 2 examined the association between social disadvantage and HIV/STI status among Garífuna men and women. To this end, the association between six exposures (education; unemployment; income or financial support; individual labor migration; partner labor migration; and experience of discrimination) and three biological outcomes (HIV infection; HSV-2 infection; non-viral sexually transmitted infection) was assessed.

Exposure measures

Socioeconomic status was measured by three separate indicators: education, employment, and access to income.

In the study questionnaire, **education** was assessed by a single question: "What was the last level of education that you finished?" The response choices were as follows: 1) I did not attend school 2) Primary school incomplete 3) Primary school complete 4) Secondary school incomplete 5) Secondary school complete 6) University incomplete 7) University complete. The distribution of responses was examined; less than 10 percent of respondents fell into the extreme categories of not attending school or attending some university, while roughly equal proportions attended some or all of primary school, or some or all of secondary school. Different categorizations of education were explored as they related to each of three disease outcomes to determine salient cutpoints, with the goal of

creating a meaningful differentiation between categories with the least number of indicator variables. Ultimately, a three-part variable was used to assess the relationship between education and HIV, for which the categories were not completing primary school; completing primary but not secondary school; and completing secondary school or beyond. The category of completing primary but not secondary school was the category with the most observations, and thus was selected as the referent group to improve the precision of effect estimates. A binary exposure variable was utilized for assessing the relationship between education and HSV-2 and non-viral STIs, as the association between education and these outcomes was essentially identical for those who had not completed primary school and those who had completed primary but not secondary school. Thus, the exposure to less education for the non-HIV outcomes matched the variable definition used in Aim 1.

Unemployment was defined using responses to the question "What do you do for a living?" to which the participant could respond 1) I don't do anything for a living/I don't have a job 2) I work; 3) I work and am a student; 4) I am a student. Subjects were defined as being employed if they reported that they worked (whether or not they were also a student), and unemployed if they reported not working or only being a student.

Income was captured as the average individual monthly income earned among those who currently had a job. Various categorizations and transformations of income were explored without the identification of meaningful cutpoints that were informative to how income was associated with the outcomes of interest. It was suspected that this measure may not represent the underlying access to financial resources that participants had. Among those who were not currently employed or reported zero average monthly income, 89% received help with their expenses from relatives (63%), friends (2%), partners (44%) or through remittances (18%). However, participants were not asked to quantify this support, so neither the amount of household income nor the absolute amount of income to which the participant had access were available. Thus, the measure of income utilized focused on those that may have been most vulnerable to the potential deleterious effect of poverty. **Not receiving income or financial support** was defined as not currently being employed (and thus having no

official source of income) or reporting an average monthly income of zero, and also reporting "no one" in response to the question "Who helps you with your expenses?"

In contrast to Aim 1, **migration for work** was defined as those who had spent more than one month away from home *and* reported that they left their home community to work in the past 12 months. The proportion of total time spent away for work versus other reasons was not assessed in the survey. However, the same temporal cutoff was used as in Aim 1, as those who spent more than one month away were more likely to work in other departments in Honduras or outside Honduras, thus being farther from their existing social and sexual networks, and from HIV/STI prevention and treatment resources with which they may be more familiar at home. **Partner's migration for work** was also defined by participant's reporting that they had a partner who left the respondent's community to work in the last 12 months, and was away for more than one month during that period.

Subjects were classified as having experienced **racial/ethnic discrimination** if they responded "yes" to at least one of four survey items: ever being a victim of abuse or maltreatment for being Garífuna (including physical and verbal mistreatment); ever being denied a job for being Garífuna; ever being dismissed from or asked to leave a job for being Garífuna; or in the last 12 months, ever suffering any type of discrimination for being Garífuna. Subjects were classified as not having experienced racial/ethnic discrimination if they responded "no" to each of these items.

Outcome measures

The three outcomes of interest were HIV, HSV-2, and non-viral STI.

HIV status was based on concordant results of two rapid tests (Determine, Abbot Laboratories; Oraquick, OraSure Technologies) conducted with serum samples. HIV status was confirmed by an additional enzyme-linked immunoabsorbent assay (ELISA) test at the National Reference Laboratory of Honduras. Indeterminate results on this final ELISA test were then confirmed with Western Blot analysis (HIV Blot 2.2, MP Diagnostics). Due to the small number of cases (n=23), incident cases remained grouped with those who reported already knowing that they were HIV-positive. Thus,

regression analyses focused on identifying the social and socioeconomic correlates of HIV prevalence, rather than solely identifying risk factors among those recently infected.

HSV-2 status was determined using the HerpesSelect ELISA IgG test (Focus Diagnostics), conducted at the National Reference Laboratory of Honduras. While some concerns have been raised about the specificity of this test (97), particularly in populations where HIV/HSV-2 co-infections are somewhat prevalent (98), both sensitivity and specificity of this assay remained high when compared to Western Blot results across three sites in Latin America (99).

Non-viral STI status was defined by whether the participant had current infection with at least one of the following non-viral STIs: *Chlamydia trachomatis*; *Trichomonas vaginalis; Mycoplasma genitalium*; or *Treponoma pallidum*. *C. trachomatis*, *T. vaginalis*, and *M. genitalium* were diagnosed using nucleic acid amplification tests (NAATs) with real-time PCR (RT-PCR) on urine samples (male) and vaginal swab samples (women), while active syphilis was defined as having a rapid plasma reagin (RPR) titer ≥1:8 and a reactive *Treponema pallidum* particle agglutination (TPPA) assay result. While infection with *N. gonorrhoeae* was initially included in this composite measure, the assay performed poorly and resulted in many indeterminate test results. Additional diagnostics and quality control is still underway, the results of which are pending.

Behavioral correlates and covariates

Also investigated were the relationships between each disease outcome and more proximate behaviors and sexual history characteristics that are traditionally associated with increased HIV/STI risk, including ever receiving money for sex; ever providing money for sex; ever experiencing forced sex; condom use; ever having a STI; and drug use. Each of these variables was reported in the survey as a single item with binary response options. Three separate condom use variables were examined: ever use of condoms; frequency of condom use with stable partners in the last 12 months, among those who reported at least one stable partner; and frequency of condom use with casual partners in the last 12 months, among those who reported at least one casual partner. Ever-use of condoms was explored as a substantial proportion of the population (25%) reported they had never

used a condom. While never-condom use increased significantly with age, 11% of participants under 35 had never used a condom. Lifetime drug use was examined for all disease outcomes, while the relationship between drug use in the last 12 months and non-viral STI status was also assessed.

Two variables of interest were defined based on responses to multiple survey items -- having same-sex relations among men; and problem drinking. Men were defined as having same-sex relations if they reported that their first sexual encounter was with a man; if they reported that they only have sex with men or with men and women; or if they reported that one of their three most recent partners was a man. Problem drinking was defined based on a standardized definition of having an average of 7 or more drinks per week among women, or 14 or more drinks per week among men (100). In the survey, drinking was based on the number of days on which alcohol was consumed in the last month, and the average number of alcoholic drinks consumed on each of those days. The product of these numbers was divided by four to produce an estimate of the proportion of men and women engaging in problem drinking.

Additional variables were evaluated for their potential to confound each exposure-outcome relationship, including age, rural residence, current marital status, and education. Age categories were evaluated as covariates for the outcomes of HIV and non-viral STIs, as non-viral STIs were expected to be more common among the youngest age groups. Age was treated as a continuous variable in modeling the outcome of HSV-2, as the prevalence of this infection typically increases with age (101) and age was modeled this way in the previous assessment of the Honduran Garífuna population (19). To generate the variable, the participant's age was divided by 5 so that the exponentiated β coefficient of this parameter would yield the percent change in HSV-2 prevalence associated with each 5-year increase in age. Rural residence, current marital status, and education were all defined as binary variables as described in the discussion of Aim 1 methods.

Statistical analyses

With the exception of modeling the exposure - HIV infection association, all descriptive, bivariate, and multivariable analyses were conducted separately in men and women. The small absolute number of

HIV cases (n=7 among men and n=15 among women) and corresponding poor precision indicated that presenting sex-stratified models would limit my ability to detect potential associations between my exposures of interest and this outcome. However, it was hypothesized that different measures of social disadvantage may have different associations with HIV/STI prevalence between sexes. For example, formal employment is traditionally less common among Garífuna women, who may be more likely to be employed informally or engage in subsistence agriculture (63,64,102). Thus, it was hypothesized that unemployment would be associated with greater HIV/STI prevalence among men, as it may have reflected a more specific, higher-risk social status. Prior research has also indicated that the effect of discrimination on health and health behavior outcomes may differ in men and women (76), though a dearth of research related to sexual risk behaviors and HIV/STI outcomes has simultaneously examined the effects of discrimination in both sexes. Many of the effect estimates did not differ significantly in men versus women, but necessary adjustment sets were different for each sex in multivariable models.

Crude and adjusted prevalence ratios were estimated using binomial regression models with a Poisson distribution. Potential confounders were included in adjusted models if they had a strong or significant association with the exposure and outcome (OR ≥2.0 or ≤0.5, or p<0.10) or were a strong independent predictor of the outcome (OR ≥2.0 or ≤0.5 and p<0.05). Beginning with the covariate least likely to confound the exposure-outcome relationship, variables were successively dropped from the adjusted regression model, if doing so did not result in more than a ten percent change in the main effect estimate or increase the standard error corresponding to that estimate.

In modeling HSV-2 as an outcome, HIV status was included as a covariate, since these infections are often highly correlated, and the goal was to assess each exposure's relationship to HSV-2 independent of HIV status. Ultimately, the inclusion of HIV as a covariate did not substantially alter effect estimates or confidence intervals of the exposures of interest.

Missing outcome data

HIV test results were missing for 16 individuals (2.5% of the total sample), as was the case for HSV-2 test results. Of the 23 persons missing either an HIV test result or an HSV-2 test result, 7 were also missing test results for syphilis, suggesting that there may have been an error in the collecting or processing of the serum samples, or that these seven participants refused or were unable to provide blood samples as part of their study participation.

Syphilis test results were missing for 34 individuals (5.4% of the total sample), and test results for the other non-viral pathogens (*C. trachomatis, T. vaginalis, M. genitalium*) were missing for 70 individuals (11.1% of the total sample). In total, 95 individuals were missing data for the outcome of having a non-viral STI (15.1% of total sample). Of these 95 observations, 20 samples could not be successively amplified in PCR assays in order to diagnose pathogens found in urine or vaginal swab samples, 8 urine or vaginal swab samples were recorded as collected but not received at the laboratory conducting diagnostic testing, and 46 persons (3 men and 43 women) did not provide urine or vaginal swab samples for PCR diagnostic tests. At the time of this submission, 23 genital samples had been received for diagnosis of *C. trachomatis, T. vaginalis,* and *M. genitalium*, but results were pending.

Non-viral STI observations were more likely to be missing among women and from urban sites, but additional analysis did not indicate that missingness was otherwise associated with our exposures or outcomes. However, out of concern that the moderate amount of missing data would bias my results due to correlation with unknown or unmeasured factors that affected my associations of interest, data were multiply imputed using chained equations (103–105) to assess the extent of change in both prevalence estimates and effect estimates for each exposure on the outcome of non-viral STIs. The imputation model included all covariates that were hypothesized to predict the outcome of having any non-viral STI. The outcome for each pathogen-specific test result was imputed separately and used to create a composite outcome variable across the imputed datasets (n=20). The imputation model also incorporated information about the sample clusters and strata to account for intra-class correlation of

observations, though there does not appear to be a definitive approach to appropriately account for survey structure when conducting multiple imputation with chained equations. The prevalence of most sexually transmitted infections increased slightly after imputation (Table A-2). However, exposure-outcome relationships were not significantly altered in analyses using the imputed data, except that precision expectedly decreased. Thus, given the benefits of superior precision and greater ease of analysis and interpretation, results of analyses conducted on the non-imputed data are presented. Models characterizing the association between exposures and the outcome of non-viral STI are thus restricted to 83.5% of all men and 85.7% of all women for whom survey data is available.

5. Limitations

Selection bias may have affected the validity of my analysis. Persons who were selected into the original sample but did not participate may have differed systematically from those who did participate. Women who were selected were more likely to participate than men, but this is unlikely to bias most of our findings since analyses were conducted separately by sex. Residents of Punta Piedra and Cusuna were also less likely to participate, but non-participation at those sites appeared to be largely due to general challenges in study implementation rather than widespread refusal or absence of the selected individuals. However, this non-response resulted in an under-representation of persons from those sites and residents of rural areas. It is difficult to determine whether most of or structural or behavioral indicators of interest or disease outcomes differ systematically within these communities compared to the rest of the sample, due to the small sample reached (n=23).

Perhaps more significantly, these findings may have underestimated the true underlying frequency and as migrants may have been less likely to identified and participate in the study. Those who were gone for longer durations (among whom there was an increased prevalence of having multiple sexual partnerships) may have been especially subject to non-participation as the longer duration away from their residence decreased the likelihood that a repeat visit would have resulted in successful recruitment.

Concurrency may have been misclassified, especially given the large number of observations for which sufficient data was not available to determine whether partnerships were concurrent (36/106 total persons reporting multiple sexual partnerships in the last 12 months). Concurrency is acknowledged as a difficult indicator to measure; the limitations of even recently standardized definitions (106) have been documented (60,107). While many participants with concurrent partnerships reported long periods of overlap that are unlikely to succumb to measurement error, concurrency may be underestimated when measured only through dates of first and last sexual contact, and particularly among younger individuals (108). A direct question about whether sexual relations occurred with one partner between first and last sex with a second partner is typically recommended in addition to the assessment of dates of each partnership, but the study staff were apprehensive about the potential offensiveness of this question and did not believe it would be easily comprehended. These data are also right-censored, in that we failed to capture partnerships that had the potential to be concurrent if sexual contact was resumed with two or more former partners, but we opted to maintain a conservative estimate rather than assume the participants expectations of future sexual relations would definitely result in concurrent partnerships. There may be systematic underreporting of multiple and concurrent partnerships among women and either overreporting or underreporting among men (60) due to social desirability bias, but it is unknown whether misclassification of these outcomes would be related to individual migration history and in what direction this might bias results.

