Ten-year Survival by Race/Ethnicity and Sex Among Treated, HIV-infected Adults in the United States

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Background. Ensuring equal access to antiretroviral therapy (henceforth therapy) should alleviate disparities in health outcomes among persons infected with human immunodeficiency virus (HIV). However, evidence supporting the persistence of disparities in survival following therapy initiation is mixed.

Methods. Patients initiating therapy in eight academic medical centers in the Centers for AIDS Research Network of Integrated Clinical Systems between 1 January 1998 and 30 December 2011. Patients (n = 10 017) were followed from therapy initiation until death from any cause, administrative censoring at 10 years after therapy initiation or the end of follow-up on 31 December 2011. The 10-year risk of all-cause mortality was calculated from standardized Kaplan–Meier survival curves.

Results. Patients were followed for a median of 4.7 years (interquartile range: 2.2, 8.2). During 51 121 person-years of follow-up, 1224 of the 10 017 patients died. The overall 10-year mortality risk was 20.2% (95% confidence interval [CI], 19.2%, 21.3%). Black men and women experienced standardized 10-year all-cause mortality risks that were 7.2% (95% CI, 4.3%, 10.1%) and 7.9% (95% CI, 3.9%, 12.0%) larger (absolute difference) than white men. White women, Hispanic men, and Hispanic women all had lower 10-year mortality than white men.

Conclusions. These data serve as a call to action to identify modifiable mechanisms leading to these observed mortality disparities among HIV-infected black patients. Effective interventions are needed to ensure that the goal of the National HIV/AIDS Strategy to overcome health disparities becomes a reality.

Keywords. HIV; health status disparities; cohort studies; survival analysis; antiretroviral therapy.

Documented differences in mortality by race, ethnicity, and sex among people infected with human immunodeficiency virus (HIV) [1] may be attributable to differences in the rates of diagnosis, linkage to care following diagnosis, or initiation of effective combination antiretroviral therapy (henceforth therapy). Once HIV-infected persons initiate therapy, mortality rates are dramatically reduced [2, 3], and we would expect disparities in mortality to be attenuated [1, 4, 5]. However, evidence supporting the existence of disparities in survival following therapy initiation is mixed [6, 7]. In this paper, we describe 10-year all-cause mortality after therapy initiation in the Centers for AIDS Research Network of Integrated Clinical Systems (CNICS) between 1998 and 2011 by race, ethnicity, and sex among a sample of adult patients in the United States. We standardized results to control for differences in pretreatment health status.

METHODS

Study Population

CNICS is a clinical cohort study that includes detailed information on demographics, laboratory measures, medication use, and mortality for HIV-infected patients 18 years of age and older who initiated primary care at any of 8 CNICS sites after 1 January 1995 (or the site-specific CNICS inception date) [8]. Institutional review boards at each site approved participation in CNICS, and this analysis of deidentified data was determined not to be human subjects research by the institutional review board of the University of North Carolina at Chapel Hill.

The study population included patients who initiated a first combination therapy regimen, defined as 3 or more different antiretroviral drugs, between 1 January 1998 and 30 December 2011. Race and ethnicity were patient-reported and categorized independently in the original data according to the Health Resource and Service Administration federal standards [9]. We combined race and ethnicity into one variable for analysis and classified patients as Hispanic if Hispanic ethnicity was indicated regardless of race; <2% of Hispanic patients reported their race as black and 16% did not indicate any race. Non-Hispanic patients were classified as black, white, or other race.

During the study period, 11 463 men and women initiated therapy in CNICS. We excluded 518 with reported race/ethnicity other than white, black or Hispanic, or sex other than male or female (ie, intersex). We excluded 928 patients (8%) for missing baseline data for race/ethnicity (n = 97, <1%), injection drug use (n = 219, 2%), and CD4 cell count or HIV-1 RNA viral load proximate to therapy initiation (n = 612, 6%). The final study population included 10 017 patients.

Mortality Ascertainment

The outcome was death from any cause. Mortality information is obtained from clinic sources, death certificates, and the US Social Security Death Index, which is queried regularly by contributing sites.

Statistical Analysis

We measured survival time in days from therapy initiation to death, administratively censoring patients on 31 December 2011 (patients from one site were administratively censored on 15 September 2010) or at 10 years of follow-up to maintain adequately sized risk sets (ie, >20 persons).

