Racial/Ethnic Disparities in HIV Survival Among People Diagnosed with HIV in Arizona, 1998-2012

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Abstract:

Objectives. We described the racial/ethnic disparities in survival among people diagnosed with HIV in Arizona from 1998 to 2012. We determined whether these disparities widened when adjusting for AIDS diagnosis, age at diagnosis, year of diagnosis, and gender.

Methods. We compared survival from all causes between Whites and Blacks, Hispanics, Native Americans, Asians, and Multiple/Other races via Kaplan-Meier survival curves and Cox proportional hazard models controlling for various clinical factors.

Results. Multiple/Other races (1.85), Native Americans (1.28), and Blacks (1.19) have statistically significant higher hazard ratios in all-cause mortality than Whites. When adjusting for AIDS diagnosis, these disparities widened and also showed Hispanics to have greater mortality [Multiple/Other races (2.53), Native Americans (1.44), Blacks (1.43), and Hispanics (1.22)].

Conclusions. Racial/ethnic minorities with HIV, specifically Black, Native Americans, and Multiple races, have significantly decreased overall survival. These disparities widen when considering the AIDS population. Further studies and resources could help identify the cause of these disparities and help generate a solution to diminish the survival gap.

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Introduction/Significance:

Human immunodeficiency virus (HIV) is a slowly replicating retrovirus that may lead to acquired immunodeficiency syndrome (AIDS), a disorder that causes progressive failure of the immune system to protect against infections and cancers. HIV has been linked to a host of different comorbid conditions, including cardiovascular disease, chronic renal disease, dementia, and many cancers, severely jeopardizing length and quality of life. HIV infects 50,000 individuals each year in the United States [2], and it is estimated that over one million individuals are currently living with HIV in the United States [1]. By race/ethnicity, Blacks experience the most severe burden of HIV, accounting for 44% of new infections [2].

While HIV has been the subject of much research interest, studies on HIV survival are limited as accurately known infection dates and other mortality data were difficult to obtain during the initial height of the HIV epidemic in the late 1980s. During this period, before the widespread availability of HIV surveillance and testing, many were unaware of their exposure to HIV. Of those who were aware, a great number only became aware after becoming symptomatic. This would indicate that these patients presumably got infected months to years earlier, as HIV can have a latency period of up to 8 years, if not longer [15]. Therefore, even those aware of their exposure could not confidently state the exact date of their exposure to HIV. This posed a significant challenge to conducting HIV survival studies for a major part of the short history of HIV. Even today, it is estimated that 1 in 5 living with HIV in the United States are unaware that they are infected [14].

Similar to the difficulty in obtaining reliable exposure data, mortality data was just as difficult to come by in the early years of HIV. It was not until recent improvements in therapy, specifically the advent of highly active antiretroviral therapy (HAART), that conducting a comprehensive survival study investigating ethnic disparities became feasible. Any survival studies conducted prior to HAART would have had difficulty capturing true ethnic disparities as mortality was essentially guaranteed given a positive infection. However, HAART has greatly improved survival and the life expectancy of HIV-infected individuals on HAART is much greater than it was before its advent, slowly approaching the normal human life expectancy [16].

Some of the HIV survival studies that have been conducted have looked at various factors, including: routes of transmission [9], age [11], gender [12], socioeconomic status [6], CD4 count [11], type of antiretroviral therapy [3,7,8], and other comorbidities and risk factors [4,5,10]. However, very few studies have analyzed survival rates by racial/ethnic group. A literature search performed on 02/10/2014 yields only 6 comprehensive studies investigating racial/ethnic disparities in HIV survival nationwide. None of these have investigated the issue in Arizona. This is telling since racial/ethnic disparities do exist when it comes to incidence and prevalence rates of HIV. According to the CDC, in 2011, 46% of newly HIV-infected individuals were African American, 27% Caucasian, 20% Hispanic/Latino, and 3% Asian/American Indian [2]. These percentiles are not indicative of the true demographic profile of this nation [31].

