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Role of Country of Birth, Testing Site, and Neighborhood Characteristics on Nonlinkage to HIV Care Among Latinos

Diana M. Sheehan, PhD, MPH,[1,2] Chelsea Cosner, BS,[3] Kristopher P. Fennie, PhD, MPH, MSc,[1] Merhawi T. Gebrezgi, BSc,[1] Elena Cyrus, PhD,[2] Lorene M. Maddox, MPH,[4] Julie H. Levison, MD, MPhil, MPH,[5] Emma C. Spencer, PhD, MPH,[4] Theophile Niyonsenga, PhD,[6] and Mary Jo Trepka, MD, MSPH[1]

Abstract

The objective of this study was to estimate disparities in linkage to human immunodeficiency virus (HIV) care among Latinos by country/region of birth, HIV testing site, and neighborhood characteristics. A retrospective study was conducted using Florida HIV surveillance records of Latinos/Hispanics aged ≥13 diagnosed during 2014–2015. Linkage to HIV care was defined as a laboratory test (HIV viral load or CD4) within 3 months of HIV diagnosis. Multi-level Poisson regression models were used to estimate adjusted prevalence ratios (aPR) for nonlinkage to care. Of 2659 Latinos, 18.8% were not linked to care within 3 months. Compared with Latinos born in mainland United States, those born in Cuba [aPR 0.60, 95% confidence interval (CI) 0.47–0.76] and Puerto Rico (aPR 0.61, 95% CI 0.41–0.90) had a decreased prevalence of nonlinkage. Latinos diagnosed at blood banks (aPR 2.34, 95% CI 1.75–3.12), HIV case management and screening facilities (aPR 1.76, 95% CI 1.46–2.14), and hospitals (aPR 1.42, 95% CI 1.03–1.96) had an increased prevalence of nonlinkage compared with outpatient general, infectious disease, and tuberculosis/sexually transmitted diseases/family planning clinics. Latinos who resided in the lowest (aPR 1.57, 95% CI 1.19–2.07) and third lowest (aPR 1.33, 95% CI 1.01–1.76) quartiles of neighborhood socioeconomic status compared with the highest quartile were at increased prevalence. Latinos who resided in neighborhoods with <25% Latinos also had increased prevalence of nonlinkage (aPR 1.23, 95% CI 1.01–1.51). Testing site at diagnosis may be an important determinant of HIV care linkage among Latinos due to neighborhood or individual-level resources that determine location of HIV testing.

Keywords: human immunodeficiency virus, linkage to care, Latinos, Hispanics, testing site, neighborhood

Introduction

Linkage to care is a critical step in the human immunodeficiency virus (HIV) continuum of care, with early linkage and enrolment in HIV care resulting in life expectancies similar to that of the general population for people living with HIV.[1,2] The National HIV/AIDS Strategy (NHAS) stated that by 2020 reduction in HIV infections and improvement in outcomes for people living with HIV should come by linking 85% of HIV-infected persons to care within 1 month of HIV diagnosis.[3] The current NHAS goals for screening, linkage, and retention in care could substantially reduce loss of life caused by HIV/AIDS in the United States (US).[4]

Hispanic/Latino people (hereinafter referred to as ''Latinos'') are diagnosed with HIV at approximately three times the rate of their non-Latino white counterparts.[5,6] Currently, 15% of Latinos diagnosed with HIV are not linked to care within 90 days of diagnosis.[7] In addition, linkage to care is lower among the overall population of Latinos living with HIV, as well as among Latino youth and Latino men who have sex with men (MSM), when compared with their non-Latino white counterparts.[7–9] Reported individual-level barriers to care for Latinos living with HIV have included documentation status and perceived risk of deportation, the complex nature of the US healthcare system, including provider–patient language barriers, and stigma from family and friends.[10–12]

[1]Department of Epidemiology, Robert Stempel College of Public Health and Social Work, Florida International University, Miami, Florida.
[2]Center for Substance Use and HIV/AIDS Research on Latinos in the United States (C-SALUD), Florida International University, Miami, Florida.
[3]Herbert Wertheim College of Medicine, Florida International University, Miami Florida.
[4]HIV/AIDS Section, Florida Department of Health, Tallahassee, Florida.
[5]Division of General Internal Medicine, Department of Medicine, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts.
[6]School of Population Health, University of South Australia, Adelaide, Australia.

