HHS Public Access

Author manuscript

J Immigr Minor Health. Author manuscript; available in PMC 2018 August 01.

Published in final edited form as:

J Immigr Minor Health. 2017 August ; 19(4): 825–834. doi:10.1007/s10903-016-0422-2.

Individual and Neighborhood Determinants of Late HIV Diagnosis Among Latinos, Florida, 2007–2011

Diana M. Sheehan[1,2], **Mary Jo Trepka**[1,2], **Kristopher P. Fennie**[2], **Guillermo Prado**[3], **Purnima Madhivanan**[2], **Frank R. Dillon**[4], and **Lorene M. Maddox**[5]

[1]Center for Substance Use and HIV/AIDS Research on Latinos in the United States (C-SALUD), Florida International University, 11200 SW 8th St, Miami, FL 33199, USA

[2]Department of Epidemiology, Robert Stempel College of Public Health and Social Work, Florida International University, 11200 SW 8th St, AHC 5, Room 478, Miami, FL 33199, USA

[3]Department of Public Health Sciences, University of Miami Miller School of Medicine, 1120 NW 14th St, Miami, FL 33136, USA

[4]Department of Educational and Counseling Psychology, School of Education, University at Albany – State University of New York, 1400 Washington Ave, Albany, NY 12222, USA

[5]HIV/AIDS Section, Florida Department of Health, 4052 Bald Cypress Way, Tallahassee, FL 32399, USA

Abstract

The objective of this study was to examine individual and neighborhood determinants of late HIV diagnosis by gender and birthplace among Latinos. Florida HIV surveillance data for 2007–2011 were merged with American Community Survey data to estimate the odds of late HIV diagnosis (AIDS within 3 months of HIV diagnosis). Of 5522 HIV-positive Latinos, 26.5 % were diagnosed late. The odds ratio (OR) for late diagnosis was 1.39 times higher for males than females [95 % confidence interval (CI) 1.14–1.69]. Neighborhood-level factors associated with late diagnosis included residing in the 3 highest quartiles of neighborhood unemployment for males. The OR was 1.22 times higher for foreign- than US-born Latinos (95 % CI 1.07–1.40). Among foreign-born, residing in areas in the 2nd and 3rd quartiles of unemployment, in rural areas, and areas with

Correspondence to: Mary Jo Trepka.

Author Contribution

To our knowledge this is the first study to identify neighborhood-level predictors of late HIV diagnosis for Latinos beyond rural/urban differences. Findings suggest that HIV testing campaigns in areas with high unemployment are not reaching Latino males. Additionally, foreign-born Latinos in rural and predominantly non-Latino areas appear to be at greater risk of late HIV diagnosis.

Conflict of interest

DM Sheehan declares no conflicts of interest. MJ Trepka declares no conflicts of interest. KP Fennie declares no conflicts of interest. G Prado declares no conflicts of interest. P Madhivanan declares no conflicts of interest. FR Dillon declares no conflicts of interest. LM Maddox declares no conflicts of interest.

Ethical Approval

All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The Florida International University and Florida Department of Health Institutional Review Boards approved this study.

Informed Consent

This study conducted secondary data analysis of de-identified state-level administrative data, and therefore, informed consent was not applicable.

<25 % Hispanic/Latino population were associated with late diagnosis. Population-based HIV testing campaigns may require tailoring to ensure that they effectively reach male Latinos in areas with high unemployment and foreign-born Latinos in rural and predominantly non-Latino areas.

Keywords

Latinos; Foreign-born Latinos; Human immunodeficiency virus; Acquired immune deficiency syndrome; Late diagnosis

Background

An estimated 20 % of Latinos with human immunodeficiency virus (HIV) are not aware of their HIV status [1], and over 40 % are diagnosed with acquired immunodeficiency syndrome (AIDS) within 12 months of an HIV diagnosis [2]. Nearly half of HIV transmissions in the US are from persons unaware of their HIV infection [3] who may continue risky sexual and drug-related behaviors, unknowingly putting others at risk. Moreover, concurrent HIV and AIDS diagnosis, and subsequent delayed treatment, increase the risk of poor health outcomes [4] and doubles the risk of HIV-related mortality [5].

Concurrent HIV and AIDS diagnosis is most often due to delayed HIV screening (i.e. late HIV diagnosis). Late diagnosis has, therefore, been frequently measured as a short HIV-to-AIDS interval ranging from 1 to 12 months [2, 5–7]. Reported predictors of late HIV diagnosis among Latinos include male sex, older age [2, 6], injection drug use (IDU), high-risk heterosexual contact [6], birth outside of the US [2], and being Spanish-speaking [7]. A study of Latinos diagnosed with HIV in 33 states and 5 US-dependent areas found males to be 40 % more likely to be diagnosed late compared with females after controlling for individual-level covariates [6]. Furthermore, Latinos born in Mexico and Central America were over 2 times more likely to be diagnosed late with HIV compared with US-born Latinos [6].

In addition to demographics, area level factors might also influence the timing of HIV diagnosis. Areas with low socioeconomic status (SES) have been associated with high HIV rates [8, 9] and low AIDS survival [5, 10]. Neighborhood poverty has also been shown to partially account for racial/ethnic disparities in HIV/AIDS survival [11, 12] and antiretroviral initiation [12]. Although few studies have examined the role of neighborhood factors on late HIV diagnosis [5, 13], research suggests that residential neighborhood might predict availability and utilization of health care [14, 15] and preventive services. [16–18] Ethnic composition of neighborhoods has also been linked to health outcomes [19, 20] and health care utilization [14–18] among the general Latino population, but has not been examined among HIV-positive Latinos.

