

# Hospitalizations for Cardiovascular Disease in African Americans and Whites with HIV/AIDS

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## Abstract

Therapeutic advances have resulted in an epidemiological shift in the predominant causes of hospitalization for patients with HIV/AIDS. An emerging cause for hospitalization in this patient population is cardiovascular disease (CVD); however, data are limited regarding how this shift affects different racial groups. The objective of this observational, retrospective study was to evaluate the association between race and hospitalization for CVD in African Americans and whites with HIV/AIDS and to compare the types of CVD-related hospitalizations between African Americans and whites with HIV/AIDS. Approximately 1.5 million hospital discharges from the US National Hospital Discharge Surveys for the years of 1996 to 2008 were identified. After controlling for potential confounders, the odds of CVD-related hospitalization in patients with HIV/AIDS were 45% higher for African Americans than whites (odds ratio [OR]=1.45, 95% CI, 1.39–1.51). Other covariates that were associated with increased odds of hospitalization for CVD included chronic kidney disease (OR=1.43, 95% CI, 1.36–1.51), age  $\geq 50$  years (OR=3.22, 95% CI, 2.94–3.54), region in the Southern United States (OR=1.17, 95% CI, 1.11–1.23), and Medicare insurance coverage (OR=1.71, 95% CI, 1.60–1.83). Male sex was not significantly associated with the study outcome (OR=0.99, 95% CI, 0.96–1.02). Compared to whites with HIV/AIDS, African Americans with HIV/AIDS had more hospitalizations for heart failure and hypertension, but fewer hospitalizations for stroke and coronary heart disease. In conclusion, African Americans with HIV/AIDS have increased odds of CVD-related hospitalization as compared to whites with HIV/AIDS. Furthermore, the most common types of CVD-related hospitalizations differ significantly in African Americans and whites. (*Population Health Management* 2013;16:201–207)

## Introduction

**D**ESPITE THE MANY ADVANCES in HIV/AIDS care over the years, African Americans in the United States continue to account for the majority of HIV/AIDS-related hospitalizations. In fact, African Americans are hospitalized more often than any other race or ethnicity with HIV/AIDS.<sup>1,2</sup> The rates of HIV/AIDS-related hospitalizations have markedly decreased since the introduction of highly active antiretroviral therapy (HAART) several years ago.<sup>1,3</sup> HAART has resulted in an epidemiological shift in the predominant causes of hospitalization; studies have documented a trend toward non-AIDS defining chronic illnesses, including cardiovascular disease (CVD), as an increasing cause for hospitalization for

HIV/AIDS patients.<sup>1,3</sup> However, data are limited regarding how this change has impacted the African American HIV/AIDS community. This study evaluated the relationship between race and CVD-related hospitalization among African Americans and whites with HIV/AIDS. This study also compared the types of CVD-related hospitalizations between African Americans and whites with and without HIV/AIDS.

## Methods

### Data source

This was an observational, retrospective comparison of hospital discharges by African Americans and whites with and without HIV/AIDS. Data were retrieved from the

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United States National Hospital Discharge Surveys (NHDS) for the years of 1996 to 2008. These are publicly available, national, probability sample surveys that have been administered annually by the Centers for Disease Control and Prevention since 1965.<sup>4</sup> These surveys collect data from nonfederal acute care hospitals (institutions with an average length of stay <30 days) to characterize inpatients discharged from such facilities. These data have been used previously to characterize CVD-related hospitalizations.<sup>5-7</sup>

### Study design

The Office of the Institutional Review Board at the University of Texas Health Science Center determined that this study did not involve human subjects research; therefore, approval was not necessary. This study encompassed discharges by African Americans and whites between 1996 and 2008. The primary outcome of interest was the rate of CVD-related hospitalization in African Americans and whites with HIV/AIDS. CVD-related hospitalizations were defined as having 1 of the following *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes in the principal discharge position: 401-404 (hypertension), 410-414, 429.2 (coronary heart disease [CHD]), 428 (heart failure), or 430-438 (stroke). These CVD diagnosis codes mimic those used by the American Heart Association (AHA).<sup>8</sup> Any non-CVD ICD-9-CM code in the principal position was classified as a non-CVD-related hospitalization. Codes 042-044, V08, or 079.53 in any of the 6 remaining diagnosis fields were used to denote HIV/AIDS diagnosis. Patients <15 years of age at time of hospitalization and those of non-African American or nonwhite race were excluded from the study. Hospitalizations lasting <24 hours also were excluded, as these may have been more representative of emergency care.