The validity of all diagnostic tests used to determine HIV, HSV-2, and STI status are subject to limitations. It is unlikely that HIV status was misclassified based on the multi-step protocol used to verify positive and negative tests, including pooled RNA analysis that could detect the presence of virus in the acute phase of infection when rapid antibody tests may still yield consistently negative test results. It is more likely that the HerpesSelect test may have yielded more false positives than false negatives given its typical performance within and outside of Latin America (97–99), which would have resulted in an overestimate of HSV-2 prevalence. The syphilis diagnostic process may have produced false positives if periodontal disease was prevalent in this population, as the TPPA assay is

sensitive to other treponemes. However, the low specificity may not have biased our findings much given the low prevalence of syphilis observed in the population. It is assumed that the accuracy of the tests for *Chlamydia, trichomoniasis, and M. genitalium* did not vary systematically with participant characteristics.

Table 3.1: Summary of diagnostic testing protocol for biological outcomes used in Aim 2.

Pathogen	Specimen	Type of Test	Name, Brand (as applicable)	Sensitivity	Specificity	Where test conducted	Where quality control conducted
HIV	Serum	Rapid test(s)	1) Determine, Abbot 2) OraQuick, OraSure	Determine: 100% OraQuick:98.1% (109)	Determine: 98.9% OraQuick:100% (109)	Field Site	N/A
	Serum	ELISA*	Genscreen ULTRA HIV Ag-Ab Assay, Bio-Rad	100%† (110,111)	94.9-100% (110,111)	NRLH	NHIVL
	Serum	Western Blot**	HIV BLOT 2.2, MP Diagnostics	94.9-100% (112)	100% (112)	NRLH	
HSV-2	Serum	IgG ELISA	HerpesSelect, Focus	93.8-100% (97–99)	60.4-94.0% (97–99)	NRLH	CDC
Syphilis	Serum	RPR	Macro-Vue, BD Microbiology Systems	73-100%§ (113,114)	93-99% (113,114)	NRLH	CDC
Syphilis	Serum	TPPA	Serodia, Fujirebio, Inc	88-100% (115,116)	95-100% (115,116)	NRLH	CDC
C. trachomatis	Urine (men) Vaginal swab (women)	NAAT with RT-PCR				LCGP	CDC, NRLH
T. vaginalis	Urine (men) Vaginal swab (women)	NAAT with RT-PCR				LCGP	CDC, NRLH
M. genitalium	Urine (men) Vaginal swab (women)	NAAT with RT-PCR				LCGP	CDC, NRLH

*Conducted on all serum samples, regardless of rapid test results at field site
**Conducted on all samples collected from individuals with inconclusive ELISA results
† Sensitivity among non-acute cases
§ Sensitivity over all stages of syphilis infection

<u>**Chapter IV: Aim 1**</u>

**Migration, multiple sexual partnerships, and sexual concurrency
in the Garífuna population of Honduras, 2012**

Introduction

Within Latin America, Honduras has historically been one of the countries most severely affected by HIV. Recent estimates place the national prevalence at 0.5% (117), indicating a decline from estimates of 1-2% in the 1990s and early 2000s (118). The HIV epidemic in Honduras is primarily attributed to heterosexual transmission (119), with women accounting for a greater proportion of new infections (119,120). In Honduras, the Garífuna, an Afro-indigenous ethnic minority group, have been identified as a priority population for HIV prevention and control efforts due to their historically high rates of infection (8,119). In 2006, the HIV prevalence among a representative sample of Garífuna adults was estimated at 4.5% -- which was three times the national average at the time (19), and comparable to the reported prevalence among female sex workers (121,122). In the 2006 sample, over 50% of Garífuna individuals tested positive for HSV-2 (19), and over 20% were diagnosed with a non-viral STI.

The introduction and perpetuation of HIV transmission among the Honduran Garífuna has been attributed to high rates of mobility within this population (22,29,48). Migration has played a central part in the founding, dispersion, and fragmentation of the Garífuna people (10,16,28,123,124). Contemporary Garífuna migration in Honduras is often characterized as primarily being driven by males who leave rural or semi-rural communities for employment in bigger cities, in tourist destinations such as the Bay Islands, or in other countries including the United States (10,15,19,22,29,48,63). Qualitative research underscores that Garífuna men and women perceive migration to be a central factor in the influx of HIV into their communities; men are believed to acquire partners while away, increasing their risk of HIV, and some then return home infected and may transmit the virus to new or existing partners through unprotected sex (19,22,29,47,48).

Numerous studies show that temporary migration can alter existing sexual partnerships, and provide mobile individuals opportunities to acquire new partners. Migrants physically separated from their usual social norms and networks may experience social isolation (31,35,40) and feel emotionally distanced from partners at home (35,125), which can result in the uptake of substance use and other HIV-related risk behaviors that increase the probability of unprotected sex and exposure to HIV (35,39,40,126–128). Whether they remain home or migrate to different destinations, partners of migrants may also engage in other sexual relationships during periods of separation (22,29,34,45,129,130). If remittances from migrant partners are delayed or insufficient, women may exchange sex for money in order to cover individual or familial expenses (29,45,129).

Such patterns of migration facilitate sexual concurrency (overlapping sexual partnerships), as migrants and their partners may initiate new partnerships while separated and resume relations during periods of reunification (31,33,34,44,49). Epidemiologic literature has underscored the importance of sexual concurrency in the transmission of sexually transmitted infections (STIs) including HIV (32,33,131–134), but mixed results from empirical studies have given rise to controversy as to whether concurrency increases HIV/STI transmission compared to scenarios including the same number of partnerships that occur serially rather than simultaneously (53–55,135,136).

While a number of studies have documented the increased vulnerability to HIV and other STIs faced by Mexican and Central American migrants and their partners (33), epidemiologic evidence has not consistently linked the mobility of these groups to increased numbers of sexual partners, or to increases in sexual concurrency. Prior ethnographic and epidemiologic research suggests that among the Garífuna, having multiple sexual partners is common irrespective of exposure to mobility (29,47,58). In a random sample of 530 Garífuna men and women surveyed in Belize in 2007, 59% of men and 33% of women reported having two or more sexual partners in the last 30 days (58), in contrast to 9% of adults reporting multiple partners in the last year within the general population (137,138). Ethnographic literature suggests that male infidelity is not uncommon within the culture (10,63,64), which would indicate the potential for the heightened prevalence of concurrency. Whether

mobility is linked to sexual partnership patterns, including concurrency, has not been systematically

assessed in a large sample of the Garífuna population. Accurately characterizing the relationship

between migration and sexual risk behavior not only illuminates the social context which shapes

HIV/STI vulnerability for this population, but can help guide public health programmers identify points

along existing pathways of risk at which prevention and outreach efforts may be most needed. Using

data from a national HIV/STI biological and behavioral surveillance survey conducted in Honduras,

we aim to assess the relationship between temporary migration and having multiple sexual

partnerships or concurrent partnerships among Garífuna men and women.

Methods

Data were collected through the second wave of a surveillance survey of sexual behavior and

HIV/STI prevalence in key populations in Honduras from September-December 2012. Results of the

previous wave are described elsewhere (19).

Study Design and Population

The survey was implemented using a population-based multi-stage stratified cluster probability

sample of Garífuna men and women. The 2001 national census indicated that 84% of the total

Garífuna population of Honduras resided in the departments of Atlántida, Colón, and Cortés. In 2012,

within the 20 municipalities with the densest Garífuna populations across these departments, five

urban districts and five rural communities were selected with probability proportional to size of the

Garífuna population. Field staff surveyed households in the ten selected areas to identify and locate

individuals who were at least 18 years old and who self-identified as Garífuna. Households were

entered into the study sampling frame if they had at least one Garífuna man or woman residing there;

probability of selection into the sample was proportional to the number of eligible Garífuna adults

within the household.

The final sample of individuals was designed to reach a sample size of 335 men and 465 women

(800 participants total) chosen through simple random sampling within the selected households, with

a maximum of one participant per household. Field staff visited the household of selected individuals

to invite them to participate. If the selected individual was not available, the study staff obtained

permission from other household residents to make one additional visit to recruit the individual. If the

selected individual was not available or refused to participate, field staff approached the next

household to the right that had at least one Garífuna person residing there of the same gender as the

original recruit. Willing and eligible individuals were given a written invitation to visit the study site and

complete the related study procedures.

Data Collection Procedures

Data collection occurred at seven public health centers, each located near the community or district

from which individuals were recruited. At these clinical sites, study staff reviewed consent forms and

obtained participant signatures prior to the initiation of study procedures. In a private area, trained

interviewers administered a standardized survey on an electronic tablet or on paper if technical

difficulties arose. The survey covered subject demographics, HIV knowledge and attitudes, history of

HIV testing, drug and alcohol use, and a detailed history of sexual behavior and recent sexual

partnerships. After administering the introductory section, interviewers provided participants with

sufficient literacy the option to self-administer the survey, aside from the section covering sexual

concurrency, which was administered by the interviewer. Interviewers provided instructions on how to

use the electronic tablets, and remained in the same private area with the participant as they

completed the questionnaire to address emergent questions or concerns. All surveys were

administered in Spanish. At the end of the study visit, participants were given a card for mobile phone

credit and a purse or shoulder bag, valued at ~$4USD total. All study procedures were approved by

the Biomedical Research Ethics Committee of the National Autonomous University of Honduras and

reviewed and approved by the Centers for Disease Control and Prevention in Atlanta, Georgia, and

the analyses described here were approved by the Office of Human Research Ethics at the University

of North Carolina at Chapel Hill.

Measures

A number of survey measures captured details regarding the recent migration history of participants and their partners. Participants were asked how much time they spent outside their current city or community of residence in the last 12 months. Participants who reported having a partner who had worked elsewhere were also asked how much time that partner had spent outside the city or community where the respondent resided in the last 12 months. Individuals were defined as having migrated if they spent more than one month outside their community of residence. This measure was specific to a substantial length of time away from home that allowed for repeated or prolonged exposure to other sexual partners, regardless of whether that migration was employment-related. Participants were defined as having migrant partners if they reported having a partner in the last 12 months who spent more than one month away from the community where the respondent resided. Within-partnership migration was defined as having migrated for more than one month or having a partner migrate for more than one month, among participants reporting at least one partner in the last 12 months. Additional information on where participants and their partners worked and traveled within and outside of Honduras was also collected.

Key outcomes were: 1) multiple sexual partnerships and 2) concurrent sexual partnerships in the last 12 months. Participants were asked to report their total number of sexual partners in the last 12 months, and were reminded that this count could include stable, casual, and commercial partners. Participants reporting two or more sexual partners in the last 12 months were defined as having multiple sexual partnerships.

To assess the presence of concurrent sexual partnerships, participants were asked to provide detailed profiles of their last three sexual partners within the last 12 months, including the dates of first and last sex. Interviewers were required to administer this section of the survey, in order to maximize data quality and, when necessary, facilitate recall of start and end dates of sexual relationships. Participants were defined as having concurrent partnerships if, based on these dates, there was temporal overlap between two or more of the three most recent sexual partnerships within

the last year. While UNAIDS recommends assessing the presence of temporal overlap of partnerships six months prior to the interview date (106), we adapted the measure by using the date of interview as the reference point in order to maximize participant comprehension and recall. Our definition was conservative, such that participants with two or more sexual partners in the last year were defined as not having concurrent partnerships if a temporal overlap between two or more recent partners could not definitively be established due to incomplete or missing data.

Analysis

As we hypothesized that migration experiences, partnership patterns, and their association may differ between men and women, all analyses were conducted separately by gender. Descriptive statistics regarding population demographics, migration history, and recent sexual partnership characteristics are presented as raw counts accompanied by proportions weighted to reflect the individual probability of inclusion in the sample, based on the clustered and stratified sampling design and the likelihood of non-response across the entire study population. A number of demographic and behavioral variables were evaluated for their potential to confound the association between migration and having 1) multiple or 2) concurrent sexual partnerships, including age, urban residence, marital status, education, current employment status, income, presence of economic dependents, age at first sex, and experience of forced or transactional sex. We compared the sociodemographic profile, exposure and outcome frequencies, and the distribution of recent sexual partnership indicators of men and women in our sample, and used design-based Pearson's chi-squared test statistic to assess whether significant differences existed.

Univariate, bivariate, and multivariate binomial regression analyses were conducted using Stata *svy* commands to adjust the parameter estimates and their standard errors to account for the sampling design, with the primary sampling unit defined as the community or district from which the participant was selected, and each sampling unit grouped into either the urban or rural stratum. Probability weights were constructed by multiplying the inverse of the total individual probability of selection by the non-response factor based on the fraction of the expected sample who participated. Potential

confounders were included in full multivariable models if they were significantly associated (at the level of p≤0.10) with multiple sexual partnerships or concurrent partnerships, respectively. In order to maximize the precision of effect estimates, covariates were dropped from the regression model if doing so did not result in more than a ten percent change in the main effect estimate or increase the standard error corresponding to that estimate.

Sensitivity analyses were conducted to determine the effect of missing values for participants' concurrency status; we produced bounds on the estimated prevalence of concurrency and association between migration and concurrency by redefining participants with indeterminate concurrency status either all non-concurrent (minimum prevalence bound) or all concurrent (maximum prevalence bound). All analyses were conducted using Stata version 12.1 (90).

Results

Of the 800 individuals selected to participate in the survey, 647 provided informed consent. We analyzed data from the 629 individuals (230 men and 399 women) whose completed survey responses were available. The mean age of survey participants was 36.0 years old (range 18-78). The overall age distribution was similar among men and women, though a higher proportion of men were under age 25 (Table 4.1). Forty-three percent of the population was rural, and roughly half (52.2%) had received education beyond primary school. Men were significantly more likely to be employed than women (73.1% vs. 42.2%), and had higher average monthly incomes, while women were significantly more likely to receive help with their expenses (88.0% vs. 56.9%). Women were more likely than men to be married or in a *union libre* and to have economic dependents, though the differences were not significant.

All participants were Honduran-born, and over 98% were recruited and surveyed in the city or community they considered to be their permanent residence. Migration experience in the last year was substantial, and as expected, differed by gender (Table 4.2). Nearly 30% of men and 20% of women had spent any time away from their home city or community in the last 12 months. Among all men, 27.9% had worked outside their home city/community in the last 12 months, with 13.7% having

worked outside their home department, and 1.8% having worked outside of Honduras. Fifteen

percent of all men spent more than one month outside their home community in the last 12 months.