One recent study in Florida has shown that ethnic disparities do play a role in mean survival with HIV [24]. Briefly, the study looked at all people diagnosed with AIDS from 1993 to 2004 in Florida. It compared survival from all causes between Non-Hispanic Blacks and Non-Hispanic Whites controlling for demographic, clinical, and area-level poverty factors. The findings indicated that ethnic disparities peaked during the early implementation of HAART (1996-1998) with a Black-to-White hazard ratio of 1.72 in males and 1.59 in females. These ratios declined in the 2002-2004 diagnosis cohort. Similar research is lacking in Arizona and would prove valuable in the state's HIV preventive, educational, and treatment efforts, as well as promote overall public health. While such knowledge would not allow one to ascertain the reason for the disparities (i.e. genetics, poverty, exposure to risk factors, etc), it would show evidence for the existence of such disparities and help generate awareness for the need for strategies and resources to better serve ethnic minorities.

Materials and Methods:

This analysis used available HIV/AIDS surveillance data from the Arizona Department of Health Services (ADHS) annual data reports. All Arizona residents with a confirmatory HIV-positive test and who were reported to the Arizona Department of Health Services HIV Epidemiology Program from 1998-2012 were included in the study. All health care providers in the state of Arizona are required by law to report all positive HIV test results to the local county health department, which eventually reports to ADHS [32].

The dependent variable of interest was the number of years alive with HIV. In order to determine this, the date of diagnosis was subtracted from the date of death (or Dec 31, 2012 if still living). Deaths through 2012 were ascertained by matching ADHS records with Arizona Department of Health Vital Records, National Death Index, and Social Security Database.

The other variables that were available and used for descriptive or analytic purposes are listed in Table 1. All data were obtained from the ADHS's secured databases. Race/ethnicity is self-reported by the HIV/AIDS patient. Year of diagnosis was divided into 5-year intervals: 1998-2002, 2003-2007, 2008-2012. Age at diagnosis (in years) was divided into four groups (0-19, 20-39, 40-59, 60 or greater), and mean age was also calculated. For HIV mode of transmission, 5 categories were used: men who have sex with men (MSM), injection drug use (IDU), MSM/IDU, Heterosexual, and Other. The nadir CD4 lymphocyte counts (in cells/UL) were divided into 5 groups: <50, 50-199, 200-349, 350-499, and ≥500. AIDS classification was based on the CDC case definition for AIDS classification, which is defined as having a documented confirmatory HIV-positive test and CD4 lymphocyte count <200 cells/UL or CD4% of total lymphocytes <14, or having an AIDS-defining condition [25]. With regards to cause of death, a death is deemed to be HIV-associated if any primary, secondary, or tertiary cause of death has an ICD-9 code listed as an HIV- or AIDS-associated condition.

Subjects were excluded if the following variables had missing data: date of infection, age at diagnosis, race/ethnicity, sex, and diagnosis year. This yielded a total sample size of 9,082 cases. The ADHS database does not release subject identifiers such as name, date of birth, social security number, address, and phone number and at no point were these accessed by

anyone involved in the project: All data is kept strictly confidential and secure on ADHS computers [insert citation regarding ADHS security rules].

The racial ethnic survival disparities were tested with the cox proportional hazard model method using the SAS 9.3 proc phreg procedure. The model's events are alive/dead where alive =1 and dead=0. The dead/alive outcome is regressed from 1998 to 2012 to evaluate the average odds of survival through each of these years. Afterwards, the baseline out command is used to estimate the survival function estimate for each. This function estimate displays the probability of being alive for each year and is used to graph Kaplan-Meier Curves.

Four different models were used in our analysis. Model 1 analyzed HIV survival by race/ethnicity, using Whites as the reference group, among the entire cohort. Model 2 analyzed HIV survival by race/ethnicity among the entire cohort as well, but adjusted for age at diagnosis, diagnosis year, and gender. Model 3 analyzed HIV survival by race/ethnicity among those with HIV only (non-AIDS) and adjusted for the same 3 covariates. Finally, model 4 analyzed HIV survival by race/ethnicity among those with AIDS and adjusted for the same 3 covariates. For the sake of a more visual perception of the results, Kaplan Meier survival curves were derived from the Cox Proportional Hazard models assuming that the covariates were at their mean value.

