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Original article

## Racial-ethnic differences in all-cause and HIV mortality, Florida, 2000–2011

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## ABSTRACT

**Purpose:** We compared all-cause and human immunodeficiency virus (HIV) mortality in a population-based, HIV-infected cohort.**Methods:** Using records of people diagnosed with HIV during 2000–2009 from the Florida Enhanced HIV-acquired immunodeficiency syndrome (AIDS) Reporting System, we conducted a proportional hazards analysis for all-cause mortality and a competing risk analysis for HIV mortality through 2011 controlling for individual-level factors, neighborhood poverty, and rural-urban status and stratifying by concurrent AIDS status (AIDS within 3 months of HIV diagnosis).**Results:** Of 59,880 HIV-infected people, 32.2% had concurrent AIDS and 19.3% died. Adjusting for period of diagnosis, age group, sex, country of birth, HIV transmission mode, area-level poverty, and rural-urban status, non-Hispanic black (NHB) and Hispanic people had an elevated adjusted hazards ratio (aHR) for HIV mortality relative to non-Hispanic whites (NHB concurrent AIDS: aHR 1.34, 95% confidence interval [CI], 1.23–1.47; NHB without concurrent AIDS: aHR 1.41, 95% CI 1.26–1.57; Hispanic concurrent AIDS: aHR 1.18, 95% CI 1.05–1.32; Hispanic without concurrent AIDS: aHR 1.18, 95% CI 1.03–1.36).**Conclusions:** Considering competing causes of death, NHB and Hispanic people had a higher risk of HIV mortality even among those without concurrent AIDS, indicating a need to identify and address barriers to HIV care in these populations.

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## Introduction

Non-Hispanic blacks (NHBs) and Hispanics continue to be disproportionately affected by the human immunodeficiency virus (HIV) epidemic in the United States (US). In 2012, the age-adjusted HIV mortality rate among NHBs was 9.8 per 100,000 compared with 2.2 for Hispanics and 1.0 for non-Hispanic whites (NHWs) [1]. Antiretroviral treatments significantly improve life expectancy; currently a 20-year-old person infected with HIV who is taking combination antiretroviral therapy has a life expectancy of about 50 additional years [2,3]. However, nonwhites have had a persistently

lower life expectancy than whites, which may be due to differences in socioeconomic status (SES) and access to care [3–5].

Long-term survival with HIV infection is dependent on early diagnosis, linkage to and retention in care, and adherence to treatment [6,7]. In the US, of the estimated 1.2 million people living with HIV in 2011, 14% were not yet diagnosed, 60% did not obtain medical care, and 63% were not prescribed antiretroviral therapy during the prior 12 months [6]. The percentage of NHBs not virally suppressed was estimated at 72%, higher than the 68% among NHWs and 69% among Hispanics, although the differences were not statistically significant [6]. Florida has been particularly affected by the HIV epidemic. An estimated 99,209 people in the state were living with diagnosed HIV infection in 2012 for a prevalence of 599 per 100,000, the third highest in the US [8]. There also are large racial-ethnic disparities in Florida with an estimated HIV prevalence of 1978.8 per 100,000 among NHBs, 558.9 among Hispanics, and 288.5 among NHWs [8]. A recent report on the continuum of HIV care during 2014 in Florida indicated that NHBs and Hispanics

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were less likely to have a suppressed viral load than NHWs (53%, 61%, and 66%) [9]. A study of all-cause survival among Floridians diagnosed with HIV infection from 1993 to 2004 found that survival was significantly lower among NHBs compared with NHWs [10]. The objective of the present study was to compare all-cause and HIV mortality by race-ethnicity and estimate the role of neighborhood poverty and rural-urban residence in survival disparities among people diagnosed with HIV infection in Florida.

## Methods

Data included deidentified records of Florida residents who were reported to the Florida Department of Health (DOH) Enhanced HIV-acquired immunodeficiency syndrome (AIDS) Reporting System during 2000–2009 with an HIV diagnosis meeting the Centers for Disease Control and Prevention surveillance case definition [11,12]. Individual-level variables included month and year of HIV and AIDS diagnoses (if applicable); age at HIV diagnosis; sex at birth; race-ethnicity; country of birth; HIV transmission mode; and number months between HIV diagnosis and death or December 2011, whichever came first. Race-ethnicity data were classified into four groups: NHBs, NHWs, Hispanics, and “others” which included multiracial, Asian, American Indian, and Native Hawaiian or Pacific Islanders.

### Vital status and cause of death

Deaths and underlying causes (UCs) through December 2011 were ascertained by matching Enhanced HIV-AIDS Reporting System records with Florida DOH Vital Records and the National Death Index. Causes and significant conditions were coded with the International Classification of Diseases, Tenth Revision (ICD-10) [13]. UCs were classified into two groups based on the ICD codes: HIV-AIDS and all others. The HIV-AIDS group included deaths with an UC due to HIV disease (B20–B24), laboratory evidence of HIV infection (R75), and UCs of death suggestive of HIV disease due to an apparent underreporting of HIV as an UC (see Appendix A). These included codes for which the World Health Organization recommends use of HIV disease codes (B20–B24) in a person with HIV infection [14].

