Travel, Migration and HIV: Comparing Risk Behaviors Between Native and Migrant Jamaican Persons Infected with HIV

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TRAVEL, MIGRATION AND HIV: COMPARING RISK BEHAVIORS BETWEEN NATIVE AND MIGRANT JAMAICAN PERSONS INFECTED WITH HIV

By
Yoran T. Grant

A DISSERTATION

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Coral Gables, Florida
August 2010
UNIVERSITY OF MIAMI

A dissertation submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

TRAVEL, MIGRATION AND HIV:
COMPARING RISK BEHAVIORS BETWEEN
NATIVE AND MIGRANT JAMAICAN PERSONS INFECTED WITH HIV

Yoran T. Grant

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Migration and travel have been significant factors in the human immunodeficiency virus (HIV) epidemic since its emergence in 1981. Since then, global travel and migration have increased significantly (GCIM 2005), alongside steady increases in global HIV/AIDS (UNAIDS 2008). Understanding the current effects of migration and travel on HIV/AIDS transmission and survival is essential to intervention efforts, especially for immigrants. Previous research highlights differences between immigrants and native ethnic minorities, but few studies compare immigrant groups to their peers in the country of origin (Deren et al 2006). This dissertation project attempts to fill this gap, by comparing HIV-infected persons of Jamaican birth in New York City to their peers on the island of Jamaica. The overall objective of this study was to explore the relationship between migration, travel and risk behavior among Jamaicans infected with HIV.

This dissertation study analyzed HIV/AIDS registry data from the New York City Department of Health and the Jamaica Ministry of Health by focusing on HIV positive individuals of Jamaican birth reported to surveillance from January 1, 1988 – December 31, 2007. The research included three specific aims. The first aim explored factors associated with transnational sexual partnerships among persons with HIV in Jamaica, using classification tree methodology and logistic regression modeling. The second aim compared trends in newly reported HIV and AIDS cases as well as deaths among
Jamaican cases in New York City and Jamaica. The study design was ecologic and involved the comparison through the use of general linear modeling techniques. The final aim compared factors associated with late stage HIV/AIDS diagnoses between the two locations through a case control study design and logistic regression analysis. Persons with missing gender (n=62) were excluded from all analyses. Tests for interaction by location and gender were performed with each covariate. Significant interactions by both gender and location led to stratified models in the final analysis.

A matched sample of 623 cases and 1,869 controls was analyzed to determine factors associated with overseas partnering. Persons who were deportees, in the professional or trade occupation groups, separated or divorced and categorized as MSM or IDU were more likely to have transnational sex partners. Despite being significant in the classification tree, not all factors were significant in the logistic regression, highlighting the limitations of the latter for emerging risk groups with small sample sizes. Furthermore, the elevated frequency of overseas partnering among already recognized high risk groups (MSM, IDU and young people – students) highlights the need for additional investigation of this behavior and its impact on HIV/AIDS in Jamaica.

Comparisons of HIV, AIDS and death rates between the two jurisdictions revealed significant declines in annual AIDS case rates and deaths with no significant change in newly reported HIV cases. Albeit marginally, the annual rate of newly reported HIV cases has declined significantly in Jamaica from 2001-2007 while remaining unchanged in New York City. Annual AIDS case rates decreased significantly in both locations. This decline follows a divergence in trend from 1998-2000, when rates increased in
Jamaica and declined in New York City. A similar scenario was observed with all-cause mortality rates among AIDS cases in each location. Mortality decreased steadily among Jamaicans in New York City since 1994 with a plateau from 1999-2007. In contrast, mortality rates in Jamaica fluctuated with increases in 1996 and 1999 and subsequent declines. Following a significant increase in 1999-2000, the death rate in Jamaica decreased steadily through 2007.

The final aim examined late stage HIV/AIDS diagnoses among cases in New York City and Jamaica. In both settings, rates of late stage diagnoses were alarmingly high (42% and 48% respectively). In New York City, this rate was higher than the overall rate for all new diagnoses in the period (22%) and the overall rate of among all foreign born newly diagnosed cases (33%) (NYC DOHMH 2009). Age at first diagnosis was significantly associated with concurrent diagnosis and the risk for this event increased uniformly with age. In Jamaica, additional associated factors were male gender and heterosexual or IDU transmission risk.

On the whole, Jamaicans in New York City resembled their peers in their country of birth with regard to late stage diagnoses. There were also similarities in HIV/AIDS trends as well as deaths between the two populations. These findings suggest cultural factors affecting risk and other health-related behaviors may be resilient to change even after significant events like migration. Although further investigation is necessary, these findings have significant implications for prevention efforts and HIV-related policies for immigrants to resource-rich settings. Furthermore, in the country of origin, transnational sexual partnering is associated with higher risk behaviors including MSM activity and
IDU. Additional research is critical in determining whether these partnering habits confer excess HIV risk and if there is any quantifiable impact on the country’s HIV/AIDS epidemic.
DEDICATION

This dissertation is dedicated to my grandfather, Earl Anderson (d. 9/21/2007), my uncle, Donovan Grant and my friend, Sahai Ruddock (d. 12/28/2008).

To my grandfather, who instilled the value of higher education in me at a very young age and quietly encouraged me to strive beyond expectations. He is fondly remembered and greatly missed.

To my Uncle Donovan, whose life taught me the value of the unanswered question.

To my friend Sahai, whose life taught me the true meaning of friendship, the power of happiness and not to take anything for granted. Her experiences have painfully shown me the value of access to quality care. She has renewed the merit and purpose of public health in my life.
ACKNOWLEDGEMENTS

I would first like to thank God. There are so many people who have my sincerest gratitude for making this achievement possible.

I would first like to thank Heather and Lenox Anderson, who provided me a home away from home in Florida. Your support and comfort sustained me and helped to make this accomplishment possible.

My aunts and uncles, Jacqueline & Lance Anderson, Janice & Joseph Taffe and Claudia & Robert Wilson. Their love & hospitality allowed me to execute the required activities for this project from Kingston Jamaica all the way to New York City, NY USA.

I would also like to thank Ronie Rusea-Robinson, whose moral support helped me through some of the hardest points.

Thank you to Drs. Jacqueline Duncan and Tina Hylton-Kong from the Ministry of Health in Jamaica, who trusted me with a wealth more than data. They contributed significantly to my professional growth and development.

Additional thanks to Dr. Colin W. Shepard from the New York City Department of Health, whose guidance support and mentorship has permanently shaped my future in public health.

Thank you to the University of Miami’s Fogarty International Training and Research Program in AIDS and Tuberculosis, whose financial support facilitated my data gathering on the island of Jamaica.

I owe so much gratitude to my esteemed committee. Dr. Lisa Metsch for many late nights of critical reading and review. Her input and dedication in coordinating this process was pivotal to my success. Dr. Kristopher Arheart, for his statistical expertise and patience
during several rounds of analysis. To Dr. J.Peter Figueroa, my committee member and mentor in Jamaica, whose input was critical in the documents’ accuracy and in helping me proudly represent and protect the interest of my home country.

My final but greatest gratitude is extended to my mother, Faye Anderson-Grant. There are simply not enough words to express the depth of my love and appreciation for my mother. None of my achievements would be possible without her. Her love and support have been unflinching and if I am able to reciprocate even a fraction of what she has given me throughout my lifetime, I would be truly thankful.
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Chapter 1: Introduction

Migration and travel have been significant factors in the human immunodeficiency virus (HIV) epidemic since its emergence in 1981. The literature has consistently implicated these factors in the zoonotic event that produced HIV, as well as early transmission that initiated the current pandemic (Hawkes, Hart 1993, Cohen 2006). More than 25 years later, these factors continue to have profound effects. Disparities in HIV acquisition persist globally, placing certain groups at higher risk for infection. Immigrants are one of these groups, making them a public health priority in several settings. Managing HIV and acquired immune deficiency syndrome (AIDS) among immigrants in non-native settings is critical, due to ongoing transmission, higher rates of infection and more adverse outcomes than non-immigrant groups in similar settings (UNAIDS 2008).

Understanding the current effects of migration and travel on HIV/AIDS transmission and survival is essential to intervention efforts, especially for immigrants. These effects are relevant to the immigrant group(s)’ new host country as well as the country of origin. In new settings, acculturative stress, diminished social capital, marginalization and limited access to care can collectively diminish the effects of traditional prevention programs and elevate risk (Wolfers et al 2007). In the country of origin, disassortative sexual mixing\(^1\) and concurrency\(^2\) stemming from migration can increase HIV risk in traditionally low-

---

\(^1\) Disassortative mixing refers to sexual partnering between persons from different groups (e.g. risk groups, age groups etc.) This type of mixing is associated with increased risk for HIV and STI transmission (van Veen, Kramer et al 2009)

\(^2\) Concurrency refers to the presence of simultaneous sexual partners
risk settings. This effect is intensified among migrants who engage in bidirectional travel\(^3\) (Fenton et al 2005).

In middle- and high-income countries, foreign-born residents account for a higher proportion of new HIV/AIDS cases than other minority groups. Additionally, those traveling between their countries of origin and new settlements further elevate their risk (Mulhall 2000). Previous research highlights differences between immigrants and native ethnic minorities. Relatively few studies compare immigrant groups to their peers in the country of origin (Deren et al 2006). Consequently, the relationship between migration and HIV risk remains minimally described.

*Overall Study Objective*

This study attempted to fill this gap using Jamaica and one of its largest sites for migration, New York City, as a case study. The overall objective of this study was to explore the relationship between migration, travel and risk behavior among Jamaicans infected with HIV. The data were from the national HIV/AIDS surveillance registry in each setting. Both registries were under the jurisdiction of the local health authorities – The New York City Department of Health and Mental Hygiene (NYC DOHMH) in New York and the Ministry of Health in Jamaica (JA MOH). HIV and AIDS are class I notifiable conditions\(^4\) in both settings and these reports, with supporting field

---

\(^3\) Bidirectional travel refers to frequent circular transit between the country of origin and the new migratory location

\(^4\) Notifiable conditions are legally mandated to be reported by the diagnosing provider to local and/or national health authorities. Class I conditions require immediate reporting via telephone or facsimile and include the name of the newly diagnosed case. This is in contrast to other reportable conditions which may be reported at routine intervals and as aggregate estimates versus individually. Examples of class I notifiable conditions include infectious syphilis, anthrax, botulism, tularemia and smallpox. These conditions are deemed high priority for reporting due to their public health significance (CDC 2008).
investigation forms provide source data for the registries. As such, the registries offered a wealth of information regarding the demographics and reported risk behaviors of HIV positive persons and AIDS cases in both locales.

The research aimed to answer the following questions;

**QUESTION I:** Which demographic and risk factors are associated with transnational sexual partnerships among HIV positive persons reported to surveillance in Jamaica from January 1, 1988 to December 31, 2007?

**SPECIFIC AIM I:** To identify factors associated with transnational sexual partnerships among HIV positive cases reported to surveillance in Jamaica between January 1, 1988 and December 31, 2007, controlling for the age and gender of the HIV positive case. Due to sample size limitations, there is insufficient statistical power to test hypotheses for this aim. Instead, a data mining technique, classification tree analysis, will be used to identify factors associated with transnational sexual partnerships.

**QUESTION II:** What are the similarities and differences in the HIV/AIDS epidemics among Jamaican immigrants to New York City and those living in Jamaica, W.I?

**SPECIFIC AIM II:** To compare trends in reported HIV, AIDS and mortality among AIDS cases between HIV positive persons in Jamaica’s surveillance registry and HIV positive cases of Jamaican birth in New York City’s surveillance registry reported from January 1, 1988 to December 31, 2007

**Hypothesis1:** Mortality among AIDS cases will be consistently higher in Jamaica than in New York City, controlling for programmatic changes and availability of antiretroviral therapy

---

5 Transnational refers to any sexual partner that was not a resident of Jamaica at the time of case reporting and partner disclosure to the HIV/AIDS Tracking System (HATS)
Hypothesis 2: There will be no significant differences in the annual number of new AIDS diagnoses across both settings.

QUESTION III: Are there differences in disease stage at the time of HIV diagnosis between HIV positive Jamaican immigrants to New York City and HIV positive persons in Jamaica? What factors are associated with late stage diagnosis in each setting?

SPECIFIC AIM III: To compare factors of late stage diagnosis (as defined below\(^6\)) between Jamaican HIV cases in New York City and HIV cases in Jamaica reported to surveillance from January 1, 2001 to December 31, 2007.

Hypothesis 3: The frequency of late stage diagnosis will be consistently higher among Jamaican cases in NYC than cases in Jamaica controlling for age, gender and programmatic changes influential to testing.

Hypothesis 4: Within both settings, persons with no identifiable risk will be more likely to be diagnosed at a late stage compared to cases with an identified risk group on record.

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\(^6\) Based on recommendations from the CDC, a late stage diagnosis is defined as having an AIDS diagnosis within 12 calendar months of the first positive HIV test.
Chapter 2: Background and Review of the Literature

Significance of Study

Addressing the needs of groups with a higher risk for HIV infection remains a priority in the global fight against HIV/AIDS (UNAIDS 2008). Immigrants are increasingly described as a high-risk group for HIV globally. Identifying and understanding risk behaviors in these groups can inform more targeted prevention efforts. Such information is limited for immigrants, particularly black persons who have emigrated from the major Anglophone Caribbean islands\(^7\) to high-income nations.


New York City is an ideal setting for the study, with 36% of its 8,363,710 residents being of foreign birth (NYC Census 2008). Between 2006-2007, 27% of the city’s 7,668 new HIV diagnoses were among immigrants (Wiewel et al 2006). Furthermore, 61% of all new foreign-born cases in NYC were from Africa and the Caribbean (Wiewel, Nasrallah et al 2008). The Caribbean accounts for the highest proportion (39%) of newly diagnosed foreign-born cases in the city. Within this group, the island of Jamaica has the second highest number of new cases (second to the Dominican Republic) and is the leading

\(^7\) Most commonly noted Black Anglophone Caribbean islands include the Bahamas, Barbados, Haiti, Jamaica, St. Lucia, Trinidad and Tobago.
country for new black foreign-born cases (Wiewel et al. 2006). There is an urgent need to understand what factors place this group at elevated risk.

In New York City, the number of new cases of HIV among immigrants remains stable while new cases in other groups are declining. This suggests current prevention initiatives may not be reaching these more marginalized residents. Modifications to improve these prevention initiatives should be guided by empirical evidence (Global HIV Prevention Working Group 2008). Unfortunately, comparisons of HIV prevalence among migrants are limited to native ethnic minorities in the same setting. Relatively few comparisons are made between immigrants and their peers in the country of origin.

Within this context, this investigation explored the relationship between migration and risk to determine how similar migrants are to their native peers. Specifically, we examined Jamaicans, who comprise a significant proportion of the newly diagnosed HIV cases. Jamaicans have been migrating to New York City since 1972, long before the awareness of the HIV epidemic. As such, the country has a deep-rooted immigrant community in the city. Additionally, Jamaica has a well-established HIV/AIDS surveillance system, providing the necessary data for comparison. The projected findings will be critical to improving current prevention efforts and potentially curbing the HIV epidemic in this group.

Risk, Culture and Behavioral Theory

Risk is one of the most significant factors in the management of HIV, as it informs primary and secondary prevention efforts. The term ‘risk’ is used to refer to different behaviors that confer an individual’s likelihood of HIV infection. The different behaviors are used to designate transmission risk categories (CDC 2000). These categories are then
used to guide prevention campaigns and interventions for testing, treatment and care. The most frequently used HIV risk categories are outlined in Table 1. The hierarchical structure of these categories is based on the biologic probability of infection associated with the risk behaviors (CDC 2000, Lee McKenna et al. 2003). This hierarchy also takes into account the distribution of risk categories among known HIV cases. Transmission categories are therefore relevant to guiding prevention and intervention campaigns as they reflect the burden of disease in the different ‘at-risk’ groups.

The distinct transmission risk categories vary by location, due to differences in local epidemics. This makes cross-cultural comparisons of HIV risk challenging. Understanding the differences in the distribution of risk by country setting is critical to global HIV/AIDS control efforts. More importantly, this variation between countries provides a clear illustration of the impact of culture on HIV risk. For this study, the referenced risk hierarchy was adjusted to reflect the transmission dynamics in Jamaica (see table 2). The most significant adjustment was to the heterosexual category. Other studies have found the current criteria for heterosexual risk increases misclassification of women and fail to capture the significant impact of high risk heterosexual activity on transmission (Schmidt and Mokotoff 2003). The specifics of this exercise are detailed in the methods chapter to follow.
Table 1: HIV Transmission Risk Categories

<table>
<thead>
<tr>
<th>Hierarchy of HIV Transmission Categories</th>
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<tr>
<td>Men who have sex with men (MSM)</td>
</tr>
<tr>
<td>Refers to homosexual and/or bisexual men or men who do not identify as homosexual but engage in sexual activities with other men</td>
</tr>
<tr>
<td>Intravenous Drug User (IDU)</td>
</tr>
<tr>
<td>Refers to persons who use hypodermic needles for the purposes of recreational drug use</td>
</tr>
<tr>
<td>MSM + IDU</td>
</tr>
<tr>
<td>The combination of the former two categories</td>
</tr>
<tr>
<td>Heterosexual Contact (HC)</td>
</tr>
<tr>
<td>Refers to persons who report heterosexual intercourse with a person known to be HIV positive or at elevated risk for HIV due to a history of transfusion or receipt of blood products, intravenous drug use or a male who has sex with men</td>
</tr>
<tr>
<td>Perinatal</td>
</tr>
<tr>
<td>Refers to persons infected in-utero or through breastfeeding from an HIV-infected mother</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Includes less common routes of transmission such as transfusion/transplant history, blood product recipient or a haemophiliac</td>
</tr>
<tr>
<td>No Identified Risk (NIR)</td>
</tr>
<tr>
<td>No Reported Risk (NRR)</td>
</tr>
<tr>
<td>Refers to persons who at the end of the administrative reporting period for surveillance, had no reported risk activity on record</td>
</tr>
</tbody>
</table>

The relationships among risk, behaviors and disease are quite complex. The convergence of various individual, cultural and socio-ecologic factors creates risk profiles that estimate the likelihood of infection. Douglas and Widalsky suggest the role of cultural factors in this model is significant enough to affect risk even after an individual is removed from their culture of origin (1982). This paradigm makes migration a critical factor in disease risk among migrants, as they preserve a portion of their cultural beliefs and social norms in their new settings.
Table 2: Revised HIV Transmission Risk Categories

<table>
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<tr>
<th>Hierarchy of HIV Transmission Categories for Dissertation Study</th>
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<tr>
<td>Men who have sex with men (MSM)</td>
<td>Refers to homosexual and/or bisexual men or men who do not identify as homosexual but engage in sexual activities with other men</td>
</tr>
<tr>
<td>Intravenous Drug User (IDU)</td>
<td>Refers to persons who use hypodermic needles for the purposes of recreational drug use</td>
</tr>
<tr>
<td>Heterosexual Contact (HC)</td>
<td>Refers to persons who report heterosexual intercourse with any member of the opposite sex and no IDU history; for men, there must also be no reported MSM activity</td>
</tr>
<tr>
<td>Perinatal</td>
<td>Refers to persons infected in-utero or through breastfeeding from an HIV-infected mother</td>
</tr>
<tr>
<td>Other</td>
<td>Includes less common routes of transmission such as transfusion/transplant history, blood product recipient or a haemophiliac</td>
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<tr>
<td>No Identified Risk (NIR) No Reported Risk (NRR)</td>
<td>Refers to persons who at the end of the administrative reporting period for surveillance, had no reported risk activity on record</td>
</tr>
</tbody>
</table>

Dressler et al. (2004) refer to individual spheres of reference as it relates to culture and risk. They pose individuals rely heavily on cultural norms to create constructs which inform their understanding of how society works. These constructs also define the individuals’ role in society and influence subsequent behavior. Migratory relocation complicates this concept, challenging the individuals’ cultural reference sphere and leading to acculturative stress. The result is usually a hybrid of new cultural reference spheres with the retention of more familiar spheres that are preferentially reinforced (Douglas 1992).

Perhaps the easiest models for understanding behavioral cultural theory are those stemming from migration. Migrants tend to be at higher risk for some conditions, while retaining culturally protective benefits for others (Nazroo et al. 2007). Hanna et al. explored this concept as early as 1979 among Samoan migrants to Hawaii (Hanna et al.
Looking at blood pressure, he showed Samoan migrants having a higher risk of hypertension post migration due to changes in diet. However their risk was still lower than native Hawaiians. The migrant Samoans adopted riskier dietary behaviors post acculturation while retaining some benefit from their native culture such as high levels of physical activity. Their risk profile was unique – different from their native peers and different from the Hawaiians. This understanding proved critical to managing hypertension in the population.

Current studies of migrant health risk do not effectively compare migrants to their peers in their country of origin. One of the more significant barriers is the limited collection of country of birth information in resettlement locations. With an increase in travel, it is often difficult to determine country of birth or follow migrants after arrival. Regions with high rates of legal migration and ease of identification in their new settings would provide the ideal population for such study.

Among the few studies that successfully compare immigrants to their native peers, the vast majority focus on Hispanic minorities. Several studies compare Hispanic migrants to their peers in the country of origin to explore the effect of migration on risk behavior (Deren et al. 2003, Lieb et al. 2006, Duke et al. 2009, Magis-Rodriguez 2009). Such research, however, is limited to North America and not very generalizable. Former colonies in Africa and Caribbean dominate the migration movement and provide the best opportunity for exploring culture and risk post migration across several settings.
Travel, Migration and the Emergence of HIV

Travel and migration have been linked with HIV long before the beginning of the known epidemic in 1981. HIV is the believed result of a zoonosis from its non-human primate ancestor, simian immunodeficiency virus (SIV). Comparisons of SIV and HIV’s molecular and genetic structures provide evidence that SIV is an older, evolutionary ancestor to the human virus that causes AIDS. In the colonial and post-colonial eras, increased travel, migration and mixing of formerly isolated groups may have facilitated the species jump of SIV in non-human primates (NHP) to HIV in humans.