We estimated mortality risk using the complement of the Kaplan–Meier survival function [10]. To isolate disparities arising after therapy initiation, we standardized our results to the study sample according to the distribution of risk factors for mortality measured at or just prior to therapy initiation using stabilized inverse probability weights [11, 12]. We estimated the denominator of the weights for race/ethnicity and sex categories using polytomous logistic regression, conditional on calendar date of therapy initiation, age at therapy initiation, CD4 cell count (cells/mm^3), and HIV-1 RNA plasma concentration (viral load) (log$_{10}$ copies/mL) most proximate to therapy initiation measured between 6 months prior to 14 days after therapy initiation, ART naivety (ie, no evidence of prior exposure to mono or dual therapy), prior AIDS diagnosis, history of injection drug use, history of hepatitis C virus infection, and CNICS site. We used restricted quadratic splines (with knots at the 5th, 35th, 65th, and 95th percentiles) to flexibly model all continuous covariates [13]. We stabilized the weights using the site-specific distribution of race/ethnicity and sex. The estimated weights had a mean of 1.00 (range: 0.14, 4.44).

We compared the crude and standardized absolute and relative difference in 10-year mortality risk by race/ethnicity and sex categories. We also calculated hazard ratios using a Cox regression model [14] using Efron approximation for tied death times [15]. We assessed the proportional hazards assumptions by visual inspection of log cumulative hazard functions by time (Supplementary Figure 1), as well as by statistical test of the product terms for race/ethnicity and sex categories with time. We saw no important violations of the proportional hazards assumption. We provide site-stratified hazard ratios as supplementary analysis.

We calculated 95% confidence intervals (CIs) for the standardized mortality risk differences and risk ratios using a standard error estimated from 200 nonparametric bootstrap random samples drawn with replacement [16]. For the standardized hazard ratios, we calculated CIs using the robust standard error [17].

To assess whether the magnitude of disparities in survival have changed over time, we stratified follow-up time into early and late calendar periods, varying the cut point from 2002 to 2008 by increments of 2 years, and then tested the significance of interactions between time period and race/ethnicity and sex in a Cox model. To assess how disparities observed in the CNICS compared with survival disparities seen in the US general population, we present age- and calendar time-standardized mortality rates for the general population, which we calculated from vital statistics data downloaded from CDC WONDER [18]. To assess possible hypotheses about mechanisms for disparities in survival, we calculated the proportion of patients retained in care (no gaps in laboratory monitoring >1 year within 2 years of therapy initiation) and the proportion of patients who achieved and maintained viral suppression (<400 copies/mL) at 1 year after therapy initiation, stratified by race/ethnicity and sex. Patients who died within the first 2 years of follow-up without experiencing a gap in laboratory monitoring were considered retained in care. Patients who died before achieving viral suppression (1%) were considered not virally suppressed.

All analyses were conducted using SAS version 9.3 (SAS Institute, Cary, North Carolina).
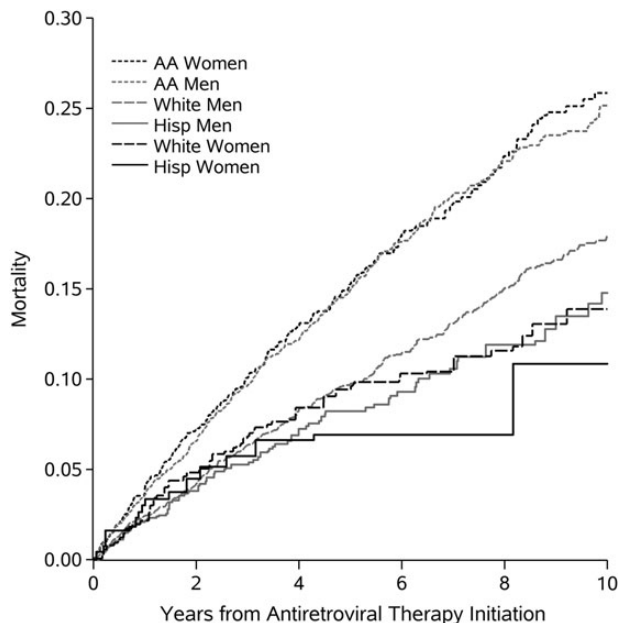
Figure 1. Cumulative all-cause mortality standardized[a] to total sample by years from therapy initiation, race/ethnicity and sex, 10 017 human immunodeficiency virus-infected adults, 1998–2011. [a]Standardized by baseline covariates: age at therapy initiation, CD4 count and viral load, all modeled with restricted quadratic splines (with 4 knots located at the 5th, 35th, 65th and 95th percentiles), antiretroviral therapy naivety, prior diagnosis of any AIDS-defining condition at therapy initiation, injection drug use, and history of hepatitis C virus infection. Abbreviation: AA, African-American.