Results:

There were 10,283 records of people diagnosed and reported with HIV between January 1, 1998 and December 31, 2012 to the Arizona Department of Health Services. Of these, 1,201 (11.7%) were excluded because of one or more of the following missing data points: mode of transmission, nadir CD4 count, and median CD4 count. This left a final cohort consisting of 9,082 HIV-positive individuals. The distributions by race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Native-American, Asian, and Multiple/Other) and characteristics of each are summarized in Table 1. Whites were the most numerous of all races/ethnicities studied, comprising 4,534 of the 9,082 included in the sample (49.9%). Hispanics were the second largest group with 2,836 (31.2%), followed by Blacks with 1,035 (11.4%), Native-Americans with 459 (5.1%), Asians with 123 (1.4%), and Multiple/Other races with 95 (1.0%). Relative to Whites (38.6 years), all other races/ethnicities had a lower age of diagnosis. Whites had a greater percentage (68.1%) of MSM as mode of transmission, and Blacks, Hispanics, Native-Americans and Multiple/Other races had a greater percentage of IVDU. Whites also had a higher median CD4+ count (443) than Blacks, Hispanics, Native-Americans and Multiple/Other races. Asians had a higher median CD4+ count (480) than Whites. Fewer Whites met AIDS classification (54.7%) compared to Blacks, Hispanics, and Native-Americans. Asians (45.5%) and Multiple/Other races (53.7%) had fewer classified as AIDS than Whites. With regards to cause of death, a lower percentage of Whites (68.3%) died from an HIV-associated illness compared to all other races/ethnicities of the study. T-tests were used to determine if mean survival months were statistically different among racial/ethnic groups. Whites (168.9 months) had significantly higher mean survival than Blacks (166.4) and Multiple/Other races (157.2). However, Asians (175.8) had a higher mean survival than Whites, while Hispanics (168.8) and Native-Americans (165.9) had no statistically significant differences than Whites.

Table 2 depicts four different Cox proportional hazard regression models. These models predict the death hazards among the specified HIV/AIDS sample (see methods section for lengthier model descriptions. Briefly, model 1 analyses the racial/ethnic differences without controlling for any covariates among the entire sample. This model reveals that Multiple/Other races (1.85), Native Americans (1.28), and Blacks (1.19) have higher hazard ratios in HIV-related

mortality than Whites (reference group) with statistical significance. Three relevant covariates (age at diagnosis, gender, and diagnosis year) are added to the analysis in model 2, but the sample remains the same as in model 1. Model 2 shows that age at diagnosis ($p<0.0001$) and diagnosis year ($p<0.0001$) are statistically significant covariates, while gender is not. Having a larger age at diagnosis increases the hazard of death, and having an earlier diagnosis year decreased the hazard of death. With the addition of the covariates in model 2, the racial/ethnic disparities widened. For example, the hazard ratio for Blacks increased from 1.19 in model 1 to 1.50 in model 2, and for Native Americans increased from 1.28 to 1.73. Additionally, Hispanics emerged to have a statistically significant hazard ratio of 1.31, which had not previously existed in model 1. Model 3 uses the same variables as model 2, with the exception that the sample in model 3 is limited to patients who do not have an AIDS diagnosis. Among this non-AIDS sample, the racial ethnic differences disappear. None of the racial/ethnic minorities have a significantly different hazard ratio than Whites. Model 4 also uses the same variables as model 2, but limits the sample only to patients with an AIDS diagnosis. When analyzing the AIDS sample, the racial/ethnic disparities reappear. Model 4 indicates that Blacks (1.43), Hispanics (1.22), Native Americans (1.44), and Multiple/Other races (2.53) have a statistically significant greater hazard ratio than Whites.

The Kaplan-Meier survival curves in Figures 1, 2, and 3 visualize these data. Figure 1 depicts model 1, which includes the entire cohort without covariates. Figure 2 depicts model 2, which includes the entire cohort controlling for covariates. Figure 3 depicts model 4, which includes only the AIDS cohort and adjusts for covariates. Model 3, the HIV-only cohort, was not graphed as there were no statistically significant differences between the races/ethnicities. All three figures show that with the exception of Asians, Whites had the greatest survival. In the AIDS cohort, disparities in survival widened for all races/ethnicities compared with Whites with the exception of Asians, whose gap with Whites narrowed (Fig. 3).