For an effective zoonosis, the infectious agent requires i) an efficient vehicle for transmission, ii) regular contact between this vehicle and the new host and iii) ongoing transmission within the new host population. There is a need, therefore, for a synergistic balance among biologic, sociocultural and environmental factors. Evidence suggests Cameroon, Chad, the Democratic Republic of the Congo (DRC) and Gabon, or what was formerly French Equatorial Africa (AFE) provided such an environment. This region is the suggested site for HIV’s emergence long before the epidemic began in 1981.

Socioculturally, this region experienced a rapid upsurge in travel and migration between 1892 and 1960. European empires entered the region to exploit natural resources for manufacturing and industry. In 1892, infrastructure development to support the new industry included steamboat services up the Sanaga and Congo rivers. This connected densely forested interiors to larger cities near the coast. Africans were transported by river from small closed village communities to larger cities such as Kinshasa and Brazzaville for labor. This forced migration caused the disruption of their traditional

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8 The transmission of an infectious agent from a vertebrate animal species to humans
lifestyle and destruction of their familial units (Headrick 1994). Increased social mixing between previously isolated groups and the separation from main partners/spouses fueled sexual promiscuity. This created a favorable biologic mechanism for transmitting pathogens like HIV within the population.

The upsurge in travel also increased social mixing with colonial citizens residing in the region. This mixing created adaptive stress including exposure and forced adoption of European customs. Of particular significance was the exposure to guns and firearms. This technology enabled increased game hunting for food and sport. Guns particularly allowed for hunting larger game that may have been dangerous at close range without firearms. Such game included bushmeat from non-human primates.

Environmentally, increased traffic through the natural habitat of the non-human primates facilitated exposure for the SIV zoonosis. Though transit increased access to the non-human primates, hunting would provide biologic pathway for SIV to infect humans, evolving to HIV. Hunters who regularly came in contact with infected bushmeat through cuts and lacerations in their skin provided the ideal environment for SIV to transform to HIV.

Other factors assisting SIV’s zoonosis include the introduction of Western medicine in West-central Africa. From 1893-1935, colonial leaders would protect their native labor force through smallpox vaccination and screening & treating sleeping sickness. Prior to 1914, the vaccine for smallpox was difficult to transport to the interior areas of the region. Therefore the ‘arm-to-arm’ method was used to inoculate more marginalized labor forces. Additionally, sterile practices were not observed and sleeping sickness was

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9 'Arm-to-arm' would involve drawing blood from a previously inoculated individual and using it to inoculate others.
treated intravenously with recycled needles and syringes. These biologic factors further aided SIV in its quest for sustainable human infection. High transmission of infection between laborers would be hard to avoid, including those from the interior who may have been exposed to SIV-infected bushmeat.

More recently, Hahn and colleagues isolated SIV from pan troglodytes troglodytes chimpanzees in wild west-central Africa (Hahn et al. 2004). The team found SIV positive chimps in the southern region of Cameroon, which is accessible to the Democratic Republic of the Congo (DRC) via the Sanaga and Congo Rivers. Previous SIV has been isolated from animals in captivity, making these recent findings significant. Confirmation of SIV in the wild in this geographic region is cohesive with current data from the two earliest known HIV cases in 1959 and 1960. These were both from Kinshasa, Democratic Republic of the Congo (Zhu et al. 1998, Worobey et al. 2008).

Hahn’s research also confirms the transit route for HIV’s evolution and solidifies the role of travel in the earliest stages of the epidemic. The pan troglodytes chimpanzees reside in remote, heavily forested areas, making them inaccessible to most humans. Therefore the hunters mentioned previously acted as a bridging population for HIV.

Travel and migratory patterns along the river travel routes allowed for the continued spread of HIV. The construction of a railroad from the coast of the DRC to the interior (as far as Gabon) introduced more conduits for travel and an increased need for labor. Forced migration of villagers to the sites for construction was not uncommon. Not only would these persons be coming from the environmental niche for SIV, but would also live in labor camps with vaccination campaigns and severe gender imbalances.

Commercial sex workers were encouraged in the labor camps, facilitating ongoing HIV
transmission through sexual contact. These travel and migratory dynamics transformed the emerging infection into a continental epidemic, with long–lasting disparities.

Contenders of the hunter theory question the timing of the HIV’s emergence, citing that bush meat hunting is a traditional practice in existence long before the colonial era of 1892-1960. Despite the pre-existence of the practice, the absence of regular travel and migration coupled with closed societal networks likely curtailed the agents’ emergence. Put simply, infected individuals would only infect their main sex partners and offspring. By remaining in closed niches, infected individuals would die without transmitting to other networks. Thus the infection remained contained in small groups without contributing to ongoing transmission. Additionally, if hunting were only used to supplement agriculture, contact with infected animals would be less frequent. SIV’s evolutionary clock would progress slowly, due to limited contact with its potential new host.

Phylogenic research of HIV’s ‘molecular clock’ provides genetic evidence to support the hunter theory of HIV’s evolution including the onset of the current epidemic. Scientists used the rate of genetic mutation in both SIV and HIV with the identification of the two virus’ last common ancestor to determine when HIV became a sustained human infection (Wertheim and Worobey 2009, de Sousa et al. 2010). This research suggests HIV emerged as early as 1930 (95% CI 1912-1949). Although HIV infection was happening earlier, 1930 provides an estimate of when HIV became a sustained infection capable of successful transmission from one human being to another. Experts further

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10 Molecular clock is defined as the rate of molecular change in the nucleotide sequences in DNA (or amino acids for proteins) that reflect the change in an organism genetic structure. Assuming a constant rate of change over time allows molecular biologists to compare strains of bacteria/virus/fossils and estimate their evolutionary timeline.
hypothesize a ten to twenty-five year time lag for the virus to reach its epidemic phase within Africa. The earliest confirmed cases of HIV in 1957 and 1959 coincide with this timeline precisely. The variation in the pre-epidemic phase is largely due to the differential probability of infection based on the mode of transmission. As discussed previously, intravenous injection is a more significant mode of transmission than heterosexual sex. This is especially the case in male-to-female transmission, which would be the predominant mode in Africa due to the gender bias of who participated in hunting activities and the colonial labor force.

Postcolonial Travel, Migration and HIV

After World War II, several African countries were liberated from their colonial powers. French Equatorial Africa remained under colonial rule until liberation in 1960. In the post WWII era, infrastructure development increased significantly, with the construction of roads and buildings, particularly for industry. Large-scale urbanization occurred, with continued fragmented migration within families. This led to increased commercial sex work and informal sexual liaisons (Gray et al. 2009). Circular migration between rural and urban settings introduced HIV from high prevalence urban settings to lower prevalence rural settings (Gray et al. 2009). This era of economic growth introduced the mass importation of foreign labor. Professionals from different countries traveled to the African regions to offer expertise in road and bridge construction, manufacturing efficiency, exportation and trade. This facilitated ongoing social mixing and continued HIV transmission. Additionally, as foreign laborers and professionals returned to their native countries, they potentially
spread HIV from Africa to other continents (Frøland et al. 1988, Gilbert et al. 2007). This is the hypothesized theory for the entry of HIV into Europe.

Posthumous testing of tissue samples from a Norwegian family that died in 1976 revealed infection with HIV-1. This confirmed the presence of HIV in Europe before 1980 (Frøland et al. 1988). The husband in this family was a sailor who frequented West African trade ports from 1964-1969. He was treated for gonorrhea during his first trip, confirming his sexual activity in this region. The infection of his wife and nine-year old child with HIV imply both heterosexual and perinatal transmission in HIV’s pre-epidemic stage. Similar situations explain the entry of HIV into Europe, as several colonial citizens traveled to French Equatorial Africa (AFE).

After the collapse of AFE in 1960, travel and migration remained significant factors for HIV transmission. Foreign multi-nationals such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) established programs to aid in education and economic development (Gardinier 1974). These programs aimed to improve literacy, secondary school education and develop a skilled labor force within the former French and Belgium colonies. As such, the influx of French-speaking foreign nationals to serve as teachers and instructors was encouraged. This facilitated interregional transit, increasing the potential for HIV transmission to other hemispheres substantially.

A significant proportion of these instructors originated from Belgium, France and Montréal (Canada), but the majority were from Haiti. From 1960-1964, UNESCO reported over half (53%) of all foreign instructors being of Haitian origin (Fuller 1964). They specifically served as educational technicians and were predominantly single men who returned to Haiti frequently for holidays, potentially introducing the virus in their
country (Vangroenweghe 2001). Recent research suggests Haiti as the point source for the introduction of HIV into Northern America (Gilbert et al. 2007), but this claim is largely debatable. Gilbert and colleagues examined archival tissue samples from five (5) Haitian Americans who were among the first cases of HIV in the US. The authors outline two existing theories regarding the evolution of the pandemic subtype B strains in the Americas. The first identifies the US as the point of origin for HIV in the Americas, with subsequent spread to Haiti through increased travel and sex tourism in the 1970s. The second theory proposes HIV arrived in Haiti from West Central Africa and subsequently spread to other countries in the Americas including the US. The authors tested the latter theory by comparing the HIV strains in the archival Haitian American samples to 117 previously published subtype B strains from 19 different countries. The results showed that sequences from the env gene in the archival strains occupied basal positions in the other 117 non-Haitian strains. The authors suggest some evolutionary ancestral link to the Haitian strain based on the maintenance of this homologous sequencing within the varying subtype B strains examined. The epidemiology of HIV in the US and Haiti are, however, not in concert with Gilbert’s proposed theory.

The earliest confirmed cases of HIV in Haiti were between 1978-1982 (Pape et al. 2008). This is similar to timelines from other Caribbean islands, suggesting Haiti’s epidemic was not significantly older than other countries in the region. An older epidemic would be required to initiate an emerging US epidemic in 1981. Additionally, the oldest confirmed case of HIV in the US dates to earlier than 1969 in St. Louis, MO (Kolata 1987). This case predates the oldest known Haitian cases making it unlikely the origins of
the US epidemic were from Haiti. The spread, however of HIV from the Congo to Haiti is still significant as it provided another regular transit route and source population for the exportation of HIV out of West Central Africa.

**Modern Travel & Migration and Associated Factors for HIV**

In the current era of globalization, travel has become a simple, frequently used practice. Rapid transit between countries and continents drives several factors that can increase HIV risk. Frequent travel is associated with higher rates of casual sex. These temporary sexual liaisons increase sexual mixing and have other effects on partnering habits including increased concurrency and overall number of partners – all factors for higher HIV risk (Beyrer 2007).

As countries continue to develop economically, the concept of transnationalism has emerged as a new risk factor for HIV. Several persons work in higher income nations for economic gain while maintaining residence and ties to their countries of origin (Stone et al. 2005). This leads to bidirectional travel, elevating HIV risk to both home and host countries (Fenton et al. 2005). In this scenario, preventive strategies such as partner notification and contact tracing are more challenging and it is difficult to identify point of infection.

Migration also intersects with gender, a widely recognized factor in HIV risk. In the Caribbean, women tend to emigrate first and often engage in bidirectional travel until their partner emigrates later. They often maintain intermittent sexual contact with their main partner and are likely to acquire new partners during the separation period (Hondagneu-Sotelo 2003). This leads to concurrency for both the emigrated female and the male in the country of origin. Fragmented migration also increases the likelihood of
commercial sex work patronage, further elevating risk (Yang 2004). One perceived benefit of this gender imbalance is increased empowerment for condom usage and against domestic violence for the woman (Hondagneu-Sotelo 2003). The overlap, however, of gender inequalities and migration can increase HIV risk significantly.

Other travel and migratory related risks for HIV include illegal migration. Illegal immigrants may perceive themselves to have limited access to preventive services fear of discovery & deportation (Fairchild et al. 2004). This can lead to delayed diagnosis and ongoing transmission. Illegal immigration is sometimes linked to poverty as lack of legitimate residency limits employment options. Poverty is a well-recognized risk factor for HIV and is exacerbated among illegal immigrants (Thomas et al. 2010).

Even legal migration can be linked with poverty. Many migrants relocate for economic stability and financial gain (ECLAC 2006). In the new residence, initial low income housing typically overlaps with drug use and sexual relationships linked to financial assistance (Hondagneu-Sotelo 2003). Overtime, increased exposure to high-risk behaviors can translate to elevated individual risk (Thomas-Hope 2006).

**The Caribbean Region: A Culture of Travel and Migration**

The Caribbean region is a gateway within the Americas, connecting North America to South America and these areas to the rest of the world. A conglomeration of small islands with large safe sea access, the region has a history of high travel and transient populations (O’Neil et al. 2005). Caribbean outward movement to North America has its roots in labor migration.

Travel in the region is diverse, ranging from intraregional transit to the previously mentioned seasonal migrant travel to the US and Canada. More permanent migration is
linked to the exportation of high skilled labor in the current globalized market. The International Organization on Migration (IOM) cites the Caribbean as one of the highest points from migration in the world (IOM 2006). This introduces new elements that can affect disease and community health; namely sustained transnationalism, increased prominence of deportees and increased repatriation after long periods living abroad. Repatriation and deportees impact HIV on two levels. Returning residents acquire new risk behaviors from host country, which they introduce upon their return home. Secondly, reintegration into native society after extended absence can be difficult, causing challenges similar to acculturative stress during initial migration (Shedlin et al. 2005). This is especially the case for deportees returning to their native country with limited economic opportunities. They often engage in high risk behaviors such as drug trafficking, extortion and organizing prostitution. These behaviors may also include exchanging sex for commodities or money for financial stability. The dynamics of this scenario increase high-risk behavior such as sexual mixing and drug use, which can elevate HIV risk. Additionally, some return infected with HIV without access to similar prevention and case management services. This impedes secondary prevention and related outcomes.

Several historic cultural and social events link travel and migration to HIV in the Caribbean. Between 1900 and 1920, travel into the US became increasingly common from Caribbean countries including Haiti, the Dominican Republic and Jamaica. In this post slavery era, the US offered employment opportunities to these groups for sugar cane harvesting and other seasonal labor. This had significant implications for HIV
transmission among patrons of commercial sex workers in a similar fashion to the labor
camps previously mentioned in HIV’s emergence in Africa during the colonial era. Other
regional events linking travel to HIV include the return of Cuban soldiers from liberation
conflicts in Angola. Cuban military personnel supported Angola in their war to gain
independence from Portugal from 1975 – 1989 (Becker et al 2008). This timeframe
coincides with the sustained transmission of HIV throughout Africa during the era that
would yield the onset of the recognized epidemic in 1981. It is therefore likely that the
Cuba epidemic began in similar time blocks as the Haitian epidemic, with the return of
nationals from campaigns in Africa at the same time.
Not only was travel outside of the region increasing, but intraregional transit was also
becoming increasingly popular. Transit among groups already at elevated risk for HIV
was very common. Anecdotal reports from contact investigators in Jamaica revealed
routine travel to the US and other islands among commercial sex workers and men who
have sex with men. The latter group sometimes maintained lasting relationships outside
of their home country to avoid stigma and discrimination. Intraregional travel to Haiti for
sexual encounters has also bee reported in this group (Figueroa 2010). Routine travel
slowly transitioned to dual residency or frequent bidirectional travel – both trademarks of
transnationalism.
Transnationalism refers to the maintenance of significant ties to both the native and new
countries, with frequent travel between. This situation increases HIV risk through the
separation of families, reduced social capital and increased isolation (Karras 2007). These
factors are associated with acquisition of new sexual partners, increased number of
partners and more complex patterns of sexual mixing including disassortative mixing &
concurrency (Gras et al. 1998). Additionally, frequent travelers act as bridging populations between low- and high-risk groups or settings.

Patterns of migration throughout the Caribbean are heavily linked to economics and usually correlate with other well documented risk factors for HIV (ECLAC 2006). Drug use, poverty and incarceration stemming from acculturative stress and financial instability are not uncommon. These factors along with gender inequality are well-recognized features of the ongoing HIV pandemic.

Caribbean countries are largely misogynistic societies with men taking on the more dominant role. Males are expected to maintain macho personas, maintaining control and treating women as subordinates, especially in personal relationships. Women, however, are more likely to pursue education beyond high school and become active in the labor force. This has implications for which partner migrates first and post-migratory empowerment (Livingston et al. 2007) as discussed later. Cultural norms include widespread promiscuity among men and submission of women to male partners. Women are expected to be monogamous, which encourages minimal disclosure of infidelity among women. This complex web of social gender norms makes key prevention behaviors like condom negotiation difficult.

Currently, the Caribbean has the highest regional prevalence of HIV outside of sub-Saharan Africa (UNAIDS 2008). Country level epidemics are diverse with different post-migratory effects in their natives. Within predominantly Hispanic countries such as Puerto Rico and the Dominican Republic, intravenous drug use (IDU) and male-to-male sex (MSM) are the more significant risk factors (Caceres 2002; Deren et al. 2005). In Black West Indian settings such as Jamaica, the Bahamas and Trinidad and Tobago,
high-risk heterosexual sex and emerging MSM epidemics are driving transmission (Dougan et al. 2004; Kramer et al. 2005). Common to both settings is the high rate of continued travel & migration. Post-migration, much of the high-risk behaviors of the home country are retained. However exposure to additional behaviors in the new setting can elevate risk beyond the cultural base (Fenton et al. 2006).

Recent studies of HIV among immigrants in resource-rich settings revealed Caribbean migrants as a growing group in several settings (Fenton et al. 2005). Despite a well-recognized HIV epidemic and a long history of migration, few studies have focused on HIV and migration in the context of risk between native and migrant West Indians. Even fewer have focused on West Indian blacks as opposed to Hispanics. Commonly cited limitations to such studies are the absence of well established surveillance systems and insufficient migrants in foreign settings for comparison. However, several islands have amassed significant HIV surveillance data. These data can now facilitate the required research. Additionally, the steady trend of migration overtime has led to a substantial population of Caribbean migrants in settings such as the Great Britain, Wales, Ireland and the US. Jamaica, one of the larger islands in the region provides an optimal case study for addressing this significant research gap.

**Jamaica: A Closer Look**

Jamaica is the third largest island (7250 mi²) in the Caribbean region (including the Greater and Lesser Antilles situated in the Caribbean Sea). It is the fifth most populous island in the region with an estimated 2.6 million inhabitants in 2008 compared to 11 million in Cuba and 4 million in Puerto Rico (STATIN Jamaica 2009). Sixty-one percent
of the island’s population is between 15 and 64 years of age, with the median age being 23 years in 2008 (CIA World Factbook 2009). The island is predominantly black (76.3%) with a significant Afro-European group (15.1%) and smaller groups of East Indian (3.4%), Caucasians (3.2), Chinese (1.2%), Syrian (0.9%) and Lebanese (0.9%) descent (UWI Population Division 2010). Gender distribution is approximately equal with a female to male ratio of 1:0.98. First colonized by Spain, Jamaica remained a British colony until 1962 when it gained independence. At this time the island transformed into a bicameral parliamentary government\(^\text{11}\), while remaining a member of the British Commonwealth.

The Central Intelligence Agency (CIA) classifies Jamaica as a low middle-income country with GDP of US$4200 per annum and main income sources being tourism and bauxite (a natural ore required for the production of aluminum) (CIA 2004). With a Gini index of 45.5, Jamaica has severe inequities in distribution of wealth (UNDP 2009). This, coupled with high rates of unemployment (11% island wide with rates at the community level up to 34%), has been a consistent factor fueling migration even before the island’s independence.

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\(^{11}\) A bicameral parliamentary system refers to a government structure with two houses – similar to the US and the UK. In Jamaica these two house are the lower house (House of Representative) and the upper house (the Senate).
Jamaica has a semi-socialized healthcare system. Over 90% of the island’s 348 hospitals and clinics are public. The island also has 6 public laboratories used for diagnostic and advanced imaging services. Care is free at government hospitals and clinics across the island, although there was formerly a fee for medications. This fee was abolished in 2008. There is a strong private sector health care arm (Duncan 2009). Private insurance is
available for purchase but is not necessary for accessing care. Several private physician offices and hospitals offer services for cash where insurance is unavailable. Regarding HIV, care is offered at all government facilities, and includes nutrition and psychological visits as well as basic medical care. In 2005, the national antiretroviral therapy initiative was implemented, although the medications were available from private doctors 3-5 years earlier. In public facilities, the cost of medication is based on a graduated system of need. Those who are deemed financial able are asked to make a small contribution to the price of their medication. However, no individual is denied medication due to inability to contribute.

**Jamaica and Migration**

Jamaica is one of the largest migration sites in the region, with net migration rate of -7.6 migrants per 1000 population (IOM 2006). Approximately 50% of all migrants are female. Prior to 1970s, relocation was mainly to the United Kingdom. However, as a result of UK restrictions and the need for migrant labor in the Americas, there was a significant increase of migration to the US and Canada. Migration to other European nations is also becoming increasingly common (IOM 2006).

Currently, migration from Jamaica is predominantly to the United States and Canada with increasing relocation to Costa Rica, Panama, Cuba, Nicaragua and Colombia. There is anecdotal evidence of an emerging trend of migration from Jamaica to Egypt and Ethiopia but the data are sparse to validate this claim.

London, Great Britain and Dublin, Ireland are home to the largest Jamaican communities in the United Kingdom. In London alone, 7% of all residents are of Jamaican descent. In Canada, Toronto, Ottawa, Montreal and Van Couver are the primary sites for Jamaican
resettlement. Within the United States, Jamaican populations can be found in the greater Miami/Fort Lauderdale area, Orlando and Tampa, Florida, Atlanta, Georgia, New York City and Buffalo New York, Hartford and Stamford Connecticut, Philadelphia, Pennsylvania and the D.C./Baltimore area. New York City, New York and the Miami, Florida area remain the U.S.’s largest settlements for Jamaicans.

