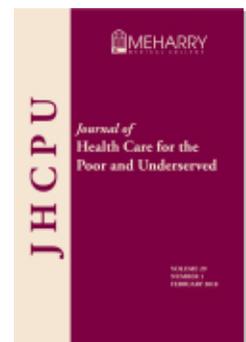# PROJECT MUSE®

Delayed Diagnosis of HIV among Non-Latino Black Caribbean
Immigrants in Florida 2000–2014

Elena Cyrus, Diana M. Sheehan, Kristopher Fennie, Mariana Sanchez, Christyl
T. Dawson, Marsha Cameron, Lorene Maddox, Mary Jo Trepka

➡ *For additional information about this article*
    https://muse.jhu.edu/article/686966

Delayed Diagnosis of HIV among Non-Latino Black Caribbean Immigrants in Florida 2000–2014

Elena Cyrus, MPH, PhD
Diana M. Sheehan, MPH, PhD
Kristopher Fennie, MS, MPH, PhD
Mariana Sanchez, PhD
Christyl T. Dawson, MPH
Marsha Cameron, BA
Lorene Maddox, MPH
Mary Jo Trepka, MD, MSPH

Abstract: Prompt HIV diagnosis decreases the risk of HIV transmission and improves health outcomes. The study objective was to examine rates of delayed HIV diagnosis among non-Latino Black Caribbean immigrants in Florida. The sample included 39,008 Black HIV-positive individuals, aged 13 or older from the Caribbean and the mainland U.S. Delayed HIV diagnosis was defined as AIDS diagnosis within three months of HIV diagnosis. After adjusting for demographic factors, year of HIV diagnosis, transmission mode, neighborhood level socioeconomic status, and rural-urban residence, a disparity persisted for Caribbean-born Blacks in the Bahamas and Haiti compared with U.S.-born Blacks. Male Jamaican-Bahamian-Haitian-born Blacks were more likely to have delayed diagnosis (aOR 2.17, 95% confidence interval [CI] 1.53–3.03; aOR 1.88, 95% CI 1.01–3.44; aOR 1.58, 95%CI 1.58). Findings suggest the need for targeted, culturally relevant interventions to reduce delayed diagnosis incidence among specific Caribbean-born Blacks.

Key words: Caribbean, HIV, delayed diagnosis, immigrant.

HIV acquisition is a health concern for vulnerable, at-risk populations such as immigrants, who may encounter barriers to accessing routine health care, including HIV testing, thereby reducing the chances of an early diagnosis and successful viral

ELENA CYRUS and MARIANA SANCHEZ are associated with The Center for Research on U.S. Latino HIV/AIDS and Drug Abuse, Florida International University, Miami, FL. DIANA SHEEHAN, KRISTOPHER FENNIE, and MARY JO TREPKA are associated with the Department of Epidemiology, Robert Stempel College of Public health and Social Work, Miami, FL. CHRISTYL DAWSON is associated with CRUSADA, FIU, Miami, FL and the Department of Epidemiology, Robert Stempel College of Public health and Social Work, Miami, FL. MARSHA CAMERON is associated with the George Washington Milken Institute School of Public Health, Washington, DC. LORENE MADDOX is associated with the HIV/AIDS Section, Florida Department of Health, Tallahassee, FL. Send correspondence to: Dr. Elena Cyrus, Center for Research on U.S. Latino HIV/AIDS and Drug Abuse, Florida International University, 11200 SW 8th Street, AHC5 417-A, Miami, FL 33199; E-mail: ecyrusca@fiu.edu.

load suppression.[1] Early detection of HIV infection can help avert the progression to AIDS, prevent HIV transmission, and improve survival.[2] Low income, less education, stigmatization and inadequate access to health care—factors that may be more prevalent among immigrants—can all contribute to delayed diagnosis within Caribbean-born communities.[3]

Just over 1% of the United States (U.S.) population is made up of Caribbean immigrants.[3] Florida is home to approximately 40.0% of the total Caribbean-born population in the United States.[4] From 2001–2007, Caribbean-born immigrants, primarily from Haiti, Jamaica, Trinidad and Tobago, and the Bahamas, constituted approximately 54.1% of HIV-infected foreign-born Black cases in the United States.[2] Haitian-born immigrants continue to be at highest risk for HIV acquisition, accounting for 16% of all HIV cases in South Florida (Miami-Dade, Broward, and Palm Beach Counties) while representing only 2% of the total Florida population.[5]

Research regarding delayed HIV diagnosis among Black Haitian-born and other Black Caribbean-born immigrants living in the U.S. is sparse.[1,6] The present study identifies factors associated with delayed diagnosis (AIDS diagnosis within three months of an HIV diagnosis) among multinational non-Spanish-speaking, Black Caribbean-born immigrant groups in South Florida.

Methods

Study sample. De-identified records were obtained from the Florida Department of Health (DOH) Enhanced HIV/AIDS Reporting System (eHARS) of Florida residents aged 13 years or older who were diagnosed with HIV infection from 2000–2014 and met the Centers for Disease Control and Prevention (CDC) case definition.[7] The CDC case definition includes laboratory or clinical criteria as a basis for diagnosis—i.e., a positive result on a screening test for an HIV antibody, a positive result of a detectable quantity on any HIV virologic (nonantibody) test, diagnosis of HIV based on documented laboratory results in patient's medical records, or conditions that meet criteria included in the case definition for AIDS. Data in eHARS primarily come from health care provider reports, laboratory reports, and data abstracted from medical records by county health department staff.

U.S.-born Blacks and all foreign-born Blacks from non-Spanish-speaking Caribbean countries were included in the analysis. U.S.-born Blacks were selected as the referent group to minimize race as a confounder, which allowed for other contextual variables, such as country of origin or culture, to be considered as explanatory variables. Caribbean countries with fewer than 90 HIV-positive individuals were grouped together for analysis (Guyana, Turks and Caicos, Barbados, St. Lucia, Dominica, Antigua and Barbuda, Grenada, St. Vincent and the Grenadines, Bermuda, British Virgin Islands, Aruba, St. Kitts and Nevis, Cayman Islands, and Anguilla). Countries that were Departments or Constituents of other countries (Dutch Antilles and French Guiana), were excluded. Records were excluded from the analysis if HIV diagnosis occurred when the individual was younger than 13 years of age (n=270), missing month and year of HIV diagnosis (n=140), missing country of birth (n=907), missing or invalid residential ZIP code (n=1,856), or HIV diagnosis occurred at a correctional facility (n=2,231).