### Data analysis

All data were analyzed using JMP 8.0 (SAS Institute Inc., Cary, NC). A prespecified, 2-tailed alpha level of 0.05 was used to determine statistical significance. Patient discharge weights were incorporated to generate nationally representative estimates. Annual noninstitutionalized civilian population estimates for persons  $\geq 15$  years of age were retrieved from the US Census Bureau to generate population-based incidence rates for discharges. Chi-square tests were used for bivariable analysis of categorical data. A binomial logistic regression model was constructed to identify independent risk factors for CVD-related hospitalization. Independent variables included race, year of hospitalization, age, sex, geographic region, insurance status, and presence of chronic kidney disease (CKD). After fitting the main effects model, tests for statistical interactions were then conducted entering interaction terms simultaneously in a backward stepwise regression. Nonstatistically significant or unstable terms were removed.

## Results

### Hospitalization rates by race in patients with and without HIV/AIDS

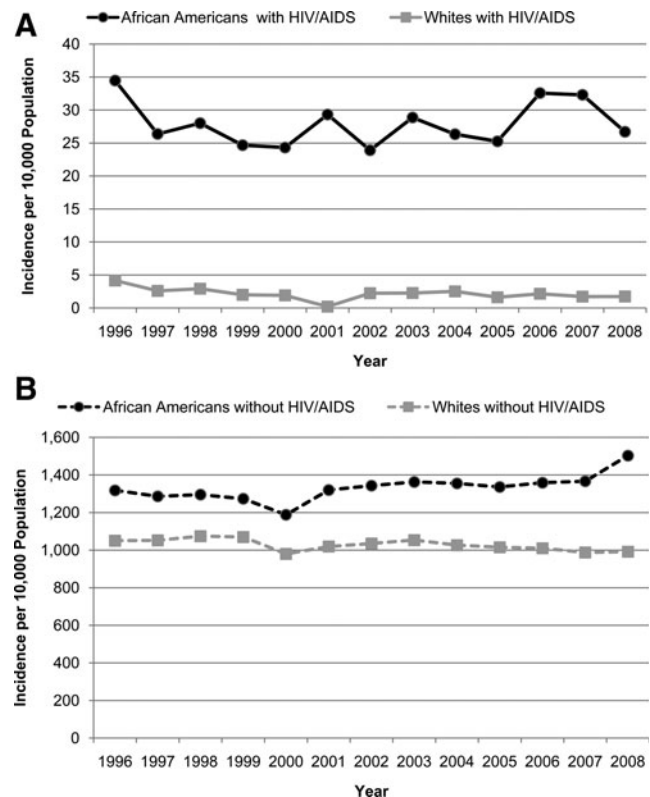
Between 1996 and 2008, an estimated 1.5 million hospital discharges occurred in African Americans and whites with

HIV/AIDS, and an estimated 288 million hospital discharges occurred in African Americans and whites without HIV/AIDS. The incidence rate for HIV/AIDS discharges in African Americans was 34.5 per 10,000 population in 1996 and decreased to 26.7 per 10,000 population by 2008 (Fig. 1a); the rate of decline varied from year to year. For whites, the incidence rate for HIV/AIDS discharges in 1996 was 4.2 per 10,000 population and decreased to 1.7 per 10,000 population by 2008.

The incidence rate for non-HIV/AIDS discharges in African Americans was 1318 per 10,000 population in 1996 and increased to 1503 per 10,000 population by 2008 (Fig. 1b). For whites, the incidence rate for non-HIV/AIDS discharges in 1996 was 1050 per 10,000 population and decreased to 992 per 10,000 population by 2008. The prevalence of primary CVD diagnosis for HIV/AIDS discharges was 4% in African Americans and 2% in whites, whereas the prevalence of primary CVD diagnosis for non-HIV/AIDS discharges was 15% for both African Americans and whites.