The positive effects of migration for Jamaica include annual remittances amounting to more than 20 million dollars per year or 20% of the annual GDP (IOM 2006). Additionally, some residents returning to Jamaica after migration bring with them sustained foreign income revenue and high-level skills to contribute to local labor and academic realms. Negative migratory effects discussed previously include fragmented migration, illegal migration, deportation and the brain drain dilemma.

The demographic pattern of migration in Jamaica is essential in understanding related HIV risk. Young adults may migrate for higher education and sometimes remain abroad post baccalaureate. Middle-age adults migrate for economic stability and may leave independently, returning for their school age children and/or spouses after legitimizing their status (fragmented migration) (Hondagneu-Sotelo 2003). There is a severe imbalance in fragmented migration related to gender. Women tend to migrate from Jamaica to foreign nations first and establish the new household. This creates shifts from patriarchal to matriarchal households. Women who are empowered may take on new partners until their main partner/spouse arrives. Men left behind in Jamaica will take on new partners (possibly concurrently), as there is a high cultural norm for acceptable promiscuity and infidelity among men (Sharpe 2006). Upon
reunification, new partnerships may not be dissolved creating a complex web of concurrent, multiple partnerships further impacting risk.

Others who are denied visas or ineligible for legitimate migration enter countries illegally, elevating their individual HIV risk. Elevated risk is linked to limited or no access to health, diminished empowerment or social isolation in their new host country. Many limitations are centered on fear of deportation. All these socioeconomic factors further fuel risk.

The combination of social norms and migratory factors has led to the emergence of Jamaicans as a growing risk group for HIV abroad. This has clear implications for future immigration policy, specifically regarding HIV/AIDS. More importantly, there are larger implications for Jamaica’s local epidemic.

**Jamaica’s HIV epidemic**

The link between migration and HIV is embedded in the origins of Jamaica’s HIV epidemic. The first documented case occurred in a Jamaican male living in NYC who returned to Jamaica with AIDS in 1982 (Figueroa et al. 1995). The first reported female case was the common-law wife of an infected migrant laborer. Jamaica’s epidemic originated as a mixture of MSM cases coupled with heterosexual men who were often farm workers and migrant or seasonal laborers (Figueroa et al. 2010).

From 1988-1993, men accounted for the majority of new cases reported to surveillance. Since then, there has been a steady and significant increase in the number of new cases reported among women, particularly heterosexual females. Currently, the predominant mode of transmission is sexual intercourse, with heterosexual sex being reported among
90% of new cases who reveal sexual behaviors as their source of HIV transmission (MOH 2009). Sex with commercial sex workers and crack/cocaine use are also consistent risk factors among newly reported cases (MOH 2009). Though MSM activity does not account for risk in a significant proportion of new cases, it is interesting to note 40-43% of newly reported male cases have no identified risk. The society has limited affinity for homosexuality and stigma affects risk reporting among cases. Additionally, surveillance data is biased as it largely reflects the public sector. More ostracized groups seek care privately where possible for fear of discrimination.

UNAIDS estimates 27,000 persons of the total 2.6 million in Jamaica are living with HIV, with at least 50% or 13,500 HIV-positive persons unaware of their status (UNAIDS, 2008).

*Figure 2: Spatial distribution and concentration of HIV/AIDS cases in Jamaica.*
The Ministry of Health Jamaica (MOH) reports a prevalence of 1.6%, with 23,972 of HIV/AIDS reported between January 1982 and December 2008 (MOH 2009). There were 1,228 new HIV cases and 925 new AIDS diagnoses in 2008. There were 401 deaths in this same year. This represents a 17% decline in AIDS cases compared to 2004 (MOH 2009).

Surveillance data reveals at least 3% of persons in the database report transnational sexual contacts, representing a modest increase over time (from 1996-2007). Early in the epidemic, a significant proportion of MSM cases reported transnational sexual contacts (particularly in the US). Similar trends occurred among male heterosexual cases in the early phase of the epidemic. These cases were often migrant laborers and reported unprotected sex with commercial sex workers. Although a small proportion, this reflects the sustained presence of transnational interactions in Jamaica’s HIV epidemic.

Possible infection transnational and subsequent repatriation can also explain this trend. Unfortunately these dynamics are not adequately monitored. Additional evidence of migratory links includes the growing number of deportees who are infected abroad and return home in need of continuity of care.

The management of these issues is only one layer of the effect of migration on HIV in Jamaica. Another point to consider is the new or modified risk behaviors that may bridge high risk groups abroad to low risk groups in native countries through post repatriation contact. Other considerations include persons knowingly returning home to ‘live out their days’ with advanced HIV and AIDS as well as the bridging of high-risk groups in Jamaica to lower risk groups abroad. For infection that takes place in Jamaica, this may
have future immigration implications as foreign nations tighten immigration policies for HIV positive persons.

Jamaicans are one of the highest migratory groups in the Caribbean and therefore appear to account for a more significant portion of foreign born cases. Further study is needed to elucidate what risk behaviors are motivating purported increased rates of infection. We also need to explore the possible point of infection to target interventions. Lastly, it is necessary to compare risk with native Jamaicans to identify which risk behaviors if any change upon migration and how these behaviors can be targeted for prevention.

New York City provides an ideal setting for this research for several reasons. Primarily, there is a significant source population of Jamaicans in New York, as Jamaica is among the top 3 highest migration points to New York (NYC Census 2008). Jamaicans can be found in the five boroughs of New York City but the Bronx and Brooklyn remain the most popular settlement locations.

Primary reasons for migration for Jamaicans included the pursuit of economic stability or education. Within the boroughs of New York City, the socioeconomic status of Jamaican migrants varies significantly (Moloney 2007). Migrants include doctors, nurses and financial professionals who tend to be mid-to high-middle class. Others work in a more service-oriented category including hospitality, home health care and as child caretakers (nannies). There is also a minimal amount of social mixing with other national groups but most Jamaicans tend to mix with their fellow countrymen or persons from within the Caribbean region.

Additionally, New York City has a well established HIV surveillance system that has consistently collected country of birth information from its inception in 1985. Not only
does this facilitate comparison to Jamaica’s surveillance data, but also it provides a comparable timeline. Most importantly, both settings routinely collected information on risk behaviors allowing for a comparison of risk profile among cases over time. This information is critical for determining the impact of migration on risk in both settings.
Chapter 3: Methods

This study compared risk behaviors among HIV positive Jamaicans in New York City and Jamaica. All data for analysis came from the HIV surveillance registries in each of the study sites.

Methods for Source Data

Data Source I: The HIV/AIDS Registry System (HARS), New York City Department of Health and Mental Hygiene

History and Evolution of HIV/AIDS reporting in New York City

New York City began legally-mandated name-based AIDS surveillance in 1983, after identifying a cluster of homosexual men with the rare immune deficiency. In the absence of an HIV test, reporting was limited to individuals with specific AIDS defining illnesses. In 1993, the national case definition for AIDS changed and reporting expanded to include all cases with the new criteria. In 2000, reporting legislation expanded to include HIV positive persons regardless of AIDS status. The latest changes to reporting legislation occurred in 2005. Laboratories were required to report all CD4 counts and viral loads. Additionally, mandatory reporting of provider-based information on any known sexual or needle-sharing partners began in the same year. The latter is used for a legally mandated partner notification program and this data is stored in a separate location.

Data Flow, Collection, Storage and Security

The US Centers for Disease Control and Prevention (CDC) has a national database containing all HIV/AIDS cases reported for surveillance. This HIV/AIDS Registry System (HARS) is facilitated and maintained by the CDC, but is dependent on registries at the level of the reporting jurisdictions. Each jurisdiction maintains a live, electronic
database (eHARS) on a remote server that links to the master database at the CDC. All new cases and case updates are received at the CDC in real time.

As one of the largest epicenters for the HIV epidemic in the US, New York City is one of a few city-level surveillance jurisdictions. All new HIV cases occurring in one of New York City’s five boroughs are reported to the NYC DOHMH. In turn, NYC DOHMH reports directly to the CDC, bypassing New York State (for all data except laboratory data).

Data from NYC HARS is generated from several different sources and through the complex triangulation of data. The main reporting sources are laboratories and medical care providers. Laboratories account for 73% of reported HIV data and are usually the initial reporters of new cases. The laboratories send their data to the New York State HIV surveillance unit, which routes all relevant cases back to NYC DOHMH. Laboratories are required to report new cases that meet one of the following criteria adapted from the CDC case definition of 1993 (MMWR 1993);

- Positive result on a screening test for HIV antibody (e.g., repeatedly reactive enzyme immunoassay), followed by a positive result on a confirmatory (sensitive and more specific) test for HIV antibody (e.g., Western blot or immunofluorescence antibody test) or

- positive result or report of a detectable quantity on any of the following HIV virologic (nonantibody) tests;
  - HIV nucleic acid (DNA or RNA) detection (e.g., DNA polymerase chain reaction [PCR] or plasma HIV-1 RNA)
  - HIV p24 antigen test, including neutralization assay
- HIV isolation (viral culture)

Medical providers are responsible for approximately 15% of reported HIV data and are required to report cases based on clinical criteria. Providers include 80 hospitals, 500 freestanding clinics and more than 2200 private physicians. The providers report using the provider report form (PRF), which contains the minimum required fields for entry into HARS. The remaining 12% of reported data to the NYC HARS comes from a variety of sources including New York State surveillance, medical examiners, the national death index (NDI) and the routine interstate duplicate review (RIDR).

All information is routed to the NYC DOHMH to separate new case information from existing case updates. New case data is routed to public health advisors for field investigation and completion of the provider report form where necessary. From there, the surveillance unit enters the data and the field services unit (FSU) begins the partner notification process. Generally, the reporting lag is 9 months.

Once the data are collected, there are several points for sorting and storage. Any data collected by the field services unit (FSU) is stored in an independent database. Although this data does have identifiers, it can only be linked to other surveillance data using the case’s unique city number.

NYC HARS is stored in two different formats. The first is a live database that contains case names and is linked to the CDC which has its own virtual remote server. This database is used solely for public health purposes including querying existing cases and verifying records.

A limited copy of the database is made every 6 months and these ‘frozen’ datasets are used for analysis and data requests. This circumvents the problems of analyzing the live
database. Each case receives several updates from different sources and can cause wide variation in numeric estimates. The frozen datasets provide a cross-sectional view of the epidemic at a single time point while allowing for trend analysis, due to routine updates. For security, all the datasets are housed internally at the NYC DOHMH. In compliance with HIPAA and NYS confidentiality laws, access is restricted to employees in the HIV unit. There are two barriers – access to the physical unit where the network is housed and access to the network server or drive where the data are stored. Physical access requires activated electronic badges and fingerprint recognition software. Access to the name-based live data is limited to key personnel and requires granted access from the database administrators as well as password-restricted entry. For enhanced security, any machine that connects to the live database cannot have shared internet access. This decreases the likelihood of a confidentiality breach from internet hacking and/or external entities.

*Figure 3: Data Flow through the New York City Department of Health’s HIV/AIDS Registry*
Approximately 69% of the eligible total 1,780 Jamaican cases in NYC HARS are male. The median age of cases living in 2007 is 39 years with an age range of 16-62 years. The median age at first report is 38 years and the median age at death is 43 years. The predominant reported risk behavior is MSM although 35% of all cases have no identified risk on file (see Table 3). The NYC HARS has been used extensively in prior investigations of HIV/AIDS in New York City. A trend analysis of reported AIDS cases in the city was performed in 1993, ten years after AIDS surveillance was first implemented (Thomas et al. 1993). Since then, NYC HARS data is represented in the literature in a variety of topics including descriptions of particular at risk groups (Murrill et al. 2008) as well as trends in accessing care (Torian et al. 2008) and mortality (Wong et al. 2000).

Table 3: Distribution of Transmission Risk by Gender among Jamaican-born HIV cases in NYC

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSM</td>
<td>453</td>
<td>25.45</td>
</tr>
<tr>
<td>IDU</td>
<td>122</td>
<td>6.85</td>
</tr>
<tr>
<td>MSM &amp; IDU</td>
<td>23</td>
<td>1.29</td>
</tr>
<tr>
<td>Adult Hemophiliac</td>
<td>5</td>
<td>0.28</td>
</tr>
<tr>
<td>Adult transfusion/transplant</td>
<td>4</td>
<td>0.22</td>
</tr>
<tr>
<td>Pediatric non-perinatal (behavioral)</td>
<td>1</td>
<td>0.06</td>
</tr>
<tr>
<td>Male heterosexual [CDC definition]</td>
<td>159</td>
<td>8.93</td>
</tr>
<tr>
<td>Probable MSM</td>
<td>1</td>
<td>0.06</td>
</tr>
<tr>
<td>NIR</td>
<td>457</td>
<td>25.67</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDU</td>
<td>38</td>
<td>2.13</td>
</tr>
<tr>
<td>Adult Hemophiliac</td>
<td>4</td>
<td>0.22</td>
</tr>
<tr>
<td>Adult transfusion/transplant</td>
<td>3</td>
<td>0.17</td>
</tr>
<tr>
<td>Presumed Perinatal</td>
<td>2</td>
<td>0.11</td>
</tr>
<tr>
<td>Female heterosexual [CDC definition]</td>
<td>237</td>
<td>13.31</td>
</tr>
<tr>
<td>Female probable heterosexual [HEP definition]</td>
<td>64</td>
<td>3.60</td>
</tr>
<tr>
<td>Female probable heterosexual [CSTE definition]</td>
<td>38</td>
<td>2.13</td>
</tr>
<tr>
<td>NIR</td>
<td>169</td>
<td>9.49</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1780</td>
<td>100</td>
</tr>
</tbody>
</table>
More recently, the data were used at the individual level to match with the New York City Community Household Survey and compare rates of unreported HIV infection in the population (Nguyen et al. 2008). Though highly confidential, the data is routinely used for investigations relevant to maintaining public health both within and outside the NYC DOHMH.

**Data Source II: HIV/AIDS Tracking System (HATS) – Jamaica Ministry of Health**

*History and Evolution of HIV/AIDS reporting in Jamaica West Indies*

In Jamaica, individual name-based HIV/AIDS surveillance began in 1995 when the condition became reportable to the government health authority, Ministry of Health Kingston (MOHHQ). However informal reporting occurred since 1985. Despite this late start, intense retrospective case finding, triangulation and entry was undertaken to gain a clear picture of the epidemic. The HIV/AIDS control program was integrated into the existing sexually transmitted infections (STI) program. Existing contact tracing and partner notification methods for syphilis were applied to HIV/AIDS at this time.

Although the program is managed at the MOHHQ, reporting begins at the local level in one of the island’s four decentralized regional health authorities (RHA).

In 1996, the surveillance registry was made electronic and retrospective cases were entered back to 1982. Originally on a DOS platform, the registry was ported twice before its final and current Access and SQL format.

In 2005, antiretroviral therapy (ART) was added to the reporting form after the start of the national ART program. The form was revised again in 2007 to include viral load, cd4 count and an additional stage of disease – advanced HIV for person with CD4 counts
between 350 and 200 per ml of blood. The gender of each reported sexual contact was also introduced to the database at this time.

*Data Flow, Collection, Storage and Security*

HIV/AIDS reporting in Jamaica is grouped under a list of class I notifiable diseases. The health care provider performing the test reports persons who have a single positive HIV test result. Providers include laboratories, public health clinics, private physician or field outreach specialists. Public health clinics and laboratories report the majority of cases. Outreach includes voluntary testing and counseling activities at known high-risk venues, social events and HIV awareness drives. Although reporting is legally mandated, it is neither heavily monitored nor enforced. As a result the primary reporters are public sector health providers or the national public health laboratories throughout the island.

Class I notifications for HIV are sent to the regional medical officer of health (MO(H)), who will route to the Ministry of Health, Headquarters (MOHHQ). After initial reporting of positive test results, contact investigators in the relevant RHA perform fieldwork to obtain supporting case information. This includes demographic data, transmission route and risk information collected on the HIV confidential reporting form. The hard copy form is sent to the regional MO(H) who routes to the MOHHQ for entry into the surveillance registry. The reporting lag ranges from 6 – 12 months.

The surveillance data is stored in the HIV/AIDS Tracking System (HATS). The system is housed remotely at the MOHHQ and is accessible via Microsoft Access across an SQL server. An electronic version is being piloted for case reporting but has not yet been implemented. The database is always live. Archived backups are used for reporting through specific time points but no frozen datasets are maintained. Access to HATS is
currently limited to the Director of Monitoring and Evaluation, the database administrators, and two data entry clerks.

Figure 4: Data Flow through the Jamaica Ministry of Health’s HIV/AIDS Registry

Approximately 55% of the 22,653 cases in HATS are male while a negligible proportion has no sex on file (0.23% or 52 cases). Accurate date of birth data is missing for 6,292 cases, making them ineligible for analysis. For the remaining 16,361 cases, the median age of cases living at the end of 2007 is 35 years. The median age at first report is 30 years and the median age at death is 37 years. The predominant reported risk behavior is heterosexual sex although 44% of all cases have no identified risk on file.

Access to the HIV/AIDS Registries

Each of the health agencies was approached independently to negotiate access to individual level data from their respective HIV/AIDS registries. Both agencies required a research proposal for institutional review board approval, which was required before any data share agreements could be negotiated. The director of the Monitoring and Evaluation
Unit within the Jamaica Ministry of Health’s national HIV/STI programme granted the graduate student access to the requested data in June 2008. A data share agreement outlined the terms and restrictions associated with using this data. These included not saving the data table or raw data files on any desktop or laptop hard drive, keeping the storage drive encrypted and password protected and not disseminating results without review by the Jamaica Ministry of Health. Additionally, an epidemiologic consultancy at the Ministry of Health facilitated training with database administrators to become better versed in this datasets.

In New York City, the director of the HIV Epidemiology and Field Services Unit within the Bureau of HIV/AIDS Control approved the project and access to the database during August 2009. The data share agreement included clauses protecting the removal of an individual level data from the NYC DOHMH’s physical premises at 346 Broadway, New York NY. Additional clauses required collaborative, supervised analysis of the requested data with full time staff within the department and the prohibition of dissemination without approval from the bureau’s ethics in research committee.

**Study Data Storage and Management**

SAS v 9.1.3 (SAS Institute, Cary NC) was used to create analytic datasets for the proposed research. Using the source surveillance data, all eligible cases and their respective observations were abstracted and merged into a new dataset with only the variables needed for analysis.

Analytic datasets from NYC HARS were stored on a secure, access-limited drive at the NYC DOHMH. Analytic datasets from JA HATS were stored as encrypted password protected SAS datasets on a locked external hard drive. The source data from JA HATS
remained in Access database format, encrypted, password-protected and located on the locked hard drive. No data from the JA HATS were saved on the NYC DOHMH network. Additionally, no data from NYC HARS were removed from the host facility. To protect the integrity of each individual agency, datasets were only merged in temporary SAS libraries for analysis. No permanent merged datasets were stored on the network or any portable drives. At the end of the study, analytic datasets will be archived at the NYC DOHMH for future analysis if necessary. In compliance with HIV confidentiality laws in the state, these datasets will be destroyed 12 months after their creation or upon completion of the dissertation requirements.

**Study Population**

The study included HIV-infected persons of Jamaican birth reported to the HIV/AIDS surveillance systems in New York City and Jamaica between 1988 and December 31, 2007. There were no restrictions by age or vital status at the time of enrollment. No active participant recruitment was required, as the research used secondary data and extracted only information collected during routine HIV/AIDS surveillance.

As of December 31, 2007 JA HATS had 22,653 cases reported to surveillance. By the same date, there were 1,780 cases of Jamaican birth reported to NYC HARS. Age distribution was similar between locations, although Jamaican cases in New York were slightly older at first report to surveillance. The median age of Jamaican cases in NYC was 39 years, 4 years older than the median age of Jamaican cases (35 years). At first report to surveillance, the median age was 38 years among Jamaican cases in NYC and 30 years in Jamaica. There was a statistically significant difference in gender distribution
between the two locations. Males accounted for 69% of Jamaican cases in NYC compared to 55% of all cases in Jamaica.

Inclusion Criteria: There were two levels of inclusion and exclusion criteria for this study. The more general criteria were for the entire study, while additional criteria were applied for the independent research questions. To be included participants were required to have an HIV diagnosis, have been notified of their HIV status, and have had their HIV diagnosis or simultaneous HIV and AIDS diagnoses reported to HATS or HARS between 1988 and December 2007. Additionally, participants must be of Jamaican birth and a resident of New York City or Jamaica at initial diagnosis.

For the first research question addressing transnational partners and risk in Jamaica, eligible cases had to have at least one reported sexual contact in Jamaica’s HATS database.

Exclusion Criteria: Persons born outside of Jamaica or who met the case eligibility criteria, but relocated during the follow-up period were excluded from participation.

Sampling

All cases eligible for participation were included for analysis.

QUESTION I: Which demographic and risk factors were associated with transnational\textsuperscript{12} sexual partnerships among HIV positive persons reported to surveillance in Jamaica from January 1, 1988 to December 31, 2007?

This research question was explored using a classification tree analysis in JMP Statistical Discovery software (SAS Institute, Cary NC) (see detailed study design for additional description). Only data from JA HATS was used. Eligible participants were sorted into

\textsuperscript{12} Transnational refers to any sexual partner that was not a resident of Jamaica at the time of case reporting and partner disclosure to the HIV/AIDS Tracking System (HATS)
two groups; those with at least one sexual partner outside of Jamaica (cases) and those with sexual partners in Jamaica only (controls). Cases were matched with their respective controls by gender and age. Gender matching only included sex at birth and did not account for transgender sub-groups as the data are not routinely collected and entered in HATS. Age matching was based on five year age ranges to account for potential outliers. The matching process was performed using simple random sampling in SAS. After random number generation for controls, small tables were generated linking each case to their eligible control pool. Using non-replacement sampling, a single control pool was generated and merged with eligible cases to provide a comprehensive analytic dataset.