To date, we did not identify studies that examined the role of neighborhood SES and ethnic composition on late HIV diagnosis among Latinos. However, an earlier Florida study showed that 26 % of Latinos diagnosed in urban areas, and 43 % of Latinos diagnosed in rural areas were diagnosed late with HIV indicating that late HIV diagnosis is common [13]. Given Florida’s large and diverse Latino population and that Florida has the 7th highest HIV

incidence rate and 3rd highest number of HIV cases among Latinos in the US, [21] this study was undertaken to (1) examine individual and neighborhood determinants of late HIV diagnosis (operationalized as AIDS within 3 months of HIV) among Latinos and (2) compare differences in the context of gender and country of birth.

Methods

Study Population

De-identified HIV surveillance data were obtained from the Florida Department of Health Enhanced HIV/AIDS Reporting System (eHARS). Latinos, ages 13 and over, who met the Centers for Disease Control and Prevention (CDC) case definition for HIV [22] between 2007 and 2011 were included. Cases with missing or invalid data for zip code at time of HIV diagnosis (n = 271), and cases diagnosed in a correctional facility (n = 102) were excluded.

Individual- and Neighborhood-Level Variables

The following individual-level variables were extracted from eHARS: year of HIV diagnosis, sex at birth; age at HIV diagnosis; HIV transmission mode; birth country; HIV-to-AIDS interval in months (if case progressed to AIDS); residential zip code at time of HIV diagnosis; and whether the case was diagnosed at a correctional facility. Late HIV diagnosis was defined as AIDS diagnosis within 3 months of HIV diagnosis. A 3-month time period was chosen to allow for comparison to a recent CDC study using HIV surveillance data [23]. Latinos were classified as US-born if they were born in any of the 50 states, District of Columbia, Puerto Rico, or any US dependent area, and foreign-born if born elsewhere. The US- versus foreign-born categorization was used to stratify the analysis. The “birthplace” variable was a further categorization of place of birth and included: US (excluding Puerto Rico), Puerto Rico, Cuba, Mexico, Central America, South America, and other. The “birthplace” variable was used to describe the sample and for models where we stratified by gender. The 2011 American Community Survey/Census Bureau Hispanic origin classification was used to define the Central and South America categories [24].

Neighborhood-level variables were obtained from the 2007–2011 American Community Survey (ACS) [25]. Zip codes were matched to a corresponding zip code tabulation area (ZCTA). ZCTAs are generalized areal representations of zip code service areas used by the ACS to tabulate summary statistics [26]. There were 983 ZCTAs in Florida 2007–2011. On average, ZCTAs had a population size of 19,012, and were 66 % non-Latino white, 17 % Latino, and 14 % non-Latino black [25]. Extracted ZCTA-level characteristics were: percent of the population living below the poverty line; percent of the population aged 16 years and older who are unemployed; percent of the population aged 18 years and older that was a high school graduate; and percent of the population who identified as Hispanic or Latino. Neighborhood-level SES variables were divided into quartiles of the Florida population. Based on previous research [27, 28], the percent of Hispanics/Latinos in the ZCTA was divided into 3 categories: <25, 25–49, and ≥50 %. Version 2.0 of Rural-Urban Commuting Area (RUCA) codes, developed by the University of Washington WWAMI Rural Research Center [29], were used to divide ZCTAs into rural or urban status. RUCA codes divide zip codes into urban and rural levels based on population dispersion and commuting patterns.

We combined codes using categorization C of the RUCA codes. Categorization C allowed us to address the small number of cases in rural towns by combining the RUCA codes for large rural cities, small rural towns, and isolated small rural towns [29].

Analysis

Latinos were categorized as having a late HIV diagnosis or not. Timing of HIV diagnosis was compared across individual- and neighborhood-level variables using chi-square tests for categorical variables. The bivariate analyses were repeated comparing Latinos by gender and US/foreign-born status. An $\alpha \leq 0.25$ was used to determine which individual- and neighborhood-level variables to include in the multilevel logistic regression models [30]. Multilevel (level 1: individual; level 2: ZCTA) modeling was used to account for correlation among cases living in the same ZCTA. SAS GLIMMIX procedure was used to calculate crude (OR) and adjusted (aOR) odds ratios, treating ZCTA as a random effect. Models were stratified by gender and US- versus foreign-born status. SAS software, version 9.3 (SAS Institute, Cary, NC 2002) was used to conduct all analyses. The Florida International University and Florida Department of Health Institutional Review Boards approved this study.

Results

Of the 5522 Latinos who met the inclusion criteria, 1462 (26.5 %) were diagnosed with AIDS within 3 months of an HIV diagnosis (Table 1). The proportion of females (28.9 %) and males (26.0 %) diagnosed late with HIV was similar ($p = 0.0657$). Late HIV diagnosis was more common among foreign- (28.5 %) compared with US-born (23.7 %) Latinos ($p < 0.0001$).

Male Versus Female Latinos

The adjusted odds of late diagnosis was 1.39 times higher for males compared with females [95 % confidence interval (CI) 1.14–1.69] (not in table). Being diagnosed with HIV at 25 years of age or older compared with 13–24 and being born in Mexico or Central America were independently associated with higher odds of late diagnosis in both females and males (Table 2). For females only, being born in Puerto Rico was marginally associated with late diagnosis. Mode of transmission of men who have sex with men (MSM) compared with heterosexual transmission was associated with lower odds of late diagnosis for males. Neighborhood factors were not associated with late diagnosis for females. Males residing in neighborhoods with higher unemployment compared with the lowest unemployment quartile were at higher odds of late diagnosis.

US Versus Foreign-Born Latinos

The adjusted odds of late diagnosis was 1.22 times higher for foreign- compared with US-born Latinos (95 % CI 1.07–1.40) (not in table). Being 25 years or older at time of diagnosis compared with 13–24 was associated with higher odds of late HIV diagnosis for both US-born and foreign-born Latinos (Table 3). Reporting the HIV transmission mode of MSM compared with heterosexual sex was associated with lower odds of late diagnosis for both groups. For foreign-born Latinos only, being male compared with female, and residing in the

second and third highest quartiles of neighborhood unemployment compared with the lowest quartile, the third highest quartile of high school graduates compared with the highest quartile, an area with <25 % compared with ≥50 % Hispanic/Latino population, and in a rural compared with an urban area was associated with higher odds of late HIV diagnosis.