Prisoners who were diagnosed at a prison facility were excluded because they are not necessarily representative of the ZIP code area they reside in, and may not be influenced by neighborhood characteristics.

Individual-level characteristics. Individual-level variables available in the eHARS dataset for cases included residential ZIP code and county at time of HIV diagnosis and AIDS diagnosis (if applicable); month and year of HIV diagnosis and AIDS diagnosis (if applicable); country of birth; age at HIV diagnosis; sex; race/ethnicity; HIV transmission mode; and whether the diagnosis occurred at a correctional facility. AIDS case definition was met if the person's medical record indicated the development of an AIDS-defining illness, a CD4 lymphocyte count <200 cells/μL, or CD4% of total lymphocytes <14.[8] People were classified as being born in the United States if they were born in mainland U.S., Hawaii, Alaska, or Guam. Puerto Ricans were not included in the analysis due to the exclusion criterion concerning Spanish-speaking individuals, and Black individuals from the U.S. Virgin Islands were included as part of the Caribbean-born Black sample.[9–11] Individuals with a reported mode of transmission of men who have sex with men (MSM) combined with injection drug use (IDU) were grouped with whose reported mode of transmission was IDU only, because between the two risk categories, IDU presents higher risk than MSM.

Delayed HIV diagnosis was defined as an AIDS diagnosis within three months of an HIV diagnosis. Other studies have variously defined a delayed diagnosis as a time period of one, three, or 12 months between HIV and AIDS diagnosis.[12] A three-month time frame was chosen for this study to allow sufficient time for people with positive HIV screening tests to obtain clinical follow-up and to be consistent with the recommendation of the National HIV/AIDS Strategy to have people linked to care within three months of initial diagnosis.[13]

Neighborhood-level characteristics. Thirteen neighborhood-level socioeconomic status (SES) indicators were extracted from the 2009–2013 American Community Survey (ACS) to develop an SES index of Florida neighborhoods ZIP code tabulation areas (ZCTAs):[14] proportion of households without access to a car, proportion of households with one or more individuals per room, proportion of population living below the poverty line, proportion of owner-occupied homes worth $300,000 or more, median household income in 2013, proportion of households with annual income less than $15,000, proportion of households with annual income of $150,000 or more, income disparity (derived from proportion of households with annual income less than $10,000 and proportion of households with annual income of $50,000 or more), proportion of population age 25 years or older with less than a 12th grade education, proportion of population age 25 years or older with a graduate professional degree, proportion of households living in rented housing, proportion of population age 16 years or older who were unemployed, and proportion of population age 16 years or older employed in high working class occupation (ACS occupation group: managerial, business, science, and arts occupations). Income disparity was calculated as the logarithm of 100 times the proportion of households with annual income less than $10,000 divided by the proportion of households with annual income of $50,000 or more and was used as a proxy for the Gini-coefficient.[14,15] All neighborhood-level indicators were coded so that higher scores corresponded with higher SES; they were standardized.[14]

To calculate the SES index, we started by conducting a reliability analysis. The Cronbach's alpha for all 13 indicators was 0.93. We selected seven indicators based on the correlation of the indicator with the total index (high correlation) and the Cronbach's alpha if the item was deleted (low alpha). The seven indicators selected were: proportion below poverty, median household income, proportion of households with annual income of less than $15,000, proportion of households with annual income of $150,000 or more, income disparity, proportion of population age 25 years or older with less than a 12th grade education, and high working class occupation (as defined previously). The resulting Cronbach's alpha increased (0.94).

Second, we conducted a principal component analysis with and without varimax rotation, which revealed one factor with an eigenvalue greater than 1 (5.14). This factor accounted for 73.5% of the variance in the indicators. Because all the factor loadings were high (between 0.80 and 0.93), we retained all seven indicators. Finally, we added the standardized scores for the seven variables and categorized the scores into quartiles.

To categorize ZIP code tabulation areas (ZCTA) into rural or urban, we used Categorization C of Version 2.0 of the Rural-Urban Commuting Area (RUCA) codes, developed by the University of Washington WWAMI Rural Research Center.[16]

Analytic plan. Individual- and neighborhood-level data were merged by matching the ZIP code at time of HIV diagnosis of each case with the ZIP code's corresponding ZCTA. First, we compared individual- and neighborhood-level characteristics by country of birth. We used the Cochran-Mantel-Haenszel general association statistic for individual-level variables controlling for ZCTA, and the chi-square test for neighborhood-level variables. Multi-level (Level 1: individual; Level 2: neighborhood) logistic regression modeling was used to account for correlation among cases living in the same neighborhood. Crude and adjusted odds ratios and 95% confidence intervals for delayed diagnosis were calculated comparing cases by country of birth. To identify unique predictors of delayed diagnosis for each group, separate models were estimated stratifying by country of birth. Odds ratios were adjusted for year of HIV diagnosis, sex at birth, age, mode of transmission, neighborhood socioeconomic status, and rural/urban status. SAS software, version 9.4 was used to conduct analyses.[17] The study was reviewed and approved by a local institutional review board, and the Florida Department of Health designated this study as non-human subjects research.

Results

Demographic factors. In Florida, there were 45,484 new HIV infections between 2000–2014 among U.S.-born Blacks and foreign-born non-Latino Blacks born in non-Spanish-speaking Caribbean countries. A total of 39,008 cases met the inclusion criteria. Table 1 compares the characteristics of Caribbean-born Blacks with those of U.S.-born Blacks in South Florida. Caribbean-born Blacks were 18.8% of the study population, with the largest groups originating from Haiti (14.8%) and Jamaica (2.3%). Bahamas, U.S. Virgin Islands, and Trinidad and Tobago each represented less than 1% of the study sample. The "Other" groups included non-Spanish-speaking Caribbean countries with 50 or fewer individuals and included the countries Guyana, Turks and Caicos, Barbados, St. Lucia, Dominica, Antigua and Barbuda, Grenada, St. Vincent and

Table 1.