**QUESTION II:** What were the similarities and differences in the HIV/AIDS epidemics among Jamaican immigrants to New York City and those living in Jamaica, W.I.? This research question was explored using a general linear model estimating the rates of newly reported HIV and AIDS cases in each setting (refer to the detailed study design section for a description of analytic methodology). There was no sampling for the second research question as it was a trend analysis. Trend analyses use aggregate data to create ecologic statistical models. As such, all cases reported to surveillance between January 1988 and December 2007 who meet the eligibility criteria were included in the statistical models for new AIDS diagnoses per year and annual deaths among AIDS patients. For the model including new HIV cases per year, only eligible cases between January 2001 and December 2007 were included due to the absence of name-based HIV reporting in New York City prior to this period.
QUESTION III: Were there differences in disease stage at the time of HIV diagnosis between HIV positive Jamaican immigrants to New York City and HIV positive persons in Jamaica? What factors were associated with late stage diagnosis in each setting? Only persons reported to NYC HARS or JA HATS between January 2001 and December 2007 were eligible for analysis. This is due to the implementation of name-based HIV surveillance in New York City in June of 2000. Prior to this period, all reported cases already had AIDS and would be considered a late diagnosis. Cases were HIV-positive persons with an AIDS diagnosis within 12 months of first learning of their HIV positive status or those first reported at AIDS or at death. Controls were HIV positive persons (non-AIDS) who remained AIDS-free within the first 12 months after their first report to surveillance. The sampling scheme was the same as that of the first specific aim with the exception of the purposive sampling of non-heterosexual men (see detailed study design for additional description).

Power Calculations
All power calculations were performed using Power Analysis and Sample Size software 2008. The proposed research was conducted at the 5% level of significance with 80% power.

QUESTION I: Were there differences in demographics and transmission risk between HIV positive persons in Jamaica reporting transnational sexual partners and those who only report local sexual partners? Could these differences be identified using an exploratory data mining technique?
Although the research design is exploratory, the study was powered as an unmatched case control study. The required sample size with a 1:3 case control ratio is 2,492 individuals.
This sample allows for the detection of 50% difference between cases and controls at the 5% significance level with 80% power. This is considered a large effect.

**QUESTION III:** Were there differences in disease stage at the time of HIV diagnosis between HIV positive Jamaican immigrants to New York City and HIV positive persons in Jamaica? What factors were associated with late stage diagnosis in each setting? The required sample size for the logistic regression with a 1:1 case control ratio (m) was 3,276 individuals in each setting, for a total sample of 6552. This sample allows for the detection of 9% difference between cases and controls. Oversampling in Jamaica was required due to significantly fewer cases in New York City than Jamaica. Additionally, subgroup analysis within New York City was limited due to sparse data in particular cells.

**Detailed Study Design and Analyses**

**Variable Management**

**Date of Birth:** Available in both datasets and formatted as a date (DDMMCCYY in Jamaica and MMDDCCYY in NYC). This variable was transformed to MMDDCCYY and used to adjust the statistical models. This variable was also used to calculate age at diagnosis for first report to surveillance and each subsequent disease stage. Persons of unknown date of birth were excluded from analysis or generated missing data for certain variables where the main effect is not age dependent.

**Sex:** Both New York City and Jamaica classified cases as either male or female in their surveillance systems. Although New York City does have a category for gender that includes transgendered individuals, this variable was not used for the purposes of this analysis.
**Risk:** For the purpose of this analysis, the following transmission risk categories were used; MSM, IDU, Heterosexual, Perinatal, Other (transfusion, haemophiliac etc.) and NIR/NRR (see Table 2). The standard approach of combining MSM who report IDU into a single category was not employed in this analysis, due to particularly small samples (less than 1%) of IDU in both settings. Any individual who reported IDU was classified as such. Distinct differences in risk classification existed between the two settings. In New York City, risk was classified in the group listed in Table 1. In Jamaica, there is no distinct single variable for risk. Instead, transmission risk was implied from three fields on the HIV reporting form (see Appendix I); transmission category, sexual practice and risk behaviors. For analytic purposes, these variables in Jamaica’s reporting form were transformed to match NYC’s risk classification using sex-specific algorithms (see Appendix IIIA-B). Additionally, the heterosexual category in New York City was expanded to include intercourse with a member of the opposite sex (with no same sex encounters for men) regardless of that partner’s HIV risk (see Appendix IIIC-D).

Although crack cocaine use was particularly relevant to the epidemic in Jamaica, it does not confer transmission risk directly and was only included as a covariate for statistical modeling. Analytic risk categories were mutually exclusive. Persons with more than one risk group were placed in the highest-ranking group based on the risk hierarchy list (see Table 2).

**Disease Stage:** This ordinal variable had three levels; HIV, AIDS and AIDS death. The disease stage used was the most recent CD4 count or staging by December 31, 2007 in each of the surveillance systems using the traditional approach. This approach mandated all cases retain their disease classification in the order of disease progression. In other
words, a case remained classified as HIV until the first AIDS defining event (a CD4 count less than or equal to 200 cells per microlitre of blood or an AIDS defining illness as stipulated jointly by the CDC and WHO). Once classified as AIDS, a case retained this classification until death. Rebounding CD4 counts or resolution of AIDS defining illnesses did not change the case to the earlier HIV classification.

**Stage at Diagnosis:** This dichotomous variable was an indicator for early or advanced disease stage at diagnosis. Early stage included HIV (acute, non-symptomatic). Late stage included persons with an AIDS diagnosis within 12 months of their HIV diagnosis, concurrent HIV and AIDS diagnosis (AIDS diagnosis within 31 days) or first report at death.

**Analysis Plan**

**Specific Aim 1:** To identify factors associated with transnational sexual partnerships among HIV positive cases reported to surveillance in Jamaica between January 1, 1988 and December 31, 2007, controlling for the age and gender of the HIV positive case. As of December 31, 2007 there were 623 individuals alive in Jamaica’s HATS who report transnational sexual contacts. The question of interest was if these persons were significantly different from those who exclusively report sexual partners in Jamaica. Accounting for less than 7% of the total persons in the registry, traditional case control comparisons would yield sparse data across several covariates of interest. As such, this research question was explored using a data-mining technique called classification tree analysis (Pregibon 1997). As previously described, 623 cases were matched to 1869 controls by age and gender using non-replacement simple random sampling in SAS.
Data mining is designed to explore data and identify patterns consistent within a specific category of data. Unlike traditional statistical analyses, data mining does not aim to infer causality through association but is predictive (Hill et al. 2006). Data mining is used extensively in market analysis to build profiles of consumers. The results help business enterprises target products to persons most likely to buy them. This method has also been used in predicting adverse outcomes among cancer patients. For example, Koziol et al. used tree-based regression to identify predictors of poorer prognosis among men with prostate cancer (2008). Their research identified age, treatment method and method of immuno-suppression to be accurate predictors of prognosis among their cohort. Campo et al. also used this methodology to identify predictive factors of accepting a change in antiretroviral therapy among HIV-infected adolescents (2007). Their results were consistent with a generalized estimation equation (GEE) and showed non-Hispanic patients were more likely to accept the change in medication.

Lemon et al. (2003) also explored the use of classification trees in public health, with comparisons to the traditional logistic regression model as proposed for our analysis. A fundamental difference was the use of classification trees on a large robust dataset derived from a representative population. The data in Lemon et al. ’s study could be analyzed sufficiently using the traditional logistic regression approach. Their study explored factors associated with influenza vaccination among the elderly. Our proposed methods will therefore extend this body of work by comparing classification trees to logistic regression in a highly specialized data set with very few observations. Classification tree development is nonparametric, making it ideal for small data sets and for identifying unique subgroups based on rare events or phenomena. With less than 7%
of cases in Jamaica reporting a transnational sex partner, this method provided a potentially viable alternative to traditional inferential statistics and hypothesis testing which would not be appropriate. As such, the results of the classification trees analysis were compared to a traditional logistic regression model.

Within this specific aim, classification trees were used to identify factors of transnational sexual partnerships. The literature described this behavior as a significant risk factor for HIV transmission among immigrants in foreign settings (Fenton et al. 2005). There were, however, no descriptions of the potential effect on the partners in the country of origin or reported frequencies and dynamics of this purported high risk behavior. A successful predictive model could identify defining characteristics of these persons and guide future investigation of their outcomes relative to their peers who maintain solely protective partnerships.

The classification tree modeling analysis involved three stages after sample selection. The first stage involved data preparation, feature selection and exploratory analysis to identify the more relevant features. The next stage entailed recursive, hierarchical splits of randomly sampled subsets of the master data file to decipher the most salient factors. This is referred to as a k-fold cross validation approach. In situations where there are low numbers, this validation method is a reliable substitute for fitting the data to a learning data set and validating it with a test data set. This validation method can be thought of as a series of simple chi square tests with subsequent ranking by most significant factor to the least significant. At each split, all factors were considered in the new subset of data to decipher the next, most significant factor. This process was repeated with different subsets of the data to yield a series of classification trees. Not only was the ranking of the
factors significant, but also the frequency of appearance in a single tree. Factors that appeared repeatedly across different subgroups were usually highly associated with the outcome of interest.

The next stage involved building the model or final tree. The factors that were consistently ranked higher up across the different trees in the first stage were used to build the final regression model for comparison.

The analytic data set included 623 cases (persons reporting an transnational sexual contact) and 1869 controls. The features of interest included sex at birth, age group, transmission risk category, crack/cocaine use (yes/no), number of reported sexual contacts (two or less, more than two), history of deportation (yes/no), occupation category, marital status and disease stage at diagnosis (early versus late). The first split was the case control criteria and the k-fold cross validation\textsuperscript{13} method was used to identify significant factors. The tree was split to exhaustion and then pruning was performed until the predictive indicator for the model changed by less than 1\%. From the final tree, a predictive model was determined by selecting the consistently higher ranked factors across the trees.

The developed classification tree was applied to this data to determine its utility in accurately identifying cases and subgroups at highest risk. The ROC curve was used to compare the final model to the standard regression model. The area under the curve (AUC) reflects the model’s ability to accurately classify cases. Misclassification statistics

\textsuperscript{13} K-fold cross validation refers to the random division of the learning or test data set for fitting trees simultaneously. This assists with assessing differences in classification across the different subsets. Significant differences limit the overall generalizability of the final tree and would be similar to interactive effects in regression which call for stratified analyses.
were also used to compare models with the lower misclassification rate reflecting the superior model.

A logistic regression was run with the factors of interest in a stepwise selection method, similar to the splitting and pruning used for tree development. A ROC curve was generated for the regression and the AUC was compared to that of the classification tree. The curve with the larger AUC was deemed a better predictive model for the data and therefore, more suitable in identifying factors associated with transnational partnering.

**Specific Aim II**: To compare trends in HIV, AIDS and AIDS deaths between HIV positive cases in Jamaica’s surveillance registry and HIV positive cases of Jamaican birth in New York City’s surveillance registry

An ecologic analysis using a general linear model was used to compare reported HIV cases, AIDS cases and AIDS deaths per year between New York City and Jamaica. The analysis was performed on a merged dataset of aggregate rates from both locations using SAS 9.1.3. The dataset included annual rates of new HIV diagnoses, new AIDS diagnoses and the number of deaths among AIDS cases. The statistical models included 14-40 observations depending on the rate under scrutiny. The number of reported AIDS cases and the number of reported AIDS deaths was modeled by location. The model was age-adjusted. The primary predictor was residence (NYC versus Jamaica) and the model was weighted by the inverse of the standard error for each rate.

Ad hoc analyses were performed in the HIV and mortality analyses. The proportion of new HIV cases among all HIV cases in JA HATS in 2005 were compared to the same proportions in 2003 and 2004 using a traditional chi square analysis. This investigation determined if there was a significant increase in new cases after an initiative to increase
testing island-wide. The second ad hoc analysis compared the death rate among persons with AIDS in Jamaica from 2003-2007 using chi square analysis. This sub-analysis identified significant changes in mortality two years before and after the implementation of a national antiretroviral therapy program in 2005.

**Specific Aim III:** To compare factors associated with late disease stage at diagnosis between Jamaican HIV cases in New York and HIV cases in Jamaica

A case control study was used to examine the effect of country of residence and transmission risk group on disease stage at diagnosis. The results elucidated whether the disease stage at diagnosis differs between the two locations and identified groups at elevated risk for later stage at diagnosis.

A logistic regression model in SAS 9.1.3 was used to examine this specific aim. The outcome was HIV disease stage at the time of diagnosis (early versus late). Cases were persons who at first report to surveillance;

- Developed AIDS within 12 months of their HIV diagnosis
- had concurrent HIV and AIDS (AIDS within 31 days of HIV diagnosis) or
- whose HIV positive status was first reported at their time of death

Controls were individuals first reported to surveillance with HIV (asymptomatic or advanced) and no AIDS. The main covariates were country of residence and transmission risk group including no identified risk. The model was age-adjusted and tested for an interactive effect by the factors of interest and location. Significant interactions precipitated stratified analysis by location.
Within location models, interactive effects were tested by gender due to the association between this variable and risk groups (i.e. men who have sex with men are only male by definition). Significant interactions prompted further stratification by gender where cell sizes permitted.
Chapter 4: Transnational Sexual Partnerships among HIV-Infected Residents of Jamaica

Understanding the current effects of migration and travel on HIV/AIDS transmission and survival is essential to intervention efforts, especially for immigrants. Currently, the research highlights differences between immigrants and native ethnic minorities, but few studies compare immigrant groups to their peers in the country of origin (Deren et al. 2006) or examine migratory effects in the country of origin. In an attempt to fill this gap in the literature, the study explored factors associated with transnational sexual partnerships among persons with HIV in Jamaica, W.I.

Using HIV/AIDS registry data from Jamaica, W.I., persons reporting sexual partners external to Jamaica were compared with those reporting sexual contacts exclusively in Jamaica. The study also aimed to assess the utility of classification tree methodology in lieu logistic regression modeling. With small samples in newly emerging risk groups, logistic regression is limited in its ability to identify significant factors. The classification tree was developed using JMP by SAS and the significant factors were included in the logistic regression model in SAS 9.1.3. Receiver operating characteristic (ROC) curves were used to compare the ability of each model in accurately classifying cases.

A matched sample of 623 cases and 1,869 controls was analyzed to determine factors associated with overseas partnering. Persons who were deportees, in the professional or trade occupation groups, separated or divorced and categorized as MSM or IDU were more likely to have transnational sex partners. Despite being significant in the classification tree, not all factors were significant in the logistic regression, highlighting the limitations of the latter for emerging risk groups with small sample sizes.
Furthermore, the elevated frequency of overseas partnering among already recognized high risk groups (MSM, IDU and young people – students) highlights the need for additional investigation of this behavior and its impact on HIV/AIDS in Jamaica. The significant intersection transnational sex partnering with previously recognized high risk groups in the country of origin highlights the need for further investigation of this behavior. Additional research is critical in determining whether these partnering habits confer excess HIV risk and if there is any quantifiable impact on the country’s HIV/AIDS epidemic.

**Background**

The existing research on global travel and HIV is sparse and limited in context (Deren et al. 2003, Kendall et al. 2010). The literature currently describes travel with regard to HIV among immigrants in resource-rich settings or sexual tourism and HIV risk across several countries. Relatively few studies explore the impact of travel on HIV outside of these two settings.

Immigrants are a growing group of interest for HIV in many countries (Fenton et al. 2005, Pezzoli et al. 2009, Padilla et al. 2010, Monge-Maillo 2009). Though not always at elevated risk for infection, immigrants routinely engage in activities associated with higher HIV incidence. These include frequent circular travel between the new resettlement location and the country of origin, residence in dense urban city centers with elevated HIV prevalence and increased risk of drug use and risky sexual behavior during the acculturation process (Sanchez et al. 2010, Mitha et al. 2009). Common to all these
activities are the selection of sexual and/or drug-using partners from specific high-risk networks.

Partnering habits are one of the foremost features of individual and group HIV risk. The individual’s number of partners coupled with the temporal spacing of these partners significantly impact risk for HIV infection and ongoing transmission. Studies of multiple partnership and concurrency revealed elevated HIV risk as the number of lifetime partners exceeds three (Do et al. 2009). Concurrent partnerships exacerbate this risk, as sexual networks overlap simultaneously instead of sequentially (Ragnarsson et al. 2009). Although HIV risk and patterns of sexual partnering are extensively outlined in the literature, few studies explore this in the context of migration and frequent travel. Recent research among immigrants in different regions largely suggests those who routinely visit their country of origin are at higher risk of infection with HIV (Fenton et al.). In addition to maintaining concurrent sexual relationships in both settings, persons involved in bidirectional travel have other risk factors including multiple partners and increased engagement in commercial sex (Kramer et al. 2007, Surrat 2007). This combination not only increases risk for incident infection but fuels ongoing transmission among the previously infected.

The majority of the literature on HIV among immigrants addresses the topic among ethnic and minority migrants (Wiggers et al. 2003, Sauve et al. 2002, Gras et al. 1999, Organista et al. 1998, Jochelson et al. 1991). Immigrant research is also limited to persons of low socioeconomic status who are usually seeking improved financial stability (Levy et al. 2005). Few studies explored HIV risk among professional, highly skilled
migrants who may exhibit different risk profiles. Lastly, most immigrant HIV research reflects the perspective of the resettlement country. Relatively few studies have explored the impact of migration and bidirectional travel on HIV in the country of origin.

In an attempt to bridge existing gaps in immigrant HIV research, this study explored transnational sexual partnerships among individuals infected with HIV in a high emigration setting. With a well-established HIV/AIDS surveillance system and a long history of contact tracing among cases, registry data from Jamaica was used to compare the profiles of cases with international sexual contacts to cases with domestic sexual contacts.

**Methods**

Traditional methods for estimating risk and comparing between groups rely on inferential statistics such as chi square analyses and logistic regression. Although useful, these methods have several limitations. Simple bivariate comparisons such as those in chi square analyses can be useful in highlighting differences but do not control for other independent variables, which may also have an effect in the outcome of interest (Lemon et al. 2003). Other approaches such as logistic regression address this problem, but still present other challenges. The first is the assumption that the study population is drawn from some specific probability distribution. When this assumption is not met, parametric approaches are not robust enough to produce reliable results. Secondly, logistic regression requires adequate sample sizes across the different strata of the independent variables in question. For small or newly emerging risk groups, inadequate sample sizes potentially make the variables of interest appear insignificant.
These limitations make non-parametric methods such as classification trees increasingly appealing in identifying new and emerging risk groups.

**Population**

For this analysis, data from HIV-infected individuals reported to surveillance in Jamaica between 1988 and December 31, 2007 were examined. Eligible cases were identified from the HIV/AIDS Tracking System; the registry housed in the Monitoring and Evaluation Unit of the Ministry of Health (MOH) in Jamaica, W.I. Information regarding sexual contacts originated from field investigations performed by contact investigators with the newly diagnosed cases. The public health purpose of the inquiry was to identify any sexual contacts and alert them to potential exposure to HIV. The contact investigators therefore obtained locating information for these contacts and routinely listed the country of residence for those who do not live in Jamaica. This information was housed in the HATS registry and all contacts were linked to their index cases using the patient identification number. Contact investigators obtained address and other locating information in addition to identifying information such as name, gender and age. For contacts with unknown country of residence, the index case may simply have identified the residence as ‘international’ or external to Jamaica. This research utilized both demographic information and sexual contacts lists for cases reported from January 1988-December 31, 2007. The data contained the minimum identifiers needed to preserve the confidentiality and privacy of reported cases.
Outcome Variable

The main outcome of interest was any reported sexual partner outside of Jamaica. A dichotomized indicator of transnational sexual partnering was created for each case. Having a transnational sexual contact was determined in two ways;

1. listing the parish of residence for the partner as ‘EXO’ meaning outside of Jamaica or
2. listing the country of residence as any other than Jamaica

Persons with no address information for any of their contacts were excluded as they could not be classified within the outcome variable’s definition. For each case three eligible controls matched by age group and gender were selected. Matching was performed in SAS using an automated simple random sample technique. This yielded 623 cases and 1869 controls.

Independent Variables

The following factors were assessed for their association with the outcome; transmission risk group, crack/cocaine use (yes/no), deportation history (yes/no), occupation category, marital status and number of reported sex partners. The factors were all categorical with the exception of the number of reported sex partners, which was continuous. Within the Jamaica surveillance system, mutually exclusive transmission risk categories do not exist. These groups were derived from algorithms combining sexual practice information, transmission category and risk history details (see Appendix III). For each gender, a hierarchy was developed to mirror the adjusted risk hierarchy represented in Table 2. For example, among men, any reported sexual activity with a male partner constituted
classification within the men who have sex with men (MSM) risk group. The details of this exercise are outlined in the risk algorithms in Appendices IIIA-IIIB. The number of sexual partners was deduced through SAS automation using an array to count each case’s cumulative number of partners.

Analysis

This analysis sought to identify factors associated with overseas sexual partnering in Jamaica. Sixty-two observations with missing gender were excluded from analysis. Six thousand two hundred and ninety-two observations with missing date of birth were also excluded. Traditional analytic approaches to such a study include case control analysis using a classic logistic regression model. The investigator, however, sought to assess the utility of an exploratory analytic approach for several reasons. Primarily, exploratory analysis may be better suited for relatively small samples with limited variability. As a nonparametric method, classification tree analysis has no requirements of the data to fit any statistical distribution. This increased the ability to detect relevant covariates in analysis. Another projected advantage of this method was the ease in interpreting the outcome. Unlike inferential statistics that follow some underlying distribution, there was no need to transform the output for interpretation. Rather the audience can examine visual images displaying the relevant subgroups in the data as they relate to the chosen outcome. Although exploratory analysis is not new to public health (Lemon et al. 2003, Török et al. 2007, Lin et al. 2006, Reuter et al. 2006), it remains poorly utilized. As such, the
investigator sought to determine the advantages of these methods by comparing the outcomes with the more traditional logistic regression model.