Men who had spent more than one month away in the last year were more likely to be married

(63.1% vs. 46.2%), less likely to be currently employed (61.2% vs. 74.1%), and were younger at

sexual debut compared to men who did not migrate (14.7 years old vs.15.5 years old). A smaller

proportion of women were migrants (8.5%), as defined by having spent more than one month away in

the last year. Compared to men, fewer women worked outside their home city/community (14.4%), in

a different department (5.4%), or outside of Honduras (0.9%). Women were significantly more likely

than men to have migrant partners; 12.4% of women had partners who spent more than one month

away in the last 12 months, compared to only 2.4% of men. Among the sociodemographic and

behavioral variables investigated, only age emerged as a significant correlate of migration among

women; migrant women were more likely to be younger (18-24) compared to non-migrant women

(37.6% vs. 22.4%).

Men reported a greater number of sexual partners in the last year compared to women (mean 2.2 vs.

0.9) (Table 4.2). Men were also more likely to report having sexual partners outside their home

community (19.6% among all men vs. 11.2% among all women). Only six respondents (<1%)

reported providing or receiving money for sex in the last year. Men were more than four times as

likely to have had multiple sexual partnerships in the last 12 months, compared to women (31.7% vs.

6.2%). In an adjusted binomial regression model (Table 4.3), men who spent more than one month

away from home had an increased likelihood of multiple sexual partnerships in the last 12 months

(APR 1.7, 95% CI 1.2-2.4). Multiple sexual partnerships were more likely among men aged 18-34 and

men who were not currently married or in a *union libre* (APRs 1.6, 95% CI 0.9-2.9; and 2.0, 95% CI

1.0-4.0, respectively), and were less likely among men who were older at sexual debut (APR 0.6,

95% CI 0.5-0.7).

Migrant women were more likely to have multiple sexual partners in the last 12 months than non-

migrant women, though precision was poor and the association was not significant (APR 3.0, 95% CI

0.7-12.4). Having multiple sexual partnerships was significantly less likely among women with a later sexual debut (APR 0.3, 95% CI 0.1-0.7).

Among the 106 respondents who reported having at least two partnerships in the last year, only 80 provided sufficient information to determine whether they had concurrent partnerships. Thus, bounds were applied to the estimates of concurrency by defining all those with indefinite status as non-concurrent (minimum bound) or concurrent (maximum bound) as described above. Among those with complete information, 18.0% of men reported concurrent sexual partnerships (bounds 16.5-24.8%). In contrast, only 2.9% of women had concurrent sexual partnerships (bounds 2.9-5.1%). In both unadjusted and adjusted models, migrant men had a higher prevalence of sexual concurrency in the last year (APR 1.6, 95% CI 0.7-3.5), though precision was low for this association [Table 4.4]. In adjusted models, the only major correlates of sexual concurrency were having less education (APR 0.6, 95% CI 0.3, 0.9) and sexual debut at age 17 or later (APR 0.3, 95% CI 0.2-0.7). The main effect estimates and corresponding confidence intervals for the association between migration and concurrency were minimally altered when the minimum and maximum prevalence bounds of concurrency were used as described above (adjusted prevalence ratios ranged from 1.4-1.5).

Concurrency was also more prevalent among migrant women, though the low incidence of the outcome resulted in very low precision for the estimated prevalence ratio (APR 3.7, 95% CI 0.7, 20.7) [Table 4.4]. The effect estimate was also sensitive to defining missing outcomes as either concurrent or non-concurrent, as the corresponding adjusted prevalence ratios for having migrated ranged from 2.8 (95% CI 0.4-18.9) to 3.7 (0.7-19.6), respectively. In the final model omitting observations missing concurrency values, younger age (18-24 years old) was associated with an increased probability of concurrency (APR 3.3, 95% CI 1.3-8.2).

Initially, we sought to investigate whether within-partnership migration (migration of either an individual *or* their partner) was associated with multiple sexual partnerships or concurrency. However, only 5 men reporting having a partner who spent more than one month away from home, limiting our ability to investigate the effect of partners' migration on men's practice of concurrency. Among women

who reported having at least one partner in the last 12 months, those with migrant partners were less likely to have multiple sexual partners themselves, relative to women whose partners did not migrate (APR 0.2, 95% CI 0.0-1.8). Thus, we did not combine partner's migration history with individual migration history as a single exposure variable, as they had opposing effects on the probability of having multiple sexual partnerships among women. There were no women with migrant partners who reported having concurrent partners themselves.

Discussion

In a population sample of Garífuna adults, we found that, among men, temporary migration was significantly associated with having multiple sexual partnerships. These findings are consistent with qualitative studies of the Garífuna in Honduras, in which male migration has been linked to the acquisition of new sexual partners (22,29,48). However, the evidence is somewhat less compelling for the association between temporary migration and concurrency, which was less prevalent than expected. It is possible that in this context, migration more meaningfully impacts sexual partnership patterns by increasing the likelihood of partnership dissolution and increasing serial partnerships, rather than through facilitating concurrent partnerships. Prior research conducted among Mexican men and Puerto Rican women indicates that extensive time in the United States is associated with union dissolution (139,140), but less is known about the impact of shorter-term internal migration on marital and non-marital partnerships in Central America.

Among women, there was a strong association between temporary migration and having multiple sexual partnerships in the last 12 months, though the corresponding confidence interval was wide and included the null. In recent studies conducted in sub-Saharan Africa, female migrants were similarly shown to have a significantly higher number of lifetime partners (141) and recent partners (93) relative to non-migrants. In our sample, the magnitude of association between temporary migration and having multiple sexual partners was even larger among women than among men (APR 3.0, 95% CI 0.7-12.4 vs. APR 1.7, 95% CI 1.2-2.4, respectively), though the difference in estimates was not statistically significant. Still, the impact of women's mobility on sexual behavior merits further inquiry (38,93). HIV/STI vulnerability among migrant women in Latin America is primarily described in

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relation to their increased likelihood to engage in transactional sex, to experience sexual violence, and to becoming victims of sexual trafficking (33). Recent sex work and forced sex were rare in this sample, and were not associated with recent migration. Prior literature has described the social spaces that both migrant and non-migrant Latino men access to meet sexual partners (40,41,125), but has not well characterized the social environments and types of venues in which migrant women in Central America meet consensual, non-commercial partners. Additional research in this area may enhance the effectiveness of both surveillance and intervention efforts (142). Our findings did not support the notion that women with migrant partners were more likely to have multiple partners, as has been suggested in previous research within the Garífuna community (29). Women with migrant partners may be monitored by peers and family members during their partner's absence, as has been reported elsewhere in the region (130,143), thus limiting the opportunity to form new partnerships.

The prevalence of multiple sexual partnerships has declined among both Garífuna men and women of Honduras. In the 2006 wave of this surveillance study, 56.6% of men and 44.0% of women reported having two or more partners in the last year while it was reported by 31.7% of men and 6.2% of women in 2012. Still, multiple sexual partnerships were markedly more prevalent in our sample of Garífuna adults than in the general Honduran population residing in the three departments where our study was conducted (occurring among 16.2-20.7% of men and 1.2-2.9% of women), based on data from the 2011-2012 Honduras Demographic and Health Survey (DHS) (6). We did not find strong evidence to suggest that concurrency is more prevalent within the Garífuna population than in the Honduran population at large. Nationally, 11% of men aged 15-49 reported concurrent partnerships in the last 12 months (6), which is within the confidence bounds of the estimate obtained in our sample among men in the same age group (21.1%, 95% CI 8.6-33.7%). The incidence of concurrent partnerships among women in the national survey (<1%) and women in our sample aged 15-49 was also similar (3.1%, 95% CI 0.6-5.6%).

A number of limitations may have impacted the validity and generalizability of our results. Research involving mobile populations necessarily involves methodological challenges. We acknowledge the potential for selection bias in our study; migrants are less likely to be captured in household surveys

and therefore less likely to participate than non-migrants. In particular, men who migrate internationally may have been underrepresented, as 9% of women reported having partners who had worked outside Honduras in the last 12 months, while less than 2% of men surveyed reported recent international employment. If migrating across borders is accompanied by longer absences from home and increased feelings of social isolation and/or slackening of social controls that may promote new partner acquisition, then under-sampling international migrants may have led to an underestimate in the prevalence of multiple and/or concurrent sexual partnerships. We also acknowledge the potential for differential reporting bias by gender regarding the number of recent partnerships and presence of concurrent partnerships (i.e., overreporting by men, and underreporting by women), which has been described elsewhere (59–61). Our sensitivity analysis suggests that the missing data regarding concurrency among women with multiple sexual partners may have led to an overestimate of the prevalence ratio associated with migration.

The cross-sectional design of the study does not allow us to confirm that migration preceded the acquisition of sexual partnerships. However, having partners outside one's home community was significantly associated with multiple sexual partnerships in the last year among both men and women, suggesting that the experience of migration and the exposure to new environments and sexual networks may indeed be an important driver of this behavior. Our modest sample size also constrained our power to assess whether specific destinations or trajectories (rural-urban, urban-urban) modified the relationship between migration and sexual partnerships/concurrency.

Independent of concurrency, multiple partnerships constitute a risk factor for acquiring HIV and other STIs. Serial partnerships with short gaps between them may result in biologic, if not behavioral concurrency, since an infected person may expose a new partner to HIV/STI while transmission probabilities are highest (56). Given the historically high rates of HIV and other STIs within the Honduran Garífuna population, the high frequency of multiple partnerships may play a crucial role in the course of these epidemics. Forthcoming research from this group will explore whether migration and partnership patterns are associated with current HIV/STI status.

This study contributes to the body of evidence linking migration to increased HIV/STI-related risk behavior in Latin America, but few such studies have been conducted within representative population-based samples of men and women. Future research focused on HIV/STI vulnerability in Latin America should continue to incorporate measures of short- and long-term mobility within and beyond national borders.

Table 4.1. Demographic and behavioral characteristics by gender in a population-based sample of Garífuna adults in Honduras, 2012.

Variable	Total N	Total %*	Men N	Men %	Women N	Women %	p-value**
Age (mean)	**629**	36.0	**230**	36.5	**399**	35.8	
Gender							
Female	399	63.6	0	0.0	399	100.0	0.52
Male	230	36.4	230	100.0	0	0.0	
Age group							
18-24	162	26.0	68	30.3	94	23.5	0.05
25-34	208	32.3	69	27.9	140	34.9	
35-44	102	15.8	27	11.5	75	18.3	
45-54	72	11.3	29	13.4	43	10.0	
55+	85	14.6	38	16.9	47	13.4	
Residence (by interview site)							
Rural	237	43.3	90	43.8	147	43.1	0.88
Non-Rural	392	56.7	140	56.2	252	56.9	
Current relationship status							
Married/Union Libre	354	54.4	119	49.2	235	57.4	0.23
Single, Separated, Divorced, or Widowed	275	45.6	111	50.7	164	42.6	
Education							
Primary school or less	285	47.8	116	50.8	169	46.0	0.43
More than primary school	344	52.2	114	49.2	230	54.0	
Employment status							
Employed	334	53.5	169	73.1	165	42.2	<0.01
Not Employed	292	46.5	60	26.9	232	57.8	
Missing	3		1		2		
Monthly income among employed (mean, in Lempiras)	333	4,422	168	5,262	165	3,599	0.05
Any dependents							
Yes	498	79.0	171	74.3	327	81.8	0.27
No	117	21.0	56	25.7	61	18.2	
Missing	14		3		11		
Receives help with expenses							
Yes	483	76.7	132	56.9	351	88.0	<0.01
No	146	23.3	98	43.1	48	12.0	

*All percents are weighted
*Reflects difference between weighted proportions among men versus women

Table 4.2. Recent migration and sexual partnership characteristics by gender in a population-based sample of Garífuna adults in Honduras, 2012.

Variable	Men N	Men %*	Women N	Women %	p-value**
12-month Migration History	**230**		**399**		
Spent any time away					
Yes	70	28.8	90	19.4	0.05
No	159	71.2	309	80.6	
Missing	1				
Spent more than one month away					
Yes	37	15.0	39	8.5	0.03
No	192	85.0	360	91.5	
Missing	1				
Worked outside home city/community					
Yes	70	27.9	63	14.4	<0.01
No	160	72.1	336	85.6	
Had partner who spent any time away					
Yes	7	3.6	79	19.5	<0.01
No	198	85.1	242	62.8	
No Partner in last 12 months	23	11.3	74	17.7	
Missing	2		4		
Had partner who spent more than one month away					
Yes	5	2.4	48	12.4	<0.01
No	200	86.2	273	69.9	
No Partner in last 12 months	23	11.3	74	17.7	
Missing	2		4		
Had partner who worked outside city/ community*					
Yes	9	4.3	103	25.9	<0.01
No	196	84.4	216	56.2	
No Partner in last 12 months	23	11.3	74	17.9	
Missing	2		6		
12-month sexual partnership history					
Mean number of sexual partners		2.2		0.9	<0.01
Multiple sexual partnerships	78	31.7	28	6.2	<0.01
Concurrent sexual partnerships	39	18.0	11	2.9	<0.01
Multiple sexual partnerships in last 30 days	39	17.4	11	2.0	<0.01
Expect to have future sexual relations with 2+ recent partners	21	11.6	4	1.3	<0.01

*All percents weighted
**Reflects difference between weighted proportions among men versus women

Table 4.3. Multiple sexual partnerships in last 12 months by recent migration history among men and women in a population-based sample of Garífuna adults in Honduras, 2012.