Contextual characteristics about the neighborhood of residence at time of HIV diagnosis, such as the proportion of the population whose income is under the poverty level, the racial/ethnic composition, and rural/urban status, have also been associated with HIV outcomes among Latinos and other minorities, but their role in prompt linkage to HIV care among Latinos has not been explored.[13–18]

Despite disparities identified along other steps of the HIV care continuum and survival by country/region of birth for Latinos,[14,19–22] a systematic review of the literature found no studies that compared linkage to care within Latino populations in the United States by country/region of birth.[23] Further, different HIV testing sites, both in the healthcare and nonhealthcare setting, show a range in utilization by race and ethnicity.[24,25] Thus, for Latinos, it is important to consider both country/region of birth and specific testing site when examining and addressing linkage to HIV care at time of diagnosis. Therefore, the objective of this study was to estimate the magnitude of disparities in linkage to HIV care among Latinos by country/region of birth, HIV testing site, and neighborhood characteristics.

Methods

Datasets

Deidentified HIV surveillance records of individuals reported as Hispanic or Latino ethnicity were obtained from the Florida Department of Health (FDOH) enhanced HIV/AIDS reporting system (eHARS). All cases reported in eHARS must meet the Center for Disease Control and Prevention (CDC) HIV case definition.[26] Latino individuals were included in this study if they were diagnosed during 2014 or 2015 and were aged 13 or older. Individuals who died within 3 months of HIV diagnosis or who had missing or invalid data for ZIP code at time of diagnosis, a reported ZIP code with a population of zero based on American Community Survey (ACS), or cases diagnosed in a correctional facility were excluded. The 2009–2013 ACS was used to obtain characteristics of the neighborhood at time of diagnosis using ZIP code tabulation areas (ZCTAs).[27] ZCTAs are used by the US Census Bureau to tabulate summary statistics and approximate US Postal Service ZIP codes.[28]

Variables

Outcome.

Linkage to HIV care was defined as documentation of an HIV laboratory test (HIV viral load or CD4 cells/μL) within 3 months of HIV diagnosis.

Predictors

Individual-level variables. The following data for individuals were extracted from eHARS: ethnicity, race, year of HIV diagnosis, sex at birth, age at HIV diagnosis, county of birth, mode of HIV transmission, HIV testing site, time between HIV diagnosis and death in months, time between HIV and AIDS diagnosis (if case progressed to AIDS), time between HIV diagnosis and first viral load test, time between HIV diagnosis and first CD4 test, residential ZIP code at time of diagnosis, and whether the person was diagnosed at a correctional facility.

Country/region of birth was categorized into the following mutually exclusive areas: the United States (excluding Puerto Rico), Puerto Rico, Cuba, Mexico, Central America, South America, and other/unknown. The US Census Bureau Hispanic origin classification was used to select the countries included in the Central and South America categories.[29] Mode of HIV transmission was self-reported during HIV testing, reported by a healthcare provider, or extracted from medical chart reviews. Due to the small number of cases, males with the risk factors of both injection drug use and MSM ($n = 36$) were included in the injection drug use category.

Testing site variable. HIV testing site for each individual was extracted from eHARS and categorized into the following groups: Blood bank, HIV facility (HIV case management agencies and HIV counseling and testing sites), hospital (including emergency room departments), outpatient (general, infectious disease, tuberculosis/sexually transmitted disease/family planning clinic), and other/unknown (drug treatment center, laboratory, ''other,'' and ''missing'').

Neighborhood-level variables. Neighborhoods were defined by ZCTA. Based on previous work by Niyonsenga et al.,[30] 13 socioeconomic status (SES) indicators were extracted from the ACS by ZCTA to develop an SES index of Florida neighborhoods: percent of households without access to a car, percent of households with ≥1 person per room, percent of population living below the poverty line, percent of owner-occupied homes worth ≥$300,000, median household income in 2013, percent of households with annual income <$15,000, percent of households with annual income ≥$150,000, income disparity (derived from percent of households with annual income <$10,000 and percent of households with annual income ≥$50,000), percent of population aged ≥25 with less than a 12th grade education, percent of population aged ≥25 with a graduate professional degree, percent of households living in rented housing, percent of population aged ≥16 who were unemployed, and percent of population aged ≥16 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 percent of households with annual income <$10,000 divided by the percent of households with annual income ≥$50,000. In addition, we extracted the proportion of the population in each ZCTA that was Hispanic/Latino and categorized it into three categories: <25%, 25–49%, and ≥50%.[31,32] To categorize ZCTAs into rural or urban, we used Categorization C of Version 2.0 of the rural–urban commuting area codes, developed by the University of Washington WWAMI Rural Research Center.[33]

Statistical analyses

Development of neighborhood SES index.