The analysis took place in three stages; (i) descriptive analysis comparing frequencies between cases and controls, (ii) classification tree analysis using JMP® version 8 and (iii) logistic regression analysis using SAS® version 9.1.3.

The differences in proportions of cases and controls for each of the independent variables were compared using chi square tests. Fisher’s exact tests were used for sparse data where necessary.

The next step involved the development of the classification tree. The k-fold cross validation method, with a k of 15, was used to reduce model over fitting. This method sampled subsets of the data and applied the classification algorithm to identify factors consistently significant across the majority of these smaller datasets. The more significant factors were then used for the splitting in the parent dataset. The first split was by the outcome variable and this formed the parent node. The next step was the recursive splitting of the data to produce two types of child nodes; leaf nodes and terminal nodes. Terminal nodes defined an ending point in classification while leaf nodes branched further, as there were additional significant splits in that node. The data were split until all final nodes were terminal nodes. From this point, successive pruning was performed until the area underneath the relative change in the area under the ROC curve was less than the area underneath the relative change in the area under the ROC curve with a threshold of 60%.

---

14 ROC curves examine the misclassification rate of the existing tree by plotting the true positive rate (sensitivity) against the false positive (1-specificity) rate with the area underneath the curve representing the predictive power of the tree. We chose a threshold of 60%, as at this level the classification tree would offer a predictive improvement 10% greater than by chance alone.
than 1%. Upon completion, final classification tree was used to identify factors for inclusion in the logistic regression model.

The final step of the analysis was the regression model for comparison to the classification tree output. Using stepwise selection method and relaxed entry criterion of 0.10 versus the 0.05 default of SAS/JMP, the logistic regression was performed on the entire data set and included all significant factors from the classification tree. A ROC curve was generated for the regression and compared to the ROC curve for the classification tree to assess the utility of one method versus the other.

**Results**

The total sample included 623 cases and 1,869 controls. The male: female ratio in the sample was 1:1.3 and the majority of cases were ages 20-39 years of age (see Table 4). Due to matching, no comparisons of cases and controls by age or gender were made. Univariate analysis revealed persons with MSM or IDU risk, separated or divorced, deportees, professionals or students had higher frequencies of transnational partnering. Additionally, persons who reported higher numbers of sexual partners were also more likely to have an overseas sex partner. There were no statistically significant differences by era of diagnosis and crack/cocaine use.

The results of the classification tree analysis identified deportee status, the number of sex partners, risk group, occupation category and era of diagnosis as the most highly ranked split variables. Other significant variables included crack/cocaine use, which emerged as a factor associated with overseas partnering among deportees (see Figure 5).
The logistic regression was performed using the significant factors from the classification tree with the exception of the deportee variable that was removed due to missing data. The entry criterion was relaxed to 0.10 and stepwise entry selection was used to align the regression as closely to the classification tree as possible. The final model included risk group, marital status and occupation category. Adjusted odds ratios showed heterosexuals and MSM as more likely to have overseas sexual partners than persons of unknown risk (aOR=1.57 95% CI {1.05-2.35} and aOR=2.82 95% CI {1.64-4.85} respectively). Additionally, persons separated, divorced and/or widowed were more likely to report transnational partners than other marital groups (aOR=2.19 95% CI {1.13-4.27}). Within occupation categories, professionals were more likely than the unemployed to report transnational contacts (aOR=1.59 95% CI {1.18-2.14}). The logistic regression was compared to the classification tree using ROC curves to assess the predictive accuracy of each model. The results showed the classification tree had a predictive accuracy of 69% compared to 53% for the logistic regression. The classification tree also had a lower false positive rate for cases than the regression as indicated by the blue portion of the ROC curve (see Figure 6).

**Discussion**

Contextually, there were interesting differences between HIV cases in Jamaica who report transnational contacts and those who do not. Within the risk category variable, groups with traditionally dense social networks emerged as more likely to have transnational sexual partners. While this may seem intuitive, it is interesting to note MSM and IDU only emerged as significant factors of overseas liaisons among persons with
more than 3 sexual partners. The association between partnering factors and HIV risk previously outlined in the literature review manifested in these groups. In this analysis, two of the groups at highest risk for HIV infection and ongoing transmission had significantly higher frequencies of transnational partnering.

Employment status was another significant predictor in this analysis. Professionals and students have an increased likelihood of routine travel that elevates the chance of transnational liaisons. Within these groups, the potential for transnational partnering is
Table 4: Characteristics of Persons Reporting Transnational Sexual Partners in Jamaica. W.I.

<table>
<thead>
<tr>
<th></th>
<th>Transnational Partner</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Row %</td>
<td>Yes</td>
</tr>
<tr>
<td>Total</td>
<td>1869</td>
<td>75.0</td>
<td>623</td>
</tr>
<tr>
<td>Gender†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1053</td>
<td>35.1</td>
<td>351</td>
</tr>
<tr>
<td>M</td>
<td>816</td>
<td>29.7</td>
<td>272</td>
</tr>
<tr>
<td>Age Group†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - 12</td>
<td>21</td>
<td>7.2</td>
<td>7</td>
</tr>
<tr>
<td>13 - 19</td>
<td>87</td>
<td>31.0</td>
<td>29</td>
</tr>
<tr>
<td>20 - 29</td>
<td>582</td>
<td>75.9</td>
<td>194</td>
</tr>
<tr>
<td>30 - 39</td>
<td>564</td>
<td>77.6</td>
<td>188</td>
</tr>
<tr>
<td>40 - 49</td>
<td>417</td>
<td>79.9</td>
<td>139</td>
</tr>
<tr>
<td>50+</td>
<td>198</td>
<td>72.2</td>
<td>66</td>
</tr>
<tr>
<td>Era of Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior to 1995</td>
<td>59</td>
<td>72.0</td>
<td>23</td>
</tr>
<tr>
<td>1995-2003</td>
<td>897</td>
<td>74.3</td>
<td>310</td>
</tr>
<tr>
<td>2004-present</td>
<td>913</td>
<td>75.9</td>
<td>290</td>
</tr>
<tr>
<td>Transmission Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>1612</td>
<td>75.1</td>
<td>534</td>
</tr>
<tr>
<td>IDU</td>
<td>8</td>
<td>61.5</td>
<td>5</td>
</tr>
<tr>
<td>MSM</td>
<td>72</td>
<td>61.5</td>
<td>45</td>
</tr>
<tr>
<td>Perinatal</td>
<td>18</td>
<td>72.0</td>
<td>7</td>
</tr>
<tr>
<td>Unknown</td>
<td>159</td>
<td>83.2</td>
<td>32</td>
</tr>
<tr>
<td>Crack/Cocaine Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1794</td>
<td>75.1</td>
<td>594</td>
</tr>
<tr>
<td>Yes</td>
<td>75</td>
<td>72.1</td>
<td>29</td>
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<tr>
<td>Marital Status</td>
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<tr>
<td>Married</td>
<td>294</td>
<td>73.5</td>
<td>106</td>
</tr>
<tr>
<td>Separated/Divorced</td>
<td>29</td>
<td>59.2</td>
<td>20</td>
</tr>
<tr>
<td>Single</td>
<td>1352</td>
<td>75.4</td>
<td>440</td>
</tr>
<tr>
<td>Unknown</td>
<td>194</td>
<td>77.3</td>
<td>57</td>
</tr>
<tr>
<td>Number of Sex Partners*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three partners of less</td>
<td>1602</td>
<td>74.8</td>
<td>541</td>
</tr>
<tr>
<td>More than three partners</td>
<td>267</td>
<td>76.5</td>
<td>82</td>
</tr>
<tr>
<td>Mean number of partners</td>
<td>3.16</td>
<td></td>
<td>3.22</td>
</tr>
<tr>
<td>Deportee</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>975</td>
<td>75.6</td>
<td>314</td>
</tr>
<tr>
<td>Yes</td>
<td>8</td>
<td>34.8</td>
<td>15</td>
</tr>
<tr>
<td>Missing</td>
<td>886</td>
<td>75.1</td>
<td>294</td>
</tr>
<tr>
<td>Occupation Category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Sex Worker</td>
<td>22</td>
<td>73.3</td>
<td>8</td>
</tr>
<tr>
<td>Other</td>
<td>76</td>
<td>78.4</td>
<td>21</td>
</tr>
<tr>
<td>Professional</td>
<td>207</td>
<td>67.4</td>
<td>100</td>
</tr>
<tr>
<td>Self-employed</td>
<td>142</td>
<td>75.1</td>
<td>47</td>
</tr>
<tr>
<td>Student</td>
<td>41</td>
<td>68.3</td>
<td>19</td>
</tr>
<tr>
<td>Trade</td>
<td>743</td>
<td>75.1</td>
<td>246</td>
</tr>
<tr>
<td>Unemployed</td>
<td>619</td>
<td>78.0</td>
<td>175</td>
</tr>
<tr>
<td>Missing</td>
<td>19</td>
<td>73.1</td>
<td>7</td>
</tr>
</tbody>
</table>

Matching variables
not limited to partner visits to Jamaica, but includes the index case traveling outside of Jamaica. Other findings are in convergence with this theory, displaying that bidirectional travel increases in both directions as a result of transnational partnering (Fenton et al. 2005). This is a key feature of bridging sexual networks.

The emergence of marital status as a significant predictor was not surprising, however the failure of current marriage to be significant was. Our findings show persons who are separated, divorced or widowed as being more likely to have overseas sexual partners. This was only in the logistic regression analysis in comparison with persons of unknown or unstated marital status. The interpretation of this factor is further limited by lack of temporal sequencing in the data set. It is unclear if the transnational partner is the former spouse, another past partner or a current partner. This proves relevant in determining whether or not overseas marital unions are a significant force behind transnational sexual partnerships.

Methodologically, the comparison of the classification tree and logistic regression highlighted the limitations of both methods and no single method proved superior. The developed models were not an ideal fit for the data. The number of significant factors was very low (2-3) and model instability was common in both methods.

In the regression analysis, deportee status, which is intuitively linked to transnational partnering, emerged significant only after eliminating 47% of the sample. Conversely, the classification tree analysis quickly identified this factor, without sacrificing observations. Similarly, the number of reported sexual partners and occupation category were quickly partitioned in the classification tree, but did not emerge in the regression model.
Advantages of the classification tree analysis included the hierarchical ranking of associated factors. By applying recursive data splits, the investigator easily identified what factors were more relevant in which groups. This was far more applicable than comparison to a specified and often arbitrarily defined reference group, as is the case with logistic regression. Using the era of diagnosis and crack/cocaine use for example, the classification tree analysis identified that these factors were most relevant within occupation category for person reporting more than three sexual contacts and among deportees respectively (see Figure 5). The results demonstrated that persons with more than three reported sex partners diagnosed at the beginning of the epidemic and more recently were most likely to report overseas contacts compared to those diagnosed in the 1995-2003 era. This is relevant as the HIV epidemic in Jamaica has its origins in overseas labor and residence (Figueroa et al. 1995). Conversely, in the logistic regression model, era of diagnosis failed to meet the entry criterion even after a 5% relaxation in entry criterion.

Despite the utility of classification tree analyses several limitations exist. Over fitting is a more frequent problem than with traditional inferential modeling. Also, trees can get lengthy to interpret and splits may not always lead to clear conclusions. Nonetheless, classification tree analysis seems an applicable tool in public health research particularly when exploring new topics with limited data.

On the whole, classification methods were able to describe factors associated with transnational partnering in excess of those found in a traditional inferential statistical model. Though these exploratory methods remain under-utilized in public health, the
potential exists to apply exploratory analysis - particularly when the existing literature limits the capacity to make assumptions about the outcome. These methods can always be cross-validated with traditional hypothesis testing after identifying relevant factors. For dynamic epidemics such as HIV, exploratory methods may help identify emerging risk groups and increase the opportunities for early intervention.

**Limitations**

Despite the significance of the findings, there were several limitations to the research. Missing values rendered almost thirty percent of the data ineligible for inclusion in the study. As a result, 792 cases were excluded from analysis. Additionally, the reliability of partner information is subject to bias in several ways. Stigma and discrimination may cause index cases to withhold information about partners of the same sex. This is particularly relevant in this study, as the MSM risk group had higher frequencies of overseas partnering. This may be an underestimation if significant proportions of men do not disclose their same sex partners. A similar limitation is foreseeable with the reporting of overseas partners. Anecdotal reports from contact investigators in Jamaica revealed cases were less likely to report overseas contacts due to limited knowledge of locating information and the misconception that sexual contacts would be informed of the index case’s HIV status (Grant et al. 2006). This potentially leads to an underestimation of overseas partnering, especially if the transnational partner provides financial support via remittance.

Despite these limitations, the research has several strengths. To the investigator’s knowledge, this is the first description of travel and migratory effects on HIV from the
country of origin’s perspective. Appreciating the potential for bidirectional travel to impact local epidemics is significant, especially in low prevalence settings with specialized epidemics like Jamaica. This research also highlighted the utility of exploratory analysis for identifying emerging risk behaviors, particularly when sample sizes are limited. Thirdly, the research emphasized how the dynamics are linked. Our findings indicate transnational partnering is most frequent in groups already at elevated risk for HIV primary and secondary transmission. This provides useful considerations for designing and implementing interventions to reduce HIV transmission and may also guide prevention campaigns in by identifying groups more likely to benefit from testing.

**Conclusions**

The findings highlight the need for novel research approaches to identify risk behaviors that may fuel the current HIV/AIDS epidemic. With the frequency of transnational partnering greatest among traditionally defined high risk groups, prevention efforts may need to address newly emerging behaviors that increase the likelihood of ongoing HIV transmission. Additionally, high rates of transnational partnering among professionals and students underscore the need for effective management of repatriated citizens upon their return to the island. Risk assessment and measurement are vital to curtailing HIV/AIDS and novel approaches such as what we presented provide the tools necessary to identify emerging risk groups.
Figure 5: Classification Tree of Transnational Sexual Partnerships in Jamaica W.I.
Figure 6: Comparing Receiver Operating Characteristic (ROC) Curves for Classification Tree and Logistic Regression Analyses

Classification Tree

Logistic Regression
Chapter 5: Trends in HIV/AIDS Diagnoses and Deaths among HIV-infected cases in Jamaica and New York City

Ongoing surveillance for HIV/AIDS remains a pivotal component of the prevention effort. Monitoring the epidemic helps track trends over time and facilitates disparities research that helps identify groups and populations experiencing disproportionate burdens of disease. It is normally sufficient to quantify epidemics within national/regional boundaries, but increased migration and travel create a need for cross-country comparisons. This is relevant among highly transient populations such as migrants engaged in routine bidirectional travel. This topic was explored through comparison in HIV, AIDS and deaths between Jamaica-born HIV cases residing in New York City and Jamaica W.I.

Using HIV registry data in Jamaica and New York City, the rates of newly reported HIV cases from 2001-2007 and of AIDS cases and deaths from 1988-2007 were compared. General linear models of rates by location were performed with weighting by the standard error of the corresponding rate. Tests of significance examined trends over time within and between locations.

The HIV model included 14 observations and the AIDS and death models included 40 observations. Overtime, neither location experienced significant changes in newly reported HIV rates. Annual AIDS case rates decreased significantly over time in both locations. New York City’s most significant decline occurred from 1993-2000 and Jamaica’s decline occurred from 2001-2007. This decline followed a divergence in trend from 1998-2000, when rates increased in Jamaica and declined in New York City. Mortality decreased steadily among Jamaicans in New York City since 1994 with a plateau from 1999-2007.
In Jamaica, rates increased in 1996 and 1999 then decreased steadily through 2007.

The key differences in rates occurred in the timing of changes in trend, with events in New York City predating those in Jamaica. In New York City, Jamaican-born cases did not share the improvement in rates observed for other cases in the city. These findings suggest some resiliency of cultural factors driving the epidemic coupled with the adoption of factors from the new setting. These observations are relevant for migration to resource-rich settings and have significant implications for prevention efforts, suggesting that a generalized approach may no be appropriate in culturally diverse settings.

**Background**

Despite advances in HIV/AIDS treatment and improved survival, certain populations and subgroups continue to experience more adverse outcome and elevated mortality (CDC 2009). HIV surveillance remains critical in identifying these groups and guiding subsequent efforts to lessen their burden of disease. Surveillance allows public health practitioners to assess existing prevention campaigns to determine where the impact (if any) has occurred. Additionally, surveillance aids in quantifying disease frequencies among existing high risk groups while identifying emerging risk groups before they approach in-group epidemic thresholds\(^{15}\). Recent findings reveal immigrants to resource-rich settings

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\(^{15}\) In-group epidemic thresholds refers to a frequency of incident cases that exceeds the expected or projected level based on the frequency across all component groups in the population. This is the defining feature of a disparity.
may be an emerging high-risk group for HIV infection and premature mortality (Wiewel et al. 2006).

Immigrants account for an increasing proportion of new cases in several large cities across the world including London, Great Britain, Dublin Ireland, Brescia, Italy and New York City (NYC), USA (Fenton et al. 2005, Pezzoli et al. 2009, Dougan et al. 2004, NYCDOHMH 2009). Despite growing recognition of this at risk group, it remains unclear whether they resemble ethnic minorities in their new resettlement location or peers in their country of origin. Current research describes these groups in comparison to ethnic minorities in the resettlement location. The few studies that compare this population to their peers in their country of origin do so at a fixed time point, usually focusing on a specific set of behaviors (Fenton et al. 2005, Pezzoli et al. 2009, Dougan et al. 2004, NYCDOHMH 2009, Deren et al. 2005, Page et al. 2009). Understanding the dynamics of HIV in these marginalized groups is critical to developing and improving prevention efforts in the new host setting as well as the country of origin.

Globally, New York City is recognized as one of the largest points for immigration. Thirty-seven percent of the city’s 8.2 million residents report foreign birth and/or nationality (NYC Census 2008). Based on estimates by the NYC Census Bureau, Jamaica is the third largest immigrant population in NYC and has retained its ranking among immigrants since 1975.

Several factors contribute to elevated HIV risk among immigrants, but these factors vary by migrant group. Among Jamaicans, the more salient factors
affecting HIV risk are the behaviors associated with sexual partnering. Patterns of migration have a significant impact on sexual partnering habits and subsequently increase the risk for HIV. One such pattern is fragmented migration, where a family member emigrates in advance of the partner and dependents. This type of migration is associated with isolation and loneliness in the new setting which increases the likelihood that both partners will establish external sexual relationships (Hondagneu-Sotelo P 2003). These unions may persist even after reunification, leading to concurrent and multiple partnerships, all of which increase the risk of HIV infection (Ragnarrason et al. 2009).

Other functions of migration that facilitate HIV risk include partnering for economic stability. Upon arrival in the host setting, it is not uncommon for immigrants to experience difficulties securing employment. Even after being employed, earnings may not be insufficient to maintain an acceptable standard of living. The pursuit and maintenance of financially beneficial relationships may disempower partners to adequately protect themselves for fear of jeopardizing the relationship and losing financial stability. The combination of these sociocultural and economic factors contributes significantly to elevated risk, particularly among the recently emigrated (Fenton et al. 2005). Although these contextual factors are hard to monitor, routine surveillance allows us to monitor trends in the number and rate of HIV and AIDS among immigrant groups.

Within NYC, foreign born residents are less likely than the US-born and certain ethnic minorities to be newly diagnosed with HIV (Wiewel et al. 2006). They are, however, more likely to have adverse outcomes after infection. Additionally, as
the number of new cases among the US-born in the city declines, the proportion of newly diagnosed foreign-born cases continues to rise (from 17% in 2001 to 27% in 2007) (Wiewel et al. 2008).

Jamaican-born cases are one of the groups of concern, as they have the second highest frequency of new cases among the foreign-born in NYC. Jamaican-born cases accounted for 18% of foreign-born cases in 2007, surpassed only by the Dominican Republic (Wiewel et al. 2008). Although their rate of disease in the city remains low (0.57%), the number of Jamaican cases has remained steady over the past 5 years compared to other countries in the foreign-born case pool that show recent declines.

Recognizing these cases neither resemble the general HIV population in New York City nor other ethnic minorities, the study compared Jamaican cases to their counterparts in the country of origin to better understand the trends in HIV/AIDS within this group. The comparison was plausible, as both jurisdictions have had mandatory name-based AIDS and vital statistics reporting in place since 1985. The study aimed elucidate whether or not trends in NYC Jamaican-born HIV/AIDS cases and mortality mirror the epidemic in Jamaica. These trends allowed inferences to be made about migratory and/or acculturative effects on HIV risk and outcomes among migrant groups post resettlement.
Methods

The research involved an ecologic study design\textsuperscript{16}, where the units of analysis were aggregate estimates of disease frequency among Jamaican-born cases in each population in NYC and on the island of Jamaica from 1988 - 2007. In NYC, cases were extracted based on their reported country of birth at the time of reporting. In Jamaica, all cases were included as country of birth information is not routinely collected but the majority of cases are Jamaica born (Duncan 2009). The frequency estimates were jointly modeled in three distinct general linear models (GLM).