DEMOGRAPHIC CHARACTERISTICS OF BLACK U.S.-BORN AND CARIBBEAN-BORN NON-LATINOS AGE 13 AND OLDER DIAGNOSED WITH HIV INFECTION, FLORIDA, 2000–2014, (N=39,008)[a]

	U.S. Black (n,%)	Haiti (n,%)	Jamaica (n,%)	Bahamas (n,%)	Trinidad and Tobago (n,%)	U.S. Virgin Islands (n,%)	Other[b] (n,%)	p-value
Total (n(%)) [c]	31,683 (81.2)	5,754 (14.8)	896 (2.3)	313 (0.8)	93 (0.2)	101 (0.3)	168 (0.4)	
Individual-level variables								
Year of HIV diagnosis								
2000–2004	13,807 (43.6)	2,603 (45.2)	326 (36.3)	154 (49.2)	38 (40.8)	39 (38.6)	76 (45.2)	.05
2005–2009	9,956 (31.4)	1740 (30.2)	312 (34.6)	95 (30.3)	34 (36.6)	31 (30.7)	52 (30.9)	
2010–2014	7,920 (25.0)	1,411 (24.5)	258 (28.6)	64 (20.5)	21 (22.6)	31 (30.7)	40 (23.8)	
Sex at birth								
Male	18,756 (59.2)	3,069 (53.3)	555 (61.9)	151 (48.2)	60 (64.5)	78 (77.2)	109 (64.9)	<.001
Female	12,927 (40.8)	2,685 (46.7)	341 (38.1)	162 (51.8)	33 (35.5)	23 (22.8)	59 (35.1)	
Age group at diagnosis								
13–19 years	1,763 (5.6)	68 (1.2)	26 (2.9)	15 (4.8)	2 (2.1)	2 (2.0)	3 (1.7)	<.001
20–39 years	16,189 (51.1)	2,371 (41.2)	393 (43.9)	190 (60.7)	41 (44.1)	57 (56.4)	68 (40.4)	
40–59 years	12,071 (38.1)	2,820 (49.0)	395 (44.1)	93 (29.7)	40 (43.0)	34 (33.6)	83 (49.4)	
60 years or older	1,660 (5.2)	495 (8.6)	82 (9.1)	15 (4.8)	10 (10.8)	8 (7.9)	14 (8.4)	
Mode of transmission								
IDU[d]	3,143 (9.9)	114 (2.0)	32 (3.7)	15 (4.8)	4 (4.4)	12 (11.8)	11 (6.5)	<.001
MSM	9,101 (28.7)	531 (9.2)	175 (19.5)	60 (19.2)	26 (27.9)	40 (39.6)	37 (22.0)	
Heterosexual	15,885 (50.2)	4,092 (71.1)	534 (59.5)	178 (56.9)	44 (47.4)	33 (32.8)	93 (55.4)	
Other/unknown	3,554 (11.2)	1017 (17.7)	155 (17.3)	60 (19.1)	19 (20.3)	16 (15.8)	27 (16.1)	

Table 1. (*continued*)

	U.S. Black (n,%)	Haiti (n,%)	Jamaica (n,%)	Bahamas (n,%)	Trinidad and Tobago (n,%)	U.S. Virgin Islands (n,%)	Other [b] (n,%)	p-value
Late HIV diagnosis								
Yes	9,495 (29.9)	2,223 (38.6)	298 (33.3)	123 (39.3)	30 (32.6)	40 (39.6)	63 (37.5)	<.001
No	22,188 (70.1)	3,531 (61.3)	598 (66.7)	190 (60.7)	63 (67.4)	61 (60.4)	105 (62.5)	
ZIP code tabulation areas-level variables								
Socioeconomic status (SES) index, quartiles								
1 (lowest SES)	18,794 (59.3)	3,238 (56.3)	416 (46.4)	161 (51.4)	36 (38.6)	50 (49.5)	88 (52.4)	<.001
2	7,544 (23.8)	1,640 (28.5)	252 (28.1)	91 (29.1)	30 (32.5)	20 (19.8)	34 (20.2)	
3	3,528 (11.1)	603 (10.5)	136 (15.8)	45 (14.4)	21 (22.5)	18 (17.8)	30 (17.9)	
4 (highest SES)	1,837 (5.8)	273 (4.7)	92 (10.3)	16 (5.1)	6 (6.4)	13 (12.9)	16 (19.5)	
Rural Urban Commuting Area classification								
Rural	1,012 (3.2)	35 (0.6)	15 (1.7)	0 (0)	0 (0)	1 (0.9)	5 (2.9)	<.001
Urban	30,671 (96.8)	5,719 (99.3)	781 (98.3)	313 (100)	93 (100.0)	100 (99.1)	163 (97.1)	

Notes

[a] Percentage may not add up to 100 due to rounding.

[b] Includes Guyana (n=50), Turks & Caicos (n=41), Barbados (n=29), St. Lucia (n=19), Dominica (n=14), Antigua and Barbuda (n=13), Grenada (n=10), St. Vincent and the Grenadines (n=11), Bermuda (n=11), British Virgin Islands (n=6), Aruba (n=6), St. Kitts and Nevis (n=5), Cayman Islands (n=3), Anguilla (n=1).

[c] Excludes cases diagnosed under 13 years of age (n=270), missing month and year of diagnosis (n=140), missing country of birth (n=907), missing or invalid residential ZIP code (n=1,856), diagnosed in a correctional facility (n=2,231), and cases born in Dutch Antilles (n=3) and French Guiana (n=1).

[d] Includes cases reported as both IDU and MSM/IDU.

ZCTA= ZIP Code Tabulation Area

IDU= Injection Drug Use

MSM= Men who have sex with men

RUCA= Rural Urban Commuting Area

SES= Socioeconomic Status

the Grenadines, Bermuda, British Virgin Island, Aruba, St. Kitts and Nevis, Cayman Islands, and Anguilla.