To calculate the SES index, we coded all neighborhood-level variables from the ACS so that higher scores corresponded with lower SES (higher disadvantage); they were then standardized. Then we conducted 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 percent below poverty, median household income, percent of

households with annual income <$15,000, percent of households with annual income ≥$150,000, income disparity, percent of population age ≥25 with less than a 12th grade education, and high-class work. The resulting Cronbach's alpha increased (0.94).

We then conducted a principal component analysis (PCA) with and without varimax rotation. PCA revealed one component, which accounted for 73.49% of the variability in the indicators. Because all the original variables were highly correlated with the component (factor loadings 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.

Imputation of race. A total of 88 Latinos in our study were missing data on race. We used SAS software, version 9.4 (SAS Institute, Cary, NC 2002), to impute data for race. We created 10 datasets with imputed data for race using the Multiple Imputation (MI) Procedure in SAS. We used year of HIV diagnosis, sex, age, country of birth, and HIV transmission mode to predict race in a fully conditional specification model.[34] All subsequent analyses were fitted by imputation by constructing pooled estimates.

Bivariate and multi-variate analyses. Individual- and neighborhood-level data were merged by matching the current ZIP code of each case with the ZIP code's corresponding ZCTA. First, we conducted descriptive analyses comparing individual- (including testing site) and neighborhood-level characteristics by country/region of birth for Latinos. Second, we used SAS (SAS software, version 9.4, SAS Institute, Cary, NC 2002) GENMOD Procedure to estimate crude and adjusted prevalence ratios (aPRs) and 95% confidence intervals (CI) for nonlinkage to care. Models attempted using the binomial distribution and logarithm link function (log-binomial regression) did not converge. Therefore, prevalence ratios and 95% CI were estimated using Poisson regression models with robust error variance provided by the generalized estimating equation approach.[35] The repeated statement with ''subject = ZCTA'' was used to account for correlation among cases living in the same neighborhood (ZCTA).

We estimated prevalence ratios using three models: crude model (Model 1), a model adjusting for country of birth, race, sex at birth, age at diagnosis, year of diagnosis, mode of HIV transmission, HIV diagnosis facility, and AIDS within 3 months of diagnosis (Model 2), and a model adjusting for all variables in Model 2 plus ZCTA-level SES, rural/urban status, and percentage of the population that was Latino (Model 3). The Florida International University Institutional Review Board approved this study, and the FDOH Institutional Review Board designated this study to be nonhuman subjects research.

Results

Characteristics of population

Of 2777 Latinos diagnosed with HIV in Florida during 2014–2015, four were <13 years of age, 46 died within 3 months of HIV diagnosis, 39 had missing or invalid data for ZIP code at time of diagnosis, none had a reported ZIP code with a population of zero, and 21 were diagnosed in a correctional facility. After imputation of race, 75 individuals were of a race other than black or white. Due to the small number of individuals and heterogeneity of this group, they were excluded from further analysis.

Of the remaining 2659 Latinos, the largest proportions were born in Cuba (27.3%), mainland United States (26.5%), or South America (13.8%), and the majority were of white race (95.5%), male (88.3%), and between the ages of 25 and 49 (68.0%) years (Table 1). Seventy-three percent of Latinos reported MSM as a mode of HIV transmission, although the proportion varied by country/region of birth with most of those born in South America (84.2%) and Cuba (81.1%) but only 50.9% of those born in Central America reporting MSM. Of Latinos testing positive for HIV, 46.2% were tested at an outpatient clinical facility, and 31.4% were tested at an HIV counseling and testing or case management site.

In terms of neighborhood characteristics, 40.5% of Latinos resided in the lowest quartile of neighborhood SES, 98.9% in urban areas, and 43.1% in areas where greater than 50% of the population was Latino. While half of those born in Cuba and Central America lived in the lowest SES neighborhoods, only 30% of those born in South America did. Nearly three-quarters (72.9%) of those born in Cuba lived in a predominantly Latino neighborhood.

Linkage to HIV care

Of 2659 Latinos, 18.8% were not linked to care within 3 months of HIV diagnosis (Table 1). Compared with Latinos born in mainland United States, those born in Cuba (aPR 0.60, 95% CI 0.47–0.76) and Puerto Rico (aPR 0.61, 95% CI 0.41–0.90) had a decreased prevalence of nonlinkage to care (Table 2). Those diagnosed in 2014 compared with 2015 had an increased prevalence of nonlinkage (aPR 1.29, 95% CI 1.10–1.51), and those who had an AIDS diagnosis within 3 months of the HIV diagnosis had a decreased prevalence of nonlinkage (aPR 0.02, 95% CI 0.01–0.07).