Population

The data came from the respective HIV/AIDS registries in New York City and Jamaica. In New York City, the registry is owned by the US Centers for Disease Control and housed on a remote SQL server with onsite administration at the department of health. The registry has been operational since 1985 for AIDS case reporting. In 2001, HIV name-based reporting was implemented. Country of birth data has been routinely collected since the registry’s inception in 1985 and is a required field on the case reporting form. The data in the registry comes from different sources including provider report forms, electronic laboratory reporting, field investigation forms and cross-referencing with vital statistics. In Jamaica, the registry is owned housed and facilitated at the Ministry of Health’s headquarters in Kingston. The registry has been operational since 1988 but included

\textsuperscript{16} Ecologic study design refers to studies where the unit of analysis is not the individual but rather a larger, aggregate measure like a community, state, country of region. In our analysis the unit of analysis was a geographic location (city and country) and the rates each geographic entity contributed to the analytic model.
retrospective case entry dated to 1982. The data in the registry comes from reporting forms, provider- or clinic-based antiretroviral therapy databases, contact investigation activities and cross-referencing with vital statistics. Data from these registries were used for rate calculation in lieu of standard population estimates. For HIV rates, this alternate method allowed for adjustments due to biased population estimates for Jamaican residents in New York City. Of particular concern was the estimated proportion of undocumented cases in the database which may range from 7% to 32% (Udeagu 2010). As a result, the use of the population estimates for Jamaicans in NYC would have potentially biased the rate. Instead, the number of existing cases in the registry each year was used as the denominator and the new cases as the numerator. The same method was applied in Jamaica for ease of comparison although related population estimates exist. This adjusted calculation affects the estimated rate of disease, but not the overall trend.

*Outcome Variables*

The outcome was the estimated rate of HIV, AIDS and deaths each year for the locations. The number of new HIV cases, newly diagnosed AIDS cases and deaths were counted using the year from the date of report. Using SAS arrays, cumulative numbers for each condition was calculated and used in the denominator for rate calculations.

*Independent Variables*
The only independent variables in these models were the year for each rate and the location whether Jamaica or New York City. This is typical of ecologic models (Rothman 1998).

**Analysis**

The annual rates for HIV from 2001-2007 and for AIDS and deaths from 1988-2007 were calculated using count summation arrays in SAS. The data were plotted in Microsoft Excel and individual regression lines were used to assess initial fit. With no $R^2$ under 0.65, the modeling phase of analysis was initiated.

Three general linear models (GLM) were developed using SAS® v.9.1.3. The first model examined the number of new HIV cases each year as a function of the number of current or historic cases in the registry. The second looked at the number of newly reported AIDS cases over all existing cases in the registry. The final model included the number of deaths for any reason among persons known to have AIDS in the registry. Contrast statements were used to assess differences by location through the examination of the slope of the regression lines. Estimate statements were used to obtain computations for the intercept of the line comparing the two locations as well as the slope. The rates were weighted by the inverse of their standard error to accommodate the exceptionally small samples – particularly for HIV rate (N=14).

**Results**

Initial regression lines plotted in Excel displayed no clear trend for HIV in New York City or Jamaica but declining rates of AIDS in both settings. New York City also experienced a decline over time in deaths while Jamaica’s death rate
fluctuated until a steady decline in more recent years (2004-2007). On the whole, associated $R^2$ for Jamaica data were lower than those for New York City but still remained stable at 0.65 or above.

*Table 5: General Linear Model of HIV, AIDS and Death Rates among Jamaican cases in New York City and Jamaica, W.I. 1988-2007*

<table>
<thead>
<tr>
<th>Model Terms</th>
<th>HIV Rate</th>
<th>AIDS Rate</th>
<th>Death Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t-value</td>
<td>p-value</td>
<td>t-value</td>
</tr>
<tr>
<td>Intercept: J vs. NY</td>
<td>1.82</td>
<td>0.09</td>
<td>-0.31</td>
</tr>
<tr>
<td>Slope: J vs. NY</td>
<td>-1.81</td>
<td>0.09</td>
<td>0.33</td>
</tr>
<tr>
<td>Location JA</td>
<td>24.11</td>
<td>0.001</td>
<td>7.32</td>
</tr>
<tr>
<td>Location NY</td>
<td>5.069</td>
<td>0.574</td>
<td>8.01</td>
</tr>
<tr>
<td>Slope JA</td>
<td>-0.011</td>
<td>0.001</td>
<td>-7.27</td>
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<tr>
<td>Slope NY</td>
<td>-0.002</td>
<td>0.581</td>
<td>-7.98</td>
</tr>
</tbody>
</table>

The results of the general linear model are included in Table 4 above. The rate of new HIV cases remained stable in New York while minimally declining in Jamaica from 2004-2007 (see Figure 7) despite significant increases in testing (MOH 2006).

*Figure 7: Annual Rate of New HIV Cases in Jamaica and New York City 2001-2007*
The rate of new AIDS cases has declined in both settings. More interestingly, the magnitude of the rate of decline was roughly the same. New York City experienced significant declines from 1993-2000 at which time the rate stabilized through 2007. Conversely, Jamaica’s most significant decline occurred in the recent era from 2001-2007.

*Figure 8: Annual Rate of New AIDS Cases in Jamaica & New York City 1989-2007*

The death rate within the settings was significant in the model, despite severe fluctuations in Jamaica’s rate in 1991, 1996 and 2000. Significant declines occurred in the era of antiretroviral therapy from 1994 onward in New York City and from 2001-2007 in Jamaica.
Figure 9: Annual All-Cause Mortality Rate in AIDS Cases in Jamaica and New York City

F (2, 12.05) p=0.0001

Discussion

On the whole, Jamaicans in New York City resembled a combination of cases overall in New York City and cases on the island of Jamaica. This was especially the case in the more recent era, from 2004-2007. Recent trends revealed declines in the number of AIDS cases and mortality each year. Failure for rates of new HIV diagnoses to decline in NYC suggest the need for increased testing and prevention activities in this population.

Even when declines occurred in both settings, the rate of decrease in Jamaica was usually greater as indicated by larger slopes. The rate of decline in NYC cases by comparison was relatively small, suggesting less change over time. Despite more favorable outcomes, the Jamaica data suffers from threatened data validity due to batch reporting and significant retrospective entry in the earlier stages of surveillance. Batch reporting and retrospective data entry compromise the
temporal advantage of investigating data anomalies discovery during data entry. This is especially relevant regarding dates which were used to calculate annual rates for these analyses.

It is interesting to note that comparisons to surveillance data for all cases in New York City revealed Jamaican cases do not share the magnitude of improvement other cases do. Regarding AIDS and mortality rates, the timing of changes in the trend coincide with the city overall, but the magnitude of the changes are diminished. While the rate of AIDS cases has declined significantly and continues to do so in the city, the rate among Jamaican cases remained stable since 2000. There were marked differences in rates between the two locations in earlier years (especially prior to 2000), but it is unclear whether this is true variation or the result of differences in surveillance reporting.

**Limitations**

Despite the demonstrated ability to compare aggregate data between the two settings, there were certain limitations that affected the analysis. The number or observations for HIV rate calculations was sparse, especially for a modeling analysis. This is due to the recent implementation of name-based HIV surveillance in NYC. This mandate has only been enforced since 2001, therefore only 7 years of data could be used for these estimates. Subsequently, this restricted the time frame for the Jamaica comparison yielding a total of 14 observations for the model. Typically, this is too small a number for effective modeling.
Another limitation is the potential for duplicate reporting between the two locations. De-duplication was not possible due to the limited nature of the data with regard to unique identifiers.

Limitations arose in the modeling of the mortality rate among AIDS cases in each location. Within the Jamaica dataset, data integrity issues arose with the coding of deaths related to AIDS. Invalid observations led to the modeling of all-cause mortality instead of AIDS case fatality rates. Trends in AIDS related mortality among Jamaican-born cases in NYC revealed similar trajectories over time. Interestingly, there were elevated deaths due to cardiovascular disease and alcoholism in 2004 and 2005.

Other limitations include no time of entry into the US for the Jamaican-born cases in NYC. The absence of this data limits the ability to identify or even estimate the residence at the time of infection. Similarly, there is no way to ascertain the duration of residence in US or temporally place the migration event with respect to infection. Such information might help in determining any effects attributable to migration or acculturation.

Seemingly cyclical trends, particularly in AIDS rates in both settings may be more appropriately analyses using time series methods. Additional analytic adjustments include the use of population-based rates with some correction for undocumented immigrants instead of registry based rates for uniform comparison.

**Conclusion**

Overall, Jamaicans residing in New York City resembled their counterparts in Jamaica more so than other cases in the city (NYC DOHMH 2009). Additionally,
both groups have showed positive trends with regard to AIDS case rates and deaths. In New York City, Jamaican-born cases have hit plateaus in their AIDS and mortality rates, suggesting novel approaches may be necessary to see continued declines in these events. Current approaches in Jamaica yielded sustained declines and may be useful in developing customized prevention initiatives for this group in New York City.

Future topics for analysis include the timing of migration and detailed individual studies to decipher the impact of migration and acculturation HIV risk. As this group continues to persistent rates of HIV infection, a better understanding of influential factors is critical for ongoing prevention and provision of timely care.
Chapter 6: Late Stage Diagnosis among HIV-Infected Individuals from Jamaica and New York City

With an average clinical latency of ten years, late stage HIV and AIDS diagnoses highlight missed opportunities for prevention and treatment. Routine testing is essential in improving early detection and optimizing care for the HIV-infected. Delayed testing increases the risk of late-stage diagnosis, ongoing transmission and rapid disease progression. Despite widely available testing services and prevention campaigns, one in four newly diagnosed HIV cases in New York City will progress to AIDS in 31 days (NYC DOHMH 2008). This rate is higher among foreign-born cases raising the question which factors drive late stage diagnoses in the presence of accessible testing. This query was explored by comparing rates of late-stage diagnoses between Jamaicans residing in New York City and in Jamaica.

The frequencies of late stage diagnoses were compared using HIV registry data from Jamaica and New York City. The associated factors were investigated using a logistic regression model. The role of gender, age at first diagnosis, crack/cocaine use and transmission risk group was investigated as a function of late stage diagnoses. Model adjustments were made for increased testing campaigns in each location by including the year of diagnosis. For this analysis, late stage diagnosis was defined as progression to AIDS in 12 months or less of the HIV confirmatory test date.
Among the 555 eligible cases from New York City and 11,512 eligible cases from Jamaica, high rates of late stage diagnoses occurred in both settings (42% and 48% respectively). Statistical interaction led to stratified regression models. In NYC, age was the single significant factor associated with concurrency. Older age at first diagnosis was associated with higher rates of concurrent diagnosis. In Jamaica, age and year of diagnosis were significantly associated with concurrency. The recently diagnosed (2004-2007), have progressively lower rates of concurrency. Significant interaction between gender and risk led to additional stratification. Jamaican males were more likely to be concurrently diagnosed and males with unknown risk were more likely than MSM. Women experienced no difference by risk but older women were more likely to be concurrently diagnosed than younger women.

Late stage HIV/AIDS diagnosis is problem for Jamaican cases regardless of setting. With the recent decline in Jamaica, New York City may explore similar testing initiatives. This approach may improve testing access for Jamaican residents in New York City and reduce delayed testing and diagnosis.

**Background**

The importance of prevention in controlling HIV is consistently underscored in the literature (Granich et al. 2009, Granich et al. 2010). Prevention for HIV is not limited to behavioral risk reduction, but also includes routine testing (Dieffenbach and Fauci 2009). Individuals who know their status can prevent ongoing transmission by protecting themselves and their partners (Marks et al. 2006).
Additionally, knowledge of status facilitates early entry into primary care, which is essential for optimal HIV case management (Gardner, Metsch et al. 2006). Late stage diagnoses of HIV and AIDS are therefore concerning, as they indicate missed opportunities for prevention and treatment. Antiretroviral therapy has improved survival among HIV infected populations significantly. This success, however, is dependent on the timing of treatment initiation. Former guidelines that recommended treatment initiation at AIDS onset have been revised. Earlier treatment initiation has been shown to reduce adverse clinical outcomes and increase Late stage diagnoses prohibit early treatment initiation, compromising the long term success of ART in improving survival.

The impact of late stage diagnosis on individual and population health is well documented in the literature (Hanna et al. 2008, Schwarcz et al. 2006). Those diagnosed late display higher viral loads and experience more adverse outcomes including increased emergency room visits, hospitalizations and instances of opportunistic infection. Such diagnoses are also associated with premature mortality in several settings.

Late stage diagnoses are elevated in specific high-risk groups (CDC 2009), posing additional challenges for control and prevention. In addition to IDU, recreational drug users and prostitutes, immigrants have disproportionately higher rates of late stage diagnosis (Carr and Turner 2006, Nelson et al. 2010). It is unclear whether this experience is a downstream effect of migration and acculturation or if immigrant testing behaviors (i.e. delayed testing) are resistant to change regardless of current residence. This analysis explored this experience by
comparing factors associated with late stage diagnosis between HIV-infected individuals in Jamaica and their infected migrant peers residing in New York City.

New York City (NYC) is the most populous city in the United States and is also home to one of the country’s largest HIV/AIDS epidemics (USCB 2009). With an estimated population of 8.2 million individuals, the city accounts for 2.2% of the total US population but 14% of the country’s total HIV/AIDS cases (Wiewel et al. 2006).

The city also has the most diverse population in the country, with 37% of its residents being of foreign birth. Among the newly diagnosed with HIV in NYC, the proportion of foreign born cases has increased from 17% in 2004 to 27.9% in 2008 (HIV DOHMH 2010). This group has not experienced the degree of decline reported among US-born cases, although the absolute number of cases has decreased.

Existing research from various large cities indicate immigrant groups may be more likely to be diagnosed late due to marginalization, limited access to testing and other sociocultural barriers. In NYC, foreign-born individuals were less likely to be diagnosed with HIV, but more likely to be diagnosed late once infected (33% of new foreign-born cases vs. 25% of new US-born cases in 2008) (NYCDOHMH 2009).

accounted for 44% of the concurrently diagnosed foreign-born cases despite accounting for only 34% of newly diagnosed foreign cases overall (Wiewel et al. 2008).

Despite well-documented rates of concurrency, it is unclear whether immigrants are more or less likely than their counterparts in their country of origin to be diagnosed later in their disease course. Furthermore, it is unknown whether similar factors facilitate late stage diagnoses in foreign settings compared to the country of origin. Understanding the factors associated with late stage diagnosis in each setting is necessary to reduce delayed testing, diagnosis and related morbidity and mortality among immigrants.

A comparison with the immigrants in foreign settings and in the country of origin has potential implications for describing the epidemic among Jamaican-born cases after migration to the US. This is significant, as Jamaicans account for a substantial proportion of NYC’s foreign-born case burden.

**Methods**

**Population**

HIV registry data from Jamaica and New York City (NYC) were used for this analysis. The data came from the respective HIV/AIDS registries in New York City and Jamaica. In New York City, the registry is owned by the US Centers for Disease Control and housed on a remote SQL server with onsite administration at the department of health. The registry has been operational since 1985 for AIDS case reporting. In 2001, HIV name-based reporting was implemented. Country of birth data has been routinely collected since the registry’s inception in 1985 and is
a required field on the case reporting form. The data in the registry comes from different sources including provider report forms, electronic laboratory reporting, field investigation forms and cross-referencing with vital statistics. In Jamaica, the registry is owned housed and facilitated at the Ministry of Health’s headquarters in Kingston. The registry has been operational since 1988 but included retrospective case entry dated to 1982. The data in the registry comes from reporting forms, provider- or clinic-based antiretroviral therapy databases, contact investigation activities and cross-referencing with vital statistics. Since name-based HIV reporting was not implemented until 2001 in New York City, only cases of Jamaican birth reported during this time point onward were eligible for inclusion. The Jamaica registry data was subsequently restricted to the same time points.

**Outcome Variable**

Late stage diagnoses are not currently monitored in Jamaica and in NYC, concurrent diagnoses are defined as an AIDS diagnosis within 31 days of the HIV positive confirmatory testing date. This analysis focused on late stage diagnosis as defined by the Centers for Disease Control and Prevention, as an AIDS diagnosis within 12 months of HIV confirmatory testing (CDC 2009). An indicator variable was created to classify cases as late stage diagnosis if the number of months between the HIV diagnosis date and AIDS diagnosis date was less than or equal to 12. Cases first reported to surveillance based on an AIDS defining illness, with a subsequent HIV diagnosis date met the criteria for late
stage diagnosis and were classified accordingly. Report dates with a missing day were imputed with a value of the 15th for the corresponding month.

Independent Variables

The selection of covariates was limited to data elements shared between the two reporting jurisdictions. The selected covariates were available from both datasets and had sociocultural implications for HIV testing behaviors. Previous research suggests recreational drug use increased the likelihood for delayed testing, prompting the inclusion of crack/cocaine use in the model (Nelson et al. 2010). Other research showed age, gender and risk group had separate effects on testing, resulting in the inclusion of these factors in the model as well (Hanna et al. 2008, CDC 2009). Other demographic covariates like marital status, education and employment were not included in the model due to unavailability in the NYC HARS data. Therefore, the model in this analysis explored the association of gender, age at first report to surveillance, year of diagnosis, risk category and crack cocaine use with late stage diagnosis. Crack/cocaine and risk variables were transformed to optimize comparability between the two locations.

Crack Cocaine – field investigations with newly diagnosed cases in each location yielded the information for this variable. In New York city, expanded behavior codes routinely collected by field services staff included a dichotomous indicator for any history of crack cocaine use. In Jamaica, a similar process was undertaken by contact investigators who populated the information in the risk history section of the HIV confidential reporting form.
Transmission risk groups - NYC routinely reports mutually exclusive transmission risk groups in compliance with the CDC reporting guidelines (CDC 2000). On average, 37% of cases in the NYC HIV/AIDS reporting system (HARS) have no identified risk on record. The only modification that was required for this analysis was the relaxation of the criteria for heterosexual contact. Currently, a case must know that their partner of the opposite sex is at direct risk for HIV in order to be classified as heterosexual. This includes the partner being a current or former IDU, having a transfusion, being a hemophiliac or having a known HIV diagnosis. For men, they must additionally deny any sexual contact with a member of the same sex. For women, a history of prostitution or crack cocaine use will also qualify them for this category (see risk algorithm in Appendix IIIB). For the purpose of this analysis the HIV risk requirement of the partner was removed and the other sex-specific criteria in combination of reported sex with a member of the opposite sex were retained. Jamaica does not routinely report mutually exclusive transmission risk groups. This variable was, therefore, created using the sexual practice, transmission category and risk history detail variables on the confidential reporting form (see Appendix I). The details of how the risk groups were created are included in the algorithms in Appendix IIIC-D.

Analysis

All analyses were performed onsite at the NYC Department of Health and Mental Hygiene as per the terms of the data use agreement. Jamaica data was provided in Microsoft Access pivot table format on an encrypted external storage drive in a
password protected file. These data were accessed from this drive for analysis with the NYC data.

We excluded cases aged 12 years or less or persons in the perinatal risk group due to the unique etiology of pediatric HIV (cite WHO perinatal HIV document). The absence of a fully developed immune system causes rapid progression to AIDS outside of the context of adult late stage or concurrent diagnosis.

**Univariate analyses**

After the data transformations were complete, eligible from cases each location were merged into a single dataset. Retaining the unique identifiers from the original dataset allowed for the categorization of cases by location. Descriptive analyses included frequency comparisons between late diagnoses by the previously listed independent variables. The continuous variables (age at first diagnosis and date of first diagnosis) were examined to assess normality, identify outliers and determine interquartile ranges. The data were then transformed into categorical groups (age at first diagnosis in deciles and date of first diagnosis into calendar years). Additional assessments included test for trend for each variable and stratification by location.

The remaining independent variables (sex, risk group and crack cocaine use) were assessed for frequency comparisons across late stage diagnosis group (yes/no) and stratified by location. Fisher’s exact tests were used for data across sparse cells – specifically crack cocaine and intravenous drug use in both locations.

Preliminary results from these univariate analyses prompted the merging of the sex at birth variable with risk groups, as some risk groups are exclusively defined
by gender (i.e. MSM). It was not feasible to split all risk groups into male and female arms, due to small sample sizes. As such only the heterosexual group was further split by sex. Other, IDU and unknown risk categories were not split by sex to prevent small cell size within location.

**Multivariate analyses**

Late stage diagnosis was modeled by the factors previously mentioned using a traditional logistic regression model in SAS. The covariates included any factor that was significant in at least one location in univariate analyses; these included crack/cocaine use, year of diagnosis, age at first diagnosis, transmission risk-gender groups and location.

During the analysis, the year of HIV diagnosis was transformed into a dichotomized indicator using 2004 as split point. In this year, both locations launched expanded HIV testing initiatives, which would bias testing outcomes including the probability of a late stage diagnosis. Statistical tests for interaction were performed by location with each predictor and significant results prompted a stratified regression analysis by location. Additional tests for interaction with sex at birth were included in the location-specific regression models.

**Results**

The analytic data set included 555 eligible subjects from NYC and 11, 512 eligible subjects from JA (see Table 5). The age distribution at first report was similar in both settings with 30-39 accounting for the majority of cases (approximately 30%) followed by 20-29 year olds and 40-49 year olds. Crack
cocaine use was relatively low in both settings, accounting for less than 5% of the total cases in the review period.

The application of the designed risk algorithms reduced the proportion of cases with unidentified transmission risk in each location. In New York City, the proportion decreased from 37.31% to 19.92% among men and from 30.45% to 11.53% among women. In Jamaica, the majority of cases with unknown risk group were male while proportion of male and females with unknown risk were roughly equal in NYC.

Compared to NYC, Jamaica had a higher proportion of heterosexual (72.5% vs. 65.9%) and unknown (18.6% vs. 9.4%) cases, while NYC had higher proportions of MSM (22% vs. 2%).