### Risk factors associated with CVD-related hospitalization in patients with HIV/AIDS

In the binomial regression model, the odds of CVD-related hospitalization in patients with HIV/AIDS were 45% higher for African Americans than for whites (Table 1). The presence of CKD was also a significant risk factor for CVD-related hospitalization. Other variables that were associated with increased odds of hospitalization for CVD included



**FIG. 1.** Population-based incidence of hospital discharges from 1996-2008 for (A) African Americans and whites with HIV/AIDS and (B) African Americans and whites without HIV/AIDS.

TABLE 1. LOGISTIC REGRESSION ANALYSIS FOR RISK FACTORS ASSOCIATED WITH CVD-RELATED HOSPITALIZATION AMONG AFRICAN AMERICANS AND WHITES WITH HIV/AIDS

Variable	$\beta$	Standard Error	Wald Chi-Sq	P Value	OR	95% CI
Intercept	-3.92	0.06	4507.79	<0.001	0.02	-
Race (White referent)	-	-	-	-	-	-
African American	0.37	0.02	314.10	<0.001	1.45	(1.39-1.51)
Sex (Female referent)	-	-	-	-	-	-
Male	-0.01	0.02	0.35	0.56	0.99	(0.96-1.02)
Age (y) (15-29 referent)	-	-	1070.86	<0.001	-	-
30-49	0.16	0.05	11.96	<0.001	1.18	(1.07-1.29)
≥50	1.17	0.05	595.75	<0.001	3.22	(2.94-3.54)
Geographic region (Northeast referent)	-	-	46.46	<0.001	-	-
Midwest	-0.10	0.05	4.21	0.04	0.91	(0.83-1.00)
West	0.02	0.04	0.33	0.57	1.02	(0.94-1.11)
South	0.16	0.03	33.17	<0.001	1.17	(1.11-1.23)
Insurance status (Private referent)	-	-	288.21	<0.001	-	-
Uninsured	-0.59	0.07	66.05	<0.001	0.56	(0.48-0.64)
Medicaid	0.26	0.03	58.20	<0.001	1.29	(1.21-1.38)
Medicare	0.54	0.04	232.24	<0.001	1.71	(1.60-1.83)
Other/unknown	-0.62	0.07	72.83	<0.001	0.54	(0.47-0.62)
Year (1996 referent)	-	-	276.16	<0.001	-	-
1997	-0.40	0.07	29.44	<0.001	0.67	(0.58-0.77)
1998	0.10	0.06	3.24	0.07	1.11	(0.99-1.24)
1999	-0.08	0.07	1.55	0.21	0.92	(0.81-1.05)
2000	0.00	0.06	0.00	0.97	1.00	(0.89-1.13)
2001	0.19	0.05	12.26	<0.001	1.21	(1.09-1.34)
2002	-0.07	0.06	1.22	0.27	0.93	(0.83-1.06)
2003	0.53	0.05	125.98	<0.001	1.71	(1.55-1.87)
2004	-0.06	0.06	1.14	0.29	0.94	(0.84-1.05)
2005	0.12	0.06	4.25	0.04	1.12	(1.01-1.26)
2006	0.36	0.06	62.68	<0.001	1.44	(1.31-1.57)
2007	-0.35	0.06	34.49	<0.001	0.71	(0.63-0.79)
2008	-0.31	0.06	27.83	<0.001	0.74	(0.66-0.82)
CKD (No CKD referent)	-	-	-	-	-	-
CKD	0.36	0.03	180.22	<0.001	1.43	(1.36-1.51)

R<sup>2</sup>(U)=0.0747; Ch-sq=2610.08; P<0.001.

CKD, chronic kidney disease; CVD, cardiovascular disease; OR, odds ratio.

older age (≥50 years), region in the Southern United States, and Medicaid and Medicare insurance coverage (Table 1). Male sex was not significantly associated with CVD-related hospitalization. After fitting the main effects model, the following interaction terms remained statistically significant: race\*sex, race\*geographic region, and race\*insurance status (P<0.001). However, the odds of CVD-related hospitalization were still greater for African Americans than for whites (odds ratio=1.96, 95% CI, 1.77-2.17).