RESULTS

The median age in the study sample was 40 years (interquartile range [IQR]: 33, 46) and the median year of therapy initiation was 2006 (IQR: 2003, 2009). The median baseline CD4 count and viral load were 238 cells/mm^3 (IQR: 85, 385) and 4.7 log$_{10}$ copies/mL (IQR: 3.9, 5.3), respectively (Table 1). Most patients (88%) were treatment-naive, 27% had a prior AIDS-defining condition, 18% had a history of injection drug use, and 16% had a history of hepatitis C virus infection. The median time spent in the CNICS prior to initiation of therapy was 68 days (IQR: 21–371 days). The prevalence of a prior AIDS-defining condition at baseline was 22% among white men, compared with 28%–34% among other race/ethnicity and sex groups. Additionally, 30% of white women had a history of injection drug use, compared to only 12%–19% in other groups, with a correspondingly high risk of HCV infection.

Patients were followed for a median of 4.7 years (IQR: 2.2, 8.2). During 51 121 person-years of follow-up, 1224 of the 10 017 patients died. The overall crude 10-year mortality risk was 20.2% (95% CI, 19.2%, 21.3%), and the overall crude mortality rate was 2.39 deaths per 100 person-years (95% CI, 2.26, 2.53). The crude 10-year mortality risk was 27.0% (95% CI, 24.6%, 29.3%) among black men and 25.0% (95% CI, 21.6%, 28.4%) among black women. In contrast, the crude 10-year mortality risk was only 16.8% (95% CI, 15.1%, 18.5%) among
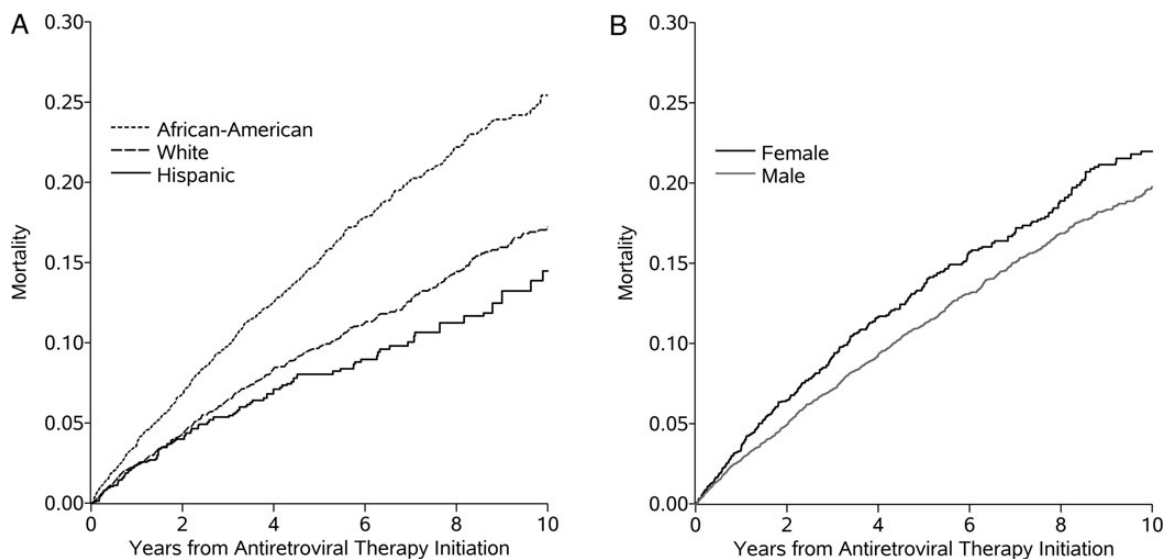

Figure 2. Cumulative all-cause mortality standardized[a] to the total study sample by years from therapy initiation and (*A*) race/ethnicity or (*B*) sex, 10 017 human immunodeficiency virus-infected adults, 1998–2011. [a]Standardized by baseline covariates: sex (*A*) or race (*B*), age at therapy initiation, CD4 count and viral load, all modeled with restricted quadratic splines (with 4 knots located at the 5th, 35th, 65th, and 95th percentiles), antiretroviral therapy naivety, prior diagnosis of any AIDS-defining condition at therapy initiation, injection drug use, and history of hepatitis C virus infection.