Discussion

Our study found that 26.5 % of Latinos diagnosed with HIV 2007–2011 in Florida were diagnosed late; similar to 2011 national rates (27.4 %) [23], and to Florida rates for non-Latino whites (25.6 %) and blacks (28.7 %) [13]. Older age was a risk factor among both sexes and among US- and foreign-born Latinos. Latinos born in Mexico and Central America were significantly more likely to be diagnosed late compared with US-born Latinos. Higher neighborhood unemployment was associated with an increased risk of late diagnosis among males. Neighborhood-level variables were not associated with late diagnosis among females or US-born Latinos. However, neighborhood unemployment, education, and percent Hispanic/Latino were associated with late diagnosis for foreign-born Latinos.

Diagnosis of HIV as an adult (24–49 years) and older adult (50 years and older) compared with youth (13–24 years) was a strong predictor of late diagnosis in this study, consistent with previous research among Latinos [2, 6]. While this may be at least partially due to faster disease progression among older individuals [31], this may also be a consequence of adults and older adults having a greater opportunity to be diagnosed late by having more possible years to progress from HIV exposure to AIDS (if exposed young). It is important for future research to differentiate between accelerated progression of HIV, where individuals who are infected with HIV develop AIDS quickly providing little opportunity for effective screening, and late diagnosis, where individuals spend many years with HIV before developing AIDS but are not screened, to determine if strategies to improve HIV testing are needed. Nevertheless, the incidence of HIV among older adult Latinos is high [32], and over 80 % of Latinos over the age of 48 have never been tested for HIV [33].

The finding that males are at increased odds of late HIV diagnosis is consistent with national results [2, 6, 34]. A study of Latinos in 33 states and 5 US-dependent areas found the adjusted odds of late diagnosis to be 1.4 times higher for males compared with females (95 % CI 1.2–1.6) [6]. This might reflect the low HIV testing rates among male compared with female Latinos [33]. Our result of foreign- versus US-born Latinos is also consistent with a national study that reported an adjusted prevalence ratio of 1.2, 95 % CI 1.16–1.24 [2]. However, a separate study in Los Angeles found no difference between foreign- and US-born Latinos [7] suggesting that Latinos, or HIV testing outreach strategies, in Florida differ from those in California.

Our study found 41 % of HIV-positive Latinos born in Mexico and 37 % born in Central America were diagnosed late. Moreover, they had over twice the odds of late diagnosis compared with US-born Latinos. These results are similar to aggregate results for the US (Mexico aOR 2.2, 95 % CI 1.8–2.5; Central America aOR 2.5, 95 % CI 2.0–3.2) [6]. Among

Latinos in the US, Mexicans are more likely to report never having been tested for HIV compared with Puerto Ricans, Central and South Americans, and other Latinos [33].

We did not find that neighborhood poverty was associated with late diagnosis despite its association with other adverse outcomes such as lower AIDS survival. Neighborhood poverty was not associated with delayed HIV diagnosis in an earlier study of Floridians that included non-Latino blacks, non-Latino whites, and Latinos [13]. This may be due to enhanced outreach efforts in Florida in poorer communities and that HIV testing is generally free of charge. In our study, males who resided in the three highest quartiles of unemployment had higher odds of late diagnosis compared with those who resided in the lowest quartile of unemployment. A study of National Health Interview Survey data found no difference in HIV testing between Latinos who were unemployed compared with those who were employed [33]. This suggests that a structural, rather than an individual-level mechanism may be playing a role. Of note, neighborhood-level factors examined in our study were not associated with late diagnosis among females. Previous research has suggested gender differences in social and structural determinants of health including socioeconomic factors and social support, with social support being more important for women and job security more important for men [35–37].

In our study, neighborhood-level variables were associated with late HIV diagnosis among foreign- but not US-born Latinos. For foreign-born Latinos, living in the 2nd and 3rd highest quartiles of unemployment increased the odds of late diagnosis. Although foreign-born Latinos (1.8 %) are less likely to be unemployed compared to US-born Latinos (2.8 %), they are more likely to be uninsured (49.3 versus 18 %, respectively) [38]. This might reflect work in industries that are less likely to offer employer-based health insurance [39]. Residing in a neighborhood with a low Latino ethnic density also increased the odds of late HIV diagnosis for foreign-born Latinos. A previous study by Gaskin et al. [15] found Latinos more likely to have an office-based physician visit when they resided in predominately Latino communities than non-Latino whites and blacks in Latino areas. The authors suggested this may be due to Latinos in predominantly Latino areas having better access to social networks and a higher rate of language-concordant patient/provider interactions. Communities with a larger proportion of Latinos might specifically target HIV testing strategies, outreach, and other resources to Latinos, including the provision of information in Spanish [40–42]. Although our study controlled for neighborhood SES, it is important to note that ethnic density was negatively correlated with neighborhood educational attainment (Pearson correlation −0.49, p value <0.0001), and unemployment (−0.22, p value <0.0001), and positively correlated with neighborhood poverty (0.15, p value <0.0001). Factors not measured in this study related to lower educational attainment and higher poverty in high ethnic density areas may be putting Latinos at risk for late diagnosis.

Finally, the proportion of Latinos diagnosed late with HIV was significantly higher in rural (42.1 %) compared with urban (26.2 %) areas, consistent with previous Florida [13] and US studies of Latinos [2]. The odds of late diagnosis was higher in rural compared with urban areas in the fully adjusted model but only for foreign-born Latinos. Only one study has compared late diagnosis among Latinos in rural and urban areas using multivariate models [2]. In this previous study, Espinoza et al. [2] found a higher prevalence of late diagnosis

among Latinos residing in rural versus urban areas in 40 states and Puerto Rico. The study did not account for neighborhood SES or ethnic composition, and did not stratify by gender or US birth. Foreign-born Latinos in rural areas may experience lower individual-level SES and may include migrant farm workers with unique and added barriers to HIV testing. It is also possible that the few number of rural cases (n = 88) limited our power to find an association in the models stratified by gender and among US-born Latinos.

