Hospitalization Rates of People Living with HIV in the United States, 2009

MARCUS A. BACHHUBER, MD^a
WILLIAM N. SOUTHERN, MD, MS^b

ABSTRACT

Objectives. We determined hospitalization rates and disparities among people with HIV, which may have been underestimated in previous studies, as only those in medical care were included.

Methods. We estimated the hospitalization rate of people with diagnosed HIV infection in the U.S. in 2009 using two nationally representative datasets. We took the number of hospitalizations from the Nationwide Inpatient Sample and searched each discharge for International Classification of Diseases, Ninth Revision codes for HIV infection and opportunistic infections (OIs). We divided the number of hospitalizations by the number of prevalent diagnosed HIV cases estimated by CDC to produce hospitalization rates, and then compared those rates using Z-tests.

Results. The estimated nationwide hospitalization rate was 26.6 per 100 population. Women had a 51% higher rate than men (35.5 vs. 23.5 per 100 population, $p=0.002$). Black people (31.2 per 100 population, $p=0.01$) had a 42% higher rate, and Hispanic people (18.2 per 100 population, $p=0.23$) had an 18% lower rate than white people (22.1 per 100 population) of hospitalization for any illness. Of hospitalizations with an OI, females with HIV had a 50% higher rate than males with HIV (5.0 vs. 3.4 per 100 population, $p=0.003$). Black people with HIV (4.7 per 100 population, $p<0.001$) had a 72% higher rate and Hispanic people with HIV (2.9 per 100 population, $p=0.78$) had a similar rate of hospitalization with an OI compared with white people with HIV (2.7 per 100 population).

Conclusions. Hospitalization rates among people living with HIV in the U.S. are higher than have been previously estimated. Substantial gender and racial/ethnic disparities in hospitalization rates exist, suggesting that the benefits of antiretroviral therapy have not been realized across all groups equally.

^aMontefiore Medical Center/Albert Einstein College of Medicine, Department of Medicine, Division of General Internal Medicine, Bronx, NY

^bMontefiore Medical Center/Albert Einstein College of Medicine, Department of Medicine, Division of Hospital Medicine, Bronx, NY
Address correspondence to: Marcus A. Bachhuber, MD, Montefiore Medical Center/Albert Einstein College of Medicine, Department of Medicine, Division of General Internal Medicine, 305 E. 161st St., Bronx, NY 10451; tel. 718-920-4321; fax 718-579-2599; e-mail <marcus.bachhuber@gmail.com>.

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Hospitalization rates among people with human immunodeficiency virus (HIV) have fallen in recent years with the widespread use of highly active antiretroviral therapy.¹⁻⁶ However, recent studies examining hospitalizations of people living with HIV in the United States have been limited to those in medical care, and it is unclear if results are generalizable to the total U.S. population with HIV. To produce more generalizable estimates, we conducted a cross-sectional analysis of hospitalization rates among people living with HIV using nationally representative data.

The outcome of hospitalization among people with HIV merits continued study. As antiretroviral therapy (ART) has been associated with a substantial reduction in hospitalization rates among people living with HIV,¹⁻⁶ measuring population-based hospitalization rates may serve as a marker for access to and success of care on a population level. Changes in hospitalization rates may be more sensitive indicators of treatment failures or toxicity than changes in mortality. In addition, hospitalizations represent a substantial portion of the cost of HIV care, especially for those with advanced disease,⁷ and decreases in hospitalizations may allow for the redistribution of resources to other aspects of HIV care.

Recent studies examining hospitalization rates among people living with HIV included only patients engaged in HIV care, possibly underestimating the true hospitalization rates. Population-based studies have estimated that approximately one-quarter of people with newly diagnosed HIV infection do not receive care within one year.⁸⁻¹⁰ In addition, previous studies have shown that in any given year, up to one-half of people living with HIV are not in HIV care.^{8,11-13} Populations not in HIV care do not benefit from ART, and, therefore, may have significantly higher hospitalization rates, particularly for diseases associated with untreated HIV, such as opportunistic infections (OIs). Therefore, by only including those engaged in HIV care, cohort studies may underestimate true hospitalization rates.

Women and those in racial/ethnic minority groups are less likely to be engaged and retained in HIV care.^{11,14,15} Therefore, previous studies may also have preferentially underestimated hospitalization rates in these groups by only including those engaged in care, thus underestimating gender and racial/ethnic disparities in hospitalization rates. To determine unbiased estimates of outcomes disparities by gender and race/ethnicity, we aimed to estimate hospitalization rates for these groups while including patients not in care.