Table 1. Characteristics at Antiretroviral Therapy Initiation, 10 017 HIV-Infected Adults, 1998–2011[a]

	Overall $n = 10017$	Black Men $n = 2679$	Black Women $n = 1,232$	White Men $n = 4228$	White Women $n = 457$	Hispanic Men $n = 1252$	Hispanic Women $n = 169$
Age, years	40 (33, 46)	40 (33, 47)	40 (33, 47)	40 (34, 46)	41 (32, 46)	37 (31, 43)	39 (30, 47)
Calendar year	2006 (2003, 2009)	2006 (2002, 2009)	2005 (2002, 2008)	2007 (2003, 2009)	2005 (2003, 2009)	2007 (2004, 2010)	2007 (2004, 2009)
CD4 count, cells/mm^3	238 (85, 385)	196 (44, 343)	210 (64, 348)	276 (126, 428)	256 (114, 407)	226 (77, 364)	217 (91, 324)
Viral load, log$_{10}$ copies/mL	4.7 (3.9, 5.3)	4.7 (4.1, 5.3)	4.7 (3.9, 5.3)	4.7 (3.9, 5.3)	4.7 (3.8, 5.3)	4.7 (3.9, 5.3)	4.5 (3.4, 5.0)
Therapy naive, n (%)	8,787 (88%)	2,364 (88%)	1,030 (84%)	3,724 (88%)	397 (87%)	1,122 (90%)	151 (89%)
AIDS, n (%)	2,735 (27%)	866 (32%)	415 (34%)	912 (22%)	127 (28%)	364 (29%)	51 (30%)
Injection drug use, n (%)	1,758 (18%)	505 (19%)	224 (18%)	715 (17%)	139 (30%)	144 (12%)	31 (18%)
Hepatitis C viral infection, n (%)	1,572 (16%)	516 (19%)	222 (18%)	528 (12%)	133 (29%)	137 (11%)	36 (21%)

Abbreviation: HIV, human immunodeficiency virus.

[a] Median (quartiles) unless noted otherwise.

white men and 17.5% (95% CI, 12.9%, 22.1%) among white women. Among Hispanic men and women, the crude 10-year mortality risk was 12.5% (95% CI, 9.5%, 15.5%) and 12.0% (95% CI, 4.5%, 19.4%), respectively.

Black men and women experienced a standardized 10-year mortality risk that was 7.2% (95% CI, 4.3%, 10.1%) and 7.9% (95% CI, 3.9%, 12.0%) larger (absolute difference) than white men. The standardized 10-year risk of mortality was 4.0% (95% CI, −8.5%, 0.4%) less among white women compared to white men. Among Hispanic men and women, the standardized 10-year risk of mortality was 3.2% (95% CI, −7.1%, 0.8%) and 7.1% (95% CI, −16.1%, 1.9%) less, respectively than the mortality risk among white men (Figure 1). Standardized risk ratios and hazard ratios exhibited a similar pattern (Table 2). Stratifying on CNICS site did not substantively change the results, but it slightly attenuated the estimated relative hazard of all-cause mortality for black men and women and shifted the estimated relative hazard for white women and Hispanic patients downward, away from the null (Supplementary Table 2).

Disparities in survival did not change significantly over the study period (P-values for interaction between time period and race/ethnicity and sex were .14 when the time period was divided into pre- and post-2002, .66 for 2004, .75 for 2006, and .43 for 2008).

The mortality rate ratio comparing black men with white men in the CNICS was higher than the mortality rate ratio comparing black men with white men in the US general population. The mortality rate ratio comparing black women with white men vastly exceeds the mortality rate ratio comparing black women with white men in the US general population. The relative rate of mortality for Hispanic men and women compared with white men in the CNICS was higher and closer to the null than the relative rate of mortality for Hispanic men and women with white men in the US general population (Table 3).