### Area-level factors

Five-year estimates of poverty data from the 2007–2011 American Community Survey were obtained from the US Census Bureau [15] and linked using the zip code tabulation area (ZCTA). The Census Bureau reports data by ZCTA, which approximates zip codes and is built by aggregating Census Bureau blocks based on the zip code of addresses in these blocks [16]. Records of diagnosed HIV cases with missing or nonexisting zip codes were excluded from the analysis. In addition, records of cases diagnosed in a correctional facility were excluded because the inmates' care is unrelated to characteristics of the surrounding ZCTA. Rural-urban status of the zip code was based on categorization C of version 2.0 Rural-Urban Commuting Area data codes [17,18].

### Analyses

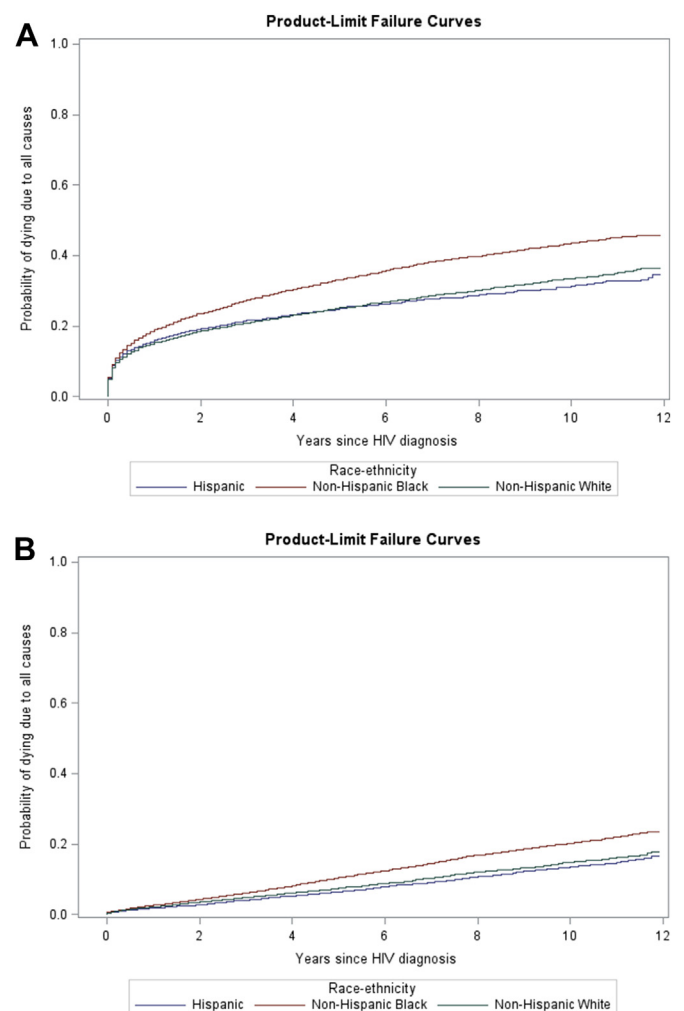
Observations were classified as cases having concurrent AIDS or cases without concurrent AIDS at the time of HIV diagnosis, because survival of people without concurrent AIDS is likely to be more strongly related to linkage, retention, and adherence to HIV care and treatment. Concurrent AIDS was defined as an AIDS diagnosis within 3 months of the HIV diagnosis based on the Centers for

Disease Control and Prevention recommendation that people start HIV care by 3 months [19].

Analyses were stratified by concurrent AIDS diagnosis status. Associations between race and potential predictors of survival (all categorical) were tested using the  $\chi^2$  test. Kaplan–Meier survival curves for all-cause mortality for each racial-ethnic group (NHB, NHW, and Hispanic) were generated. The assumption of proportional hazards required for Cox regression models was examined using log-negative-log curves and the correlation of Schoenfeld residuals with time and log of time for all variables [20]. Significant and meaningful correlations were defined as those greater than 0.3 [21], but there were none greater than 0.1. All-cause survival curves were run as failure curves for Figure 1 so that they could be easily compared with the cumulative incidence functions for HIV death.

Cox proportional hazards models were performed using the PHREG procedure to examine the association between race-ethnicity and all-cause mortality, controlling for individual-level factors, area-level poverty, and rural-urban status. Multicollinearity was assessed by checking the variance inflation factor with the REG procedure and vital status as a dependent variable, and a cutoff of 10 as indicating a potential problem [22].

In analyzing deaths due to HIV, a competing risk of death framework was used because death from HIV can be preceded by



**Fig. 1.** Unadjusted failure curves for death due to all causes by race-ethnicity among those with and without concurrent AIDS diagnosis. (A) Those with concurrent AIDS at time of HIV diagnosis. (B) Those without concurrent AIDS at time of HIV diagnosis.

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