Latinos diagnosed at blood banks (aPR 2.34, 95% CI 1.75–3.12), HIV case management and counseling and testing facilities (aPR 1.76, 95% CI 1.46–2.14), and hospitals (aPR 1.42, 95% CI 1.03–1.96) had an increased prevalence of nonlinkage to care compared with outpatient facilities. Latinos who resided in the lowest (aPR 1.10, 95% CI 1.04–1.17) and third lowest (aPR 1.33, 95% CI 1.01–1.76) quartiles of neighborhood SES compared with the highest quartile also had an increased prevalence of nonlinkage to care. Latinos who resided in neighborhoods with <25% Latinos also had increased prevalence of nonlinkage to care (aPR 1.23, 95% CI 1.01–1.51).

In post hoc analyses, we attempted to examine two-way interactions between country/region of birth, testing site, and neighborhood poverty. However, models with interactions between country/region of birth and testing site, and country/region of birth and neighborhood poverty did not converge due to small cell sizes.

Discussion

Between 2014 and 2015 in the state of Florida, linkage to care varied by country/region of birth, with nonlinkage to care within 3 months of HIV diagnosis more likely among mainland US-born Latinos than those born in Cuba and Puerto Rico. Nonlinkage was also more likely among Latinos who tested at a blood bank, HIV, and hospital facilities compared with Latinos who tested at outpatient facilities. Differences in linkage to care existed at the neighborhood-

Table 1. Latinos Aged 13 and Older Diagnosed with HIV Infection by Birth Country/Region and Selected Characteristics, Florida, 2014–2015

	All Latinos[a]	*United States-born Latinos*	*Puerto Rico*	*Mexico*	*Cuba*	*Central America*[b]	*South America*[c]	*Other*
Total (*n*)	2659	704 (26.5)	193 (7.3)	125 (4.7)	726 (27.3)	159 (6.0)	367 (13.8)	386 (14.5)
Individual-level variables								
Race[d]								
Black	121 (4.6)	53 (7.5)	9 (4.7)	1 (0.8)	27 (3.7)	4 (2.5)	4 (1.1)	23 (6.0)
White	2538 (95.5)	651 (92.5)	184 (95.3)	124 (99.2)	699 (96.3)	155 (97.5)	363 (98.9)	362 (94.0)
Sex at birth								
Female	310 (11.7)	94 (13.4)	36 (18.7)	8 (6.4)	54 (7.4)	29 (18.2)	26 (7.1)	63 (16.4)
Male	2349 (88.3)	610 (86.7)	157 (81.4)	117 (93.6)	672 (92.6)	130 (81.8)	341 (92.9)	322 (83.7)
Age at diagnosis								
13–24	440 (16.6)	199 (28.3)	23 (11.9)	18 (14.4)	92 (12.7)	18 (11.3)	41 (11.2)	49 (12.7)
25–49	1808 (68.0)	431 (61.2)	124 (64.3)	94 (75.2)	498 (68.6)	127 (79.9)	276 (75.2)	258 (67.0)
50 or older	411 (15.4)	74 (10.5)	46 (23.8)	13 (10.4)	136 (18.8)	14 (8.8)	50 (13.6)	78 (20.3)
Year of HIV diagnosis								
2014	1215 (45.7)	303 (43.0)	94 (48.7)	61 (48.8)	339 (46.7)	81 (50.9)	162 (44.1)	175 (45.5)
2015	1444 (54.3)	401 (57.0)	99 (51.3)	64 (51.2)	387 (53.3)	78 (49.1)	205 (55.9)	210 (54.6)
Mode of transmission								
Heterosexual	480 (18.1)	102 (14.5)	53 (27.5)	29 (23.2)	107 (14.7)	63 (39.6)	42 (11.4)	84 (21.8)
IDU	94 (3.5)	38 (5.4)	26 (13.5)	2 (1.6)	10 (1.4)	2 (1.3)	2 (0.5)	14 (3.6)
MSM	1941 (73.0)	520 (73.9)	107 (55.4)	87 (69.6)	589 (81.1)	81 (50.9)	309 (84.2)	249 (64.5)
Other/unknown	144 (5.4)	44 (6.3)	7 (3.6)	7 (5.6)	20 (2.8)	13 (8.2)	14 (3.8)	39 (10.1)
HIV diagnosis facility								
Blood bank	82 (3.1)	30 (4.3)	3 (1.6)	2 (1.6)	12 (1.7)	8 (5.0)	11 (3.0)	16 (4.2)
HIV counseling and testing or case management site	836 (31.4)	173 (24.6)	37 (19.2)	28 (22.4)	311 (42.8)	43 (27.0)	158 (43.1)	86 (22.3)
Hospital	264 (9.9)	67 (9.5)	29 (15.0)	24 (19.2)	47 (6.5)	25 (15.7)	20 (5.7)	51 (13.3)
Outpatient[e]	1229 (46.2)	357 (50.7)	110 (57.0)	56 (44.8)	294 (40.5)	62 (39.0)	149 (40.6)	201 (52.2)
Other/unknown[f]	248 (9.3)	77 (10.9)	14 (7.3)	15 (12.0)	62 (8.5)	21 (13.2)	28 (7.6)	31 (8.1)
AIDS in 3 months								
Yes	477 (17.9)	100 (14.2)	42 (21.8)	43 (34.4)	118 (16.3)	48 (30.2)	56 (15.3)	70 (18.2)
No	2182 (82.1)	604 (85.8)	151 (78.2)	82 (65.6)	608 (83.8)	111 (69.8)	311 (84.7)	315 (81.8)
Linkage to HIV care								
No	500 (18.8)	166 (23.6)	28 (14.5)	20 (16.0)	102 (14.1)	28 (17.6)	82 (22.3)	74 (19.2)
Yes	2159 (81.2)	538 (76.4)	165 (85.5)	105 (84.0)	624 (86.0)	131 (82.4)	285 (77.7)	311 (80.8)