This study is not without limitations. First, our definition of late HIV diagnosis differed from previous studies examining Latinos, which used a 12-month HIV-to-AIDS interval [2, 6]. However, it was important to match our definition to the CDC national report for comparison [23]. Nevertheless, sensitivity analysis using a 12-month HIV-to-AIDS interval revealed similar estimates of late HIV diagnosis in our population compared to the national study (31.4 %) [2]. In addition, we used the date of HIV and AIDS diagnosis from Florida HIV surveillance records. It is possible that some foreign-born cases were diagnosed at a previous date in their country of birth, or that some foreign-born cases returned to their birth country and were subsequently diagnosed with AIDS within our study period but not recorded in our database. Second, our dataset did not contain individual-level SES, length of time in the US or documentation status, language of preference, health insurance status, level of acculturation, or perceived risk for HIV. These variables may be important predictors of late diagnosis [33]. Furthermore, individual-level SES particularly is important because it is possible that the association between residing in a neighborhood with high poverty and late HIV diagnosis differs for individuals whose individual-level income is above the poverty level or above the mean neighborhood level. Third, we were only able to study neighborhood factors at the ZCTA-level, as it was the smallest geographic unit available in the dataset. Finally, our study may not be generalizable to the predominantly Mexican foreign-born Latino population in the US as our sample of foreign-born Latinos was largely Cuban. Despite this difference, our results appear to parallel several national studies of Latinos suggesting a higher degree of generalizability than expected. Further study of delayed HIV diagnosis among other ethnic groups such as non-Hispanic blacks would be useful especially in Florida which has both a sizeable foreign-born and US-born black population [25].

The findings of this study suggest that adult and older adult Latinos, and Latinos who are male and born in Mexico and Central America are not fully benefiting from existing HIV testing programs. HIV testing outreach among Latinos should target efforts to reach these individuals more effectively. Furthermore, population-based HIV testing campaigns designed to reach Latinos may need to be enhanced and expanded in areas with high unemployment and areas that are rural. Innovative approaches need to be developed to serve hard-to-reach Latinos in non-Latino areas. It may be important for future studies to also examine neighborhoods with a high proportion of early HIV diagnoses, as these neighborhoods could provide important information for future structural level HIV testing efforts.

Acknowledgments

Research reported in this publication was supported by the National Institute on Drug Abuse (NIDA) under Award Number F31DA037790 and by the National Institute on Minority Health and Health Disparities (NIMHD) under award 5R01MD004002 of the National Institutes of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Funding

This study was funded by the National Institute on Drug Abuse (NIDA) under Award Number F31DA037790 and by the National Institute on Minority Health & Health Disparities (NIMHD) under award 5R01MD004002 of the National Institutes of Health.

References

1. Chen M, Rhodes PH, Hall HI, Kilmarx PH, Branson BM, Valleroy LA. Prevalence of undiagnosed HIV infection among persons aged ≥13 years—National HIV Surveillance System, United States, 2005–2008. MMWR Morb Mortal Wkly Rep. 2012; 61:57–64.
2. Espinoza L, Hall HI, Hu X. Diagnoses of HIV infection among Hispanics/Latinos in 40 states and Puerto Rico, 2006–2009. J Acquir Immune Defic Syndr. 2012; 60(2):205–13. [PubMed: 22334071]
3. Hall HI, Holtgrave DR, Maulsby C. HIV transmission rates from persons living with HIV who are aware and unaware of their infection. AIDS. 2012; 26(7):893–6. [PubMed: 22313960]
4. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med. 2011; 365(6):493–505. [PubMed: 21767103]
5. Hanna DB, Pfeiffer MR, Torian LV, Sackoff JE. Concurrent HIV/AIDS diagnosis increases the risk of short-term HIV-related death among persons newly diagnosed with AIDS, 2002–2005. AIDS Patient Care STDS. 2008; 22(1):17–28. [PubMed: 18095838]
6. Espinoza L, Hall HI, Selik RM, Hu X. Characteristics of HIV infection among Hispanics, United States 2003–2006. J Acquir Immune Defic Syndr. 2008; 49(1):94–101. [PubMed: 18667927]
7. Wohl AR, Tejero J, Frye DM. Factors associated with late HIV testing for Latinos diagnosed with AIDS in Los Angeles. AIDS Care. 2009; 21(9):1203–10. [PubMed: 20024781]
8. Lopez-De Fede A, Stewart J, Hardin J, Mayfield-Smith K, Sudduth D. Spatial visualization of multivariate datasets: an analysis of STD and HIV/AIDS diagnosis rates and socioeconomic context using ring maps. Public Health Rep. 2011; 126(3):115–26. [PubMed: 21836744]
9. Ishida K, Arnold M, Stupp P, Kizito P, Ichwara J. Exploring the connections between HIV serostatus and individual, household, and community socioeconomic resources: evideance from two population-based surveys in Kenya. Soc Sci Med. 2012; 74(2):185–95. [PubMed: 22169625]
10. McFarland W, Chen S, Hsu L, Schwarcz S, Katz M. Low socioeconomic status is associated with a higher rate of death in the era of highly active antiretroviral therapy, San Francisco. J Acquir Immune Defic Syndr. 2003; 33(1):96–103. [PubMed: 12792361]
11. Trepka MJ, Niyonsenga T, Maddox L, Spencer L, Lutfi K, Pavlova-McCalla E. Community poverty and trends in racial/ethnic survival disparities among people diagnosed with AIDS in Florida, 1993–2004. Am J Public Health. 2013; 103(4):717–26. [PubMed: 23409892]
12. Arnold M, Hsu L, Pipkin S, McFarland W, Rutherford GW. Race, place and AIDS: the role of socioeconomic context on racial disparities in treatment and survival in San Francisco. Soc Sci Med. 2009; 69(1):121–8. [PubMed: 19443092]
13. Trepka MJ, Fennie KP, Sheehan DM, Lutfi K, Maddox L, Lieb S. Late HIV diagnosis: differences by rural/urban residence, Florida, 2007–2011. AIDS Patient Care STDS. 2014; 28(4):188–97. [PubMed: 24660767]
14. Haas JS, Phillips KA, Sonneborn D, McCulloch CE, Baker LC, Kaplan CP, Perez-Stable EJ, Liang SY. Variation in access to health care for different racial/ethnic groups by racial/ethnic composition of individual's county of residence. Med Care. 2004; 42(7):704–14.
15. Gaskin DJ, Dinwiddie GY, Chan KS, McCleary R. Residential segregation and disparities in health care utilization. Med Care Rese Rev. 2012; 69(2):158–75.