MEN	<2 partners (weighted %)	≥2 partners (weighted %)	Crude Prevalence Ratio (95% CI)	Adjusted Prevalence Ratio (95% CI)
Migration	56.0	44.0	1.5 (1.1, 2.0)	1.7 (1.2, 2.4)
No migration (Ref)	70.2	29.8	1	
Covariates				
Age 18-34	57.4	42.6	2.6 (1.4, 4.7)	1.6 (0.9, 2.9)
Age 35+ (Ref)	83.5	16.5	1	
Primary education or less	81.4	18.6	0.4 (0.3. 0.7)	0.7 (0.4, 1.1)
Beyond primary education (Ref)	54.7	45.3	1	
Not currently married or in union libre	56.3	43.7	2.3 (1.5, 3.5)	2.0 (1.0, 4.0)
Married or in union libre (Ref)	80.6	19.4	1	
Age at first sex 17+	78.7	21.3	0.6 (0.3, 0.9)	0.6 (0.5, 0.7)
Age at first sex <17	61.2	38.4	1	
WOMEN				
Migration	80.9	19.1	3.8 (0.9, 15.5)	3.0 (0.7, 12.4)
No migration (Ref)	95.0	5.0	1	
Covariates				
Age 18-24	84.7	15.3	4.5 (1.5, 13.2)	1.7 (0.9, 3.6)
Age 25+ (Ref)	96.6	3.4	1	
Primary education or less	96.8	3.2	0.4 (0.2, 0.9)	0.3 (0.1,1.0)
Beyond primary education (Ref)	91.2	8.7	1	
Age at first sex 18+	97.8	2.2	0.2 (0.1, 0.7)	0.3 (0.1, 0.7)
Age at first sex <18 (Ref)	90.8	9.2	1	

Table 4.4 Concurrent sexual partnerships in last 12 months by recent migration history among men and women in a population-based sample of Garífuna adults in Honduras, 2012.

MEN	No concurrent partners (weighted %)	Concurrent partners (weighted %)	Crude Prevalence Ratio (95% CI)	Adjusted Prevalence Ratio (95% CI)
Migration	72.8	27.2	1.6 (0.7, 3.9)	1.6 (0.7, 3.5)
No migration (Ref)	83.5	16.5	1	
Covariates				
Age 18-24	73.6	26.4	1.8 (1.1, 3.1)	1.5 (0.9, 2.4)
Age 25+	85.5	14.5	1	
Primary education or less	88.8	11.2	0.4 (0.3, 0.7)	0.6 (0.3, 0.9)
Beyond primary education (Ref)	74.3	25.7	1	
Age at first sex 17+	92.9	7.1	0.3 (0.1, 0.6)	0.3 (0.2, 0.7)
Age at first sex <17 (Ref)	74.9	25.1	1	
WOMEN				
Migration	87.1	12.9	6.4 (1.0, 38.8)	3.7 (0.7, 20.7)
No migration (Ref)	98.0	2.0	1	
Covariates				
Age 18-24	91.6	8.4	6.3 (2.0, 20.0)	3.3 (1.3, 8.2)
Age 25+ (Ref)	98.7	1.3	1	
Age at first sex 18+	99.0	1.0	0.3 (0.0, 2.9)	0.4 (0.3, 5.4)
Age at first sex <18 (Ref)	96.0	4.0	1	

Chapter V: Aim 2

HIV and other sexually transmitted infections in the Garífuna population of Honduras: investigating the role of social disadvantage

Introduction

The Garífuna are an ethnic group that emerged from the integration of African and indigenous Arawak populations on the Caribbean island of St. Vincent. Upon being exiled from St. Vincent by British forces, the Garífuna migrated to Honduras, forming communities on the island of Roatán and along the northern coast of the mainland. Today, sizable Garífuna populations can also be found in Belize, Guatemala, Costa Rica, Nicaragua, and the United States. Estimates of the size of the Garífuna population vary widely, ranging from 46,000 - 250,000 in Honduras and 200,000-400,000 worldwide (11–13).

In Honduras, the Garífuna have been identified as a priority population for interventions aimed at stemming incidence and reducing the burden of HIV (8). Almost since the outset of HIV surveillance in Honduras, Garífuna communities have been observed to have elevated prevalence rates relative to the general population. A study conducted in the late 1990s documented HIV prevalence of 8% in Garífuna communities in Northern Honduras (18), while the estimated national prevalence was closer to 1-2% (4,144). In 2006, the HIV prevalence in a large, representative sample of Garífuna adults was estimated at 4.5% while the national prevalence declined to less than 1% (19). The burden of other sexually transmitted infections (STIs) was also high, with 51% of participants being infected with HSV-2 (19), and over 20% being infected with at least one non-viral STI. In that study, low income and urban residence were the only non-biological factors correlated with HIV or HSV-2 status in multivariate regression analyses, highlighting the importance of socio-economic factors that contribute to HIV/STI risk.

In Honduras, the Garífuna have endured a long history of racial/ethnic discrimination (12,30,48,65), "othered" by their African and indigenous heritage in contrast to the dominant *mestizo* (Euro-

indigenous) majority. Along with other indigenous groups, the Garífuna were perceived in the colonial period as a people that required civilizing (12), and even into the 20th century were proffered low social status (12,16). While mid-century civil rights movements and subsequent legislation diminished many forms of overt discrimination (16,65), residual racism and discrimination against the Garífuna persists in rural and urban settings, in communities and through institutions (12,30,48). Recent qualitative research details experiences of Garífuna individuals being denied educational opportunities, employment and vocational advancement, and equitable medical care on the basis of their skin color or ethnicity (48). Garífuna leaders noted their communities had less access to public services including water and electricity than were available elsewhere (48). The limited availability of higher education and adequate employment in some rural Garífuna communities has perpetuated a longstanding pattern of temporary and permanent out-migration (9,30), such that these communities themselves experience social and economic divestment that threatens the longevity of Garífuna culture. Temporary migration has been linked to the uptake of sexual risk behaviors and increased HIV transmission in Latin America as elsewhere (32,33,35,49), and has been cited by researchers and community members as an important driver of the epidemic among the Garífuna (22,24,29,47,48). Our prior work documented the positive association between migration and having multiple recent sexual partners among men, and a trend toward increased prevalence of concurrency among both men and women [see Tables 4.3 and 4.4].

The literature describing how racial/ethnic minority status affects HIV/STI risk in Central America, outside the realm of commercial sex work, is virtually non-existent. In the US, the experience of racial discrimination has been linked to increased sexual risk behavior, including inconsistent condom use, having high numbers of sexual partners, and engaging in transactional sex among heterosexual African-American men and adolescents (80,84–86). It is posited that the experience of discrimination may increase sexual-risk taking through "reducing perceptions of social power and self-worth" (84). Apart from explicit changes in individual sexual behavior, discrimination can shape HIV/STI vulnerability through altered sexual networks and structural factors that result in differential access to education, prevention, testing, and treatment services (82). An ecological study of 80 US cities found

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that socioeconomic indicators including poverty, income inequality, education, and racial segregation were associated with increased HIV incidence among African Americans (75).

The objectives of this study were to estimate the prevalence of HIV, HSV-2, and non-viral STIs in a representative sample of Honduran Garífuna, and to quantify the association between indicators and sequelae of social disadvantage and HIV/STI status. We hypothesized that income and education would be negatively associated with the likelihood of disease, while temporary migration and experience of discrimination would be positively associated with current infections. Given the persistently high burden of disease in the Garífuna population, identifying sociodemographic and structural correlates of disease will could help target testing and treatment interventions to those at highest risk.

Methods

Study Population

The data were derived from an integrated biological/behavioral surveillance study of HIV/STI prevalence of vulnerable populations in Honduras conducted from September-December 2012. The survey was implemented using a population-based multi-stage stratified cluster probability sample of Garífuna men and women. The sampling frame was constructed based on national censuses conducted in 2001 and 2012 that identified areas with the highest concentration of Garífuna persons. Five urban districts and five rural communities in the departments of Atlántida, Cortés and Colón (politically-defined areas similar to states or provinces) were selected as sites in the final sample, with probability proportional to size of the Garífuna population. Within these selected 10 sites, households with at least one self-identifying Garífuna adult (age 18+) residing there were selected, with probability of selection proportional to the number of Garífuna adults in the household. Individual participants were selected from these households through simple random sampling. Field staff visited households to invite selected individuals to participate. If the individual was not available, study staff made one additional recruitment visit. If the selected individual was unavailable or refused to participate, field staff approached the next household to the right that had at least one Garífuna

person residing there of the same gender as the original recruit. Individuals that were willing and eligible to participate received a written invitation to visit a designated public health center and complete the related study procedures.

Data Collection Procedures

Data collection occurred at seven public health centers, each located near the community or district from which individuals were recruited. Study staff obtained written informed consent prior to initiating study procedures. In a private area, trained interviewers administered a standardized survey with an electronic tablet or on paper if technical difficulties arose. The survey included items regarding subject demographics, HIV knowledge and attitudes, history of HIV testing and STI symptoms, drug and alcohol use, and a detailed history of sexual behavior and recent sexual partnerships. After administering the introductory section and demonstrating how to use the electronic tablets, interviewers provided participants with sufficient literacy the option to self-administer the survey. Interviewers remained in the same private area with the participant as they completed the questionnaire to address emergent questions or concerns.

Participants consenting to diagnostic testing provided blood samples for evaluation of HIV, herpes simplex virus-2 (HSV-2), and syphilis. Urine samples (for male participants) and urogenital swab samples (for female participants) were used to assess evidence of current infection with *Chlamydia trachomatis, Neisseria gonorrhoeae, Trichomonas vaginalis, Mycoplasma genitalium,* and bacterial vaginosis (females only). All participants consenting to HIV testing were provided pre-test counseling and post-test counseling based on rapid test results. Subjects testing HIV-positive were referred to a local health center that could provide antiretroviral therapy per national guidelines. Other sexually transmitted infections were treated syndromically per national recommendations, and subjects were also provided a card with a unique numeric code which they could collect STI test results at the health center.

At the end of the study visit, participants were given a card for mobile phone credit and a purse or shoulder bag, valued at ~$4USD total. All study procedures were conducted in Spanish. All study

procedures were approved by the Biomedical Research Ethics Committee of the National Autonomous University of Honduras and the Associate Director for Science from the Centers for Disease Control and Prevention in Atlanta, Georgia, and the analyses described here were approved by the Office of Human Research Ethics at the University of North Carolina at Chapel Hill.

Exposure Measures

We explored three facets related to social disadvantage: socioeconomic status, labor migration, and experience of discrimination. Individuals' socioeconomic status was characterized by the highest level of education completed; current employment status; and lack of income or financial support, which was defined as not having reported a current occupation that provided income or reporting zero lempiras as the average monthly income received, and not having anyone who provided financial assistance to cover expenses.

Individuals were defined as labor migrants if in the last 12 months they reported leaving their community to work for any amount of time, and reported spending more than one month outside their community of residence. This composite measure was chosen to give particular focus to migration that may have been necessary due to diminished employment opportunities within participants' home communities, but was restricted to those who spent enough time away from home that allowed for repeated or prolonged exposure to other sexual partners. Participants were defined as having labor migrant partners if they reported having a partner in the last 12 months who left the community where the respondent resided to work, and spent more than one month away.

Subjects were classified as having experienced racial/ethnic discrimination if they responded "yes" to at least one of four survey items: ever having been a victim of abuse or maltreatment for being Garífuna (including physical or verbal mistreatment); ever having been denied a job for being Garífuna; ever having been dismissed from or asked to leave a job for being Garífuna; or in the last 12 months, ever having suffered any type of discrimination for being Garífuna. Subjects were classified as not having experienced racial/ethnic discrimination if they responded "no" to each of these items. These were the only items that measured exposure to racial/ethnic discrimination in the

survey, and were adapted from standardized surveys used in Honduras with other vulnerable populations such as female sex workers and men who have sex with men.

Outcome Measures

Our outcomes of interest were 1) current infection with HIV; 1) current infection with HSV-2; and 3) current infection with any of the following non-viral STIs: *Chlamydia trachomatis*; *Trichomonas vaginalis; Mycoplasma genitalium*; or *Treponoma pallidum*. HIV rapid tests (Determine, Abbot Laboratories; Oraquick, OraSure Technologies) were conducted at field sites; results were confirmed by an additional enzyme-linked immunoabsorbent assay (ELISA) test (Genscreen ULTRA, Bio-Rad). Indeterminate ELISA tests were confirmed with Western Blot (HIV BLOT 2.2, MP Diagnostics). HSV-2 status was determined using the HerpesSelect ELISA IgG test (Focus Diagnostics). HIV ELISA, Western Blot, and HSV-2 tests were conducted at the National Reference Laboratory of Honduras. *C. trachomatis*, *N. gonorrhoeae*. *T. vaginalis*, and *M. genitalium* were diagnosed with nucleic acid amplification tests (NAATs) using real-time PCR on urine samples (male) and vaginal swab samples (women) at the Laboratorio Conmemorativo Gorgas, Panama. Active syphilis was defined as having a rapid plasma reagin titer ≥1:8 (Macro-Vue, BD Microbiology Systems) and a reactive *Treponema pallidum* particle agglutination assay result (Serodia, Fujirebio, Inc.). Serum and urogenital samples were submitted for quality control at the Centers for Disease Control and Prevention Laboratory in Atlanta; results of NAATs were also reviewed at the National Reference Laboratory of Honduras.

We assessed additional risk factors as potential correlates of HIV/STI status, including drug and alcohol use, condom use, same-sex relations between men, experience of forced sex, and engaging in transactional sex. Drug use was defined by ever having used illicit drugs, and problem alcohol use was defined as consuming more than seven drinks per week among women or fourteen drinks per week among men (100), based on self-reported consumption in the last 30 days. Non-condom use was defined as never having used a condom. Being a victim of forced sex, same-sex relations between men, and providing or receiving money for sex were based on lifetime reports of these experiences.

Analysis

Univariate statistics describing the study population are provided with raw counts as well as weighted proportions that account for the clustered and stratified sampling design and participant non-response. As we hypothesized that the sociodemographic and behavioral profiles of participants and their relationship to HIV/STI status may differ by sex, we conducted stratified bivariate and multivariate binomial regression analyses separately among men and women. All analyses utilized Stata *svy* commands to ensure appropriate estimation of parameters and their standard errors given the complex sampling design, with the primary sampling unit defined as the community or district from which the participant was selected, and stratum defined as rural or urban.

A number of variables were evaluated for inclusion as covariates in multivariate regression models with the outcomes of HSV-2 and non-viral STIs. We investigated the associations between each exposure and outcome and age, education, marital status, and rural residence, and included them in initial models as confounders if they were associated with both the exposure and outcome. Risk factors including sexual history and substance use were evaluated for their association with these outcomes of interest, and were initially included in multivariable models of our primary exposures if they were associated with the outcome and were not hypothesized to fall on the causal pathway between the exposure and outcome. In order to maximize the precision of effect estimates, covariates were dropped from the regression model if doing so did not result in more than a ten percent change in the main effect estimate or increase the standard error corresponding to that estimate. Given the relatively few cases of HIV in our sample, we present only unadjusted models of the relationship between measures of social disadvantage and sexual/behavioral risk factors and HIV status.