(*continued*)

Table 1. (Continued)

	All Latinos[a]	*United States-born Latinos*	*Puerto Rico*	*Mexico*	*Cuba*	*Central America*[b]	*South America*[c]	*Other*
ZCTA-level variables								
SES index, quartiles								
1 (lowest)	1078 (40.5)	276 (39.2)	79 (40.9)	45 (36.0)	368 (50.7)	80 (50.3)	113 (30.8)	117 (30.4)
2	597 (22.5)	150 (21.3)	54 (28.0)	39 (31.2)	146 (20.1)	29 (18.2)	82 (22.3)	97 (25.2)
3	642 (24.1)	185 (26.3)	43 (22.3)	32 (25.6)	158 (21.8)	32 (20.1)	98 (26.7)	94 (24.4)
4 (highest)	342 (12.9)	93 (13.2)	17 (8.8)	9 (7.2)	54 (7.4)	18 (11.3)	74 (20.2)	77 (20.0)
RUCA classification								
Urban	2630 (98.9)	695 (98.7)	189 (97.9)	118 (94.4)	724 (99.7)	158 (99.4)	364 (99.2)	382 (99.2)
Rural	29 (1.1)	9 (1.3)	4 (2.1)	7 (5.6)	2 (0.3)	1 (0.6)	3 (0.8)	3 (0.8)
Percentage of population Hispanic/Latino								
≥50%	1147 (43.1)	209 (29.7)	45 (23.3)	30 (24.0)	529 (72.9)	57 (35.9)	154 (42.0)	123 (32.0)
25–49%	812 (30.5)	230 (32.7)	81 (42.0)	42 (33.6)	138 (19.0)	55 (34.6)	133 (36.2)	133 (34.6)
<25	700 (26.3)	265 (37.6)	67 (34.7)	53 (42.4)	59 (8.1)	47 (29.6)	80 (21.8)	129 (33.5)

Percentage may not add up to 100 due to rounding.

[a]Excludes the following: 46 who died within 3 months of HIV diagnosis, 39 who had missing or invalid data for ZIP code at time of diagnosis, and 21 who were diagnosed in a correctional facility.

[b]Includes Latinos born in Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

[c]Includes Latinos born in Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela.

[d]Race was missing for 88 Latinos who met our inclusion/exclusion criteria. After multiple imputation, 75 individuals were from a race other than black or white (American Indian/Alaskan Native, Asian, Native Hawaiian/Pacific Islander) and were excluded.

[e]Includes general, infectious disease, tuberculosis/sexually transmitted disease/family planning clinic.

[f]Includes drug treatment center, laboratory, ''other,'' and ''missing.''