Both NYC and Jamaica displayed high rates of late stage diagnosis (42.5% and 48.8% respectively; p=0.003) and men were more likely than women to be diagnosed late. Regarding age, NYC cases were older on average at first diagnosis. Within this setting, those diagnosed late were significantly older than late diagnoses in Jamaica (36 years vs. 29.6 years).
Table 6: Demographics of Persons with Late Stage Diagnoses in New York City & Jamaica 2001-2007

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Late Stage Diagnosis</th>
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<th></th>
</tr>
</thead>
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<tr>
<td></td>
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<td>Row %</td>
<td>No</td>
<td>Row %</td>
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<tr>
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<td>6212</td>
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<td>2496</td>
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</tr>
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<td>56.1</td>
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<td>2007</td>
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<td>5893</td>
<td>51.2</td>
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<td>319</td>
<td>57.5</td>
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*Removed from regression models due to sparse cells
Frequency analyses within risk groups and behaviors revealed significant
differences between locations. Crack cocaine use is associated with late diagnosis
in Jamaica (p=0.0010), but not in NYC (Fisher’s exact p=0.54). Additionally,
stratification of risk by sex revealed among men, unknown risk, IDU or
heterosexual groups are more likely to be diagnosed late than MSM. Among
women, IDU were more likely than heterosexual or those of unknown risk. Tests
for trend revealed the likelihood of late diagnoses increased with age and

*Multivariate analyses*

The effect of the individual factors on late stage diagnosis across both locations
was modeled. Significant interaction terms by location prompted stratified
analysis, the results of which are outlined below.

In the first model, late stage diagnosis was modeled by all the previously
discussed covariates and an additional indicator to identify the location for each
observation. Each covariate was tested for interaction. The year of diagnosis and
the sex/risk hybrid variable both showed significant interaction by location
(p=0.0014 and 0.033 respectively). This prompted stratification into two separate
models – one for each location.

The model for New York City included all the independent variables as well as
tests for interaction with age and year of diagnosis. The overall model fit as
indicated by the -2log likelihood statistic was superior to the full model including
both locations and also had a marginally better predictive accuracy (71% vs 70%).
The only significant term in this NYC model was the age at diagnosis (p<0.0001).
Within New York City, the risk of a late diagnosis increased with older age at first diagnosis.

The model for Jamaica only was performed identically to the New York City model, but the results were significantly different. The overall model fit was worse than the NYC model but the predictive accuracy was equal. With the exception of crack/cocaine use, all other terms in the model were significant. Late stage HIV/AIDS diagnoses in Jamaica were more likely to occur among persons first diagnosed at an older age, men, unknown and IDU risk groups and persons diagnosed in 2001-2003. There was also significant interaction between risk and gender, leading to the stratification of the Jamaica models by gender.

Two additional models were run – one for men and one for women. In the female model only age and year of diagnosis emerged significant, with similar trends to the previously described Jamaica model (see Table 6). Within the male model, risk group was the most significantly associated factor of late stage diagnosis. Men of unknown risk were more likely than MSM to have a late stage HIV/AIDS diagnosis. As with the female model, men diagnosed at older age or before 2004 were more likely to have a late diagnosis.

Summary of Model Findings

Grouping the data across location provided a poorer model fit due to significant interaction (particularly incongruent interactions across year of diagnosis and sex/risk groups). Within Jamaica, the best models were gender segregated. These models revealed no significant differences in concurrency by risk group among women and significantly higher likelihood of concurrency among men of
unknown risk. For NYC the best model was the full model that included all terms. Gender stratification was not practical due to significantly smaller sample size and the risk of sparse data cells.
Table 7: Factors Associated with Late Stage HIV/AIDS Diagnosis in New York City and Jamaica

<table>
<thead>
<tr>
<th>Model Factors</th>
<th>Crude Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
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<tr>
<td></td>
<td>OR</td>
<td>LL</td>
</tr>
<tr>
<td><strong>New York City (All)</strong></td>
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<td></td>
</tr>
<tr>
<td>Crack/Cocaine Use</td>
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<td></td>
</tr>
<tr>
<td>No (ref)</td>
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<td>--</td>
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<tr>
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<td>MSM</td>
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<td></td>
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<td>13-19 (ref)</td>
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<td>0.08</td>
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<td>50+</td>
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<tr>
<td>2004-2007</td>
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<td>0.70</td>
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<tr>
<td><strong>Jamaica (Males)</strong></td>
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<td></td>
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<tr>
<td>Crack/Cocaine Use</td>
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<td></td>
</tr>
<tr>
<td>No (ref)</td>
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<td><strong>Transmission Risk</strong></td>
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<td>MSM (ref)</td>
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<tr>
<td>Heterosexual</td>
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<td>2004-2007</td>
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<tr>
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<td>0.58</td>
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<tr>
<td><strong>Jamaica (Females)</strong></td>
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<tr>
<td>Crack/Cocaine Use</td>
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<td></td>
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<tr>
<td>No (ref)</td>
<td>1.00</td>
<td>--</td>
</tr>
<tr>
<td>Yes</td>
<td>1.72</td>
<td>1.23</td>
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<tr>
<td><strong>Transmission Risk</strong></td>
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<tr>
<td>IDU</td>
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<td>0.70</td>
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<tr>
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<td>0.05</td>
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<tr>
<td><strong>Year of HIV diagnosis</strong></td>
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<tr>
<td>2001-2003 (ref)</td>
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<tr>
<td><strong>Age at HIV diagnosis</strong></td>
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<tr>
<td>13-19 (ref)</td>
<td>1.00</td>
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<tr>
<td>20-29</td>
<td>0.47</td>
<td>0.37</td>
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<td>0.43</td>
</tr>
<tr>
<td>50+</td>
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</table>
Discussion

Delayed testing remains a significant problem for managing HIV across several settings. Factors associated with delayed testing and subsequent delayed diagnoses are not always well explored in certain high-risk groups. The results presented here highlight late stage diagnosis as a significant problem for Jamaican cases in both settings. In NYC, the rate of late stage diagnoses (42%) among Jamaican-born cases was higher than the city’s overall concurrency rate of 25% (Wiewel 2008). Additionally, the rate among Jamaican cases was higher than the collective rate for all foreign-born cases (33%) (Wiewel et al. 2008). This has significant implications for disease management among Jamaican born cases in this setting, especially since trend analyses revealed no significant decline in rates of late stage diagnosis, even after heightened testing in the city.

In Jamaica, the scenario was more optimistic. Despite a high rate of late stage diagnoses, trend analyses revealed a steady decline in the proportion in recent years. In 2007 alone, the proportion of these diagnoses was 10% lower than the rate for the entire time span. Increased testing in Jamaica from 2004 onward has shown promising returns.

Despite this positive trend, certain groups displayed disproportionately higher rates of late diagnosis. A significant proportion of males did not disclose enough information for risk ascertainment. These cases were also most likely to be diagnosed late. The literature is clear in illustrating correlations between nondisclosure of risk and delayed testing and initiation of primary care (Nelson et al. 2010). The observed pattern among men with NIR converges with these
findings. Gender specific interventions are necessary to promote early testing and linkage to care for these cases.

Age was another significant factor associated with late stage diagnosis and this finding was consistent in both locations. Moreover, this result was in concordance with other findings regarding age and concurrent diagnoses in NYC (Hanna et al 2008). Active case finding and testing initiatives should be extended to all adult populations and not limited to individuals in peak reproductive age groups. The middle age adults and elderly were more likely to be diagnosed late and suffer more adverse outcomes than those diagnosed at younger ages (Hanna et al. 2008). Other studies have identified the single most significant predictor of delayed testing and diagnosis to be social marginalization (Grigoryan et al. 2009, Nelson et al. 2010). Additionally, persons with delayed testing and diagnosis are less likely to initiate routine primary care to manage their disease (Torian et al. 2006). The research findings in New York City were in concert with previous findings and warrant immediate attention. Outreach programs to encourage routine testing will prove critical to improving timely diagnosis in this group.

Limitations

Differences in surveillance reporting limited the variables to be included in our model. Specifically, the absence of marital status, occupation code and education levels in the NYC dataset. Additionally, batch reporting in Jamaica limited the reliability of HIV and AIDS diagnosis dates. As a result, only the late diagnosis definition of 12 months was used for analysis with no supporting investigation of concurrent diagnoses (AIDS within 31 days of HIV test). A comparison of these
frequencies within the New York City dataset found a 3% difference in concurrency and late diagnosis rates, with 39% of Jamaicans having concurrent diagnoses and 42% having any late stage diagnosis.

Conclusions

On the whole, high rates of late stage diagnoses reflect delayed testing among Jamaicans in both settings. Men were more likely to delay testing and be diagnosed late, especially men of unknown transmission risk. This has significant implications for ongoing transmission, entry into medical care and HIV-related mortality in both settings. In Jamaica, continued efforts to increase testing are critical to sustaining recent declines in late stage diagnoses. In New York, increased outreach for voluntary testing and counseling is essential to halting and reversing abnormally high rates of late diagnoses among persons of Jamaican birth.
Chapter 7: Discussion

The research described aimed to explore the relationship between travel, migration and HIV among cases of Jamaican origin. The study i) examined factors associated with overseas sexual partnering in a high emigration setting, ii) compared trends in HIV and AIDS diagnosis and deaths between a migrant Jamaicans and their peers in the country of origin and iii) compares rates and associated factors of late stage diagnoses HIV/AIDS diagnoses between the same groups.

In exploring overseas sexual partnering in Jamaica, persons who were deportees, in the professional or trade occupation groups, separated or divorced and categorized as MSM or IDU were more likely to have transnational sex partners. Methodologically, these findings suggest a classification tree approach may be more informative than traditional inferential statistics in examining new phenomena or events of low frequency. The findings also highlighted the elevated frequency of overseas partnering among already recognized high-risk groups (MSM, IDU and young people – students).

Comparisons of HIV, AIDS and death rates between the two jurisdictions revealed significant declines in annual AIDS case rates and deaths with no significant change in newly reported HIV cases. Albeit marginally, the annual rate of newly reported HIV cases has declined in Jamaica from 2004-2007 while remaining unchanged in New York City. Annual AIDS case rates decreased significantly in both locations, with Jamaica’s decline being more recent (2001-2007). Mortality has decreased steadily among Jamaicans in New York City since

The investigation of late stage HIV/AIDS diagnoses among cases in New York City and Jamaica showed alarmingly high rates (42% and 48% respectively). In New York City, this rate was higher than the overall rate for all new diagnoses in the period (25%) and the overall rate of among all foreign-born newly diagnosed cases (33%) (NYC DOHMH 2009). Age at first diagnosis was significantly associated with later diagnosis, with the event risk increasing uniformly with age in both settings. In Jamaica year of diagnosis, male gender and unknown transmission risk all conferred higher risk for late stage diagnosis.

These research findings added new perspectives to the existing literature HIV among immigrants from both the resettlement location and immigrants’ country of origin (Gras et al. 1999, Pezzoli et al. 2009, Adrien et al. 2010, Barret et al. 2010). Although immigrants to New York City are at reduced risk of HIV infection compared to US-born cases, Jamaican immigrants in particular were at elevated risk for more adverse outcomes. For example, the effects of citywide prevention programs were diminished within this group. The absolute number of Jamaican cases remained high in New York City (the third largest number of new cases among all immigrant groups), despite the actual rate of new diagnoses is significantly lower than other immigrants groups in the registry (Wiewel et al.
2006). This underscored the need for accurate portrayal of disease burden when identifying emerging high risk groups.

Jamaican-born HIV cases in New York City displayed higher rates of late stage diagnosis and substantially higher mortality rates compared to other groups (Wiewel et al. 2006). Trends in newly reported HIV and AIDS cases over time did not differ significantly between settings, highlighting how much migrant Jamaicans resemble their counterparts in New York City despite access to different testing and primary health care models. Although the temporal sequence of infection and migration could not be ascertained in this study, these preliminary findings allude to the cultural resilience of testing and initiation of care behaviors among migrants, as suggested in earlier studies of HIV among immigrants (Dugan et al. 2006, Fenton et al. 2007). The premise behind this conclusion is that if migratory behavioral effects exist, rates of new HIV diagnoses and AIDS case rates will differ from the country of origin. Relative to the country of origin, persons will either engage in

1) earlier or more delayed testing

2) increased or decreased uptake of preventive services and activities

and/or

3) earlier or later initiation of primary care.

This is one of the fundamental tenants of acculturative theory with regard to health behavior (Singh et al. 2004).

This argument is further supported by the results of the late stage diagnosis study. Rates of late stage diagnoses were similar in both setting (42% and 48% in NYC...
and Jamaica respectively). Furthermore, these rates differed from any other ethnic, minority or nationality group in New York City, underscoring the similarities between migrant and native Jamaicans. In both settings, men were more likely to be diagnosed late, highlighting the retention of delayed testing behaviors among men post migration. Contrary to existing beliefs about homophobia in Jamaica, men who have sex with men were less likely than their heterosexual or unknown peers to be diagnosed late. This effect was also observed among Jamaican MSM in New York City. Based on existing models, we would expect MSM from a culturally homophobic society to be less likely to engage in routine testing for HIV for fear of discovery or disclosure of status (HRW 2004). Instead there was a protective effect associated with MSM activity and disease stage at diagnosis. This may be due to higher perceptions of HIV risk among MSM that fuel routine testing. Additional research is needed to explore this explanation.

A significant difference in rates of late stage diagnosis was the declining trend in Jamaica from 2004-2007. This may be attributable to increased availability of voluntary counseling and testing including substantial increases in rapid HIV testing. Despite similar increases in testing programs in New York City, no declines were observed in rates of late diagnosis, suggesting that more culturally targeted prevention campaigns may be necessary to improve testing among migrant groups such as Jamaicans.

The most striking difference in HIV-related trends over time between Jamaica and New York City was evident in the all-cause mortality among reported AIDS
cases. While there were steady, sustained declines in the number of deaths in New York City, deaths in Jamaica only recently began declining in 2001. This represents a seven year lag from the peak and subsequent decline in New York City. In this instance, Jamaican cases in New York City did not represent their peers in Jamaica. The earlier availability of antiretroviral therapy in New York City may be the most plausible explanation for this difference, as death rates among Jamaican cases resemble the overall death rate within the city (see Figure 10).

**Figure 10: History of the HIV/AIDS Epidemic in New York City 1981-2008**

Additionally, overall higher mortality rates in Jamaica compared to New York City likely affect estimates of mortality within this group. A final consideration included upsurges in violence and other unnatural causes of mortality. Within New York City alone, 15% of deaths among HIV-infected Jamaicans in 2006 – 2007 were due to alcoholism and non-HIV-related cardiovascular disease. Within Jamaica, peaks in the number of deaths in 1991 and 2001 may be related to political unrest surrounding elections versus HIV-specific or related causes. On
the whole, Jamaican cases of HIV in New York City closely resembled their peers in their country of origin suggesting strong cultural resiliency and limited assimilation post migration with regard to HIV.

Another aim of the study was to explore the impact of migration and travel on HIV within the country of origin. By comparing HIV-infected persons who reported overseas sexual contacts to those with contacts in Jamaica only, interesting yet predictable differences in behavioral profiles were observed. As was expected, persons with a history of deportation were more likely to report overseas sexual partners as were students and professionals. It is likely that professionals may have been educated outside of Jamaica and would therefore be more likely to establish overseas relationships. MSM and IDU risk groups were also more likely to report overseas sexual partners. This has significant implications for HIV risk, as these risk groups tend to have denser, more complex sexual networks (Ragnarsson 2010). They are also more likely to engage in dissorptive mixing and likely increased their risk significantly by maintaining overseas partnerships - particularly since these liaisons increase the likelihood of open versus closed networks with further elevated risk. Interestingly, separated and divorced individuals were more likely to report overseas partners although it is not clear from our analysis whether this was the primary partner.

Overseas sexual partnering has significant implications for HIV risk and ongoing transmission. Fenton et al. (2005) describe immigrants who engage in bidirectional travel as having elevated risk for HIV infection and ongoing transmission by bridging high risk sexual networks to lower risk networks. It
follows that the partners of such individuals in the country of origin may also experience elevated risk for HIV. Furthermore, long distance partnerships increase other risky partnering behaviors such as concurrent and multiple partnerships. The findings underscore this elevation in HIV risk, as higher transmission risk groups were more likely to engage in overseas partnering. This suggests that bidirectional travel and overseas sexual partnering is not only a concern for the resettlement location, but for the country of origin as well. The study findings indicate that the current body of literature on immigrant HIV is limited and further study is warranted to understand the experience of immigrants post migration. Former reports of elevated risk for immigrants in their resettlement location cannot be generalized to all settings. Furthermore, distinct differences in behaviors and experiences that relate to the country of origin are to be expected. Understanding these dynamics is essential to the future of HIV prevention in growingly diverse metropolises with high rates of inward migration. The findings presented are limited by the absence of temporal sequencing regarding time of infection and migration. Future studies could explore the themes introduced by following a cohort of HIV-negative migrants and tracking rates of seroconversion or employing BED™ assay analyses to identify the recently seroconverted among newly reported cases (Shepard et al. 2010). Identifying the geographic location of infection as it relates to migration would allow for improved hypothesis testing surrounding HIV risk behaviors as a function of migratory movement. Adding this new dimension to acculturative theory and HIV risk is essential to understanding HIV risk among immigrant groups.
Additional research is also needed to explore the effect of overseas partnering on HIV incidence and secondary transmission. Quantifying the attributable risk of this behavior regarding HIV is the next step in guiding prevention efforts in this potentially high risk group.

Whether or not immigrants experience elevated or diminished risk of HIV in their resettlement location, these findings highlight their cultural resiliency regarding HIV risk behaviors. As such, health authorities should explore increasingly culturally sensitive approaches to improve prevention and access to care for these potentially marginalized groups. Furthermore, countries of origin with high emigration rates should continue to monitor the rates of overseas partnering amongst their new cases as well as persons at high risk for HIV infection.
Chapter 8: Conclusions and Future Implications

As the dynamics of the HIV/AIDS epidemic become increasingly complex, research methods need to rise to the challenge. HIV/AIDS surveillance databases offer a wealth of population based data that may be more suitable for generalizations and guiding interventions. Our research highlighted how useful surveillance data can be in describing local epidemics and tracking trends over time. This research also revealed the advantage of comparing surveillance data between locations. There were however several lessons to be learned. Surveillance data can be advantageous between settings due to some mutually defined and collected information. In this analysis both databases had date of birth, gender, residence location and vital statistics information on all cases. This allowed us to compare the data to determine similarities and differences before engaging in lengthy analyses. An example of how such data affects analysis is evidenced in our model approach. We were able to age-adjust recognizing that NYC cases were older on average.

Another advantage of using surveillance data was the adoption of universal categorization of illness. Since both jurisdictions used the same criteria for defining HIV and AIDS, we could confidently make comparison about disease staging and classification.

Despite the advantages, there were several challenges associated with the use of surveillance data. Changes over time in surveillance activities significantly affect the data obtained and this limits comparison. For example, New York City did not implement name-based HIV reporting until 2001 while Jamaica engage in this
practice since 1986 when the FDA approved HIV test was available. As a result, any analysis involving HIV-non-AIDS was limited to 2001-2007. In comparing surveillance data, another limitation is access and intent. Both settings had restrictions on the use of public health data collected for surveillance being used for research. This is a necessary restriction to avoid the exploitation of cases, however, it makes gaining access to such data increasingly complex. For this study, encryption, password protection and limited mobility of data called for creative approaches for executing the research. Nevertheless, the exercise proved beneficial from a public health perspective more so than research. Our findings can aid prevention campaigns in both settings in a way that was not previously available.

The value of positive collaboration cannot be neglected in this endeavor. In an increasingly restrictive climate with regard to data sharing, it is essential for public health professionals to recall the purpose of surveillance – to monitor disease trends over time and identify priority areas for intervention. In unique situations where a single data base is not sufficient to answer the research question, collaboration between health authorities from different jurisdictions may be critical. Honesty, disclosure and research integrity are even more essential in these unique situations. It follows that routine review is necessary to ensure the collection and maintenance of surveillance data is in a similar manner to other cities, regions and countries where possible. This allows for improved comparability in general as well as for unique research endeavors like the one we performed.
The latter point is critical in a climate of growing travel and migration. The research shows how closely connected binational epidemics can be when migrants are compared to their peers from the country of origin. As a result, general prevention campaigns and interventions are likely not effective to non-natives. Understanding how closely migrants resemble their native peers may be the missing component of current prevention campaigns. The research highlighted this fact by showing how Jamaican-born cases in NYC did not equally share the benefits over time in reduced AIDS rates and mortality. In the absence of a cure, HIV prevention remains our single most effective tool in curtailing the epidemic. As such, improving the impact of prevention across all groups is an essential part of ongoing HIV/AIDS control. Customizing campaigns for foreign-born residents may reduce risk where it is elevated or reduce risky behaviors even when HIV risk is low.

Future studies in HIV among immigrants would benefit from bi- and multinational comparisons to the country of origin. Recommended topics include incidence analysis to identify the geographic point of location and sexual network analysis to quantify the attributable risk of transnational partnering. Considerations for comparing existing surveillance databases include high levels of collaboration between the facilitating health authorities, data transformation to maximize comparability and high levels of data validation to avoid spurious associations due to clustering within location. Other considerations include rigorous preliminary assessment to determine the distribution of outcomes and covariates prior to analysis. This is especially the case when comparing settings
with different types of epidemics. While the US and analogously NYC’s epidemic is considered concentrated, Jamaica’s is mixed. As such, the distribution of HIV and AIDS cases in the population is severely skewed. This limited the use of purely parametric approaches to analysis. Failure to recognize this would yield invalid results with low reliability.