*Comparison of selected baseline demographics in patients with HIV/AIDS by race*

Demographic variables that differed significantly between African Americans and whites with HIV/AIDS included: age, sex, geographic region, insurance status, and CKD (all P<0.001) (Table 2). The small differences in age categories are likely of limited practical significance. Of note, a greater proportion of African Americans were female as compared

to whites. A greater proportion of African Americans than whites resided in the Southern and Northeast United States, while a smaller proportion of African Americans than whites resided in the West. A smaller proportion of African Americans than whites possessed private insurance and Medicaid insurance, while a greater proportion had Medicare coverage. Lastly, CKD diagnosis was more common in African Americans than in whites.

*Racial comparison of the types of CVD-related hospitalizations by HIV/AIDS status*

Significant associations were observed for CVD type in both African Americans and whites by HIV/AIDS status (Fig. 2). Compared to African Americans without HIV/AIDS, African Americans with HIV/AIDS had greater proportions of heart failure and hypertension, but lower proportions of stroke and CHD (χ<sup>2</sup>=359.94; df=3; P<0.001). Whites with HIV/AIDS had slightly greater proportions of

TABLE 2. COMPARISON OF SELECTED DEMOGRAPHICS BETWEEN HOSPITALIZED AFRICAN AMERICANS AND WHITES WITH HIV/AIDS

Demographic	African Americans (n=952,959)	Whites (n=540,446)	P Value
Age (y), %	-	-	<0.001
15–29	8.5%	7.4%	-
30–49	72.1%	72.3%	-
≥50	19.4%	20.3%	-
Sex, %	-	-	<0.001
Male	60.4%	79.7%	-
Female	39.6%	20.3%	-
Geographic region, %	-	-	<0.001
Northeast	30.3%	25.5%	-
Midwest	9.6%	8.3%	-
West	6.2%	28.0%	-
South	53.9%	38.3%	-
Insurance status, %	-	-	<0.001
Private	14.0%	27.5%	-
Uninsured	9.5%	8.1%	-
Medicare	46.1%	32.2%	-
Medicaid	21.9%	26.0%	-
Other/unknown	8.5%	6.2%	-
Chronic kidney disease, %	-	-	<0.001
Yes	6.8%	2.0%	-
No	93.2%	98.0%	-

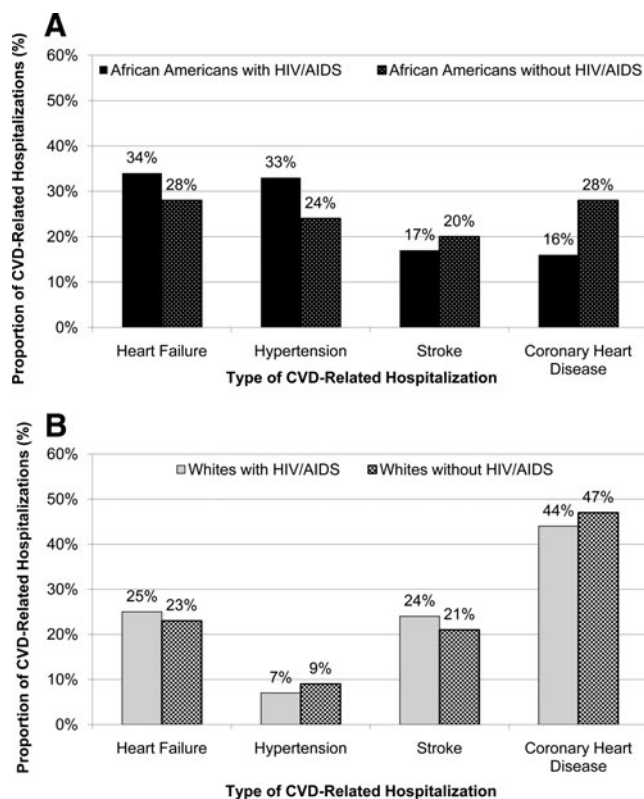


FIG. 2. Types of cardiovascular disease (CVD)-related hospitalizations in (A) African Americans with and without HIV/AIDS and (B) whites with and without HIV/AIDS.