AIDS, acquired immune deficiency syndrome; HIV, human immunodeficiency virus; IDU, injection drug use; MSM, male to male sexual contact; RUCA, rural urban commuting area; SES, socioeconomic status; ZCTA, ZIP code tabulation area.

Table 2. Nonlinkage to HIV Care by Individual and Neighborhood Characteristics Among Latinos Aged 13 Years and Older Diagnosed with HIV 2014–2015 in Florida

			Model 1	*Model 2*	*Model 3*
	Total, n	*Not linked to care,* n *(%)*	*Crude PR for nonlinkage to care (95% CI)*	*Adjusted PR for nonlinkage to care (95% CI)*	*Adjusted PR for nonlinkage to care (95% CI)*
Individual-level variables					
Country of birth					
US-born Latino	704	166 (23.6)	Referent	Referent	Referent
Central America	159	28 (17.6)	0.75 (0.50–1.11)	0.79 (0.52–1.20)	0.78 (0.55–1.10)
Cuba	726	102 (14.1)	0.60 (0.47–0.76)	0.59 (0.45–0.77)	0.60 (0.47–0.76)
Mexico	125	20 (16.0)	0.68 (0.43–1.08)	0.95 (0.58–1.53)	0.91 (0.62–1.36)
Other Latino	385	74 (19.2)	0.82 (0.62–1.07)	0.78 (0.58–1.04)	0.82 (0.64–1.03)
Puerto Rico	193	28 (14.5)	0.62 (0.41–0.92)	0.61 (0.40–0.94)	0.61 (0.41–0.90)
South America	367	82 (22.3)	0.95 (0.73–1.23)	0.92 (0.70–1.22)	0.97 (0.78–1.20)
Race					
Black	121	22 (18.2)	0.97 (0.63–1.48)	0.96 (0.61–1.49)	0.90 (0.60–1.35)
White	2538	478 (18.8)	Referent	Referent	Referent
Sex at birth					
Female	310	57 (18.4)	Referent	Referent	Referent
Male	2349	443 (18.9)	1.03 (0.78–1.35)	1.21 (0.85–1.73)	1.22 (0.91–1.64)
Age at diagnosis					
13–24	440	107 (24.3)	Referent	Referent	Referent
25–49	1808	323 (17.9)	0.73 (0.59–0.91)	0.89 (0.71–1.13)	0.91 (0.74–1.12)
50 or older	411	70 (17.0)	0.70 (0.52–0.95)	1.02 (0.74–1.42)	1.03 (0.76–1.42)
Year of HIV diagnosis					
2014	1215	262 (21.6)	1.31 (1.10–1.56)	1.29 (1.07–1.54)	1.29 (1.10–1.51)
2015	1444	238 (16.5)	Referent	Referent	Referent
Mode of HIV transmission					
Heterosexual	480	75 (15.6)	Referent	Referent	Referent
IDU	94	24 (25.5)	1.63 (1.03–2.59)	1.39 (0.83–2.34)	1.31 (0.82–2.10)
MSM	1941	343 (17.7)	1.13 (0.88–1.45)	0.80 (0.58–1.12)	0.80 (0.61–1.07)
Other/unknown	144	58 (40.3)	2.58 (1.83–3.63)	1.85 (1.27–2.70)	1.87 (1.41–2.49)
HIV diagnosis facility					
Outpatient	1229	180 (14.7)	Referent	Referent	Referent
Blood bank	82	43 (52.4)	3.58 (2.57–4.99)	2.34 (1.63–3.35)	2.34 (1.75–3.12)
HIV counseling and testing or case management site	836	213 (25.5)	1.74 (1.43–2.12)	1.74 (1.41–2.14)	1.76 (1.46–2.14)
Hospital	264	31 (11.7)	0.80 (0.55–1.17)	1.42 (0.97–2.10)	1.42 (1.03–1.96)
Other/unknown	248	33 (13.3)	0.91 (0.63–1.32)	0.96 (0.66–1.39)	0.96 (0.66–1.42)
AIDS in 3 months					
No	2182	498 (22.8)	Referent	Referent	Referent
Yes (AIDS)	477	2 (0.4)	0.02 (0.01–0.07)	0.02 (0.005–0.08)	0.02 (0.01–0.07)
ZCTA-level variables					
SES index, quartiles					
1 (lowest)	1078	225 (20.9)	1.33 (1.00–1.77)		1.57 (1.19–2.07)
2	597	105 (17.6)	1.15 (0.85–1.56)		1.33 (1.00–1.78)
3	642	116 (18.1)	1.19 (0.88–1.60)		1.33 (1.01–1.76)
4 (highest)	342	54 (15.8)	Referent		Referent
RUCA classification					
Urban	2631	496 (18.9)	Referent		Referent
Rural	29	5 (17.2)	0.96 (0.48–1.92)		1.24 (0.67–2.29)
Percentage of population Hispanic/Latino					
≥50%	1147	208 (18.1)	Referent		Referent
25–49%	812	145 (17.9)	0.91 (0.73–1.12)		0.90 (0.74–1.10)
<25	700	147 (21.0)	1.16 (0.95–1.41)		1.23 (1.01–1.51)