Participant refusals and challenges in laboratory processes led to a moderate amount of missing observations (15.1%) for the non-viral STI outcome. We conducted multiple imputation using chained equations to assess the level of bias due to missing data, and found that the prevalence of individual STIs and the value of the composite STI outcome did not differ significantly from the observed data.

Therefore, we present results of the original, non-imputed data. All analyses were conducted using Stata version 12.1 (90).

Results

Of the 800 selected for participation, 647 individuals completed a questionnaire. We present data from the 629 individuals who completed a survey and provided blood and/or genital samples for diagnostic testing. About two thirds of study participants were female (Table 5.1), reflecting the unequal sex ratio within the Garífuna population of Honduras (11). Approximately half the population were sampled from urban areas, were married or in a *union libre* (similar to a common-law marriage), and were not educated beyond primary school. About one fourth of the men and nearly 60% of women (57.8%) were not employed at the time of the interview, but the vast majority of unemployed individuals received some financial support through remittances or from family, partners, or friends. Approximately seven percent of men and four percent of women had migrated for work and spent more than one month away from their community in the last 12 months. Fifteen percent of the population had experienced some form of discrimination. Approximately 11 percent of men reported ever having sexual relations with men. Providing or receiving money for sex was rare among men and women, but six percent of men and thirteen percent of women had experienced forced sexual relations. Sixteen percent of men and thirty percent of women reported they had never used a condom.

HIV status was determined for 97.5% (n=613) of survey participants. An estimated 3.3% of men (n=7) and 4.5% of women (n=15) tested positive for HIV (Table 5.2); 2.6% of men (n=5) and 2.4% of women (n=8) reported already knowing their HIV-positive status. HIV prevalence did not differ significantly by gender or by urban vs. rural residence. Of the social and structural exposures investigated, only education was significantly associated with HIV (Table 5.3). Those who had less than a primary school education or who had completed secondary school had lower prevalence of HIV infection relative to those with an intermediate level of education. There were no cases of HIV among labor migrants, and one case among the 10.6% of men who reported sex with other men

(n=24). A positive HSV-2 test result was strongly associated with current HIV infection (UPR 6.7, 95% CI 2.1, 21.0).

HSV-2 status (available for 97.5% of participants, n=613) differed significantly by gender; the prevalence was nearly 50% higher among women versus men (58.0% vs. 40.1%). HSV-2 prevalence peaked at 75.6% among men and 89.0% among women over 54 years old (Figure 5.1). Each five-year increase in age was associated with a 16.0% increase in HSV-2 prevalence among men and a 10.5% increase among women. The association between socioeconomic status and HSV-2 status was similar among men and women (Table 5.4). Not advancing past primary school was associated with an increased prevalence of HSV-2 infection relative to initiating secondary school. Current unemployment was associated with a lower prevalence of HSV-2 infection. In multivariate analyses, lack of income or financial support, individual or partner labor-related migration, and prior experience of discrimination were not associated with HSV-2 status among men or women.

Among those who provided samples for non-viral STI assays that were successfully analyzed, 9.9% of men (n=23) and 22.0% of women (n=86) had at least one non-viral STI (Table 5.2). The most common STIs among women were *T. vaginalis* and *M. genitalium,* which were detected in 11.8% and 9.2% of participants, respectively. Among men, the most prevalent STIs were chlamydia (4.5%) and *M. genitalium* (3.1%). In unadjusted analyses, less education was associated with a lower prevalence of non-viral STI among women (UPR 0.6, 95% CI 0.6-0.9), and experience of discrimination was associated with higher STI prevalence among women, but neither of these associations were present in multivariable regression (Table 5.5). Among men, no measures of social disadvantage were linked to non-viral STIs. There were no cases of non-viral STIs among men who had migrant partners.

Other sexual history and behavioral variables were significantly associated with HSV-2 (Table 5.4) and non-viral STIs in adjusted analyses (Table 5.5). Among men, HSV-2 was more prevalent among those who had ever experienced forced sex, and those who had used drugs. Among women, HSV-2 was more prevalent among those who had ever received money for sex and those who reported

problem drinking in the last 30 days. None of these risk factors we examined were significantly associated with non-viral STIs among men in either unadjusted or adjusted models. Among women, non-viral STIs were more likely among those who ever received money for sex, those who experienced forced sex, and those who had ever used drugs.

Discussion

Our hypotheses that low socioeconomic status, labor migration, and experience of discrimination would be associated with HIV and other sexually transmitted infections in the Honduran Garífuna population were not consistently supported. Our analyses indicated that among both men and women, formal education was associated with HIV and HSV-2 status, and employment was also associated with herpes infection. However, the direction of some of these associations was unexpected; non-completion of primary school was associated with lower HIV prevalence, and unemployment was associated with lower HSV-2 prevalence among both men and women. It's possible that there are differences in the sexual networks (and corresponding STI risk) among those who are employed. Additionally, over 90% of those who reported being unemployed reported receiving financial support from others -- this too suggests the existence of social support and peer or kinship networks that may buffer economic disadvantage. Finally, unemployment was measured based on whether participants currently had a job, which may inaccurately depict participants' status, particularly in a population who historically has relied on seasonal work and informal labor (9,102).

Our measures of social disadvantage were largely unassociated with current non-viral STI status. Only having a partner who migrated for work was associated with having a STI among men. The existing accounts of the migration-HIV/STI relationship within the Garífuna population heavily focus on male migration. However, a transnational study of sexual norms and behavior among Garífuna documented the rise in perceived social acceptability of women having multiple partners or having sex outside of a relationship among Garífuna women who had migrated to the US (10); and our own work has documented a higher probability of having multiple sexual partners and a trend toward increased sexual concurrency among Garífuna women who migrate [see Table 4.4]. Thus, Garífuna men may face increased STI risk through their increased risk behavior or through their migrant

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partners. It is noteworthy that we did not find evidence to support a relationship between individual labor migration and HIV/STI status among men or women, given the extent to which prior research has underscored the importance of Garífuna migration patterns on the HIV epidemic (22,29,48,63). As the prevalence of HIV declines across Honduras, and at many of migrants' international destinations, employment-related mobility may not confer greater risk of acquisition than within Garífuna communities and neighborhoods, where HIV/STI prevalence remains high.

We acknowledge a number of limitations that may have prevented us from assessing the true underlying relationships between HIV/STI status and socioeconomic status, migration, and discrimination. First, we were unable to confirm that our exposures of interest preceded infection, or occurred within a time period at which participants were at risk of acquiring sexually transmitted infections, particularly as HSV-2 infections may have occurred and persisted undiagnosed for older participants, and the majority of individuals with HIV had already been diagnosed. Second, some of our measures may not have optimally captured the underlying social and structural factors of interest. Income was only quantified among those who were currently employed, and did not capture the amount of financial support received from others. Total household income may be a preferable measure to collect in future HIV/STI surveillance studies in this population (145), as has been used elsewhere (70,146). Our most broad assessment of discrimination (being treated unequally for being Garífuna) was only captured for the 12-month period prior to the interview, whereas more specific forms of discrimination (physical violence, threats, and denial of employment) that were captured over the lifetime were rarely reported and may not be as pertinent to sexual behavior and sexual health. Studies that have found linkages between racial discrimination and sexual risk behavior utilized a scale addressing both extreme forms of mistreatment and more nuanced manifestations of disrespect in social settings (84–86). Adapting and validating measures of discrimination that more comprehensively address the racial, ethnic and cultural "othering" that Garífuna individuals experience may enhance our ability to evaluate the impact of discrimination on HIV/STI risk,

More traditional risk factors such as drug use, alcohol consumption, and experience of forced sex were significantly associated with non-HIV outcomes among men and women. Increased drug

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trafficking in Honduras in recent years has not left Garífuna communities untouched. Shipments are trafficked through the rural coastline, sometimes in close proximity to Garífuna villages, and community members fear the wealth associated with drug trade may discourage Garífuna youth in both rural and urban settings away from pursuing higher education or other forms of employment (30). Forced sexual relations were reported by 12.6% of women, and were associated with current STI status. Existing health promotion efforts within Garífuna communities have prioritized awareness about the role of gender and gender-based violence in sexual and reproductive health risk (23), but it is unknown whether these programs also address sexual violence. Forced sexual relations were also experienced by 6.2% of all men and by 20.6% of men who had sex with men, highlighting the need for sexual violence intervention activities that extend beyond women.

The HIV epidemic in the Garífuna community of Honduras has been a longstanding one, and as high rates of infection persist, so does the need for effective interventions. Our study found inconsistent associations between socioeconomic disadvantage and HIV/STI status, but we acknowledge the need for improved measures in future sexual health surveillance research within this population.

Table 5.1: Demographic characteristics and prevalence of HIV/STI-related risk factors by gender in a population-based sample of Garífuna adults in Honduras, 2012.

Variable	Men N	Men Weighted %	Women N	Women Weighted %	Total N	Total Weighted %
Demographic characteristics						
Age (mean)	**230**	36.5	**399**	35.8	**629**	36.0
Gender						
Female	0	0.0	399	100.0	399	63.6
Male	230	100.0	0	0.0	230	36.4
Residence (by interview site)						
Rural	90	43.8	147	43.1	237	43.3
Non-Rural	140	56.2	252	56.9	392	56.7
Current relationship status						
Married/Union Libre	119	49.2	235	57.4	354	54.4
Single, Separated, Divorced, or Widowed	111	50.7	164	42.6	275	45.6
Education						
Primary school or less	116	50.8	169	46.0	285	47.8
More than primary school	114	49.2	230	54.0	344	52.2
Employment status						
Employed	169	73.1	165	42.2	334	53.5
Not Employed	60	26.9	232	57.8	292	46.5
Missing	1		2		3	
Monthly income among employed (mean, in Lempiras)	168	5,262	165	3,598	333	4,422
No income/financial support	11	5.5	19	4.9	30	5.1
Some income/financial support	217	94.5	379	95.1	596	94.9
Missing	2		1		3	
Migrant labor in last year						
Yes	22	7.4	19	4.0	41	5.2
No	207	92.6	380	96.0	587	94.8
Missing	1				1	
Migrant labor partner in last year						
Yes	5	2.4	48	12.5	53	8.8
No	223	97.6	345	87.5	568	91.2
Missing	2		6		8	
Ever experienced discrimination						
Yes	41	15.6	64	14.6	105	15.0
No	188	84.4	334	85.4	522	85.0
Missing	1		1		2	
Experienced discrimination in last 12 months						
Yes	36	13.7	55	12.6	91	13.0
No	192	86.3	343	87.4	535	87.0
Missing	2		1		3	

Table 5.1, continued	Men		Women		Total	
HIV/STI-related risk factors	N	Weighted %	N	Weighted %	N	Weighted %
Men who have sex with men*						
Yes	24	10.6		NA		NA
No	206	89.4				
Ever paid money for sex						
Yes	13	5.4	2	0.5	15	2.3
No	216	94.6	396	99.5	612	97.7
Missing	1		1		2	
Ever received money for sex						
Yes	4	2.0	14	3.3	18	2.8
No	225	98.0	384	96.7	609	97.2
Missing	1		1		2	
Ever experienced forced sex						
Yes	15	6.4	56	12.6	71	10.3
No	211	93.6	335	87.4	546	89.7
Missing	4		8		12	
Ever used condom						
Yes	196	84.5	283	69.9	479	75.2
No	34	15.5	116	30.1	150	24.8
Missing						
Condom use with stable partners in last 12 months						
Always	36	22.4	33	10.9	69	15.1
Sometimes	59	32.2	98	34.0	157	33.3
Never	72	45.4	150	55.1	222	51.6
Missing	1		1		2	
Condom use with casual partners in last 12 months						
Always	60	72.0	30	75.8	90	73.3
Sometimes	17	20.6	7	17.5	24	19.5
Never	6	7.4	2	6.7	8	7.2
Ever used drugs						
Yes	46	16.6	16	3.5	62	8.3
No	184	83.4	382	96.5	566	91.7
Missing			1		1	
Used drugs in last 12 months						
Yes	32	11.4	7	1.5	39	5.1
No	198	88.6	391	98.5	589	94.9
Missing	0		1		1	
Problem drinking in last month						
Yes	15	6.5	16	3.8	31	4.8
No	215	93.5	383	96.2	598	95.2
Previous STI diagnosis						
Yes	31	12.5	58	16.5	89	15.1
No	197	87.5	335	83.5	532	84.9
Missing	2		6		8	

Defined as ever having sexual relations with another man

Table 5.2. Prevalence of HIV and other sexually transmitted infections among men and women in a population-based sample of Garífuna adults in Honduras, 2012.

	Men		Women		Total	
	n/N	**Weighted % (95% CI)**	**n/N**	**Weighted % (95% CI)**	**n/N**	**Weighted % (95% CI)**
HIV	**7/224**	**3.3 (0.0, 6.9)**	**15/389**	**4.5 (2.2, 6.9)**	**22/613**	**4.1 (2.2, 5.9)**
HSV-2	**90/224**	**40.1 (33.3, 46.9)**	**218/389**	**58.0 (48.8, 67.2)**	**308/613**	**51.5 (44.2, 58.9)**
Chlamydia	12/212	4.5 (1.4, 7.6)	27/347	6.7 (0.7, 12.6)	39/559	5.9 (1.6, 10.2)
Trichomoniasis	3/212	1.3 (0.0, 2.7)	49/347	11.8 (5.4, 18.3)	52/559	7.8 (4.0, 11.6)
Syphilis	1/207	0.4 (0.0, 1.5)	5/388	1.3 (0.0, 3.6)	6/595	1.0 (0.0, 2.5)
M. genitalium	8/212	3.1 (0.0, 7.1)	34/347	9.2 (4.9, 13.6)	42/559	6.9 (3.7, 10.1)
Any non-viral STI*	23/192	9.9 (3.5, 16.4)	86/342	22.2 (10.8, 33.7)	109/534	17.8 (8.8, 26.8)

Defined as having a positive test result for chlamydia, trichomoniasis, active syphilis, or M. genitalium among those with available data.