Table 1. Characteristics of Arizonians Diagnosed with HIV, by Race/Ethnicity: Arizona, 1998-2012

Characteristic	Entire Cohort, No. (%) unless otherwise noted	White, No. (%) unless otherwise noted	Black, No. (%) unless otherwise noted	Hispanic, No. (%) unless otherwise noted	Native American, No. (%) unless otherwise noted	Asian, No. (%) unless otherwise noted	Multiple, No. (%) unless otherwise noted
Overall number	9082	4534 (49.9)	1035 (11.4)	2836 (31.2)	459 (5.1)	123 (1.4)	95 (1.0)
Sex							
Male	7807 (86.0)	4106 (90.6)	693 (67.0)	2472 (87.2)	364 (79.3)	95 (77.2)	77 (81.1)
Female	1275 (14.0)	428 (9.4)	342 (33.0)	364 (12.8)	95 (20.7)	28 (22.8)	18 (19.0)
Year of diagnosis							
1998-2002	3093 (34.0)	1682 (37.1)	337 (32.6)	876 (30.9)	139 (30.3)	23 (18.7)	36 (37.9)
2003-2007	3265 (35.9)	1600 (35.3)	393 (38.0)	1059 (37.4)	142 (30.9)	41 (33.3)	30 (31.6)
2008-2012	2724 (30.0)	1252 (27.6)	305 (29.5)	901 (31.8)	178 (38.8)	59 (48.0)	29 (30.5)
Age group at diagnosis, y							
<20	263 (2.9)	87 (1.9)	61 (5.9)	100 (3.5)	8 (1.8)	6 (4.9)	1 (1.1)
20-39	5358 (59.0)	2380 (52.5)	601 (58.1)	1928 (68.0)	303 (66.0)	84 (68.3)	62 (65.3)
40-59	3193 (35.2)	1907 (42.1)	349 (33.7)	744 (26.2)	137 (29.9)	26 (21.1)	30 (31.6)
≥60	268 (3.0)	160 (3.5)	24 (2.3)	64 (2.3)	11 (2.4)	7 (5.7)	2 (2.1)
Mean age at diagnosis, y	36.7	38.6	35.2	34.6	35.5	34.2	35.9
Mode of transmission							
MSM	5495 (60.5)	3087 (68.1)	388 (37.5)	1672 (59.0)	234 (51.0)	66 (53.7)	48 (50.5)
Injection Drug Use (IDU)	1013 (11.2)	467 (10.3)	152 (14.7)	319 (11.3)	59 (12.9)	4 (3.3)	12 (12.6)
MSM/IDU	676 (7.4)	346 (7.6)	63 (6.1)	204 (7.2)	47 (10.2)	2 (1.6)	14 (14.7)
Heterosexual	1051 (11.6)	338 (7.5)	244 (23.6)	357 (12.6)	77 (16.8)	25 (20.3)	10 (10.5)
Other/Unknown	847 (9.3)	296 (6.5)	188 (18.2)	284 (10.0)	42 (9.2)	26 (21.1)	11 (11.6)
Nadir CD4 count, cells/UL							
<50	2112 (23.3)	927 (20.5)	248 (24.0)	773 (27.3)	125 (27.2)	15 (12.2)	24 (25.3)
50-199	2441 (26.9)	1213 (26.8)	257 (24.8)	772 (27.2)	147 (32.0)	31 (25.2)	21 (22.1)
200-349	1476 (16.3)	716 (15.8)	159 (15.4)	478 (16.9)	84 (18.3)	25 (20.3)	14 (14.7)
350-499	1499 (16.5)	811 (17.9)	176 (17.0)	413 (14.6)	59 (12.9)	26 (21.1)	14 (14.7)
≥500	1554 (17.1)	867 (19.1)	195 (18.8)	400 (14.1)	44 (9.6)	26 (21.1)	22 (23.2)
Median CD4 count, cells/UL	407	443	387	353	338	480	416
Met AIDS classification							
Yes	5214 (57.4)	2480 (54.7)	583 (56.3)	1738 (61.3)	306 (66.7)	56 (45.5)	51 (53.7)
No	3868 (42.6)	2054 (45.3)	452 (43.7)	1098 (38.7)	153 (33.3)	67 (54.5)	44 (46.3)
Vital status in 2012							
Alive	7697 (84.8)	3858 (85.1)	855 (82.6)	2424 (85.5)	373 (81.3)	116 (94.3)	71 (74.7)
Dead	1385 (15.3)	676 (14.9)	180 (17.4)	412 (14.5)	86 (18.7)	7 (5.7)	24 (25.3)
Cause of death							
HIV-associated	996 (71.9)	462 (68.3)	129 (71.7)	317 (76.9)	64 (74.4)	6 (85.7)	18 (75.0)
Unrelated	389 (28.1)	214 (31.7)	51 (28.3)	95 (23.1)	22 (25.6)	1 (14.3)	6 (25.0)
Mean Survival, mo	168.4	168.9	166.4*	168.8	165.9	175.8*	157.2*