Model 1: Crude rates (each variable in a separate model).

Model 2: Controlling for individual-level variables (country of birth, race, sex at birth, age at diagnosis, year of diagnosis, mode of HIV transmission, HIV diagnosis facility, and AIDS within 3 months of diagnosis).

Model 3: Controlling for individual-level variables and neighborhood-level variables (ZCTA-level SES, rural/urban status, and percentage of the population who was Hispanic/Latino).

AIDS, acquired immune deficiency syndrome; CI, confidence interval; HIV, human immunodeficiency virus; IDU, injection drug use; MSM, male to male sexual contact; PR, prevalence ratio; RUCA, rural urban commuting area; SES, socioeconomic status; US, United States; ZCTA, ZIP code tabulation area.

level such that nonlinkage was more likely among Latinos who resided in neighborhoods of lower SES and those in neighborhoods with low Latino population density.

The proportion of Latinos who were not linked to care within 3 months of an HIV diagnosis in our Florida study (18.8%) was similar to findings from two studies of Latinos with HIV in 19 US jurisdictions using National HIV Surveillance System (NHSS) data from 2010 (19.7%) and 2011 (18%).[6,36] Similar to our study, these two previous studies used laboratory data to define linkage to HIV care services. Our finding was not consistent with a study of Latinos in the United States, Puerto Rico, and US Virgin Islands that examined individuals diagnosed in 2014 using National HIV Prevention Program Monitoring and Evaluation (NHM&E) data and found a 3-month nonlinkage to care rate of 38.9%.[5]

Methodological differences may explain these discrepant outcomes. The study conducted by Rao et al.[5] was of publicly funded testing events, and thus, its results would be most comparable with cases in our study tested at HIV counseling and testing or case management sites where nonlinkage was higher (25.5%) than the overall percentage. In addition, Rao et al. defined linkage to care by attendance to first medical appointment.[5] Our study used the date of the first laboratory test. It is possible, that in some settings a laboratory test is ordered before the first medical appointment in light of a positive HIV test.[37] Rao et al. also stated that their findings represent the minimum percentage of Latinos linked to care and that their calculations likely underestimate the actual percentage of individuals linked by including records with invalid data in the denominator.[5]

Our findings suggest that Latinos born in Cuba and Puerto Rico are more likely to be linked to care within 3 months of HIV diagnosis than mainland US-born Latinos. In a recent study by our group, Latinos living with HIV who were born in Cuba were also more likely to be retained in HIV care and be virally suppressed than US-born Latinos.[22] Presumably our findings are not due to differences in access to care given that Latinos born in Cuba (due to their refugee status) and Puerto Rico (due to birth in a US territory) have similar legal provisions for accessing care than US-born Latinos.[38] However, differences in SES between these groups that affect eligibility for HIV services such as the Ryan White HIV/AIDS Program may play a role in these results.

Studies of healthcare utilization among Latino groups have reported mixed findings. For example, a study using data from the National Health Interview Survey found that Cubans were more likely to delay or forgo care than other Latino heritage groups.[39] However, they also found that Puerto Ricans were less likely than any other group to delay or forgo care. A second study using a national sample of Latinas found that Puerto Ricans had the highest rate of mental health service utilization and Cubans the highest rate of specialized care utilization compared with other Latino heritage groups.[40] It is important to note that our study compared Latinos by country/region of birth and not heritage. Our data do not allow us to identify the heritage of US-born Latinos; thus, our cultural discussion of this group is limited. It is also important to highlight that Cubans are the predominant Latino ethnic origin group in Florida and that increased exposure to Cuban social networks may provide a protective effect.