For all groups, the proportion of late-diagnosis HIV cases during the last time period (2010–2014) was lower relative to the earlier time periods (Table 1). With the exception of Bahamian-born individuals, men represented the majority of those diagnosed for all groups, but the largest proportion of men was among people born in the U.S. Virgin Islands (77.2%). The U.S., Bahamian, and U.S. Virgin Island-born groups had a younger age distribution relative to the other groups. Men having sex with men was the most common mode of transmission in the U.S. Virgin Island group. In all other groups, heterosexual transmission was the most commonly reported mode of transmission with the percentage ranging from 47.4% among the Trinidadian and Tobagonian group to 71.1% of the Haitian-born group. The proportion of people diagnosed with HIV who had a delayed HIV diagnosis was highest among those born in the U.S. Virgin Islands (39.6%), followed by Bahamians (39.3%), Haitians (38.6%), "Others" (37.5%), Jamaicans (33.3%), and Trinidadians and Tobagonians (32.6%). For Jamaicans, Haitians and Others, the percentage of delayed diagnosis was highest among the group 40–59 years of age (49.0%, 44.1% and 49.4%). Delayed diagnosis was lowest for U.S.-born Blacks (29.9%).

The largest percentage of people living in the lowest socioeconomic status neighborhoods was among U.S.-born Blacks (59.3%) and Haitians (56.3%). The largest percentage of rural diagnoses was among the U.S.-born Blacks (3.2%).

Multivariate analysis. With the exception of individuals from Trinidad and Tobago, all others had significantly higher crude odds ratios (OR) for delayed HIV diagnosis relative to U.S.-born Blacks (Table 2, model 1). After adjusting for individual-level and neighborhood-level variables, the Bahamian- and Haitian-born groups were more likely than the U.S.-born group to have a delayed HIV diagnosis (adjusted OR [aOR] 1.66, 95%CI 1.31–2.11; aOR 1.29, 95%CI 2.21–1.38) (Table 2, models 2 and 3). Based on previous findings in the literature of gender differences, we tested the interaction between country of birth and gender in delayed diagnosis.[13,18,19] The interaction was significant. Therefore, the sample was stratified by gender. Post-hoc stratification revealed that for both men and women born in Bahamas and Haiti, the aORs were higher than their U.S.-born counterparts (Bahamian men aOR 1.76, 95%CI 1.27–2.48; Bahamian women aOR 1.49, 95% CI 1.07–2.09; Haitian men aOR 1.40, 95%CI 1.29–1.54; Haitian women aOR 1.12, 95%CI 1.03–1.25) (Table 3).

The within-group analysis in Table 4 highlighted the differences in factors contributing to delayed diagnosis for Caribbean- and U.S.-born Blacks. When stratifying by country of birth, the aOR for delayed diagnosis was associated with year of HIV diagnosis for U.S.-born Blacks only, with U.S.-born Blacks diagnosed 2000–2004 having a higher aOR (aOR 1.42, 95%CI 1.33–1.51) compared with U.S.-born Blacks diagnosed 2005–2009 (aOR 1.24, 95%CI 1.16–1.34).

In each group, men were more likely to have a delayed diagnosis than women, and the strength of association was greater for Jamaicans than the U.S.-born. Among Haitians, delayed diagnosis was significantly related to higher neighborhood socioeconomic levels, but there was no association for any other group. There was no statistically significant association between rural/urban status and delayed diagnosis in any

TABLE 2.

CRUDE AND ADJUSTED ODDS RATIOS AND 95% CONFIDENCE INTERVALS FOR DELAYED HIV DIAGNOSIS AMONG BLACK U.S. AND CARIBBEAN-BORN NON-LATINOS AGED 13 YEARS AND OLDER, FLORIDA, 2000−2014

Country/region of birth	Model 1[a] Crude OR (95% CI)	Model 2[b] Adjusted OR (95% CI)	Model 3[c] Adjusted OR (95% CI)
Bahamas	1.51 (1.20–1.90)**	1.59 (1.26–2.02)**	1.66 (1.31–2.11)**
Haiti	1.47 (1.34–1.56)**	1.28 (1.20–1.36)**	1.29 (1.21–1.38)**
U.S. Virgin Islands	1.53 (1.03–2.29)*	1.46 (0.98–2.21)	1.47 (0.98–2.24)
Jamaica	1.16 (1.01–1.34)*	1.04 (0.90–1.20)	1.04 (0.90–1.20)
Trinidad and Tobago	1.13 (0.72–1.72)	0.96 (0.62–1.50)	0.98 (0.63–1.53)
Other	1.40 (1.02–1.91)*	1.20 (0.87–1.68)	1.21 (0.88–1.68)
U.S.-Born Blacks	Referent	Referent	Referent

Notes
*p≤.05
**p≤.001
[a]Model 1: Crude rates
[b]Model 2: Controlling for individual-level variables (year of HIV diagnosis, sex at birth, age, race, and mode of HIV transmission)
[c]Model 3: Controlling for individual-level variables, and neighborhood-level variables (SES index and rural/urban status)
OR= Odds Ratio
CI= Confidence Interval

of the Black Caribbean groups. However, rural residence was associated with delayed diagnosis among U.S.-born Blacks (aOR 1.31, 95%CI 1.14–1.52).

Discussion

This study produced three key results pertinent to HIV delayed diagnosis among Caribbean immigrants in South Florida. Firstly, with the exception of Trinidad and Tobago, compared with U.S.-born Blacks, all Caribbean immigrant groups were more likely to have a delayed diagnosis. The disparity persisted for Bahamian and Haitian immigrants after adjustment for individual- and neighborhood-level variables. Secondly, men overall, were more likely than women to have a delayed diagnosis, and the disparity was greatest for men born in Jamaica. Finally, apart from lower neighborhood socioeconomic status being protective for Haitian immigrants, neighborhood socioeconomic levels were not associated with delayed diagnosis in the other Caribbean immigrant groups.

High rates of delayed diagnosis for both Caribbean and U.S.-born Blacks may be due to structural racism and discrimination, fear of knowing HIV test result, and

Table 3.