Figure 5.1: HSV-2 Prevalence among men and women, by age group in a population-based sample of Garífuna adults in Honduras, 2012.
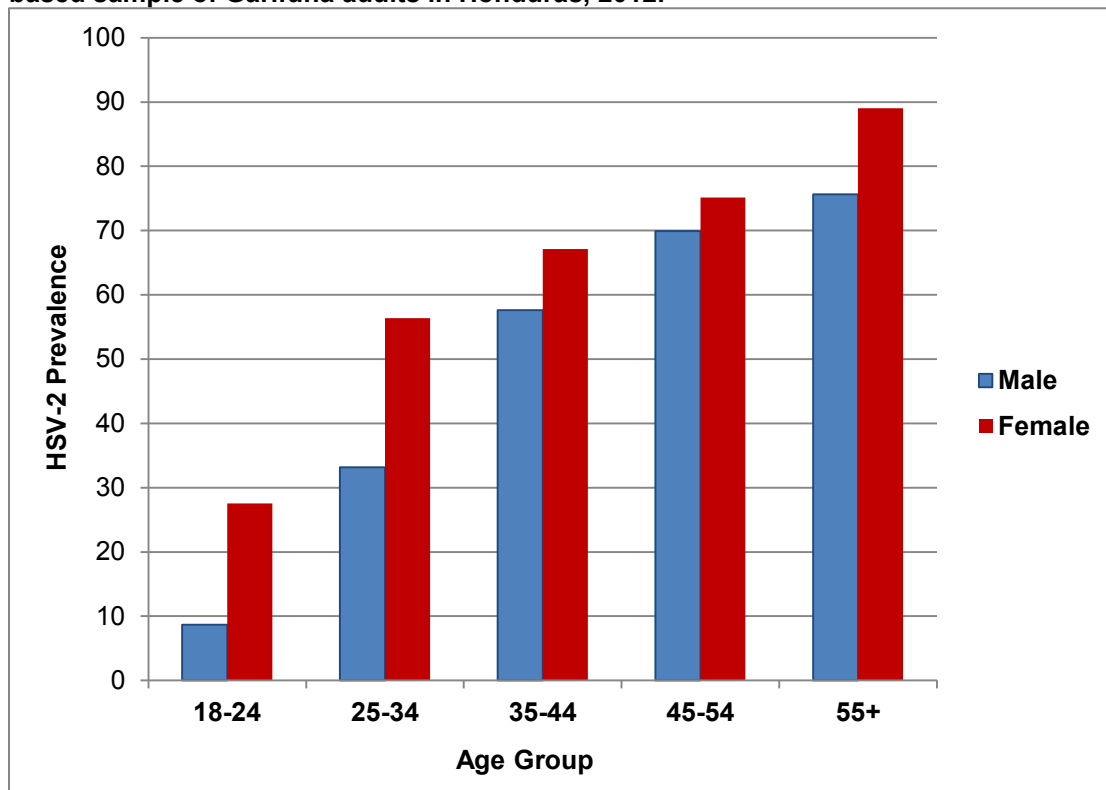
Table 5.3. Association between risk factors and HIV status in a population-based sample of Garífuna adults in Honduras, 2012.

	HIV negative (Weighted %)	HIV positive (Weighted %)	Weighted PR (95% CI)	p-value
Education completed				
Less than primary school	98.3	1.7	0.3 (0.1, 0.6)	**<0.01**
Primary school or initiated secondary school	94.1	5.9	1	
Secondary school or beyond	98.0	2.0	0.3 (0.1, 1.2)	**0.08**
Employment				
Currently unemployed	96.1	3.9	0.9 (0.3, 2.4)	0.8
Currently employed	95.7	4.3	1	
No income or financial support	100.0	0.0	--	--
Some income or financial support	95.7	4.3	1	
Migrated for work	100.0	0.0	--	--
Did not migrate for work	95.7	4.3	1	
Had partner who migrated for work	92.4	7.6	2.2 (0.8, 6.1)	0.13
Did not have partner who migrated for work	96.5	3.5	1	
Experienced discrimination	97.8	2.2	0.5 (0.1, 3.2)	0.41
Did not experience discrimination	95.6	4.4	1	
<u>**HIV/STI risk behaviors**</u>				
Ever same-sex relations among men*	96.3	3.7	1.1 (0.2. 6.5)	0.88
Never same-sex relations among men	96.8	3.2	1	
Ever received money for sex	94.1	5.9	2.0 (0.3, 12.8)	0.43
Never paid for sex	96.4	3.6	1	
Ever experienced forced sex	94.1	5.9	1.6 (0.8, 3.4)	0.17
Never experienced forced sex	96.4	3.6	1	
Never used condom	96.6	3.4	0.8 (0.3, 2.4)	0.64
Ever used condom	95.7	4.3	1	
Ever used drugs	91.7	8.3	2.2 (0.3, 14.9)	0.36
Never used drugs	96.3	3.7	1	
Problem drinking in last month	98.3	1.7	0.4 (0.0, 5.3)	0.44
No problem drinking in last month	95.8	4.2	1	
*Among men only				

Table 5.4. Association between risk factors and HSV-2 by gender in a population-based sample of Garífuna adults in Honduras, 2012.

	Men				Women			
	HSV-2 negative (Wtd %)	HSV-2 positive (Wtd %)	Adjusted PR (95% CI)	p-value	HSV-2 negative (Wtd %)	HSV-2 positive (Wtd %)	Adjusted PR (95% CI)	p-value
Education completed								
Primary school or less	45.3	54.7	1.3 (1.0, 2.0)*	0.08	25.2	74.8	**1.3 (1.2, 1.6)‡**	**<0.01**
More than primary school	74.8	25.2	1		56.7	43.3	1	
Employment								
Currently unemployed	68.2	31.8	**0.7 (0.6, 0.9)****	**<0.01**	47.2	52.8	**0.8 (0.7, 0.9)₮**	**<0.01**
Currently employed	57.2	42.8	1		34.7	65.3	1	
No income or financial support	36.6	63.4	1.3 (0.9, 2.0)**	0.18	25.3	74.7	1.3 (0.9, 1.7)₮	0.13
Some income or financial support	61.5	38.5	1		42.7	57.3	1	
Migrated for work	58.7	41.3	1.1 (0.6, 2.1)•	0.66	70.3	29.7	0.5 (0.3, 1.0)♯	0.06
Did not migrate for work	59.8	40.2	1		40.7	59.3	1	
Had partner who migrated for work	70.2	29.8	0.5 (0.1, 4.9) †	0.51	47.7	52.3	1.0 (0.8, 1.2)‖	0.88
Did not have partner who migrated for work	59.8	40.2	1		40.6	59.4	1	
Experienced discrimination	59.5	40.5	1.1 (0.7, 1.8)•	0.68	47.9	52.1	0.8 (0.6, 1.1) ‖	0.17
Did not experience discrimination	59.7	40.3	1		40.8	59.2	1	
HIV/STI risk behaviors								
Ever same-sex relations among men	49.1	50.9	1.4 (0.7, 2.8)+	0.24	N/A	N/A	N/A	N/A
Never same-sex relations among men	61.2	38.8	1					
Ever received money for sex	N/A	N/A	N/A	N/A	12.1	87.9	**1.5 (1.2, 1.9) +**	**<0.01**
Never received money for sex					42.9	57.1	1	
Ever experienced forced sex	56.1	43.9	**1.7 (1.0, 2.9) +**	**0.04**	35.0	65.0	1.1 (0.9, 1.4) +	0.45
Never experienced forced sex	59.4	40.6	1		42.5	57.5	1	

Table 5.4, continued

Never used condom	40.5	59.5	0.9 (0.6, 1.3) +	0.61	31.8	68.2	0.9 (0.7, 1.0) +	0.08
Ever used condom	63.4	36.6	1		46.5	53.5	1	
No condom use with stable partners in last 12 months	43.8	56.2	0.9 (0.7, 1.3) +	0.58	39.3	60.7	1.0 (0.8, 1.3) +	0.99
Any condom use with stable partners in last 12 months	63.5	36.5	1		45.3	54.7	1	
Inconsistent condom use with casual partners	73.0	27.0	0.9 (0.4, 2.5) +	0.90	68.1	31.9	0.4 (0.1, 1.3) +	0.11
Always used condoms with casual partners in last 12 months	74.8	25.2	1		56.8	43.2	1	
Ever used drugs	42.4	57.6	**1.4 (1.1, 1.8) +**	**0.02**	31.9	68.1	1.3 (0.9, 1.8) +	0.17
Never used drugs	63.3	36.7	1		42.4	57.6	1	
Problem drinking in last month	51.7	48.3	1.2 (0.6, 2.6) +	0.57	14.5	85.5	**1.3 (1.0, 1.7) +**	**0.03**
No problem drinking in last month	60.4	39.5	1		43.1	56.9	1	

Multivariate models adjusted for:
Age, rural residence, marital status, lifetime drug use, HIV status and sex with men
**Age, education, marital status, lifetime drug use, HIV status, and sex with men*
• *Age, marital status, lifetime drug use, HIV status, and sex with men*
† *Age*
‡ *Age, receiving money for sex, problem drinking, and HIV status.*
Ŧ *Age, education, receiving money for sex, problem drinking, and HIV status*
♯ *Age, education, receiving money for sex, problem drinking, and non-use of condoms*
‖ *Age, education, receiving money for sex, problem drinking, and HIV status*
+ *Adjusted for age, education, rural residence, marital status, and HIV status*

Table 5.5 Association between risk factors and non-viral STI status by gender in a population based sample of Garífuna adults in Honduras, 2012.

	Men				Women			
	no STI (Wtd %)	STI (Wtd %)	Adjusted PR (95% CI)	p-value	no STI (Wtd %)	STI (Wtd %)	Adjusted PR (95% CI)	p-value
Education completed								
Primary school or less	95.6	4.4	0.3 (0.1, 1.0)*	0.05	82.3	17.2	1.1 (0.7, 1.9)•	0.59
More than primary school	84.0	16.0	1		73.2	26.8	1	
Employment								
Currently unemployed	91.9	8.1	0.8 (0.3, 1.7)**	0.47	74.4	25.6	1.4 (0.7, 2.7) ₺	0.24
Currently employed	89.4	10.6	1		83.2	16.8	1	
No income or financial support	85.8	14.2	1.1 (0.4, 2.8)**	0.80	87.4	12.6	0.6 (0.1, 2.4)•	0.39
Some income or financial support	90.1	9.9	1		77.3	22.7	1	
Migrated for work	93.4	6.6	0.5 (0.1, 3.3)**	0.38	87.9	12.1	0.5 (0.1, 3.3)♯	0.45
Did not migrate for work	89.7	10.3	1		77.4	22.6		
Had partner who migrated for work	100.0	0.0	--		87.8	12.2	0.6 (0.3, 1.2)•	0.13
Did not have partner who migrated for work	89.6	10.4	1		77.1	22.9	1	
Experienced discrimination**	90.4	9.6	0.7 (0.3, 1.6)**	0.41	72.4	27.6	1.2 (0.9, 1.5)•	0.11
Did not experience discrimination	89.9	10.1	1		78.7	21.3	1	
HIV/STI risk factors								
Ever same-sex relations†	92.0	8.0	0.4 (0.1, 1.5)	0.16	N/A	N/A	N/A	N/A
Never same-sex relations	89.8	10.1	1					
Ever received money for sex†	N/A	N/A	N/A	N/A	65.4	34.6	**1.6 (1.1, 2.3)**	**0.02**
Never received money for sex					78.2	21.8	1	
Ever experienced forced sex†	92.5	7.5	0.5 (0.1, 2.8)	0.40	67.6	32.4	**1.7 (1.1, 2.6)**	**0.03**
Never experienced forced sex	89.8	10.2	1		79.1	20.9	1	
Never used condom†	93.9	6.1	1.0 (0.2, 4.6)	0.97	84.9	15.1	0.8 (0.4, 1.8)	0.57
Ever used condom	89.3	10.7	1		74.4	25.6	1	
No condom use with stable partners in last 12 months	90.2	9.8	0.8 (0.2, 3.1)	0.73	82.3	17.3	0.8 (0.7, 1.1)	0.16
Any condom use with stable partners in last 12 months	86.4	13.6	1		73.8	26.2	1	

Table 5.5, continued

Inconsistent condom use with casual partners	81.8	18.2	2.3 (0.5, 9.6)	0.22	92.9	7.1	0.15 (0.0, 1.2)	0.07
Always used condoms with casual partners in last 12 months	90.7	10.3	1		65.9	34.1	1	
Ever used drugs †	83.5	16.5	1.4 (0.5, 4.0)	0.46	41.8	58.2	**2.1 (1.1, 3.8)**	**0.02**
Never used drugs	91.3	8.7	1		78.9	21.1	1	
Problem drinking in last month†	87.3	12.7	2.3 (0.2, 22.8)	0.42	70.0	30.0	1.7 (0.8, 3.8)	0.14
No problem drinking in last month	90.3	9.7	1		78.1	21.9	1	

Multivariable models adjusted for:

*Age and marital status

**Age, education and marital status

† Age, education, rural residence and marital status

• Age, rural residence, and lifetime drug use

₮ Age, rural residence, and experience of forced sex

♯ Age, rural residence, lifetime drug use, experience of forced sex

Chapter VI: Discussion

The Garífuna have long been recognized as a priority population for HIV prevention programming in Honduras, due to the high prevalence rates of infection observed in this group relative to the general population (5,8,18,19). Qualitative and ethnographic research has linked these higher disease rates among the Garífuna to social, structural, and behavioral factors that confer increased HIV/STI vulnerability, including social marginalization due to their racial/ethnic minority status (47,48); high rates of temporary migration (19,22,29,47,48); and having multiple sexual partners (10,19,47,58). However, the relationships between these factors, sexual risk behaviors, and HIV/STI status have not been well-characterized in a large, representative sample of the Garífuna population. Identifying factors associated with higher-risk sexual behavior (such as multiple or concurrent sexual partnerships) and with disease status can help target future intervention strategies toward segments of the Garífuna population who are most vulnerable, toward improving access to socioeconomic and institutional resources associated with lower disease prevalence, and toward mitigating deleterious effects of exposures associated with increased risk of infection.