heart failure and stroke, but slightly lower proportions of CHD and hypertension than whites without HIV/AIDS ( $\chi^2=13.18$ ;  $df=3$ ;  $P<0.001$ ). A post hoc subgroup analysis of the African American cohort of patients  $\geq 50$  years of age at time of hospitalization was conducted to assess the magnitude of difference for CVD type; similar relationships were seen for the older cohort, but the differences were less pronounced ( $\chi^2=27.24$ ;  $df=3$ ;  $P<0.001$ ).

#### Racial comparison of the types of CVD-related hospitalizations in patients with HIV/AIDS by sex

Similar trends in CVD type between the 2 sexes were noted in both races, in that CHD and heart failure were greater in males than in females (Fig. 3). In contrast, hypertension and stroke were greater in females than in males. The association between CVD type and sex was statistically significant for African Americans with HIV/AIDS ( $\chi^2=339.05$ ;  $df=3$ ;  $P<0.001$ ) as well as for whites with HIV/AIDS ( $\chi^2=68.99$ ;  $df=3$ ;  $P<0.001$ ).

#### Discussion

This study investigated the relationships between race, HIV/AIDS, and hospitalizations for CVD and, thus, adds to the limited body of knowledge in this area. Pertinent findings are that race appears to influence the occurrence and type of CVD-related hospitalization in HIV/AIDS patients. There also appears to be a sex–race interaction for the various conditions; men with HIV/AIDS had greater proportions of heart failure and CHD but lower proportions of hypertension and stroke as compared to their female counterparts.

The present findings, that CVD-related hospitalizations in patients with HIV/AIDS were greater for African Americans

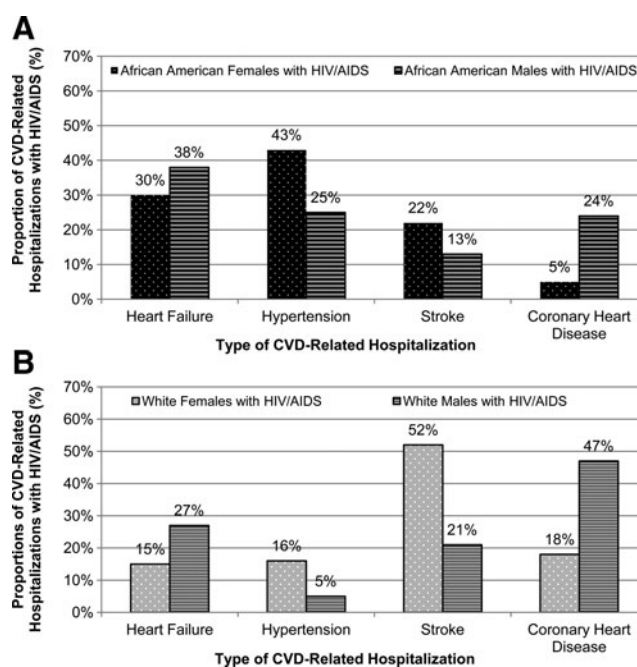


FIG. 3. Types of cardiovascular disease (CVD)-related hospitalization by sex in (A) African Americans with HIV/AIDS and (B) whites with HIV/AIDS.

than for whites, have been reported previously.<sup>1,9</sup> However, other studies have not detected such disparities. For example, it has been purported that presentation with lower CD4+ and the development of AIDS, rather than race, are predictive of cardiac events.<sup>10</sup> It has been demonstrated that African Americans with HIV/AIDS tend to have more progressive disease and lower CD4+ than other races.<sup>11,12</sup> Although these variables were not available for evaluation in the present study, the results of this investigation may help to explain the association of African American race with a higher likelihood of CVD-related hospitalization.