16. Kaestle CE, Wiles BB. Targeting high–risk neighborhoods for tobacco prevention education in schools. Am J Public Health. 2010; 100(9):1708–13. [PubMed: 20019323]
17. Quinn BC, Catalano RA, Felber E. The effect of community-level unemployment on preventive oral health care utilization. Health Serv Res. 2009; 44(1):162–81. [PubMed: 18793212]
18. Benjamins MR, Kirby JB, Bond Huie SA. County characteristics and racial and ethnic disparities in the use of preventive services. Prev Med. 2004; 39(4):704–12. [PubMed: 15351536]
19. Becares L, Shaw R, Nazroo J, Stafford M, Albor C, Atkin K, et al. Ethnic density effect on physical morbidity, mortality, and health behaviors: a systematic review of the literature. Am J Public Health. 2012; 102(12):e33–66.
20. Inagami S, Borell LN, Wong MD, Fang J, Shapiro MF, Asch SM. Residential segregation and Latino, black and white mortality in New York City. J Urban Health. 2006; 83(3):406–20. [PubMed: 16739044]
21. Centers for Disease Control and Prevention. NCHHSTP Atlas. Atlanta, GA: Centers for Disease Control and Prevention; http://gis.cdc.gov/GRASP/NCHHSTPAtlas/main.html. Retrieved Aug 2014
22. Schneider E, Whitmore S, Glynn MK, Dominguez K, Mitsch A, McKenna MT. Revised surveillance case definitions for HIV infection among adults, adolescents, and children aged <18 months and for HIV infection and AIDS among children aged 18 months to <13 years—United States. MMWR Morb Mortal Wkly Rep. 2008; 57(RR10):1–8. [PubMed: 18185492]
23. Centers for Disease Control and Prevention. HIV Surveillance Report 2013. Vol. 18. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2013. Monitoring selected national HIV prevention and care objectives by using HIV surveillance data–United States and 6 US dependent areas-2011. http://www.cdc.gov/hiv/pdf/2011_monitoring_hiv_indicators_hssr_final.pdfRetrieved Sept 2014
24. American Community Survey. American Community Survey and Puerto Rico Community Survey 2011 code list. Washington, DC: American Community Survey United States Census Bureau; 2011. http://www.census.gov/acs/www/Downloads/data_documentation/CodeLists/2011_ACS_Code_Lists.pdf. Retrieved Sept 2014
25. American Community Survey. American Community Survey 5–year estimates. Washington, DC: American Community Survey United States Census Bureau; 2011. http://factfinder2.census.gov. Retrieved Jan 2014
26. United States Census Bureau. Geography: ZIP Code Tabulation Areas (ZCTAs). Washington, DC: United States Census Bureau; http://www.census.gov/geo/reference/zctas.html. Retrieved April 2013
27. Alvarez KJ, Levy BR. Health advantages of ethnic density for African American and Mexican American elderly individuals. Am J Public Health. 2012; 102(12):2240–2. [PubMed: 23078490]
28. Shaw RJ, Pickett KE, Wilkinson RG. Ethnic density effects on birth outcomes and maternal smoking during pregnancy in the US Linked Birth and Infant Death data set. Am J Public Health. 2010; 100(4):707–13. [PubMed: 20167891]
29. WWAMI Rural Health Research Center. Rural Urban Commuting Areas (RUCA). Seattle, WA: WWAMI Rural Health Research Center; http://depts.washington.edu/uwruca/. Retrieved Sept 2014
30. Hosmer, DW., Lemeshow, S. Applied Logistic Regression. 2. New York: John Wiley and Sons, Inc; 2000.
31. Langford SE, Anaworanich J, Cooper DA. Predictors of disease progression in HIV infection: a review. AIDS Res Ther. 2007; 4:11.doi: 10.1186/1742-6405-4-11 [PubMed: 17502001]
32. Linley L, Prejean J, An Q, Chen M, Hall HI. Racial/ethnic disparities in HIV diagnoses among persons aged 50 years and older in 37 US states, 2005–2008. Am J Public Health. 2012; 102(8): 1527–34. [PubMed: 22698035]
33. Lopez-Quintero C, Shtarkshall R, Neumark YD. Barriers to HIV–testing among Hispanics in the United States: analysis of the National Health Interview Survey, 2000. AIDS Patient Care STDS. 2005; 19(10):672–83. [PubMed: 16232051]
34. Espinoza L, Hall HI, Hardnett F, Selik RM, Ling Q, Lee M. Characteristics of persons with heterosexually acquired HIV infection, United States 1999–2004. Am J Public Health. 2007; 97(1):144–9. [PubMed: 17138918]

35. Matthews S, Manor O, Power C. Social inequalities in health: are there gender differences? Soc Sci Med. 1999; 48(1):49–60. [PubMed: 10048837]