These analyses sought to assess the prevalence of multiple social, structural, and behavioral factors associated with increased HIV/STI risk, and determine their association with HIV, HSV-2, and non-viral STI status in a large, population-based multi-stage stratified cluster probability sample of the Garífuna population obtained from a cross-sectional biological and behavioral surveillance study conducted in 2012. The use of *svy* commands in Stata v. 12.1 (90) produced weighted proportions and corrected confidence intervals to account for the multi-stage clustered and stratified sampling strategy, individual probability of inclusion in the sample, and sample-wide non-response, such that the results can be generalized to the Garífuna population as captured in the national census. Aim 1 assessed the relationship between temporary migration and the outcomes of having 1) multiple sexual partnerships or 2) concurrent sexual partnerships within the last 12 months. Aim 2 assessed the relationships between current laboratory-confirmed infection with HIV, HSV-2, or non-viral STIs

and number of markers of social status and social disadvantage, including lower educational status; unemployment; lack of income or financial support; labor migration or partner's labor migration; and experience of discrimination. Because a key interest was to quantify the distribution of exposures and outcomes as they occurred in men and women, and to assess whether the exposure-outcome relationships differed in men versus women, analyses were conducted separately by sex.

Summary of findings

Aim 1

In multivariable analysis, temporary migration was associated with having multiple sexual partnerships among Garífuna men (APR 1.7, 95% CI 1.2-2.4). Sexual concurrency was also more prevalent among migrant men, though the association was not statistically significant (APR 1.6, 95% CI 0.7-3.5). Both multiple sexual partnerships and concurrent partnerships were more prevalent among migrant Garífuna women, but the low frequency of these outcomes contributed to poor precision surrounding the respective effect estimates in regression models (for multiple sexual partnerships, APR 3.0, 95% CI 0.7, 12.4; for concurrent partnerships, APR 3.7, 95% CI 0.7-20.7). Multiple sexual partnerships occurred among 31.7% of men and 6.2% of women in our sample, which was a marked decline from the 2006 wave of the surveillance study, when 56.6% of men and 44.0% of women reported having two or more partners in the last year. However, multiple sexual partnerships were more common in our sample than in the general Honduran population residing in the three departments where our study was conducted (occurring among 16.2-20.7% of men and 1.2-2.9% of women) (6). Recent concurrent partnerships occurred less frequently than expected among men (18.0%) and women (2.0%). In a large study of Garífuna adults in Belize conducted in 2007, 58.7% of men and 32.9% of women reported multiple partners within a 30-day period (58), compared to less than 2% of Belizean women nationwide reporting multiple partners in a 12-month period in 2006 (147). In our sample, temporary migration, multiple sexual partnerships, and concurrent sexual partnerships, were all more frequent among men relative to women. Nearly 28% of men worked outside their home community in the last 12 months, and 15.0% spent more than one month away from home in that time. However, 14.4% of all women reported working outside their community and

8.5% of women reported spending more than one month outside of their home community in the last 12 months -- patterns which have been relatively underexplored in recent public health research.

Aim 2

HIV, HSV-2, and STI prevalence remained fairly stable compared to 2006 estimates within the Honduran Garífuna population (19). In weighted analysis, 3.3% of men and 4.5% tested positive for HIV -- estimates that are dramatically higher than the national prevalence of 0.5%, and that support the continued prioritization of the Garífuna population in the allocation of resources for HIV prevention and treatment services. Additionally, 40.1% of men and 58.0% of women tested positive for HSV-2, and 10.8% of men and 22.2% of women received a positive result for infection with *C. trachomatis*; *T. vaginalis*, *T. pallidum;* or *M. genitalium*.

While analyses in Aim 1 indicated an association between migration and sexual risk behavior among men, no cases of HIV were found among men or women who reported migrating in the last year. In unadjusted analyses that was not stratified by gender (owing to a small number of HIV infections), the only exposure we identified as a significant correlate of HIV status was education. Relative to those who completed primary school but not secondary school, the prevalence of HIV was lower among those who had not completed primary school (APR 0.3, 95% CI 0.1- 0.6) and among those wo had completed secondary school (APR 0.3, 95% CI 0.1-1.2). In contrast, receiving only primary education was associated with a higher prevalence of HSV-2 infection among women (APR 1.3, 95% CI 1.2-1.6) relative to advancing beyond primary school; the adjusted prevalence ratio was identical in men but the association was not statistically significant (APR 1.3, 95% CI 1.0-2.0). Women with migrant partners had an increased prevalence of HIV, though precision was poor for this estimate (APR 2.4, 95% CI 0.7-8.2). Current unemployment was associated with a lower prevalence of HSV-2 infection among both men (APR 0.7, 95% CI 0.6, 0.9) and women (APR 0.8, 95% CI 0.7-0.9). In examining the relationship between markers of social disadvantage and non-viral STIs, individual labor migration, lack of income or financial support, and lifetime experience of discrimination were not associated with HSV-2 or non-viral STI status in either men or women. However, when restricted to experiences

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within the last 12 months, racial/ethnic discrimination was significantly associated with having a non-viral STI among women (APR 1.4, 95% CI 1.1-1.8).

In an examination of proximate risk factors for HIV/STI infection, being the victim of forced sexual relations was associated with increased HSV-2 prevalence among men (APR 1.7, 95% CI 1.0, 2.9) and increased non-viral STI prevalence among women (APR 1.7, 95% CI 1.1-2.6), and receiving money for sex was associated with increased HSV-2 (APR 1.5, 95% CI 1.2-1.9) and STI prevalence (APR 1.6, 95% CI 1.1-2.3) among women. Ever-use of illicit drugs was associated with HSV-2 among men (APR 1.4, 95% CI 1.4-1.8) and non-viral STIs among women (APR 2.1, 95% CI 1.1, 3.8), while problem drinking was associated with HSV-2 status among women (APR 1.3, 95% CI 1.0, 1.7).

Contributions to the public health literature

Migration, sexual partnerships and HIV/STI status

Prior research consistently links high rates of mobility within the Garífuna population to the existing high rates of HIV, and suggests that migrant men in particular are apt to acquire HIV while away from their community and then return home and infect new or existing female sexual partners. However, while our evidence suggests that migrant men (and to a lesser extent, women) may be more likely to have multiple sexual partners, HIV infections were absent among those who spent time away from their community. When we restricted our assessment of migration to those who had left their communities to work, neither individual nor partner migration was associated with either HSV-2 or non-viral STI status among men or women. However, HIV infections were more prevalent among women with migrant partners (UPR 2.2, 95% CI 0.8-6.1); there were no HIV cases among men with migrant partners. When analysis was restricted to already diagnosed cases of HIV (women who reported they already knew they were infected), a strong and significant association was observed between partner's labor migration and increased HIV prevalence (UPR 5.7, 95% CI 1.1-30.1). There were no newly-diagnosed cases of HIV among women with migrant partners. It's unknown whether women became infected through their currently migrating partners, and whether the partner's

migration experience preceded infection, or whether the partner's current migration was prompted by these women's increase in expenses for HIV-related care or other factors.

This is the first known study to assess in detail the recent migration histories, the prevalence of concurrency, and the relationship between migration, sexual behavior, and HIV/STI status in a representative sample of Garífuna men and women, and the first large quantitative study we have identified that documents sexual behavior characteristics of female migrants in Latin America who are not sex workers. In our sample, migrants engaged in higher-risk sexual behavior such as multiple or concurrent sexual partnerships, but this behavior did not necessarily translate into a greater burden of disease among them. Increased proportions of migrants' partners tested positive for HIV (among women), though we did not find evidence to support that partners of migrants were more likely to engage in multiple or concurrent partnerships. It's possible that this study undersampled migrants, who were less likely to be located or participate in the study due to their absence. Thus, the study may have been better equipped to capture the HIV risk associated with male migration through the increased proportion of infections among their female partners.

HIV/STI vulnerability in the context of migration is contingent on the social environment, sexual networks, and structural HIV/STI prevention resources available to migrants in transit and at destination sites, and the psychological impact of migration and the risky or protective behaviors it may engender among mobile individuals. Much of the research focused on HIV and related risk factors among Mesoamerican migrants has focused on sexual behavior changes (or lack thereof) among female sex workers and males who have migrated from Latin America to the United States (33). In contrast, migration within our study population occurred largely within Honduras. Internal migrants may have greater ease navigating cities and towns within Honduras that they visit, and less difficulty obtaining condoms and accessing other health services than international migrants, who may face discrimination and have limited access to clinical care due to their foreign status and/or lack of documentation. In our sample, recent HIV testing and condom use at last sex with a stable partner did not differ significantly between migrants and non-migrants, and migrants were significantly *more* likely to have used a condom at last sex with a stable partner. No male or female migrants reported

experiencing forced sex or receiving money for sex in the last 12 months, and there were no significant differences in the proportion of male or female migrants and non-migrants who provided sex for money during that period. Thus, while the HIV prevalence among higher-risk populations such as sex workers is higher in common Garífuna migrant destinations such as San Pedro Sula and La Ceiba (4), our data suggest that these are not the most frequent sexual networks to which Garífuna migrants in this sample are exposed. Rather, non-migrants who choose their partners from within Garífuna communities, where HIV prevalence is relatively high, may on average be connected to higher-risk sexual networks than migrants. Compared to non-migrants, migrants in our sample were more likely to have reported having non-Garífuna sexual partners (22.4% vs 14.7%), who reportedly have lower rates of HIV within Honduras.

Education, unemployment, income, discrimination and HIV/STI status

The low socioeconomic status of Garífuna in Honduras, relative to the non-black, non-indigenous majority has also been implicated as a contributing factor to the high rates of HIV/STI within this population (29,47). However, we did not find evidence to support that lower socioeconomic status -- as measured by lower education, unemployment, or lack of financial resources -- was associated with either HIV or non-viral STI status, and contrary to the original hypothesis, current unemployment was associated with a significantly *lower* prevalence of HSV-2 status among both men and women. It's possible that in our sample, unemployment was a proxy for *more* financial support, as 90% of those who were unemployed received help with expenses, and those who were unemployed were significantly more likely to receive remittances from abroad (67.4% vs. 32.6%, p<0.02). Unfortunately, the data were limited such that amount of household or disposable income among the unemployed could not be determined. Less education was associated with increased HSV-2 infection among women (APR 1.3, 95% CI 1.2-1.6). Prior research conducted in Africa and the Americas has generally found lower HSV-2 prevalence among those with more education (148–151), but some studies have indicated modification of these effects by gender (152,153). While women in this sample with no secondary education were almost equally likely to have heard of STIs other than HIV compared to more educated women (26.0% vs 25.1%, p<0.80), less educated women were less

likely to ever have used condoms, even after adjusting for age (APR 1.8, 95% CI 1.1-3.0). In contrast, education was not associated with lifetime condom use among men.

Experience of racial/ethnic discrimination, when examined as a lifetime exposure, was not significantly associated with any biological outcome. However, experiencing racial/ethnic discrimination within the last 12 months was significantly associated with having a non-viral STI among women (APR 1.4, 95% CI 1.1-1.8). The majority of recent discriminatory experiences reported were verbal abuses such as threats, verbal aggression or humiliation. It is plausible that such acts may have altered women's perceptions of self-worth and self-efficacy in negotiating safe sexual experiences (79,84). As Sanders-Phillips states,

> "…a woman's ability and willingness to protect herself against AIDS, especially in the context of an intimate relationship, is directly related to her sense of empowerment and perceptions of efficacy in her personal life. In turn, a woman's sense of empowerment and efficacy is influenced by the nature of her interactions with the larger community and society. The impact of self-efficacy and empowerment on HIV risk in women of color may be particularly significant since they often face multiple burdens of racism, sexism, and poverty that may increase feelings of powerlessness and hopelessness. (79)

Traditional proximate risk factors, including drug and alcohol use, experiencing forced sexual relations, and engaging in transactional sex were associated with HSV-2 and non-viral STI status; though these associations differed somewhat in men versus women. Of note, no respondents reported ever injecting drugs. Twelve percent of men and 1.5% of women had used drugs in the last 12 months, and 6.3% of men and 3.8% of women had engaged in problem drinking in the last month. Thus, while substance use may be associated with STI status, interventions targeted specifically at substance use reduction may have a limited impact due to the relatively low prevalence of these behaviors. Among men, being a victim of forced sex was more likely among men who had sex with men then among men who only had female partners (17.1% vs 5.1%, p<0.10), and was in turn associated with increased HSV-2 prevalence.

The results of these analyses complicate findings from prior research conducted within the Honduran Garífuna population, as proposed structural risk factors were not found to be significantly or consistently associated with disease status. Still, the prevalence of HIV/STIs have remained high

even as HIV rates have declined nationwide, underscoring the continued need for prevention and treatment services.

Limitations

A number of limitations may have affected the validity of our findings and corresponding conclusions. The study was susceptible to selection bias, especially given the very low participation rate in some of the rural sites and the failure to obtain survey data from nearly 20% of the intended sample. This may have affected our assessment of the frequency and correlates of migration and employment, in particular, since longer-term migrants and those who were actively employed may have been less likely to be located or to participate. Formative research suggested that optimal months for capturing migrants during their visits home were January, April, June-August, or December, while the vast majority of recruitment and study visits occurred from September-November. Beyond gender and recruitment site, characteristics of non-respondents and reasons for non-participation are not available, and further limit our ability to quantify the magnitude of bias resulting from their omission. Comparison with data from the prior wave of the surveillance study (ECVC-I) suggests there was a higher age distribution in the current wave of the study (ECVC-II), with less participation from men and women aged 18-24, particularly from rural sites. Multiple partnerships and concurrent partnerships were more prevalent in this youngest age group; the change in age distribution may have contributed to the decreased prevalence of multiple partnerships compared to what was observed in ECVC-I.

Behavioral outcomes may have been misclassified, particularly as concurrency can be challenging to measure and may be subject to underreporting when assessed exclusively through the dates of first and last sexual contact with recent partners. Training of study interviewers emphasized the importance of administering this survey items regarding concurrent partnerships, which likely improved overall data quality, but social desirability bias may have contributed to underreporting of recent partnerships (whether serial or concurrent) among women, and either underreporting or overreporting of partnerships among men. Study staff attempted to capture whether the survey was

administered by the interviewee or the interviewer, but technical errors led to the omission of this data from the final study database.