MODEL 3 ADJUSTED ODDS RATIOS AND 95% CONFIDENCE INTERVALS STRATIFIED BY SEX AT BIRTH, FOR DELAYED HIV DIAGNOSIS AMONG BLACK CARIBBEAN-BORN NON-LATINOS AGED 13 YEARS AND OLDER, FLORIDA, 2000−2014[a]

Country/region of birth	Sex at Birth	
	Female aOR, (95% CI)	Male aOR, (95% CI)
Bahamas	1.49 (1.07–2.09)*	1.76 (1.27–2.48)**
Haiti	1.12 (1.03–1.25)*	1.40 (1.29–1.54)**
U.S. Virgin Islands	1.97 (0.84–4.60)	1.37 (0.86–2.21)
Jamaica	0.80 (0.62–1.04)	1.18 (0.99–1.42)*
Trinidad and Tobago	0.76 (0.35–1.66)	1.08 (0.63–1.88)
Other	1.36 (0.79–2.37)	1.15 (0.78–1.72)
U.S.-Born Blacks	Referent	Referent

Notes
*p ≤.05
**p≤.001
[a]Odds ratios adjusted for individual-level variables (year of HIV diagnosis, sex at birth, age, race, and mode of HIV transmission), and neighborhood-level variables (SES index and rural/urban status)
aOR= Adjusted Odds Ratio
CI= Confidence Interval

pervasive health disparities that impede access to primary care for racial minorities in the U.S.[20] There was a temporal improvement for U.S.-born Blacks, but no differences for Caribbean-born Blacks, suggesting that overall HIV screening appears to have improved for U.S.-born Blacks, but not for any other groups.

For those from the Caribbean, there are additional factors such as immigration status and acculturation stressors that may lead to delayed diagnosis. Bahamians and Haitians, who are historically marginalized populations in South Florida, and have less favorable indicators compared with other immigrant groups,[21] were the two groups that had persistently elevated odds ratios for delayed diagnosis. Unexpectedly, Bahamian-born Blacks who do not have the same language barrier, fared only slightly better than Creole/French speaking Haitian-born Blacks.

Economic disparity has been related to delayed diagnosis,[22] but there were unexpected results for the Haitian HIV-infected, as the role of neighborhood socioeconomic status had an inverse relationship with delayed diagnosis. Haitian immigrants in the two lower SES strata were less likely to have delayed HIV diagnosis. Potential reasons for this may be related to the strong social network that exists in Haitian immigrant enclaves in South Florida. Haitians are the largest Caribbean immigrant group in South Florida and have strong social networks in Little Haiti and other Miami environs, which typically have lower neighborhood SES.[23] Little Haiti in particular is undergoing revitalization, with

Table 4

ADJUSTED ODDS RATIOS AND 95% CONFIDENCE INTERVALS FOR DELAYED HIV DIAGNOSIS BY SELECTED CHARACTERISTICS, STRATIFIED BY COUNTRY/REGION OF BIRTH, FOR DELAYED HIV DIAGNOSIS AMONG BLACK U.S. CARIBBEAN-BORN NON-LATINOS AGED 13 YEARS AND OLDER, FLORIDA, 2000–2014[a]

	Country/Region of Birth			
	Bahamas aOR, (95% CI)	Haiti aOR, (95% CI)	Jamaica aOR, (95% CI)	U.S.-Born Blacks aOR, (95% CI)
Individual-level variables				
Year of HIV Diagnosis				
2000–2004	1.60 (.79–3.4)	1.13 (.98–1.31)	1.03 (.71–1.49)	**1.42 (1.33–1.51)****
2005–2009	1.93 (.91–4.15)	1.08 (.93–1.26)	1.03 (.71–1.50)	**1.24 (1.16–1.34)****
2010–2014	Referent	Referent	Referent	Referent
Sex at birth				
Male	1.88 (1.01–3.44)*	1.58 (1.40–1.78)*	2.17 (1.53–3.03)*	1.33 (1.23–1.42)**
Female	Referent	Referent	Referent	Referent
Age at HIV diagnosis				
20–39 years	1.61 (0.39–6.69)	2.34 (1.18–4.60)**	2.28 (.65–7.95)	2.6 (2.23–2.05)**
40–59 years	4.25 (1.50–18.08)*	4.36 (2.21–9.01)**	3.35 (.96–11.7)*	4.81 (4.11–5.63)**
60 years +	2.8 (0.46–16.95)	4.46 (2.21–9.01)**	6.02 (1.62–22.37)**	6.44 (5.36–7.70)**
13–19 years	Referent	Referent	Referent	Referent
HIV transmission mode				
IDU	2.12 (0.61–7.36)	1.09 (.74–1.62)	1.02 (.47–2.20)	.93 (.85–1.01)
MSM	0.59 (0.26–1.33)	1.08 (.88–1.32)	.64 (.41–.98)	.91 (.85–.98)
Other/unknown	2.81 (.046–16.95)	1.27 (1.1–1.47)*	1.43 (.9–2.12)	1.33 (1.23–1.44)**
Heterosexual	Referent	Referent	Referent	Referent

Table 4. (*continued*)

	Country/Region of Birth			
	Bahamas **aOR, (95% CI)**	**Haiti** **aOR, (95% CI)**	**Jamaica** **aOR, (95% CI)**	**U.S.-Born Blacks** **aOR, (95% CI)**
Neighborhood-level variables				
Socioeconomic level				
1 (lowest SES)	0.60 (0.19–1.89)	0.71 (0.55–0.92)*	1.17 (0.70–1.96)	1.00 (0.88–1.26)
2	0.43 (0.13–1.45)	0.74 (0.57–0.97)*	1.65 (0.61–1.81)	1.01 (0.89–1.14)
3	0.49 (0.14–1.77)	0.88 (0.65–1.18)*	1.44 (0.79–2.60)	0.94 (0.80–1.06)
4 (highest SES)	Referent	Referent	Referent	Referent
Rural vs. Urban				
Rural	—	1.07 (.53–2.17)	.57 (.17–1.91)	1.31 (1.14–1.52)*
Urban	Referent	Referent	Referent	Referent

a number of community-based organizations serving in the community.[24] These social networks might facilitate access to care, and allow for more routine testing through CBOs and other alternative community health care settings.[25] Haitian-born immigrants in the two highest SES groups, who may not necessarily be part of the Haitian immigrant enclaves in South Florida, constituted approximately 15% of the study population, and it is possible that the smaller number of cases in higher SES neighborhoods limited our ability to find an association in the more complex, multivariate models.