* indicates a statistically significant value (p-value <0.05)

Table 2 : Cox Proportional Regression Hazard Ratios

	Model 1 (Entire Sample)		Model 2 (Entire Sample)		Model 3 HIV Only Sample		Model 4 HIV/AIDS Sample	
Race/Ethnicity (REF = White)	Hazard Ratio	Pr > ChiSq	Hazard Ratio	Pr > ChiSq	Hazard Ratio	Pr > ChiSq	Hazard Ratio	Pr > ChiSq
Black	**1.19**	**0.0415**	**1.50**	**<.0001**	1.18	0.5119	**1.43**	**<.0001**
Asian	**0.37**	**0.0080**	0.65	0.2618	0.00	0.9749	0.84	0.6538
American Indian	**1.28**	**0.0290**	**1.73**	**<.0001**	1.44	0.3599	**1.44**	**0.0025**
Multiple Race	**1.85**	**0.0031**	**2.14**	**0.0003**	0.98	0.9785	**2.53**	**<.0001**
Hispanic	0.98	0.6808	**1.31**	**<.0001**	0.87	0.4904	**1.22**	**0.0039**
Age at HIV Diagnosis			**1.05**	**<.0001**	**1.06**	**<.0001**	**1.04**	**<.0001**
Female			0.90	0.1608	0.87	0.8736	1.01	0.8806
Diagnosis Year			**0.85**	**<.0001**	**0.82**	**<.0001**	**0.88**	**<.0001**

Figure 1. Kaplan-Meier Survival Curves for entire cohort, by race/ethnicity (Model 1)