While the diagnostic tests utilized for this study have greater accuracy and were subject to greater quality control than is typically available in clinical settings in Honduras, there may have been misclassification of diagnostic test results. The rigorous criteria and multi-stage testing algorithm for HIV greatly reduced the likelihood of inaccurate results for this outcome. Bidirectional misclassification of HSV-2 and syphilis test results may have resulted from the limitations in the sensitivity and specificity of the test used, and from the increased likelihood of false positives if related pathogens were prevalent in the study population. The substantial number of missing observations for *C. trachomatis, T. vaginalis, and M. genitalium*, due to participant refusals, the loss of samples, and poor quality of samples resulting in an inability to run necessary assays highlighted the importance of sensitivity analysis to determine whether findings were robust to a reclassification of outcomes. Analysis of multiply imputed data indicated that our exposure-outcome associations were not significantly altered (data not shown). The prevalence of each individual non-viral STI increased in the imputed dataset, but the confidence intervals associated with the imputed proportions always contained the original weighted estimate (Table A-2). Thus, we may have slightly underestimated the prevalence of non-viral STIs. Due to poor assay performance with the available samples, we were not able to accurately estimate the prevalence of gonorrhea, and it was thus excluded from our non-viral STI composite outcome.

Measures of employment, income, and discrimination may have been limited in their validity and ability to capture the underlying constructs of interest, as detailed in Chapters 3 and 5. Current employment status may not have accurately represented participants' long-term employment history or access to labor wages; limitations in available income data may have prevented us from assessing meaningful variations in income and its relationship to disease status. For this reason, we chose a very specific measure of decreased access to financial resources -- those who reported no income, were assumed to have no income due to current unemployment, and who did not receive financial support from friends, family or partners. The relatively small proportion of individuals within this

stratum (n=30) may have restricted our ability to detect a meaningful association between wealth and disease status. Various manifestations of discrimination were explored in the survey, but these items may not have captured the type of discrimination would result in either altered sexual behavior or altered access to health services that could impact HIV/STI status.

The lower-than-expected participation rate, in combination with the clustered sampling design, limited the statistical power of the analyses. A key focus of both aims was to estimate the frequency of exposures and outcomes of interest, and to determine whether exposure-outcome relationships were modified by sex. As our gender-stratified analyses reduced cell sizes and limited the number of outcomes observed in each exposure-covariate stratum, we were not able to examine whether effects differed by urban vs. rural residence.

Finally, the cross-sectional nature of the data obstructs our ability to interpret any observed associations as causal. While Aim 1 assesses migration and sexual partnerships within the one-year period prior to the interview, it is not known when migration experiences occurred in relation to the partnerships reported, or whether more remote migration history contributed to recent sexual partnership patterns or partnership status. In Aim 2, we used measures of disease prevalence, rather than incidence, as only a small number of HIV cases had not previously been diagnosed (n=9), and results from prior evaluations for non-viral STIs were not available. It is unlikely that most participants would have prior records of HSV-2 status since this test is not routinely performed, nor is treatment readily available in this setting. With the exception of education and lifetime discrimination, our exposure assessment was limited to the 12 months prior to the survey, while infections may have occurred prior to that time. Thus, we were limited to identifying correlates of current disease status, and cannot necessarily interpret these correlates as risk factors for infection. The incongruence of these time scales, and lack of longitudinal data, is likely to have limited our ability to have detected meaningful associations between social status and HIV/STI.

Directions for future research

This study highlights a number of ways in which HIV/STI surveillance conducted in the Garífuna population can be improved. While this round of surveillance collected more information on the migration histories of participants and their partners than had previously been obtained, a more thorough characterization might help more definitively assess the relationship between mobility, sexual behavior, and HIV risk in this population. Questions that future surveys should consider include: the reasons for migration or visits to specific destinations; whether migration events occurred with a partner; and the number and duration of trips; as these distinctions may modify the impact of migration on existing partnerships, the opportunity and desirability of forming new sexual partnerships, and the likelihood of engaging in concurrency versus serial partnerships (33,34). Assessing where (geographically) sexual partners were met or sexual relations took place may help distinguish whether migrants are more likely to acquire new partners while away from home and thus bridge disparate sexual networks, or whether migrants have more partners even within their home communities.

This study was the first to assess the prevalence of concurrency within the Garífuna population, and one of few published studies reporting this prevalence in a heterosexual, non-sex worker population in Latin America. Though there were some limitations in the validity and reliability of the measurement of sexual partnerships and concurrent partnerships, the study demonstrated that concurrency measurement was feasible and acceptable within the Garífuna population. Additional assessment of sexual concurrency, such as direct questions and measurement of perceived partner concurrency, may help improve the accuracy of reporting and understanding of HIV/STI risk for individuals, since partner's concurrency is a more salient correlate of that risk (52).

Using standardized and validated measurements of socioeconomic status -- including household income, measures of poverty or access to basic needs, and quantifying the financial or material support received from partners, family and friends would improve our ability to determine whether SES is associated with HIV/STI status and sexual behavior patterns. These measures may more accurately depict the actual resources to which individuals have access (51,145), especially among

women, who were less likely to be employed and more likely to receive financial support from others. Given that there are over forty Garífuna communities on the Honduran mainland and additional districts in urban areas in which the Garífuna population is concentrated, a sampling strategy with a greater number of clusters may allow for the incorporation of neighborhood-level measures of SES, which may have an independent impact on STI/HIV risk (70,75).

While the survey instrument captured recent and remote experiences of forced sex, it did not capture exposure to other experiences of violence outside of racially-motivated physical abuse. Political instability, widespread organized crime, and an increase in drug trafficking in urban and even rural Honduras has contributed to a national culture of violence (30), which may in turn shape sexual-risk taking (154,155) and the normalization of intimate partner violence (156), which is widespread within Honduras (29). The extent of exposure to community or domestic violence and its relationship to sexual behavior and HIV/STI risk in the Garífuna population is unknown.

Future research on HIV/STI risk among the Garífuna may also benefit from incorporating additional measures of perceived discrimination and social cohesion/support. It's possible that segments of this population experience discrimination on multiple fronts -- due to their race/ethnicity, migrant status, economic position, gender, sexual orientation, and/or HIV status that could amplify its effect on health behaviors and outcomes (79,157–159), and that social support may buffer the effect of discrimination (76,85). A meta-analysis demonstrated that the association between discrimination and physical health and/or health behavior may be greater among those experiencing chronic discrimination versus lifetime discrimination (76); an assessment of the frequency of discrimination and the utilization of a validated scale capturing experience of perceived discrimination may help clarify its relationship to sexual risk behaviors and disease status in this population.

These findings indicate that the HIV prevalence in the Garífuna population in Honduras is over eight times that of the national average (4.1% vs. 0.5%), supporting current national recommendations that this population remain a priority group for HIV prevention programming (5). However, it should be noted that the Garífuna population in Honduras is primarily situated in the departments with the

highest number of HIV cases (5,8), and that the sexual networks of Garífuna and non-Garífuna individuals are interconnected, particularly among young adults. In this sample, 18-24 years olds were significantly more likely to report having non-Garífuna sexual partners in the last 12 months (22.9% vs. 13.5%, p<0.02). Still, Garífuna are identified with the HIV burden in Honduras (24,48), exacerbating existing racial/ethnic discrimination (10,63). Ongoing population-based HIV/STI surveillance in the non-Garífuna population inhabiting the northern coast of Honduras may help identify transmission hotspots, and whether structural and behavioral risk factors are associated with risk of infection independent of racial/ethnic identity. Capturing more variation in socioeconomic status may result in a better characterization of its linkage to disease outcomes.

Avenues for intervention

These findings contrast prior research that emphasized the association between migration and HIV in the Garífuna population. Disseminating these findings within and beyond Garífuna communities may help adjust the perception that the HIV/STI risk is concentrated among migrants and their partners, and that sexual concurrency is much more frequently practiced among Garífuna men and women than in the Honduran population at large. There was not compelling evidence that socioeconomic indicators were strongly and consistently associated with HIV, HSV-2 and STI status; prevalent infections were more uniformly distributed across social strata than was expected. Thus, a generalized, population-wide approach to expanding HIV/STI prevention programming, linkage to care services, and treatment may be most effective within the Garífuna population at this stage.

Experiencing forced sexual relations was associated with increased disease prevalence among men and women; interventions aimed at reducing sexual violence are vital and may be strengthened through coordination with governmental and non-governmental institutions focusing on education, human rights, and social justice.

The prevalence of HSV-2 was high in both men and women in this sample (40.1% and 58.0%, respectively), and was significantly associated with HIV infection (UPR 6.7, 95% CI 2.1-21.0). Though the WHO recommends syndromic antiviral treatment with acyclovir when HSV-2 prevalence exceeds

30% (27), this therapy is not routinely available in primary care facilities in Honduras, and access is not guaranteed per current national treatment guidelines. In light of the substantial HIV and HSV-2 disease burden in the Garífuna population, expanded access to HSV-2 screening and treatment with acyclovir may be worth consideration. Consistent condom use may reduce transmission, but its efficacy is somewhat limited given the potential for transmission via skin and mucosa that remain unprotected (160) and the propensity for diminished condom use with stable partners (76.1% reported not using a condom at last sex with a stable partner). In the absence of consistent access to antiviral therapy, early education, provider support for disclosure of HSV-2 status to partners, and abstinence when active lesions are visible may help reduce future transmissions in this population (160).

Conclusions

HIV, HSV-2 and non-viral STI prevalence remains high in the Garífuna population of Honduras, in spite of a reduction in the frequency of having multiple sexual partners and a low prevalence of recent drug or alcohol use or engagement in transactional sex. Among men, recent temporary migration was associated with having multiple sexual partners; among women, partner's work-related migration was associated with already-diagnosed HIV. Individual or partner's migration was not associated with HSV-2 or STI status among men or women. Measures of social disadvantage were not associated with HIV infection, and were inconsistently associated with HSV-2 and STI status among men and women. Future surveillance and programs targeted at stemming the HIV/STI burden in this population should continue to improve the assessment of both structural and behavioral factors to enhance the effectiveness of prevention interventions.

Appendix

Table A-1. Multiple sexual partnerships in last 12 months by cumulative recent migration history among men and women in a population-based sample of Garífuna adults in Honduras, 2012.

MEN	<2 partners (weighted %)	≥2 partners (weighted %)	Crude Prevalence Ratio (95% CI)	Adjusted Prevalence Ratio* (95% CI)
Any migration	58.6	41.4	1.5 (1.2, 1.8)	1.5 (1.3, 1.7)
No migration	71.9	28.1	1	
Spent >1 month away	56.0	44.0	1.5 (1.1, 2.0)	1.7 (1.2, 2.4)
Spent ≤1 month away (Ref)	70.2	29.8	1	
Spent >3 months away	56.2	48.3	1.4 (1.0, 2.2)	1.6 (1.1, 2.3)
Spent ≤3 month away (Ref)	69.6	30.4	1	
Spent >6 months away	64.5	35.5	1.1 (0.3, 3.8)	1.2 (0.4, 3.7)
Spent ≤6 month away (Ref)	68.3	31.7	1	
Adjusted for age, education, marital status, and age at first sex				
WOMEN	<2 partners (weighted %)	≥2 partners (weighted %)	Crude Prevalence Ratio (95% CI)	Adjusted Prevalence Ratio* (95% CI)
Any migration	89.4	10.6	2.1 (0.7,6.4)	1.5 (0.6, 3.7)
No migration	94.9	5.1	1	
Spent >1 month away	80.9	19.1	3.8 (0.9, 15.5)	3.0 (0.7, 12.4)
Spent ≤1 month away (Ref)	95.0	5.0	1	
Spent >3 months away	79.9	20.1	3.7 (1.1, 12.2)	3.4 (0.8, 14.1)
Spent ≤3 month away (Ref)	94.6	5.4	1	
Spent >6 months away	69.4	30.6	5.8 (1.8, 18.4)	4.7 (1.2, 18.1)
Spent ≤6 month away (Ref)	94.7	5.3	1	
Adjusted for age, education, and age at first sex				

Table A-2. Imputed and non-imputed prevalence of HIV and other sexually transmitted diseases among men and women in a population-based sample of Garífuna adults in Honduras, 2012.

	Men			Women			Total		
	n/N	Weighted % (95% CI)	Imputed % (95% CI)	n/N	Weighted % (95% CI)	Imputed % (95% CI)	n/N	Weighted % (95% CI)	Imputed % (95% CI)
HIV	7/224	3.3 (0.0, 6.9)	3.8 (0.0, 7.8)	15/389	4.5 (2.2, 6.9)	4.7 (2.2, 7.3)	22/613	4.1 (2.2, 5.9)	4.4 (2.4, 6.3)
HSV-2	90/224	40.1 (33.3, 46.9)	40.9 (34.5, 47.3)	218/389	58.0 (48.8, 67.2)	57.8 (48.4, 67.2)	308/613	51.5 (44.2, 58.9)	51.6 (44.2, 59.0)
C. trachomatis	12/212	4.5 (1.4, 7.6)	5.0 (1.1, 9.0)	27/347	6.7 (0.7, 12.6)	7.4 (1.1, 13.7)	39/559	5.9 (1.6, 10.2)	6.5 (1.7, 11.4)
T. vaginalis	3/212	1.3 (0.0, 2.7)	1.3 (0.0, 2.7)	49/347	11.8 (5.4, 8.3)	12.9 (5.4, 20.5)	52/559	7.8 (4.0, 11.6)	8.7 (4.0, 13.4)
T. pallidum	1/207	0.4 (0.0, 1.5)	1.0 (0.0, 4.4)	5/388	1.3 (0.0, 3.6)	1.5 (0.0, 4.1)	6/595	1.0 (0.0, 2.5)	1.3 (0.0, 3.5)
M. genitalium	8/212	3.1 (0.0, 7.1)	3.3 (0.0, 7.8)	34/347	9.2 (4.9, 13.6)	9.9 (4.9, 14.9)	42/559	6.9 (3.7, 10.1)	7.5 (3.7, 11.3)
Any non-viral STI*	**24/192**	**10.8 (5.1, 16.5)**	**10.9 (4.7, 17.0)**	**86/342**	**22.2 (10.8, 33.7)**	**23.5 (11.6, 35.4)**	**110/534**	**18.1 (9.6, 26.7)**	**18.9 (10.1, 27.7)**

*Defined as having a positive test result for *C. trachomatis*, *T. vaginalis*, active infection with *T. pallidum*, or *M. genitalium* among those with available data.

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