Compared with women, men consistently, across all groups including U.S.-born Blacks, were more likely to have delayed HIV diagnosis, and the association appeared to be strongest for Jamaican men (Table 4). Therefore, while U.S.-born Black men are being diagnosed later, the gender disparity was even greater for Jamaican men, possibly reducing their odds of survival or, successful management of the disease. With the exception of Bahamians, delayed diagnosis increased as age at diagnosis increased for all groups, including U.S.-born Blacks. However for older individuals, we do not know to what extent the difference is attributed to late screening or faster progression of the disease.[26] The phenomenon of delayed diagnosis among older individuals and men is not unique for Caribbean immigrants and U.S.-born Blacks, but is also seen in other populations in the U.S., Australia, Asia, and Europe.[13,18,19,27–37]

Delayed diagnosis was not associated with rural/urban status, or mode of transmission. The lack of variance in rural/urban status, and the smaller sample sizes for Caribbean countries, may not have allowed for differences to be detected in multivariate analysis. The majority of Caribbean immigrants (≥96%) resided in urban areas. Despite non-significant findings, the trend was for IDU to be associated with increased risk for delayed diagnosis among Bahamian, Haitian, and Jamaican immigrants.

Although this study identified a problem with delayed HIV diagnosis for some Caribbean immigrant groups, a deeper comprehensive analysis is needed to understand the complexity of the problem. Cultural considerations can influence perceived risk among Caribbean immigrants and may reinforce HIV testing avoidant behavior.[38] Pre-existing cultural norms from countries of birth that reinforce stigmatization of HIV-infected individuals can inhibit HIV testing behavior.[39] Language, which is not necessarily indicative of acculturation in strong immigrant enclaves, should also be evaluated, because it can be challenging for non-English speakers, such as Haitians, to secure employment or access social services, which can inhibit HIV testing behavior.[40]

Primary data collection on additional demographic factors and social determinants is needed to examine reasons for more delayed HIV diagnosis among Haitians and Bahamians, and gender differences in HIV risk perception that might explain more delayed diagnosis among men. Qualitative methods are also important to capture contextual and explanatory variables for delayed diagnosis among Caribbean immigrants. A final recommendation for future analysis is to use Latino immigrants as an additional reference group to determine if probabilities for delayed HIV screening for Caribbean Black immigrants will differ from Latino immigrants, and if those differences can be attributed in part to varying immigration experiences.

There is a possibility that cases in the study were previously diagnosed in their country of birth and are not true delayed HIV-diagnosis cases. A policy change implemented at the end of 2009 eliminated the requirement of mandatory HIV reporting for all

foreign-born immigrants to the United States,[41,42] and cases diagnosed after 2009 may have been misclassified as delayed diagnosis. A sensitivity analysis exploring delayed diagnosis pre- and post-2009 to assess the potential impact of the policy change on the findings was unsuccessful, as dividing the population decreased the sample size for Caribbean-born immigrants to an extent that the statistical models became unstable.

The analysis could not account for the role of acculturation and migratory patterns of immigrants who may travel frequently to their countries of birth; nor could it account for second-generation immigrants, or U.S.-born Blacks who were ethnically non-Latino Caribbean immigrants.

Conclusion. The study is consistent with the priorities of the National HIV/AIDS strategy to target all points on the HIV care continuum in at-risk populations.[42] Compared with U.S.-born Blacks, HIV-positive Bahamians and Haitians presented as the two groups with higher likelihoods for delayed HIV diagnosis; additionally, men had higher odds than women for delayed diagnosis; and finally older individuals were more likely to be diagnosed late. Results yielded from this study provide justification for targeting Caribbean immigrants, particularly Bahamians, Haitians, and Jamaicans, for promotion of routine HIV counseling and screening. The results also highlighted the potential role of cultural differences among Caribbean immigrants by country of birth, reinforcing the need for culturally tailored interventions to improve HIV testing rates for this population. This study suggests that race may not be the primary predictor of disparity in HIV screening and care, and that culture and social norms may have a greater role.

Additional recommendations include using longitudinal methods to evaluate if the risk of delayed diagnosis changes over time, or if U.S. acculturation influences rates of access to routine care and HIV testing. In other immigrant populations, acculturation has been shown to have either a protective role or to increase risk, depending on other contextual factors such as the socio-political environment of the host societies.[43] In immigrant enclaves such as those that exist in South Florida for Haitian and Cuban immigrants,[44] stronger social networks are developed as these communities receive more immigrants from one or two dominant sending countries. The social networks in the enclaves can be protective, as can be speculated in this study for Haitian immigrants.[45] In other communities, with less social support for immigrants, high-risk sexual behavior has been seen as a coping mechanism for acculturative stress.[46] High-risk sexual behavior combined with less health care access can exacerbate these immigrant populations' vulnerability for delayed diagnosis. Additionally, immigration policy and the culture of enforcement of immigration laws, can also affect the behavior of undocumented Black Caribbean immigrants. Undocumented immigrants may have a fear of deportation, which can be associated with lower rates of routine health care,[47] including HIV screening.

Immigration rates from the Caribbean region are consistently increasing in the U.S. and in South Florida, which is one of the epicenters of the U.S. HIV epidemic.[2] The findings presented here are consistent with other research that has found delayed HIV-diagnosis to be more prevalent among immigrants, men, and those who were older age at time of diagnosis.[39] Prevention efforts are important for this community of

foreign-born Black Caribbean immigrants, especially Haitians and Bahamians; however, equally important is routine HIV screening and early diagnosis. Additional studies are needed to determine which specific barriers and facilitators exist in each group, so that targeted culturally responsive interventions can be developed.

Acknowledgments

References

1. Saint-Jean G, Devieux J, Malow R, et al. Substance abuse, acculturation, and HIV risk among Caribbean-born immigrants in the United States. J Int Assoc Physicians AIDS Care (Chic). 2011;10(5):326–32.
   https://doi.org/10.1177/1545109711401749
   PMid: 21511982

2. McCabe K. Caribbean immigrants in the United States. Washington, DC: Migration Policy Institute, 2011 Apr 7. Available at: http://www.migrationpolicy.org/article/caribbean-immigrants-united-states.