Overall, 66.6% (95% CI, 65.7%, 67.5%) of patients were virally suppressed around 1 year after ART initiation and 75.9% (95% CI, 75.1%, 76.8%) of patients were retained in care at 2 years after ART initiation. There were substantial differences in viral suppression at 1 year post-ART initiation. Only 59.5% (95% CI, 58.0%, 61.1%) of black patients were virally suppressed 1 year after ART initiation, compared to 70.9% (95% CI, 69.6%, 72.2%) of white patients and 72.0% (95% CI, 69.7%, 74.3%) of Hispanic patients. Patterns were similar in men and women. There were only minor, nonsignificant differences in retention in care at 2 years post-ART initiation by race/ethnicity and sex. Weighting the data to standardize on baseline covariates had little impact on the results (Table 4).

DISCUSSION

We observed markedly higher risk of death from any cause among black men and women compared to other race/ethnicity

Table 2. Standardized[a] 10-year Mortality Risk Differences and Hazard Ratios and by Race/Ethnicity and sex, 10 017 HIV-Infected Adults, 1998–2011

	Observed			Standardized[a]			
	No. Deaths	No. Person-years	10-year Mortality Risk, %	10-year Mortality Risk, %	Risk Difference, % (95% CI)	Risk Ratio (95% CI)	Hazard Ratio (95% CI)
Overall	1224	51,121.1	20.2	20.2	. . .	. . .	. . .
Race/ethnicity/sex							
Black women	207	6,730.0	25.0	25.8	7.9 (3.9, 12.0)	1.44 (1.21, 1.72)	1.57 (1.32, 1.87)
Black men	458	13,338.4	27.0	25.2	7.2 (4.3, 10.1)	1.40 (1.23, 1.61)	1.53 (1.33, 1.76)
White men	405	21,792.3	16.8	18.0	0	1	1
Hispanic men	86	5,924.6	12.5	14.8	−3.2 (−7.1, .8)	0.82 (.63, 1.08)	0.82 (.64, 1.05)
White women	53	2,482.0	17.5	13.9	−4.0 (−8.5, .4)	0.77 (.57, 1.05)	0.85 (.61, 1.19)
Hispanic women	15	853.9	12.0	10.8	−7.1 (−16.1, 1.9)	0.61 (.26, 1.42)	0.68 (.37, 1.23)
Race/ethnicity							
White	458	24,274.3	16.9	17.2	0	1	1
Black	665	20,068.4	26.3	25.4	8.2 (5.6, 10.8)	1.48 (1.30, 1.67)	1.29 (1.12, 1.49)
Hispanic	101	6,778.5	12.5	14.5	−2.7 (−6.6, 1.1)	0.84 (.65, 1.09)	0.75 (.59, .96)
Sex							
Men	949	41,055.3	19.7	19.8	0	1	1
Women	275	10,065.8	22.2	22.0	2.2 (−0.7, 5.2)	1.11 (.97, 1.28)	0.95 (.82, 1.10)

Abbreviations: CI, confidence interval; HIV, human immunodeficiency virus; No., number.

[a] Standardized for calendar date of therapy initiation, age at therapy initiation, CD4 cell count (cells/mm^3) and HIV-1 RNA plasma concentration (viral load) (log$_{10}$ copies/mL) most proximate to therapy initiation measured between 6 months prior to 14 days after therapy initiation, antiretroviral therapy naivety (ie, no evidence of prior exposure to mono or dual therapy), prior AIDS diagnosis, history of injection drug use, and history of hepatitis C virus infection; additionally, race/ethnicity risk was standardized for sex and sex risk was standardized for race/ethnicity.

groups in the CNICS cohort following ART initiation (Figure 2A). Survival by race/ethnicity and sex varies substantially in the general US population due to differences in the prevalence of non-HIV-related conditions like diabetes, hypertension, kidney disease and violence, for example [19]. As a result, by estimating the risk of all-cause mortality, rather than focusing specifically on AIDS-defining illness-associated mortality, we have likely captured differences in the risk of non-AIDS-related causes of death. However, the disparities seen in the CNICS comparing mortality among black persons with white men exceeds the disparities in the US general population comparing black person with white men, especially for black women [18]. As we have standardized estimates to control for disparities in HIV-related health status prior to therapy initiation [4–6, 20], the overall lower survival among HIV-infected black persons is only compounded by disparities after therapy initiation as is evident in contrasts of crude mortality risks. Although a thorough mediation analysis is beyond the scope of this study, we observed

Table 3. Crude Mortality Rate Ratios for 10 017 HIV-Infected Adults in the CNICS, 1998–2011, and age- and Calendar Time-standardized Mortality Rates in the US General Population Based on Vital Statistics Data, 1999–2011