Other factors that were significantly associated with an increase in CVD-related hospitalization included older age, CKD, Southern region, and Medicaid and Medicare coverage. The associations for age and CKD were expected, as both are associated with an increased risk for the development of CVD in the general population.<sup>8</sup> The association for Medicare insurance might be explained by the fact that Medicare provides coverage largely to adults older than 65 years of age, which likely coincides with the age association. Medicaid coverage might be explained by the fact that Medicaid recipients with HIV/AIDS have been reported to have a high prevalence of comorbidities.<sup>13</sup> These comorbid conditions may place patients with HIV/AIDS at greater risk for CVD diagnosis and subsequent CVD-related hospitalizations. The association between the Southern region and CVD-related hospitalizations may denote the high prevalence of obesity in the South; obesity is a risk factor for heart disease and is on the rise in the African American population.<sup>14</sup>

It is worthwhile to note some of the racial demographic differences in patients with HIV/AIDS. Geographic variations, in that African Americans with HIV/AIDS are more likely to reside in the South, are supported by national surveillance data.<sup>15,16</sup> This work also provides support for a possible sex-race interaction for HIV/AIDS and CVD as the burden of disease type varied greatly by race and by sex. African American females were overly represented as compared to white females, a disparity that has been well documented.<sup>5,15,16</sup> Insurance coverage varied greatly between African Americans and whites. Medicaid coverage was reported in nearly half of all African Americans as compared to one third of whites. Patients can qualify for Medicare insurance if they are: older than 65 years of age, have a qualifying disability, or have end-stage renal disease.<sup>17</sup> The higher prevalence of CKD in African Americans might help explain the greater proportion of Medicare as such associations have been demonstrated.<sup>18-20</sup> Although the prevalence of CKD in the general population is greater in African Americans than in whites, the prevalence of CKD between the 2 races in this study was 2-fold greater for African Americans with HIV than for African Americans without HIV. It is possible that race alone does not explain the observed differences in CKD. Further research should explore how HIV/AIDS status is differentially associated with CKD development in African Americans as compared to whites.

The present study also included a comparison of the different types of CVD in the 2 HIV/AIDS race cohorts. Of the 4 types of CVD in this study, CHD has the highest mortality rate and is associated with the highest health care-related costs. CHD is the leading cause of death in the United States, accounting for approximately 1 of every 6 deaths.<sup>21,22</sup> The prevalence of CHD in the general population for the 4

subgroups is somewhat similar. As of 2006, the disease prevalence was 9.4% among white males, 8.8% among African American females, 7.8% among African American males, and 6.9% among white females.<sup>23</sup> This study revealed that the highest proportion of disease was CHD in whites with HIV/AIDS, particularly in males. This coincides with national prevalence data; the greatest proportion of CHD is in white males. Disease burden is next greatest for African American females, yet this study revealed that African American females with HIV/AIDS had the lowest proportion of CHD-related hospitalizations.

It is likely that African Americans with HIV/AIDS and CHD were underrepresented in this study. This may especially be the case for African American females, the subgroup with the lowest prevalence of CHD-related hospitalizations. Because of the study design, out-of-hospital cardiac events were not captured. African Americans have been shown to have nearly double the incidence of out-of-hospital cardiac events than whites, namely cardiac arrest, at an age-adjusted incidence of 10.1 per 10,000 adults compared to a rate of 5.8 per 10,000 adults.<sup>24</sup> Cardiac arrest does not necessarily imply CHD, but CHD is a risk factor for cardiac arrest. Moreover, it is estimated that approximately 250,000 deaths occur each year from sudden cardiac death prior to hospitalization, most frequently in African American men.<sup>25</sup> Similarly, it has been documented that African Americans are less likely than whites to be hospitalized for cardiac-related procedures and are less likely to be admitted to cardiac hospitals.<sup>26</sup> These findings underscore the need to ensure that all patients with HIV/AIDS have adequate access to primary care and preventive health services in order to reduce the occurrence of cardiac events.

Similar to CHD, the prevalence of stroke in the general population is quite similar across the 4 subgroups: African American females (4.3%), African American males (3.8%), white females (3.1%), and white males (2.3%).<sup>23</sup> Stroke is typically more common in women than in men. However, this study revealed an absolute difference between the sexes that was more pronounced in whites with HIV/AIDS than in African Americans with HIV/AIDS; the greatest proportion of stroke was noted in white females. A plausible explanation for this finding could be failure to recognize stroke symptoms in African American females, leading to decreased hospitalizations for stroke.<sup>27</sup> If African American females lack timely recognition of stroke symptoms, they may experience more out-of-hospital events, including mortality. These results reiterate the need for adequate cardiac preventive services for all HIV/AIDS patients in the ambulatory care setting.