3. Johnson AS, Hu X, Dean HD. Epidemiologic differences between native-born and foreign-born Black people diagnosed with HIV infection in 33 US states, 2001–2007. Public Health Rep. 2010;125(Suppl 4):61–9.
   https://doi.org/10.1177/00333549101250S410
   PMCid: PMC2882976

4. Florida Department of Health in Miami-Dade, Epidemiology, Disease Control and Immunization Services, HIV/AIDS Surveillance. HIV among the Haitian-born in Florida and Miami-Dade. Miami, FL: Florida Department of Health in Miami-Dade County, 2012. Available at: http://miamidade.floridahealth.gov/programs-and-services/infectious-disease-services/hiv-aids-services/_documents/2012-haitians.pdf

5. Ojikutu B, Nnaji C, Sithole-Berk J, et al. Barriers to HIV testing in Black immigrants to the U.S. J Health Care Poor Underserved. 2014 Aug; 25(3):1052–66.
   https://doi.org/10.1353/hpu.2014.0141
   PMid: 25130224

6. Hoffman S, Beckford Jarrett ST, Kelvin EA, et al. HIV and sexually transmitted infection risk behaviors and beliefs among Black West Indian immigrants and US-born Blacks. Am J Public Health. 2008 Nov;98(11):2042–50.
   https://doi.org/10.2105/AJPH.2006.106443
   PMid: 18309140

7. Fleming PL, Ward JW, Janssen RS, et al. Guidelines for national human immunodeficiency virus case surveillance, including monitoring for human immunodeficiency

virus infection and acquired immunodeficiency syndrome. MMWR Recomm Rep. 1999 Dec 10;48(RR-13):1–27, 29–31.
PMid: 10632297

8. Buehler M, Berkelman MRL. 1993 revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. MMWR Recomm Rep. 1992 Dec 18;41(RR-17):1–19.
PMid: 1361652

9. Surratt H, Inciardi J, Weaver J, et al. Emerging linkages between substance abuse and HIV infection in St. Croix, US Virgin Islands. AIDS Care. 2005 Jun; 17(Suppl):S26–35.
https://doi.org/10.1080/09540120500121151
PMid: 16096115

10. Surratt H. Sex work in the Caribbean basin: Patterns of substance use and HIV risk among migrant sex workers in the US Virgin slands. AIDS Care. 2007 Nov;19(10): 1274–82.
https://doi.org/10.1080/09540120701426490
PMid: 18071971

11. McCoy HV, Malow R, Edwards RW, et al. A strategy for improving community effectiveness of HIV/AIDS intervention design: the community readiness model in the Caribbean. Subst Use Misuse. 2007;42(10):1579–92.
https://doi.org/10.1080/10826080701212535
PMid: 17918028

12. Mukolo A, Villegas R, Aliyu M, et al. Predictors of late presentation for HIV diagnosis: a literature review and suggested way forward. AIDS Behav. 2013 Jan; 17(1):5–30.
https://doi.org/10.1007/s10461-011-0097-6
PMid: 22218723

13. Yang B, Chan SK, Mohammad N, et al. Late HIV diagnosis in Houston/Harris County, Texas, 2000–2007. AIDS Care. 2010 Jun;22(6):766–74.
https://doi.org/10.1080/09540120903431348
PMid: 20467939

14. Niyonsenga T, Trepka MJ, Lieb S, et al. Measuring socioeconomic inequality in the incidence of AIDS: rural-urban considerations. AIDS Behav. 2013 Feb;17(2):700–9.
https://doi.org/10.1007/s10461-012-0236-8
PMid: 22711226

15. Singh GK, Siahpush M. Increasing inequalities in all-cause and cardiovascular mortality among US adults aged 25–64 years by area socioeconomic status, 1969–1998. Int J Epidemiol. 2002 Jun;31(3):600–13.
https://doi.org/10.1093/ije/31.3.600
PMid: 12055162

16. Rural Health Research Center. Rural-urban commuting area codes. Seattle,WA: University of Washington. Available at: http://depts.washington.edu/uwruca/.

17. SAS Institute. The SAS System for Windows Version 9.4. Cary, NC: SAS Institute, 2011.

18. Castilla J, Sobrino P, de la Fuente L, et al. Late diagnosis of HIV infection in the era of highly active antiretroviral therapy: Consequences for AIDS incidence. AIDS. 2002 Sep 27;16(14):1945–51.
https://doi.org/10.1097/00002030-200209270-00012
PMid: 12351955

19. Trepka MJ, Fennie KP, Sheehan DM, et al. Late HIV diagnosis: differences by rural/ urban residence, Florida, 2007–2011. AIDS Patient Care STDS. 2014 Apr;28(4):188–97.

https://doi.org/10.1089/apc.2013.0362
PMid: 24660767

20. Allgood KL, Hunt B, Rucker MG. Black:White disparities in HIV mortality in the United States: 1990–2009. J Racial Ethn Health Disparities. 2016 Mar;3(1):168–75.
https://doi.org/10.1007/s40615-015-0141-8
PMid: 26896117

21. Grenier, G.J., Stepick III, A., ed. Miami Now! Immigration, Ethnicity and Social Change. Gainesville, FL: University of Florida, 1992 Sep 20.

22. Fisher M. Late diagnosis of HIV infection: major consequences and missed opportunities. Curr Opin Infect Dis. 2008 Feb;21(1):1–3.
https://doi.org/10.097/QCO.0b013e3282f2d8fb
PMid: 18192778

23. Nwosu C, Batalova J. Haitian immigrants in the United States. Washington, DC: Migration Policy Institute, 2014 May 29. Available at: http://www.migrationpolicy.org/article/haitian-immigrants-united-states-2

24. Metellus, G.M., Community Voices Miami, Little Haiti Community Collaborative. Health care needs and issues in Little Haiti: a Community Voices project report. Miami, FL: Haitian Neighborhood Center, Sant La, 2004. Available at: http://www.santla.org/docs/healthcareneedsandissuesinlittlehaiti.pdf

25. Joint United Nations Programme on HIV/AIDS (UNAIDS). Expanding access to HIV treatment through community-based organizations. Geneva, SUI: UNAIDS, 2005. Available at: http://data.unaids.org/Publications/IRC-pub06/jc1102-expandaccesstohivtreatm_en.pdf.