Our study did not find differences in linkage to care by race, sex, or age. In addition, we did not find differences by mode of HIV transmission except for the ''other/unknown'' category. We were unable to identify any study that examined disparities in linkage to HIV care by race among Latinos. Our finding that men, women, and individuals in varying age groups have similar linkage to care is consistent with a study of Latinos in 19 US jurisdictions.[6]

Testing at a blood bank, HIV counseling and testing site or case management site, or a hospital compared with an outpatient facility was a significant predictor of nonlinkage to care among Latinos in our study. Previous studies have suggested that if the person who provided the patient with a positive HIV diagnosis scheduled the follow-up appointment, the patient was more likely to be linked to care.[24,41] It is possible that this level of assistance linking individuals to HIV care is not possible at blood banks. It is also possible that individuals testing at blood banks are different in demographics, risk perception, access to care, HIV disclosure preferences, or neighborhood factors from those testing in other settings. For example, in our study, 26.8% of blood bank cases had no identified or reported risk factor compared with 5.0% of outpatient facilities cases. In our study, HIV facilities included HIV screening sites.

These sites may have included health departments, community testing sites, or mobile testing units. A CDC study that examined linkage to care by HIV testing site reported that the proportion of newly diagnosed persons linking to care within 3 months was lower for nonhealthcare community HIV testing sites (67.7%) compared with primary care clinic (89.2%) and STD clinic testing sites (85.3%).[25] Similar findings were observed in two other studies.[42,43]

Our study found a marginal difference in the prevalence of nonlinkage to care between hospitals and outpatient facilities. Due to the way cases are reported in Florida, our group of Latinos diagnosed at hospitals/inpatient facilities included Latinos diagnosed at emergency room settings. Therefore, the increased prevalence of nonlinkage to care among those diagnosed in hospital settings may be a reflection of emergency room testing that does not lead to hospitalization. Linkage to care among individuals diagnosed in emergency departments (86.8%) has been reported to be lower than among individuals diagnosed in primary care settings (89.2%) and inpatient facilities (94.4%).[25]

Latinos who resided in the lowest and third lowest quartiles of neighborhood SES were at increased prevalence of nonlinkage to care in our study. Neighborhood poverty has been associated with HIV outcomes, particularly with survival after HIV diagnosis, in other studies.[13–16,18] Possible mechanism for these associations could be increased psychosocial stress among individuals who live in disadvantaged neighborhoods, decreased positive social networks, and fewer health and social support services.[44–46] Notably, in a previous study by our group, we were unable to find an association between neighborhood SES status and retention in HIV care or viral load suppression among Latinos, suggesting that the mechanisms for the effect are different for each step along the HIV care continuum.[47]

Our study also found a marginal increased prevalence among Latinos residing in areas where <25% of the population identified as Latino/Hispanic compared with areas where ≥50% of the population was Latino. In a previous study that examined delayed HIV diagnosis among Latinos, residing in an area with <25% Latino population density was also a risk factor compared with areas with ≥50% Latinos.[48]

These findings may reflect a shortage of culturally targeted support services in nonpredominant Latino communities. Future studies are needed to explore characteristics of low and high Latino density areas, such as geographically clustered social capital or social support networks, that may explain the relationship between Latino population density and continuum of care outcomes.[49] Our study did not find a significant association between rural/urban status and linkage to care.

Our study has four main limitations. First, limited research suggests that foreign-born Latinos may be seeking care in their home countries. Therefore, we may underestimate linkage to care by examining care in the United States only.[50,51] Second, laboratory tests may be ordered before a medical visit. Thus, defining linkage to care by laboratory test only may overestimate the proportion of Latinos linked to HIV care.[37] Third, HIV surveillance systems do not collect information on heritage, limiting our discussion of cultural factors affecting US-born Latinos. Finally, testing facility type for HIV tests performed at emergency room departments in Florida hospitals are documented as inpatient/hospital facility. Therefore, it was not possible for us to determine the associated risk of nonlinkage to care among Latinos tested in emergency settings.

Blood banks and HIV testing facilities appear to be two important junctures for intervention where Latinos who are likely to link to care late get tested and diagnosed for HIV. Further, Latinos residing in areas of low SES and in areas of low Latino population density may require additional help linking to HIV care after diagnosis. The protective associations observed among Latinos born in Cuba and Puerto Rico should be explored further to determine the extent that culture, heritage, and social capital influence linkage to care.

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Author Disclosure Statement

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Address correspondence to:
Diana M. Sheehan, PhD, MPH
Department of Epidemiology
Robert Stempel College of Public Health and Social Work
Florida International University
11200 SW 8th Street
AHC 5, Room 479
Miami, FL 33199

E-mail: dsheehan@fiu.edu