36. Denton M, Walters V. Gender differences in structural and behavioral determinants of health: an analysis of the social production of health. Soc Sci Med. 1999; 48(9):1221–35. [PubMed: 10220021]

37. Ballantyne PJ. The social determinants of health: a contribution to the analysis of gender differences in health and illness. Scand J Public Health. 1999; 27(4):290–5. [PubMed: 10724473]

38. Brown, A., Patten, E. Statistical portrait of Hispanics in the United States, 2012. Washington, DC: Pew Research; 2014. http://www.pewhispanic.org/2014/04/29/statistical-portrait-of-hispanics-in-the-united-states-2012/#persons-without-health-insurance-by-age-race-and-ethnicity-2012Retrieved Sept 2014

39. Brown, A., Patten, E. Statistical portrait of the foreign–born population in the United States, 2012. Washington, DC: Pew Research; 2014. http://www.pewhispanic.org/2014/04/29/statistical-portrait-of-the-foreign-born-population-in-the-united-states-2012/Retrieved Sept 2014

40. Whitley R, Prince M, McKenzie K, Stewart R. Exploring the ethnic density effect: a qualitative study of a London electoral ward. Int J Soc Psychiatry. 2006; 52(4):376–91. [PubMed: 17262983]

41. Lee MA. Neighborhood residential segregation and mental health: a multilevel analysis on Hispanic Americans in Chicago. Soc Sci Med. 2009; 68:1975–84. [PubMed: 19359082]

42. White K, Haas JS, Williams DR. Elucidating the role of place in health care disparities: the example of racial/ethnic residential segregation. Health Serv Res. 2012; 47(3):1278–99. [PubMed: 22515933]

Table 1

Characteristics of Latinos with late HIV diagnosis (AIDS diagnosis within 3 months of HIV diagnosis) versus those without late diagnosis (no AIDS diagnosis within 3 months of HIV diagnosis), Florida, 2007–2011

Characteristic	Total, n[a]	Late diagnosis (AIDS diagnosis within 3 months of HIV diagnosis)		p value[b]
		Yes n (%)	No n (%)	
Total	5522	1462 (26.5)	4060 (73.5)	
Individual-level variables, n (%)				
Year of HIV diagnosis				0.5259
2007	1225	303 (24.7)	922 (75.3)	
2008	1140	311 (27.3)	829 (72.7)	
2009	1097	299 (27.3)	798 (72.7)	
2010	1048	272 (26.0)	776 (74.1)	
2011	1012	277 (27.4)	735 (72.6)	
Sex at birth				0.0657
Male	4584	1191 (26.0)	3393 (74.0)	
Female	938	271 (28.9)	667 (71.1)	
Age group at diagnosis				< 0.0001
13–24 years	756	109 (14.4)	647 (85.6)	
25–49 years	3799	983 (25.9)	2816 (74.1)	
50 years or older	967	370 (38.3)	597 (61.7)	
Mode of transmission				< 0.0001
IDU[c]	342	101 (29.5)	241 (70.5)	
MSM	3254	703 (21.6)	2551 (78.4)	
Heterosexual	1340	441 (32.9)	899 (67.1)	
Other/unknown	586	217 (37.0)	369 (63.0)	
US- versus foreign-born				< 0.0001
US-born[d]	2290	542 (23.7)	1748 (76.3)	
Foreign-born	3232	920 (28.5)	2312 (71.5)	
Birthplace				< 0.0001
United States	1828	410 (22.4)	1418 (77.6)	
Puerto Rico	462	132 (28.6)	330 (71.4)	
Cuba	909	201 (22.1)	708 (77.9)	
Mexico	325	134 (41.2)	191 (58.8)	
Central America[e,f]	535	196 (36.6)	339 (63.4)	
South America[e,g]	582	142 (24.4)	440 (75.6)	
Other[h]	881	247 (28.0)	634 (72.0)	
ZCTA-level variables, n (%)				
Percent of population below poverty line (average 2007–2011), quartiles				0.2546
<8.7	410	108 (26.3)	302 (73.7)	
8.7–12.9	1186	304 (25.6)	882 (74.4)	

Characteristic	Total, n[a]	Late diagnosis (AIDS diagnosis within 3 months of HIV diagnosis)		*p* value[b]
		Yes n (%)	No n (%)	
13.0–19.3	1951	496 (25.4)	1455 (74.6)	
≥19.4	1975	554 (28.1)	1421 (72.0)	
Percent of population 16 and older who is unemployed (average 2007–2011), quartiles				0.0012
<4.2	940	202 (21.5)	738 (78.5)	
4.2–5.5	1041	278 (26.7)	763 (73.3)	
5.6–7.2	1447	389 (26.9)	1058 (73.1)	
≥7.3	2094	593 (28.3)	1501 (71.7)	
Percent of population 18 years and older that is a high school graduate (average 2007–2011), quartiles				0.0034
≥92.1	514	111 (21.6)	403 (78.4)	
86.9–92.0	1031	292 (28.3)	739 (71.7)	
80.4–86.8	1657	409 (24.7)	1248 (75.3)	
<80.4	2320	650 (28.0)	1670 (72.0)	
Percent of population who identified themselves as Hispanic/Latino				0.1155
≥50	2017	509 (25.2)	1508 (74.8)	
25–49	1668	436 (26.1)	1232 (73.9)	
<25	1837	517 (28.1)	1320 (71.9)	
RUCA classification[i]				0.0008
Rural	88	37 (42.1)	51 (58.0)	
Urban	5434	1425 (26.2)	4009 (73.8)	

US United States, *ZCTA* zip code tabulation area, *IDU* injection drug use, *MSM* male to male sexual contact, *RUCA* Rural–Urban Commuting Area. Percentage may not add up to 100 due to rounding

[a] Excludes cases diagnosed in a correctional facility, missing residential zip code at time of HIV diagnosis, or diagnosed under the age of 13