	CNICS, 1998–2011				US Population, 1999–2011 [18]	
Race/Ethnicity/Sex	No. Deaths	No. Person-years	Mortality Rate per 10 000 Person-years	Rate Ratio	Standardized Mortality Rate[a]	Rate Ratio
Black women	207	6,730.0	307.6	1.66	45.7	1.05
Black men	458	13,338.4	343.4	1.85	73.9	1.70
White men	405	21,792.3	185.8	1.00	43.6	1.00
Hispanic men	86	5,924.6	145.2	0.78	27.0	0.62
White women	53	2,482.0	213.5	1.15	25.9	0.59
Hispanic women	15	853.9	175.7	0.95	18.5	0.42

Abbreviations: CNICS, Centers for AIDS Research Network of Integrated Clinical Systems; HIV, human immunodeficiency virus.

[a] Directly standardized to match the age group and calendar time distribution of the CNICS data.

Table 4. Crude and Standardized[a] Probabilities of Retention in Care[b] at 2 Years post-ART Initiation and Viral Suppression at 1 Year post-ART Initiation, by Race/Ethnicity and Sex, 10 017 HIV-Infected Adults, 1998–2011

	Crude		Standardized	
	Retention in Care 2 Years After ART Initiation, % (95% CI)	Viral Suppression at Approximately 1 Year After ART Initiation, % (95% CI)	Retention in Care 2 Years After ART Initiation, % (95% CI)	Viral Suppression at Approximately 1 Year After ART Initiation, % (95% CI)
Overall	75.9 (75.1, 76.8)	66.6 (65.7, 67.5)		
Race/ethnicity/sex				
Black women	76.2 (73.8, 78.6)	57.8 (55.0, 60.6)	76.0 (73.6, 78.4)	57.7 (54.9, 60.5)
Black men	75.1 (73.5, 76.7)	60.3 (58.4, 62.2)	75.3 (73.6, 76.9)	60.5 (58.7, 62.4)
White men	76.4 (75.1, 77.7)	72.0 (70.6, 73.3)	76.2 (74.9, 77.5)	71.7 (70.3, 73.1)
Hispanic men	76.2 (73.8, 78.6)	73.1 (70.6, 75.5)	77.0 (74.7, 79.4)	72.3 (69.9, 74.8)
White women	74.0 (69.9, 78.0)	61.3 (56.8, 65.7)	75.2 (71.3, 79.2)	64.3 (59.9, 68.9)
Hispanic women	78.1 (71.9, 84.3)	63.9 (56.2, 71.1)	76.9 (70.5, 83.4)	65.3 (58.0, 72.5)
Race/ethnicity				
White	76.2 (75.0, 77.4)	70.9 (69.6, 72.2)	75.8 (74.6, 77.1)	70.2 (68.9, 71.5)
Black	75.5 (74.1, 76.8)	59.5 (58.0, 61.1)	75.3 (74.0, 76.7)	59.8 (58.2, 61.3)
Hispanic	76.4 (74.2, 78.6)	72.0 (69.7, 74.3)	76.9 (74.7, 79.1)	71.5 (69.2, 73.8)
Sex				
Men	76.0 (75.0, 76.9)	68.3 (67.3, 69.3)	76.1 (75.1, 77.0)	68.1 (67.1, 69.1)
Women	75.8 (73.9, 77.8)	59.2 (56.9, 61.5)	75.2 (73.2, 77.2)	60.0 (57.8, 62.2)

Data can be referenced [18].

Abbreviations: ART, antiretroviral therapy; CI, confidence interval; HIV, human immunodeficiency virus.

[a] Standardized for calendar date of therapy initiation, age at therapy initiation, CD4 cell count (cells/mm^3) and HIV-1 RNA plasma concentration (viral load) (log$_{10}$ copies/mL) most proximate to therapy initiation measured between 6 months prior to 14 days after therapy initiation, ART naivety (ie, no evidence of prior exposure to mono or dual therapy), prior AIDS diagnosis, history of injection drug use, and history of hepatitis C virus infection; additionally, race/ethnicity risk was standardized for sex and sex risk was standardized for race/ethnicity.

[b] Retention in care defined as no gaps in laboratory monitoring of ≥1 year.

lower viral suppression at 1-year after therapy initiation among black patients. Other studies have documented greater loss-to-follow-up, more missed visits, and poorer therapy adherence among black patients [21, 22], which may explain some of the survival disparities observed in this cohort.