26. Nogueras M, Navarro G, Anton E, et al. Epidemiological and clinical features, response to HAART, and survival in HIV-infected patients diagnosed at the age of 50 or more. BMC Infect Dis. 2006 Nov 6;6:159.
https://doi.org/10.1186/1471-2334-6-159
PMid: 17087819

27. Ellman TM, Sexton ME, Warshafsky D, et al. A forgotten population: older adults with newly diagnosed HIV. AIDS Patient Care STDS. 2014 Oct;28(10):530–6.
https://doi.org/10.1089/apc.2014.0152
PMid: 25211596

28. Weis KE, Liese AD, Hussey J, et al. Associations of rural residence with timing of HIV diagnosis and stage of disease at diagnosis, South Carolina 2001–2005. J Rural Health. 2010 Summer;26(2):105–12.
https://doi.org/10.1111/j.1748-0361.2010.00271.x
PMid: 20446996

29. Adler A, Mounier-Jack S, Coker R. Late diagnosis of HIV in Europe: definitional and public health challenges. AIDS Care. 2009 Mar;21(3):284–93.
https://doi.org/10.1080/09540120802183537
PMid: 19031304

30. Chin T, Hicks C, Samsa G, et al. Diagnosing HIV infection in primary care settings: missed opportunities. AIDS Patient Care STDS. 2013 Jul;27(7):392–7.
https://doi.org/10.1089/apc.2013.0099
PMid:23802143

31. Hall HI, McDavid K, Ling Q, et al. Determinants of progression to AIDS or death after HIV diagnosis, United States, 1996 to 2001. Ann Epidemiol. 2006 Nov;16(11):824–33.

https://doi.org/10.1016/j.annepidem.2006.01.009
PMid: 17067817

32. Smith RD, Delpech VC, Brown AE, et al. HIV transmission and high rates of late diagnoses among adults aged 50 years and over. AIDS. 2010 Aug 24;24(13):2109–15.
https://doi.org/10.1097/QAD.0b013e32833c7b9c
PMid: 20616697

33. Thanawuth N, Chongsuvivatwong V. Late HIV diagnosis and delay in CD4 count measurement among HIV-infected patients in southern Thailand. AIDS Care. 2008 Jan;20(1):43–50.
https://doi.org/10.1080/09540120701439303
PMid: 18278614

34. Wolbers M, Bucher H, Furrer H, et al. Delayed diagnosis of HIV infection and late initiation of antiretroviral therapy in the Swiss HIV cohort study. HIV Medicine. 2008 Jul;9(6):397–405.
https://doi.org/10.1111/j.1468-1293.2008.00566.x.
PMid: 18410354

35. Wong K, Lee S, Low KH, et al. Temporal trend and factors associated with late HIV diagnosis in Hong Kong, a low HIV prevalence locality. AIDS Patient Care STDS. 2003 Sep;17(9):461–9.
https://doi.org/10.1089/108729103322395492
PMid: 14588084

36. Grabar S, Weiss L, Costagliola D. HIV infection in older patients in the HAART era. J Antimicrob Chemother. 2006 Jan;57(1):4–7.
https://doi.org/10.1093/jac/dki411
PMid: 16284223

37. Mojumdar K, Vajpayee M, Chauhan NK, et al. Late presenters to HIV care and treatment, identification of associated risk factors in HIV-1 infected Indian population. BMC Public Health. 2010 Jul 13;10:416.
https://doi.org/10.1186/1471-2458-10-416
PMid: 20626905

38. Schwarcz S, Richards TA, Frank H, et al. Identifying barriers to HIV testing: Personal and contextual factors associated with late HIV testing. AIDS Care. 2011 Jul;23(7):892–900.
https://doi.org/10.1080/09540121.2010.534436

39. Yazdanpanah Y, Lange J, Gerstoft J, et al. Earlier testing for HIV—How do we prevent late presentation? Antivir Ther (Lond). 2010;15 Suppl 1:17–24.
https://doi.org/10.3851/IMP1526
PMid: 20442457

40. Latino Commission on AIDS, Centers for Disease Control and Prevention. HIV prevention for immigrant and migrant communities: The research report. New York: New York State Department of Health AIDS Institute, 2001. Available at: https://www.latinoaids.org/publications/HIV_Prevention_Immigrant_Migrants.pdf.

41. Zaller ND, Fu JJ, Nunn A, et al. Linkage to care for HIV-infected heterosexual men in the United States. Clin Infect Dis. 2011 Jan 15;52 Suppl 2:S223–30.
https://doi.org/10.1093/cid/ciq046
PMid: 21342911

42. Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services (HHS). Medical examination of aliens—removal of human immuno-

deficiency virus (HIV) infection from definition of communicable disease of public health significance. Final rule. Fed Regist. 2009 Nov 2;74(210):56547–62.
PMid: 20166276

43.   Shedlin MG, Decena CU, Oliver-Velez D. Initial acculturation and HIV risk among new Hispanic immigrants. J Natl Med Assoc. 2005 Jul;97(7 Suppl):32S–37S.
PMid: 16080455

44.   Deren S, Shedlin M, Kang S, et al. HIV risk and prevention among Hispanic immigrants in New York: The salience of diversity. Subst Use Misuse. 2011;46(2–3):254–63.
https://doi.org/10.3109/10826084.2011.523215
PMid: 21303245

45.   Winett L, Harvey SM, Branch M, et al. Immigrant Latino men in rural communities in the Northwest: Social environment and HIV/STI risk. Cult Health Sex. 2011 Jun;13(6):643–56.
https://doi.org/10.1080/13691058.2011.565369
PMid: 21462005

46.   Battacharya G. Social capital and HIV risk among acculturation Asian Indian men in New York City. AIDS Educ Prev. 2005 Dec;51(6):555–67.
https://doi.orgl0.1521/aeap.2005.17.6.555
PMid: 16398577

47.   Berk ML, Schur CL, Chavez LR, Frankel M. Health care use among undocumented Latino immigrants. Health Aff (Millwood). 2000 Jul–Aug; 19(4):51–64.
https://doi.org/10.1377/hlthaff.19.4.51