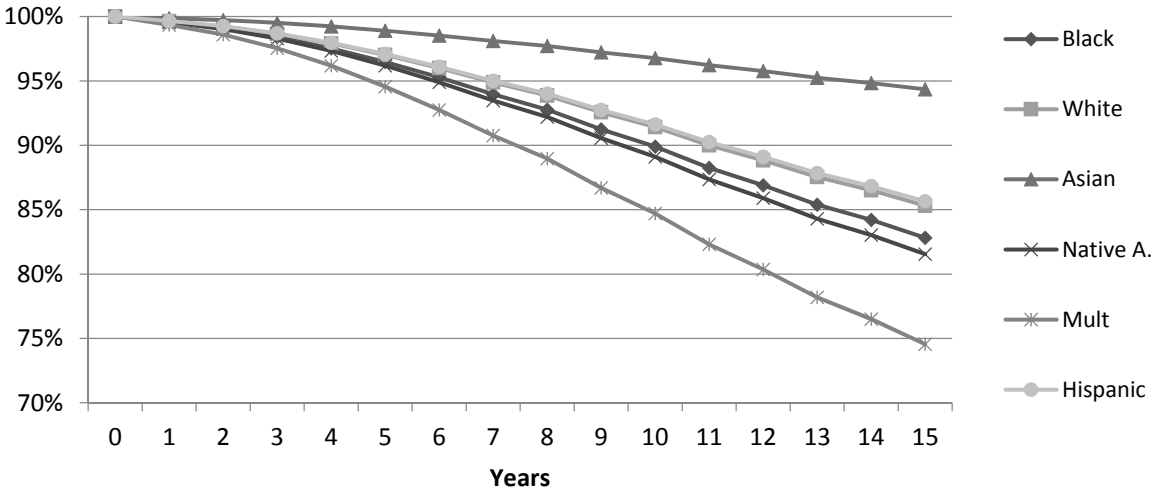


Figure 2. Kaplan-Meier Survival Curves for entire cohort, by race/ethnicity with covariates (Model 2)

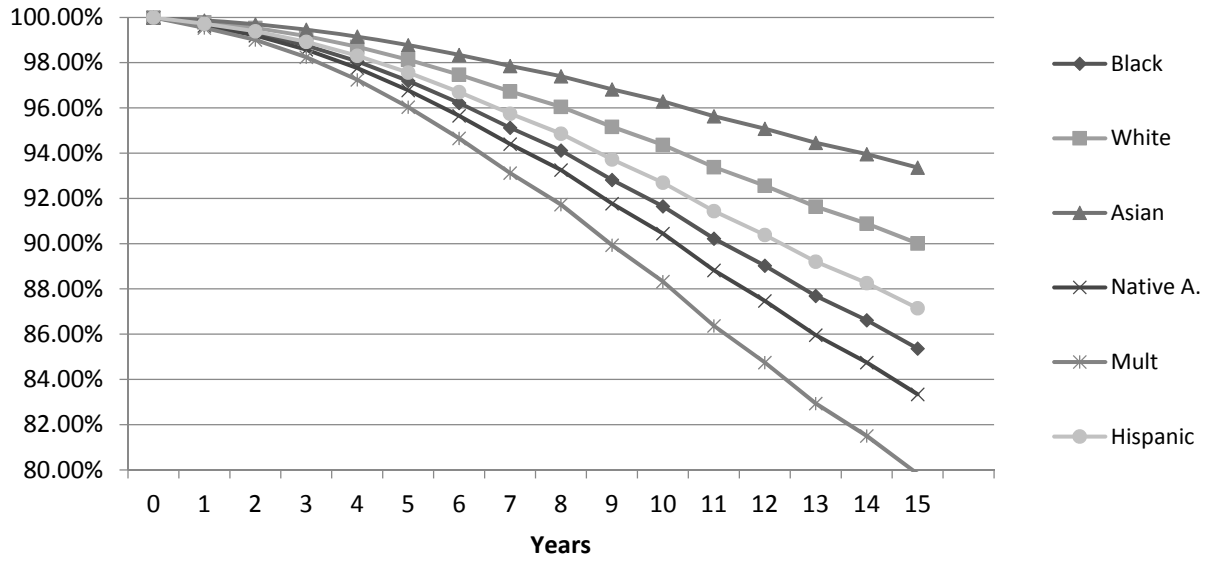
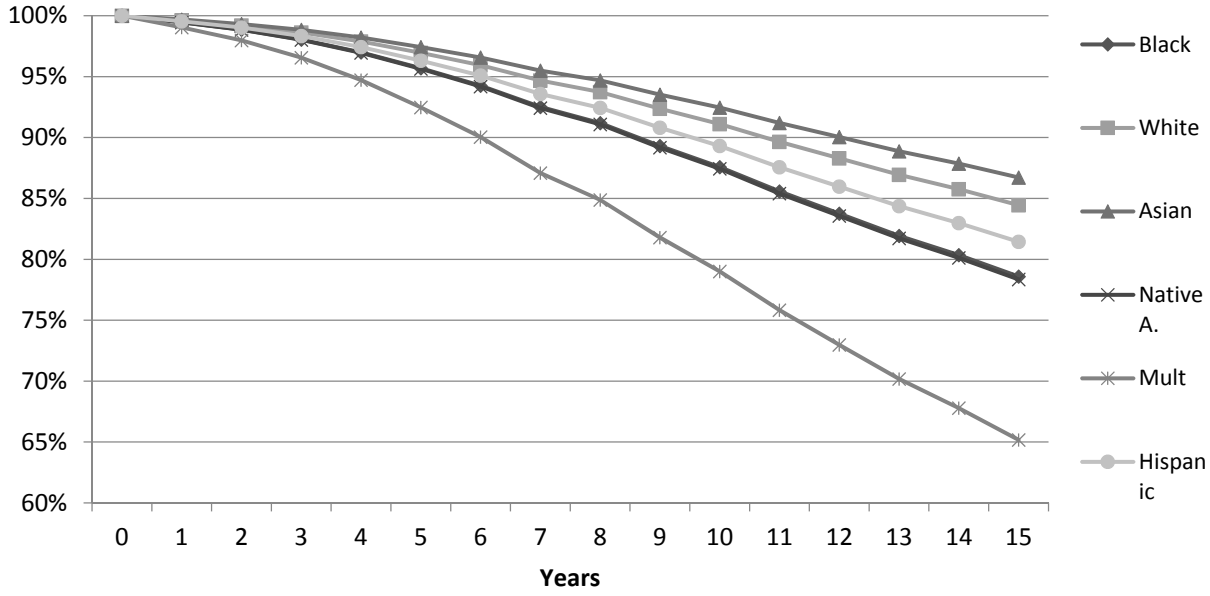