Hypertension is a risk factor for other forms of CVD.<sup>8</sup> The prevalence of this disease is more disparate for African Americans than for any other race. Worldwide, African Americans retain the highest prevalence of hypertension; a rising statistic, especially for females.<sup>28</sup> As of 2006, the prevalence of hypertension was 44.8% among African American females, 43.0% among African American males, 31.1% among white females, and 34.3% among white males.<sup>23</sup> The proportion of hypertension-related hospitalization was greatest in African American women. African Americans tend to have higher blood pressure readings and develop the disease at relatively younger ages compared to whites.<sup>29</sup> A study of hypertensive patients from 28 physician

practices nationwide revealed that the odds of blood pressure control were over 50% lower in African Americans than in whites.<sup>29</sup> Mortality attributed to hypertension also varies by subgroup. According to 2006 national vital statistical data, the rate of mortality (per 100,000 population) was 51.1 in African American males, 37.3 in African American females, 15.6 in white males, and 14.3 in white females.<sup>21</sup> As the incidence of HIV infection is on the rise in the young African American population, and hypertension develops in African Americans at younger ages and can lead to other forms of CVD, there is growing cause for concern about CVD in African Americans with HIV/AIDS.

Heart failure was least common compared to the other forms of CVD. Of all the types of CVD in this study, the least amount of disease discordance was noted for heart failure, implying that the concern for race- and sex-based disparities for HIV/AIDS and heart failure may not be as great when compared to the other conditions.

Race also appears to have an influence on HIV/AIDS status and CVD type. The greatest magnitude of difference across all CVD types was 12% in African Americans (CHD) compared to 3% in whites (CHD and stroke). Per post hoc subgroup analysis of the older African American cohort, the magnitude of disease difference for those with HIV/AIDS and those without HIV/AIDS was still most pronounced for CHD (9%). Earlier, it was discussed that African Americans with cardiac arrest may be less likely to receive care in the hospital setting, leading to possible underrepresentation in this study. This is especially concerning for African Americans with HIV/AIDS who have a CHD diagnosis. This unexpected disparity warrants further investigation.

This study was subject to limitations that were primarily related to the nature of the design of the NHDS. All diagnoses were based on coding of up to 7 discharge diagnoses. Determining preexisting conditions and timing of diagnoses was not possible. Medication histories were not available within the NHDS, which precluded evaluating the relationship between long-term HAART exposure and the development of CVD. All data were presented in terms of hospital discharges based on weighted estimates rather than in terms of individual patients. The study was a compilation of cross-sectional data over 13 years, rather than a longitudinal study following the same cohort of patients over a period of time. Information for Hispanic patients was not included, as ethnicity is not collected in these surveys. Lastly, the sample of hospitals included in the NHDS may have changed from year to year, which ultimately may have affected the population of patient discharges that were included in each year. Despite these limitations, this study has advantages compared to prior studies. The present study was long in duration and had a large sample size. CVD was based on the AHA definition and ICD-9-CM codes were used to denote primary diagnoses. This study compared differences in CVD-related hospitalizations by race, sex, and HIV/AIDS status to provide some insight into this complex interaction. The data add to the limited body of literature that pertains to racial and sex-related disparities in CVD-related hospitalizations.

## Conclusion

The study sought to explore the relationship between race, HIV/AIDS, and CVD in an acute care setting. The

findings suggest that African Americans with HIV/AIDS have increased odds of CVD-related hospitalization as compared to whites with HIV/AIDS, and the most common types of CVD-related hospitalization differed significantly by race. There also appears to be a sex-race interaction of CVD type that merits further investigation. These findings underscore the need to ensure that patients with HIV/AIDS, particularly minority patients, have adequate access to primary care and preventive cardiac health services in order to reduce the occurrence of CVD-related hospitalizations.

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