In summation, as the HIV/AIDS epidemic continues to challenge public health globally, novel and useful research approaches are increasingly necessary.
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APPENDIX I:
DATA COLLECTION FORMS FOR HIV/AIDS
SURVEILLANCE REGISTRIES
HIV/AIDS CONFIDENTIAL REPORTING FORM

Send all reports to S.M.O., National HIV/STI Program

Ministry of Health,
2 King Street, Kingston
Telephone: 967-1100/1/3/5, Fax # 967-1280
AIDS/STD Helpline Tel: 967-3830

Trace () Do not contact trace () Contact partners only () Update () Copy sent to CI ()

1. NAME: ___________________________ Last First Middle Pet name
Sex: M( ) F( )

2. ADDRESS: ________________________ PARISH: ________________________ Tel: ________________________

4d 4m 4y weeks if infant employed☐ unemployed☐

4a. MOTHER’S NAME ___________________________ Name ___________________________ Relation ___________________________ Address ___________________________

5. Sexual contacts (Surname) First Name Relation Address Parish

6. SEXUAL PRACTICE of Patient: Heterosexual () Homosexual () Bisexual () Not known ()

7. Risk History

<table>
<thead>
<tr>
<th>Blood transfusion</th>
<th>Crack/Cocaine use</th>
<th>Intravenous drug use</th>
<th>Current STD</th>
<th>History of STD</th>
<th>Genital Ulcers/sores</th>
<th>Sex with CSW</th>
<th>Multiple Partner</th>
<th>Ever in Prison</th>
</tr>
</thead>
</table>

8. Clinical Status

<table>
<thead>
<tr>
<th>Weight loss (&gt;10%)</th>
<th>Cough (&gt;3 weeks)</th>
<th>Fever (&gt;1 month)</th>
<th>PCP</th>
<th>Recurrent Pneumonia</th>
<th>Tuberculosis</th>
<th>If Yes: Pulmonary/Extra Pulmonary/Disseminated</th>
<th>CNS involvement</th>
<th>Severe Bacterial Infection</th>
<th>(specify)</th>
</tr>
</thead>
</table>

If pregnant, please complete box on reverse of this form

Candidiasis (,) Y( ) N( )
If Yes Oral/ Oesophageal Vaginal
Gen. Lymphadenopathy (,) Y( ) N( )
Diarrhoea (>1 month) (,) Y( ) N( )
Chronic Herpes simplex (,) Y( ) N( )
Shingles (,) Y( ) N( )
Gen. Dermatitis (,) Y( ) N( )
Invasive cervical cancer (,) Y( ) N( )
Kaposi’s Sarcoma (,) Y( ) N( )
Other (specify) (,) Y( ) N( )

9. TRANSMISSION CATEGORY: Sexual () Vertical () IV Drug Use () Haemophilia () Blood Transfusion ()

10. CD4 COUNT CD4/CD8 ratio Date of CD4 count VIRAL LOAD Date of Viral load

11. IS PT ON ANTIRETROVIRAL TREATMENT (ART)? Y( ) N( ) START DATE OF ART: / / /

12. CURRENT STATUS OF PT: HIV (no symptoms) () HIV (minimal symptoms) () Advanced HIV (CD4 count 201 – 350) () AIDS () AIDS Death ()

13. DATE OF ONSET OF SYMPTOMS: / / /

14. Date diagnosed as Advanced HIV/AIDS / / / Date of Death / / /

15. CONFIRMATORY HIV TEST DATE: / / /

CONFIRMATORY Lab: ____________ Result: Pos ☐ Neg ☐

Rapid Test: Date: / / / Result: Pos ☐ Neg ☐

Test Type: ____________

Where tested? Antenatal Clinic ☐ Private Antenatal ☐ STI Clinic ☐ Blood Bank ☐ Hospital ☐ Private doctor ☐

Other ☐ Specify ____________

16.
6. Number of children under 15 years of age: _____

7.1 Blood transfusion: / / Hospital transfused: __________________________ 7.2 Deportee? Y ( ) N( )

FOR PREGNANT PATIENTS ONLY, PLEASE ENTER THE FOLLOWING INFORMATION:

Estimated gestational Age: ______ weeks Estimated date of delivery: / / 

Clinic site: __________________ Parish: _______________ Clinic: _______________ MRN #: _______________

Patient referred to: VJH clinic ( ) UHWI ( ) Spanish Town ( ) CRH ( ) Mandeville ( ) St. Ann’s Bay ( )

Other: __________________ Date of referral appointment: / / Pt. Not referred ( ) Pt. Refused referral: ( )

Post test counseling done by: ___________________________ (Enter name) Date of Post test counseling: / / 

PREGNANCY OUTCOME:

Mother

Delivery date: / / 

Received ART during pregnancy? Yes ( ) No ( ) Don’t Know ( )

AzT ( ) NVP ( ) HAART ( )

Pregnancy outcome: ( ) Live birth ( ) Still birth

Other

ART adherence (Y/N): _______________

Baby #1

Received ART at delivery?

Yes ( ) No ( ) Don’t Know ( )

AzT ( ) NVP ( ) HAART ( )

PCR result: 6 weeks PCR result: 3 months ELISA: 18 months

Other

Baby #2

Received ART at delivery?

Yes ( ) No ( ) Don’t Know ( )

AzT ( ) NVP ( ) HAART ( )

PCR: 6 weeks PCR result: 3 months ELISA: 18 months

Other

Definitions:

16. Multiple partners --- Persons who report having sex with more than one person in the last 12 months.

17. CSW --- Commercial sex worker

18. PCP --- Pneumocystis Jiroveci Pneumonia

19. CNS involvement --- Unexplained recent onset of seizures, dementia, toxoplasmosis, CMV, Cryptococcus, encephalopathy

20. Recurrent pneumonia --- Two or more episodes within a 1-year period

21. Gen. lymphadenopathy --- Two or more sites with enlarged lymph nodes

PLEASE NOTE:

17. Enter all dates in the format dd/mm/yy.

18. Reporting physicians are advised to initiate interview of index case to identify sexual contacts and encourage partner notification.

19. If all sexual partners have been investigated, please tick “Do not contact trace” on front of form.

20. DO NOT SEND PATIENTS to the Ministry of Health, 2-4 King Street with confidential reporting forms.

21. If you have an “update” on the clinical condition or death of a patient please complete and send new reporting form.

22. Send report under confidential cover to the MO(H) at the Parish Health Department or S.M.O. at top of form.

PATIENT’S DOCTOR: __________________ Address/hospital: __________________ Tel: ___-

SOURCE OF INFORMATION: __________________ REPORTED BY: __________________ Date reported: / / 

Confidential patient counseling, information for providers, and automated information are available from AIDS/STD Helpline

Tel: 967-3830, 967-3764, 1-888-991-4444 Hours: 10:00 a.m. – 10:00 p.m. Monday through Friday

Web Page: www.jamaica-nap.org

Revised: Sept 20/07
NYC Field Investigation Form

<table>
<thead>
<tr>
<th>Assigned:</th>
<th>Field Investigation Form</th>
<th>Due:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYS#</td>
<td>MR#</td>
<td>NYSD</td>
</tr>
</tbody>
</table>

| Last      | First       | Middle | DOB | AGE |

| AKA Last  | AKA First   | AKA DOB |

| Type R C H S U | Address |

| City | State | Zip | PI |

<table>
<thead>
<tr>
<th>Sex</th>
<th>Ethnicity</th>
<th>Race</th>
<th>Country of Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Hispanic</td>
<td>Black/African Am.</td>
<td>U.S.</td>
</tr>
<tr>
<td>F</td>
<td>Non Hispanic</td>
<td>Hawaiian/P.I.</td>
<td>U.S.</td>
</tr>
</tbody>
</table>

| Mortality Status | DOD | DC |

| HARS Name | NYC # |

| OFFICE USE ONLY |

| Physician | (List) | (First) | (MI) |

<table>
<thead>
<tr>
<th>I. LABORATORY TESTS</th>
<th>MM / DD / YYYY</th>
<th>MM / DD / YYYY</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB/IFA</td>
<td>/</td>
<td>VL [Qv]</td>
</tr>
<tr>
<td>Earliest WB/IFA</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>PCR DNA/RNA</td>
<td>/</td>
<td>/</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If positive, record test type and date of last doc. neg. test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
</tbody>
</table>

| AHI/PHI at diagnosis? | Yes | No | Unk. |

<table>
<thead>
<tr>
<th>II. PHYSICIAN DIAGNOSIS</th>
<th>(MM / DD / YYYY)</th>
<th>This case was previously diagnosed before the WB date and/or the &quot;doc. by physician&quot; date, but the prior date is unknown.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documented by physician?</td>
<td>Yes</td>
<td>/</td>
</tr>
</tbody>
</table>

| III. DATA SOURCE | MM | DD | YYYY |

| IV. PATIENT HISTORY | MM | DD | YYYY |

| Case needs to be reinitiated here |

<table>
<thead>
<tr>
<th>V. CLINICAL STATUS</th>
<th>MM / DD / YYYY</th>
<th>(Name)</th>
<th>(Address)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>VII. CASE STATUS - SELECT ONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

| Comments: | Sup. Init. | Completed: | |
|-----------|-----------|-----------|
### Field Investigation Form

**Assigned:**
- NYS# __________
- MB# __________
- NSID __________
- SR __________
- PHA __________

**Name:**
- Last __________
- First __________
- Middle __________
- DOB __________
- AGE __________

**AKA Last** __________
**AKA First** __________
**AKA DOB** __________

**Type:** __________
**Address:** __________

**City:** __________
**State:** __________
**Zip:** __________
**PI:** __________

**Sex:**
- M __________
- F __________

**Ethnicity:**
- Hispanic __________
- Non Hispanic __________

**Race:**
- Black/African American __________
- Am. Indian/Alaskan __________
- White __________
- Hawaiian/P.I. __________
- U.S. __________
- U.S. D & P __________

**Country of Birth:** __________

**Mortality Status:**
- DOD __________
- DC __________

**HARS Name:** __________

**Office Use Only:**
- NYC # __________

**Physician:**
- (Last) __________
- (First) __________
- (MI) __________

#### I. Laboratory Tests

<table>
<thead>
<tr>
<th>Test Type</th>
<th>MM/DD/YYYY</th>
<th>MM/DD/YYYY</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB/IFA</td>
<td><strong>/</strong>/_____</td>
<td><strong>/</strong>/_____</td>
</tr>
<tr>
<td>Earliest WB/IFA</td>
<td><strong>/</strong>/_____</td>
<td><strong>/</strong>/_____</td>
</tr>
<tr>
<td>PCR DNA/RNA</td>
<td><strong>/</strong>/_____</td>
<td><strong>/</strong>/_____</td>
</tr>
</tbody>
</table>

**If pos., record test type and date of last doc. neg. test:**

- Type __________
- __/__/_____ cells __________
- __________

**AHF/PHI at diagnosis?**
- Yes __________
- No __________
- Unk. __________

**This case was previously diagnosed before the WB date and/or the "doc. by physician" date, but the prior date is unknown.**

#### II. Physician Diagnosis

**Documented by physician?**
- Yes __________
- No __________

**MM/DD/YYYY** __________

#### III. Data Source

- Database __________
- Contact __________
- Chart __________

**MM DD YYYY** __________

#### IV. Patient History

<table>
<thead>
<tr>
<th>Id#6, provide date:</th>
<th><strong>/</strong>/_____</th>
</tr>
</thead>
<tbody>
<tr>
<td>If #8, specify occup:</td>
<td>__________</td>
</tr>
</tbody>
</table>

#### V. Clinical Status

<table>
<thead>
<tr>
<th>MM/DD/YYYY</th>
<th>(Name)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 D/P</td>
<td>__________</td>
</tr>
<tr>
<td>2 D/P</td>
<td>__________</td>
</tr>
<tr>
<td>3 D/P</td>
<td>__________</td>
</tr>
</tbody>
</table>

**Address** __________

**Case needs to be reincluded here**

#### VII. Case Status - Select One

- New Case __________
- Decl. Non Case # __________
- Prev. Rptd. NYC # __________
- Chart N/A __________
- Pos. Case/Miss Info. __________
- Provider Refused __________
- Pt. Not At Site __________
- Dep. NSID __________
- OJ __________

**Comments:** __________
**Sup. Init.** __________
**Completed:** __________
CODE MEN and WOMEN
100 Probable Heterosexual Transmission
113 No History of Injection Drug Use (IDU)
102 Heterosexual Partner had an Infected Partner
103 Multiple Sex Partners Sex with >5 partners after 1977; can use if chart has multiple sex partners only or MSP.
104 Sexually Transmitted Disease History of herpes simplex, gonorrhea, chlamydia, syphilis, chancroid, condyloma, genital HPV, lympho-granuloma venereum, etc.
105 Sexual Partner of Non-Injecting Drug User
106 Sexual Contact with a Male Prostitute
107 Sexual Contact with a Female Prostitute
108 Sexual Contact with a Prostitute Sex not specified.
109 Prostitution History of sex for money, drugs, or other.
110 Sexual Abuse History of abuse, rape, incest, etc.
111 Monogamy Claims history of a single sex partner.
112 Abstinence Claims no history of sexual contact.
200 Marijuana (Cannabis) Use
201 Alcohol Use
202 Heroin Use For non-IDU.
208 Heroin Use When route not specified.
203 Crack / Cocaine Use
204 Methadone Use
205 Methamphetamine (“crystal meth”) Use
206 Substance Abuse Other or type not specified.
300 Accidental Needlestick or Other Exposure Involving Body Fluids
301 Blood Transfusion Unconfirmed or after 3/85.
302 Dental Procedure Claims as risk.
303 Medical Procedure Claims as risk.
304 Hemodialysis or Peritoneal Dialysis >1977 Claims as risk.
305 Medical Condition Requiring Frequent Injections Such as for diabetes, allergies, etc.
306 Acupuncture
400 Hepatitis B Diagnosis of infection noted in chart.
401 Hepatitis C Diagnosis of infection noted in chart.
500 Activities Involving Blood, Needles, Knives Includes electrolysis, piercing, scarring, etc.
501 Tattoos Includes tattoos that have been removed.
600 Incarceration Includes any history, past or current.
601 Partner Has History of Incarceration
602 Mental Illness
603 Domestic Violence
604 Homelessness
700 Other Select this code and describe in the comments.
CODE MEN only
800 Proctitis
802 Anal or Rectal Sexually Transmitted Disease
803 Anal Cancer
801 Transgender (male-to-female)
CODE WOMEN only
901 Mother of a Pediatric Case
902 Artificial Insemination
903 Transgender (female-to-male)
APPENDIX II:

DATA SHARE AGREEMENTS & IRB APPROVALS
Should you perform the proposed analysis, you will need to perform your work at the office of HEFSP on the 7th floor of 348 Broadway, New York, NY. Under no circumstances will you be allowed to remove record-level NYC HIV surveillance data from the HEFSP office.

3) You will be required to register with the DOHMH formally as a volunteer, and submit all of the required documentation that provides you with this status. You will not be able to begin working on your proposed analysis until you have received volunteer status and the appropriate, official identification that accompanies it.

4) You will be required to abide by all HEFSP and DOHMH policies related to protecting the confidentiality of NYC HIV surveillance data, including satisfactory completion of confidentiality training.

5) You will work at all times under the supervision of the program director or his/her designee.

6) All public presentations, publications and reports that include NYC HIV surveillance data must be presented in aggregate form only, and no cell containing fewer than 6 cases from the NYC HIV surveillance registry may be publicly released. HIV-related information is protected against disclosure by New York State Sanitary Code Section 24.2, New York State Public Health Laws 298 (1)(j), Article 37F, New York State Codes, Rules and Regulations, Title 19, Part 63, and New York City Health Code Section 11.07.

7) Any publication of analysis that includes NYC HIV surveillance data must be approved and cleared by DOHMH. You may not independently publish, present, or otherwise report any findings obtained through the use of NYC HIV surveillance data to any individual or group without the permission of the program and official clearance from the DOHMH.

It is imperative that you uphold all parts of this agreement, and that you use the data provided to you for the purposes outlined in this memo only. Failure to abide by both the spirit and the letter of the agreement would be considered a violation of professional integrity, cause for severance of your relation with the DOHMH, and disqualification from further collaboration with the agency.

Data Use Agreement

I have read and understood this data use agreement. My signature below indicates that I agree to abide by its provisions. I have been given a copy of this agreement.

[Signature] - [Date: July 24, 2009]

[Signature] - [Date: 9/15/09]

Signature - Agency Responsible Party (Colin Shepard, MD)
November 2, 2009

Re: IRB# 09-070 “HIV and Migration: Comparing Risk Profiles of Jamaican-born cases in New York City and Jamaica, WI”
Principal Investigator: Yoran T. Grant
This Action: Approval, Expedited by Chair
Expiration Date: November 02, 2010

Yoran T. Grant
Consultant Epidemiologist/Biostatistician
New York City Department of Health and Mental Hygiene
346 Broadway, Room 706
New York, NY 10013

Dear Ms. Grant:

Your application to conduct the study “HIV and Migration: Comparing Risk Profiles of Jamaican-born cases in New York City and Jamaica, WI”, has been approved by the Chair under 45 CFR §60.111(b)(1)(category F3) as “research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for non-research purposes (such as medical treatment or diagnosis)”. The IRB has determined that the study poses minimal risk to participants.

As principal investigator, you are responsible for ensuring that the study continues to be conducted according to the protocol approved by the IRB. You may submit written requests to modify the protocol to the IRB, but you may not implement any modifications until you have received written approval from the IRB as this would constitute non-compliance and deviance of IRB reviewed and approved procedures. You must also advise the IRB immediately of changes in sponsorship, funding, key personnel, address, phone number or suspension of approval by another IRB. Your study is subject to random or for-cause audit at any time.

Any adverse physical or psychological event affecting a study participant, violation of your data security protocol, or breach of confidentiality, must be reported in writing to the IRB within 5 days of occurrence. Serious adverse events must be reported in writing within 24 hours. You are also responsible for the accurate documentation, investigation and follow-up of all study-related adverse events and unanticipated problems involving risks to participants or others. At the conclusion of the investigation, a detailed report on the resolution of the adverse event, must be submitted to the IRB within 10 days.

This approval expires on November 02, 2010. If at that time you have completed your study, please submit a final report. If you wish to continue the study, please submit a progress report. In either case, the IRB requests that these reports be received not less than four weeks prior to expiration date.

Sincerely,

Deville Burton, MSW, Mbe
Chair, Institutional Review Board

OB/Jr
MINISTRY OF HEALTH
The National HIV/STI Programme
2-4 Kings Street, 4th Floor
Kingston, Jamaica W.I.
876.967.1277/876.967.1643 (fax)

DATA SHARING AGREEMENT

To Whom It May Concern:

This agreement includes an amendment to the original data share agreement between Kevin Harvey on behalf of the Jamaica Ministry of Health and Environment and Yoran T. Grant, Department of Epidemiology Miller School of Medicine University of Miami made and entered into the 12th day of August, 2008. The original terms are as follows;

Under the guidance of the dissertation committee and a field advisory committee from Jamaica’s National HIV/AIDS programme, Yoran Grant will conduct an in-depth analysis of national HIV/AIDS surveillance data in Jamaica alongside similar data from the New York City Department of Health & Mental Hygiene. This data from Jamaica is and will remain the property of the Ministry of Health for the duration of the research project and thereafter. Thus all parties agree to the following:

- The data released to Yoran Grant are for the sole purpose of her dissertation research and cannot be used for future or additional analyses without permission and a new agreement from the Ministry of Health
- The data are to be released in a de-identified format to protect case identities
- The data cannot be shared or released to any third party (whether individual or other entity). Supervised viewing of the data will only be permitted for advising purposes (e.g. biostatistical support etc.)
- No publications will be permitted with prior approval from the Ministry of Health
- The final academic product in the form of a dissertation will be the property of the University of Miami with confidentiality and sharing restrictions up until scholarly publication. The Ministry of Health will be provided courtesy copies
- Financial disclosure regarding funding from the Fogarty AIDS International Training Program (AITRP) at the University of Miami must be included in public displays, presentation and/or publication of the results of this project.

AMENDMENT: All manuscripts prepared for publication in scholarly journals must be presented to and approved by the Chief Medical Officer of the ministry of health prior to submission.

This agreement is subject to revision at the bequest of a single party and agreement of all.

Kevin Harvey, M.B.BS MPH
Senior Medical Officer
The National HIV/STI Programme
Ministry of Health
Date: 7/2/09

Yorai T. Grant, MPH
Doctoral Candidate
Department of Epidemiology
Miller School of Medicine, Univ. of Miami
Date: 7/4/09
May 20, 2010

Lisa Metsch, Ph.D.,
University of Miami
Department of Epidemiology and Public Health
Medical Campus
Miami, FL 33136

HERO STUDY NUMBER: 20090897
STUDY TITLE: Travel, Migration and HIV: Risk and Other Behaviors Among Native and Migrant Jamaican Persons infected with HIV
IRB ACTION DATE: 5/13/2010
STUDY APPROVAL EXPIRES: 5/12/2011
SPONSOR NAME: There are no items to display
FWA: FWA00002247

On May 13, 2010, an IRB Chair approved the following items under the expedited review process, with a waiver of informed consent.

APPROVAL INCLUDES:

New Research Protocol

Sincerely,

[This is a representation of an electronic record that was signed electronically and this page is the manifestation of the electronic signature]

Amanda Coltes-Rojas, MPH, CIP
Director
Regulatory Affairs & Educational Initiatives

/"
APPENDIX III:

TRANSMISSION RISK ALGORITHMS
Appendix IIIA: Risk Algorithm for Males in the Jamaica HIV/AIDS Tracking System (HATS)
Appendix IIIB: Risk Algorithm for Females in the Jamaica HIV/AIDS Tracking System (HATS)
Appendix IIIC: Risk Algorithm for Jamaican Males in the New York City HIV/AIDS Registry System (HARS)

Sex = 'Male'

IF No Reported Risk Group on Record THEN

IF Reported sex with a female on record THEN Classify as Heterosexual Risk

IF No reported sex with a female THEN classify as NRR/HIR

IF Reported Risk = MSM, IDU, Heterosexual, Perinatal or Other THEN retain existing classification
Appendix IIID: Risk Algorithm for Jamaican Females in the New York City HIV/AIDS Registry System (HARS)