[b] *p* value from Chi square tests

[c] Includes cases reported as both IDU and MSM/IDU

[d] Category includes cases born in any of the 50 states, District of Columbia, or any US dependency

[e] Category defined based on the 2011 American Community Survey/Census Bureau Hispanic origin classification

[f] Includes cases born in the following countries: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama

[g] Includes cases born in the following countries: Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela

[h] Includes cases identified as “Hispanic/Latino” and born in countries other than the United States, Puerto Rico, Mexico, Cuba, Central American and South America with the exception of Brazil. This category includes cases born in Brazil (n = 112) and the Dominican Republic (n = 94)

[i] Classified as rural or urban based on categorization C from the Rural–Urban Commuting Area (RUCA) data codes developed by the University of Washington WWAMI Rural Research Center

Table 2

Odds ratios and 95 % confidence intervals for late HIV diagnosis (AIDS diagnosis within 3 month of HIV diagnosis) for Latinos reported with HIV by gender, Florida, 2007–2011

	Females			Males		
	Crude OR (95 % CI)	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**	**Crude OR (95 % CI)**	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**
Individual-level variables						
Age group at diagnosis						
13–24 years	Referent	Referent	Referent	Referent	Referent	Referent
25–49 years	2.30 (1.34–3.97)	2.44 (1.39–4.27)	2.49 (1.41–4.39)	2.03 (1.61–2.57)	1.91 (1.50–2.43)	1.99 (1.56–2.53)
50 years or older	3.55 (1.98–6.35)	3.68 (2.01–6.76)	3.86 (2.08–7.14)	3.71 (2.85–4.84)	3.53 (2.67–4.66)	3.64 (2.75–4.82)
Mode of transmission						
Heterosexual	Referent	Referent	Referent	Referent	Referent	Referent
IDU[c]	0.70 (0.38–1.30)	0.70 (0.37–1.32)	0.70 (0.37–1.34)	0.73 (0.54–0.99)	0.83 (0.61–1.13)	0.82 (0.60–1.13)
MSM	–	–	–	0.44 (0.37–0.53)	0.54 (0.45–0.65)	0.56 (0.47–0.68)
Other/unknown	1.44 (0.99–2.10)	1.52 (1.04–2.24)	1.49 (1.00–2.21)	0.95 (0.74–1.22)	0.95 (0.74–1.24)	0.93 (0.72–1.21)
Birthplace						
United States	Referent	Referent	Referent	Referent	Referent	Referent
Puerto Rico	1.87 (1.17–2.99)	1.63 (1.00–2.64)	1.66 (1.01–2.72)	1.26 (0.96–1.64)	1.08 (0.82–1.42)	1.06 (0.81–1.40)
Cuba	1.64 (0.94–2.85)	1.34 (0.76–2.37)	1.36 (0.75–2.46)	0.93 (0.76–1.15)	0.78 (0.63–0.97)	0.82 (0.65–1.02)
Mexico	3.26 (1.51–7.04)	3.61 (1.64–7.94)	3.51 (1.58–7.80)	2.35 (1.81–3.06)	2.20 (1.68–2.88)	2.16 (1.64–2.84)
Central America	2.07 (1.31–3.25)	1.91 (1.20–3.03)	1.96 (1.22–3.15)	1.98 (1.57–2.50)	1.78 (1.40–2.27)	1.82 (1.42–2.33)
South America	1.38 (0.77–2.48)	1.11 (0.61–2.01)	1.22 (0.66–2.25)	1.08 (0.85–1.37)	1.02 (0.80–1.30)	1.06 (0.83–1.36)
Other	1.48 (0.99–2.22)	1.20 (0.79–1.81)	1.22 (0.80–1.87)	1.32 (1.07–1.62)	1.11 (0.89–1.37)	1.12 (0.91–1.39)
ZCTA-level variables						
Percent of population below poverty line (average 2007–2011), quartiles						
< 8.7	Referent	*d*	*d*	Referent	*d*	Referent
8.7–12.9	1.36 (0.69–2.66)			0.95 (0.70–1.29)		0.81 (0.59–1.11)
13.0–19.3	1.37 (0.73–2.59)			0.99 (0.74–1.32)		0.79 (0.57–1.09)
≥19.4	1.28 (0.69–2.39)			1.15 (0.86–1.54)		0.77 (0.53–1.10)
Percent of population 16 and older who is unemployed (average 2007–2011), quartiles						
< 4.2	Referent	*d*	*d*	Referent	*d*	Referent

	Females			Males		
	Crude OR (95 % CI)	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**	**Crude OR (95 % CI)**	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**
4.2–5.5	1.19 (0.67–2.14)			1.28 (0.96–1.71)		1.37 (1.06–1.78)
5.6–7.2	1.20 (0.69–2.07)			1.27 (0.97–1.67)		1.29 (1.01–1.66)
≥7.3	1.16 (0.69–1.96)			1.44 (1.11–1.87)		1.33 (1.03–1.72)
Percent of population 18 years and older that is a high school graduate (average 2007–2011), quartiles						
≥92.1	Referent	*d*	Referent	Referent	*d*	Referent
86.9–92.0	1.75 (0.93–3.29)		1.82 (0.95–3.49)	1.35 (1.00–1.83)		1.51 (1.10–2.07)
80.4–86.8	1.35 (0.74–2.48)		1.47 (0.78–2.76)	1.27 (0.95–1.70)		1.36 (0.97–1.90)
< 80.4	1.67 (0.94–2.97)		1.86 (1.00–3.47)	1.43 (1.08–1.90)		1.45 (1.00–2.10)
Percent of population who identified themselves as Hispanic/Latino						
≥50	Referent	*d*	Referent	Referent	*d*	Referent
25–49	0.72 (0.50–1.04)		0.78 (0.52–1.16)	1.23 (0.99–1.52)		1.14 (0.93–1.39)
< 25	0.99 (0.71–1.38)		1.22 (0.82–1.83)	1.23 (1.01–1.50)		1.10 (0.89–1.36)
RUCA classification						
Urban	Referent	*d*	*d*	Referent	*d*	Referent
Rural	1.49 (0.53–4.15)			2.02 (1.22–3.34)		1.60 (0.96–2.68)