Figure 3. Kaplan-Meier Survival Curves for AIDS cohort, by race/ethnicity (Model 4)



Discussion:

There are two principal findings from this study: racial/ethnic disparities, particularly between Whites and Blacks/Hispanics/Native Americans/Multiple races, exist in all-cause survival among those diagnosed with HIV/AIDS in the past 15 years, and the largest disparities are seen among AIDS-specific patients. These findings support hypothesis 1 (Cox proportional hazard ratios will indicate that racial/ethnic minorities, particularly Blacks, have lower HIV survival rates than Whites) and hypothesis 2 (Racial/ethnic disparities in HIV survival will widen when considering confounding variables such as age at diagnosis, gender, and diagnosis year).

The first principal finding can be explained by various factors. As confirmed by other studies [27,28], low nadir CD4 count, low CD4 count at any point after diagnosis, and injection drug use (IDU) have been associated with greater morbidity and mortality. In this study, Whites had a higher proportion in the group with the highest nadir CD4 count, higher median CD4 count, and fewer IDU than all other races/ethnicities studied besides Asians. Additional reasons for the survival disparities could be factors such as perceived racial/ethnic discrimination, discrimination by providers, distrust in providers, certain beliefs about or lack of knowledge of HIV discouraging adherence, less access to care, and general stress [24]. Older age has also been associated with lower survival [27], but is not a possible explanation in this study because Whites had the highest mean age at diagnosis out of all races/ethnicities considered.

The lack of major disparity between Whites and Asians has been previously described in the literature. This is not specific to HIV/AIDS as Asians have been noted to have lower mortality in other common diseases such as cardiovascular disease [28, 29], cerebrovascular disease [28, 29], cancer [28, 29], and chronic obstructive pulmonary disease [28, 29]. However, even in HIV, Asians have been noted to have lower mortality [28, 29]. The reasons are most likely multi-factorial with genetic, environmental, dietary, and lifestyle factors playing a role [28,29]. Hispanics did show statistically significant disparities in models 2 and 4, where covariates such as age at diagnosis, diagnosis year, gender, and AIDS status were adjusted for, but did not show overwhelming differences. This has also been described in the literature [30]. The lack of statistically significant disparities in HIV survival as seen in model 3 is not surprising. HIV survival in those with non-AIDS are comparable to the normal uninfected population, while

survival in those with AIDS are much lower than the normal population [31]. In other words, HIV-associated mortality is very rarely due to HIV that has not progressed to AIDS. The vast majority of those that succumb to their HIV do so on the basis that their CD4 lymphocyte counts drop to a level where they become classified as AIDS [32].