The 10-year mortality risk in the CNICS cohort was slightly lower for Hispanic patients compared to non-Hispanic white patients (Figure 2A). Although Hispanic men and women in the CNICS tend to experience lower mortality rates than white men, the magnitude of rate ratio is less than the rate ratio comparing Hispanic men and women to white men in the general population [18]. The survival advantage that Hispanic persons in the general population is still incompletely understood [23]. As such, it is difficult to interpret the relative risk of mortality for Hispanics in the CNICS as a survival advantage (since they do better than their white male counterparts) or as a disadvantage (since they do not do as much better as their HIV-uninfected counterparts). This study is one of a few with sufficient size to estimate survival among Hispanic ART initiators. In some settings, Hispanic patients appear to have poorer retention in care [24] and lower probability achieving viral suppression [25] as compared to white patients. However, other studies have found

no evidence of ethnic disparities for similar outcomes [26], or even a lower hazard of AIDS incidence or death for Hispanic patients with equal access to care [7]. The discrepant results may be due to many factors including: exposure misclassification associated with self-reported ethnicity; geographical differences in structural discrimination and access to care experienced by Hispanics; or the heterogeneity of the Hispanic community, owing to different countries of origin, residency statuses and generations since immigration to the United States, among other things [23, 27, 28].

Mortality risk observed in the CNICS was similar or slightly higher among women than among men after accounting for differences in baseline covariates (including race/ethnicity) (Figure 2B). In other cohorts, mortality rates were higher among men than among women [29] or there were no differences in survival between men and women [30]. Although women have been reported to be more likely than men to be retained in care [26, 31], we observed similar prevalence of gaps in care by two years after therapy initiation. Notably, we found that while black women had poorer survival than black males, white and Hispanic women generally had better survival than white and Hispanic men, respectively. Few previous studies

that have examined survival by sex have simultaneously stratified by race/ethnicity, despite evidence of heterogeneity of HIV death rates within strata of both race/ethnicity and sex [32, 33].

We estimated all-cause mortality following therapy initiation by race/ethnicity, and sex, standardized to the total cohort at therapy initiation to control for baseline differences in health status. We view race, ethnicity, and sex as markers for unmeasured factors, such as environment, income, social status, social capital, discrimination, structural violence and other phenomena, which may partially or completely explain the demographic disparities we observed [34]. We did not standardize for these factors because our purpose was not to explain demographic disparities but rather to document their presence and estimate their magnitude.

Measurement bias is unlikely to explain the strong survival disparities observed in this study. Sex, race, ethnicity, and death are likely measured with negligible error. Race and ethnicity are collected differently across sites but are typically based on self-report and are classified in CNICS using Health Resources and Services Administration standards. Patients were classified as having a single race, which may have oversimplified race in multiracial patients, although the proportion of the US population that is multiracial is relatively low (2.9%, according to the 2010 Census) [35]. Selection bias is also unlikely to explain our observed results, as the primary outcome, mortality, was ascertained via a national database; patients were not lost to follow-up because administrative censoring was unnecessary (eg, after prolonged gap in labs or visits). Additionally, nearly all members of the eligible cohort were included in these analyses (only 8% of otherwise eligible subjects were excluded due to missing data).

Our findings may or may not generalize to the US population [36]. The CNICS cohort has proportionally more white patients, fewer young adults, more men, and more injection drug users than are HIV-diagnosed and living in the United States. Furthermore, CNICS clinics are all associated with academic medical centers, which may not reflect the HIV care provided in nonacademic settings. However, the geographic distribution of study sites more closely resembles the US population than studies conducted in any single clinic.

A subsequent investigation into the causes of death would be invaluable to tease out the relative contributions of AIDS-related and non-AIDS-related mortality to the disparity described in this study. At this time, however, cause of death data is not available for all CNICS patients, and the data that are available are generally from the underlying cause of death on the death certificate, which has been shown to have poor specificity [37, 38].

In summary, we identified elevated and meaningful differences in mortality among black men and women following combination ART initiation in a large, demographically and geographically diverse cohort. These results serve as a call to action to identify modifiable factors that contribute to these observed differences, so that efficacious interventions may be developed and implemented so that the goal of the National HIV/AIDS Strategy [39] to overcome health disparities becomes a reality.

Supplementary Data

Notes

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