US United States, *ZCTA* zip code tabulation area, *IDU* injection drug use, *MSM* male to male sexual contact, *RUCA* Rural–Urban Commuting Area, *OR* odds ratio, *aOR* adjusted odds ratio, *CI* confidence interval

[a] Adjusted for individual-level variables with $\alpha \leq 0.25$ in bivariate analysis

[b] Adjusted for individual-level variables and ZCTA-level variables with $\alpha \leq 0.25$ in bivariate analysis

[c] IDU and IDU/MSM categories have been combined to address small cell numbers

[d] Variable not included in the model

Table 3

Odds ratios and 95 % confidence intervals for late HIV diagnosis (AIDS diagnosis within 3 month of HIV diagnosis) for Latinos reported with HIV by US- versus foreign-born, Florida, 2007–2011

	US-born Latinos			Foreign-born Latinos		
	Crude OR (95 % CI)	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**	**Crude OR (95 % CI)**	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**
Individual-level variables						
Gender						
Female	Referent	Referent	Referent	Referent	Referent	Referent
Male	0.91 (0.72–1.15)	1.28 (0.95–1.74)	1.29 (0.95–1.75)	0.78 (0.63–0.97)	1.41 (1.09–1.81)	1.38 (1.06–1.78)
Age group at diagnosis						
13–24 years	Referent	Referent	Referent	Referent	Referent	Referent
25–49 years	2.06 (1.54–2.77)	1.99 (1.48–2.67)	1.99 (1.48–2.69)	1.98 (1.43–2.72)	1.87 (1.35–2.58)	2.05 (1.47–2.86)
50 years or older	3.22 (2.26–4.59)	2.87 (2.00–4.11)	2.85 (1.98–4.10)	3.70 (2.62–5.23)	3.15 (2.22–4.48)	3.56 (2.48–5.11)
Mode of transmission						
Heterosexual	Referent	Referent	Referent	Referent	Referent	Referent
IDU[c]	1.07 (0.76–1.51)	0.92 (0.64–1.33)	0.91 (0.63–1.32)	0.82 (0.54–1.27)	0.76 (0.49–1.18)	0.76 (0.48–1.19)
MSM	0.70 (0.56–0.89)	0.66 (0.48–0.89)	0.66 (0.49–0.89)	0.48 (0.40–0.58)	0.46 (0.37–0.57)	0.51 (0.41–0.64)
Other/unknown	1.28 (0.91–1.81)	1.14 (0.79–1.64)	1.13 (0.78–1.63)	1.11 (0.86–1.43)	1.06 (0.82–1.38)	1.02 (0.78–1.34)
ZCTA-level variables						
Percent of population below poverty line (average 2007–2011), quartiles						
<8.7	Referent	*d*	*d*	Referent	*d*	Referent
8.7–12.9	0.90 (0.61–1.32)			1.06 (0.72–1.55)		0.95 (0.63–1.43)
13.0–19.3	0.90 (0.62–1.31)			1.09 (0.75–1.57)		0.99 (0.65–1.51)
≥19.4	0.83 (0.57–1.20)			1.38 (0.96–1.99)		1.11 (0.70–1.77)
Percent of population 16 and older who is unemployed (average 2007–2011), quartiles						
<4.2	Referent	*d*	*d*	Referent	*d*	Referent
4.2–5.5	1.21 (0.84–1.76)			1.42 (1.01–2.02)		1.45 (1.04–2.04)
5.6–7.2	1.11 (0.79–1.57)			1.56 (1.12–2.17)		1.43 (1.04–1.97)
≥7.3	1.27 (0.92–1.76)			1.61 (1.17–2.21)		1.23 (0.88–1.73)
Percent of population 18 years and older that is a high school graduate (average 2007–2011), quartiles						
≥92.1	Referent	*d*	*d*	Referent	*d*	Referent

	US-born Latinos			Foreign-born Latinos		
	Crude OR (95 % CI)	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**	**Crude OR (95 % CI)**	**aOR[a] (95 % CI)**	**aOR[b] (95 % CI)**
86.9–92.0	1.25 (0.85–1.85)			1.58 (1.09–2.30)		1.68 (1.12–2.52)
80.4–86.8	1.20 (0.83–1.74)			1.33 (0.93–1.91)		1.34 (0.87–2.06)
<80.4	1.20 (0.83–1.73)			1.58 (1.12–2.22)		1.57 (0.98–2.51)
Percent of population who identified themselves as Hispanic/Latino						
≥50	Referent	*d*	Referent	Referent	*d*	Referent
25–49	1.01 (0.77–1.32)		0.95 (0.73–1.24)	1.26 (0.98–1.62)		1.24 (0.95–1.61)
<25	1.19 (0.94–1.52)		1.13 (0.88–1.44)	1.30 (1.03–1.65)		1.37 (1.05–1.79)
RUCA classification						
Urban	Referent	*d*	Referent	Referent	*d*	Referent
Rural	1.55 (0.76–3.12)		1.32 (0.65–2.68)	2.24 (1.24–4.06)		2.01 (1.08–3.73)

US United States, *ZCTA* zip code tabulation area, *IDU* injection drug use, *MSM* male to male sexual contact, *RUCA* Rural–urban commuting area, *OR* odds ratio, *aOR* adjusted odds ratio, *CI* confidence interval

[a] Adjusted for individual-level variables with $\alpha \leq 0.25$ in bivariate analysis

[b] Adjusted for individual-level variables and ZCTA-level variables with $\alpha \leq 0.25$ in bivariate analysis

[c] IDU and IDU/MSM categories have been combined to address small cell numbers

[d] Variable not included in the model