The second principal finding was that disparities widened among the AIDS cohort. The explanation for these disparities are likely similar to the explanations given above for the entire cohort. However, there may be a larger effect from a lack of access to care and adherence, which are strongly tied to socioeconomic factors. Pre-HAART, one would expect people to progress to AIDS due to a lack of effective treatment. However, in a post-HAART time period such as the one in this study, those that have progressed to AIDS are likely to be a group of people with less access to care or difficulty with adherence [24]. Difficulty with adherence is a variable that is difficult to elucidate in terms of why it occurs. However, it is likely correlated with a lack of health insurance, access to care, and other socioeconomic factors [24]. Adherence is not merely a product of strong will or attentiveness. A daily commitment to stick with medication is cultivated also by a continuous and trustworthy patient-physician relationship, positive conveyance of information by a provider, and long-term stability of care. All of these require adequate access to health care [24].

The decision to analyze HIV survival in the past 15 years from 1998 to 2012 was twofold. Firstly, it was crucial to ascertain that any potential disparities in HIV survival not be due to major differences in HIV treatment guidelines. With the advent of highly active antiretroviral therapy (HAART) in July 1996, by 1998 HAART had already had a reasonable amount of time to be firmly established and circumvent any potential confounding effect brought upon by differences in treatment. There is also evidence that disparities in HAART use, though still present, began to decrease by 1998 [26]. Secondly, prior to 1998 ADHS encountered some challenges with regards to data integrity. However, by 1998, these issues had been sufficiently resolved with the installment of a new and modern standard for quality assurance.

Future Directions:

Inevitably, there are some limitations to this study. First, there were some limitations to the ADHS databases. For instance, at the time of analysis (September 2013), the ADHS death data for 2012 was incomplete. While this was limited to a minimal number of cases and may have little to no effect on the conclusions of the study, it is a noted limitation. Also, there was some difficulty trying to create a standardized definition of what an HIV-associated death is. There are over 900 ICD-09 codes that can be attributed to cause of death, and many cases have secondary, tertiary, and even quaternary causes of death listed. For the purposes of this study, it was determined that an HIV-associated death was any case with HIV mentioned in the ICD-09 code as a cause of death. There were 3 such codes that fit this description. We realize that this may underreport the number of HIV-associated deaths. Moreover, we recognize that reported causes of death may differ depending on the determining physician, clinic site, number of comorbidities, year of death, and so on.

Second, while this study illustrates that racial/ethnic disparities in HIV survival exist, it does not definitively explain why these disparities exist. Several attempts to explain them were made with evidence from literature, but conclusive statements are outside of the scope of this study since socioeconomic factors such as household income, zip codes within poverty area limits, and education were not included in this study. The reasons are likely multi-factorial, but further studies are necessary to ascertain this to be true.

Future studies can look to circumvent these limitations by taking into consideration these other multiple factors. For instance, socioeconomic factors could be considered by perhaps analyzing the dataset based on zip codes, household income, or education status. Further projects could also investigate biological differences between ethnicities, performing genomic tests to see if differences in virology or immune defenses exist within ethnicities.

Conclusion:

Caucasian HIV-positive patients outlive their minority counterparts (have higher median survival) at all stages of their illness (both HIV and HIV/AIDS). Caucasians also appear to be managed better on their HIV, demonstrating higher nadir and median CD4+ counts, and a lower percentage classified as AIDS. With the exception of Asians, who had higher survival than Whites, all other races/ethnicities studied (Blacks, Hispanics, Native-Americans, Multiple/Other) had poorer survival than Whites. Blacks, Native-Americans, and Multiple/Other demonstrated shorter survival at all stages of their HIV diagnosis, while Hispanics showed shorter survival among the AIDS cohort. Disparities widened when adjusting for AIDS diagnosis. Identifying the cause of these disparities is beyond the scope of this study. Still, it is evident that a significant disparity in HIV survival exists in racial/ethnic minorities. Further studies investigating genetic, socioeconomic, and other statewide factors would be useful to ascertain the cause. Nevertheless, the available evidence indicates that there are striking disparities in Arizona when it comes to HIV survival that must be addressed.

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