The goals of this study were to (1) estimate the nationwide rate of all-cause hospitalizations, hospitalizations for OIs, and in-hospital deaths among people

living with HIV; and (2) determine if significant gender and racial/ethnic disparities exist in these outcomes for all people living with HIV in the U.S. We hypothesized that hospitalization rates among people living with HIV would be higher than has previously been reported, and that black people, Hispanic people, and women would have higher rates of overall hospitalization, more hospitalizations related to OIs, and a higher rate of in-hospital death.

METHODS

Study overview and outcomes

We used a cross-sectional design to estimate nationwide hospitalization rates among people living with HIV and to determine if there are disparities by gender and race/ethnicity. The primary outcome was hospitalization for any illness. Secondary outcomes included hospitalization with a diagnosis of any OI, hospitalization with a diagnosis of an OI preventable through the use of antibiotic prophylaxis (i.e., prophylaxis-preventable OI), and in-hospital death.

Data sources

We used two data sources for this study. We estimated the number of hospitalizations and in-hospital deaths among people living with HIV in the U.S. using the Nationwide Inpatient Sample (NIS), a part of the Healthcare Cost and Utilization Project, sponsored by the Agency for Healthcare Research and Quality.¹⁶ We took the number of prevalent diagnosed HIV cases from estimates produced by the Centers for Disease Control and Prevention (CDC) using public health reporting data and mathematical modeling.¹⁷

Number of hospitalizations

The NIS is a stratified survey sample of inpatient discharges in the U.S. In 2009, it consisted of data from 1,050 hospitals in 44 states weighted to allow calculation of national estimates. Discharge records in the NIS contain up to 15 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes that correspond to discharge diagnoses. We included all discharges of people ≥ 13 years of age that contained an HIV diagnosis code (042 and V08) in this analysis. Previous research demonstrated the sensitivity of an 042 code for detecting a hospitalized person with HIV from the medical record to be 98%.¹⁸ Data were extracted from the 2009 NIS using procedures to account for the complex weighted survey sample design.¹⁹ Race was reported to the NIS in the form of either one race/ethnicity variable or two separate race and ethnicity variables. When reported as

two separate variables, ethnicity took precedence over race (i.e., Hispanic people could be of any race).²⁰ The NIS samples hospitalizations without patient identifiers; therefore, it is not possible to determine whether the same person was hospitalized multiple times.

All OIs from the 1993 acquired immunodeficiency syndrome (AIDS) case definition²¹ were linked to corresponding ICD-9 codes, as has been done previously.^{18,22–25} OIs included candidiasis (not including infections of skin and mucous membranes, 112.4, 112.5, 112.81, and 112.83–112.85), disseminated or extrapulmonary coccidioidomycosis (114.1–114.3), extrapulmonary cryptococcosis (117.5 and 321.0), cryptosporidiosis (007.4), cytomegalovirus disease (07.85, 484.1, and 573.1), *Herpes simplex* infections (054), disseminated or extrapulmonary histoplasmosis (115.01–115.04, 115.09, 115.11–115.14, 115.19, 115.91–115.94, and 115.99), isosporiasis (007.2), *Mycobacterium tuberculosis* (010–018), and salmonella septicemia (003.1). Prophylaxis-preventable OIs were defined as *Pneumocystis jiroveci* pneumonia (136.3), disseminated or extrapulmonary *Mycobacterium avium* complex infections (031.1 and 031.2), and toxoplasmosis (130.0–130.9).²⁶ If a hospitalization contained a code for both a prophylaxis-preventable OI and a non-prophylaxis-preventable OI, it was counted only once as prophylaxis-preventable. To determine the contribution of pregnancy, labor, and delivery to the overall hospitalization rate of females, hospitalizations were also searched for these diagnosis codes: 640–649, 650–659, 660–669, 670–677, 792.3, V22–V24, V27, and V28. If a hospitalization contained a code for pregnancy, labor, or delivery and a code for an OI, it was counted as both a pregnancy, labor, or delivery hospitalization and an OI hospitalization.

Calculation of hospitalization rates

We calculated hospitalization rates by dividing the number of hospitalizations of people living with HIV (the numerator) by the number of prevalent cases of HIV (the denominator). The number of prevalent HIV cases (the denominator) by gender and racial/ethnic group in the U.S. in 2009 was taken from CDC estimates.¹⁷ CDC estimates report patients with diagnosed and undiagnosed HIV infection. Patients who were discharged from the hospital with undiagnosed HIV infection would not be found in our search of the NIS (the numerator), given that their status was unknown and, therefore, not coded in the medical record. Therefore, we used only estimates of prevalent diagnosed HIV cases as our denominator. In 2009, CDC estimated the number of prevalent diagnosed HIV cases to be 940,600 (95% confidence interval [CI] 908,237, 972,963).

We estimated the number of hospitalizations or in-hospital deaths (the numerator) using the NIS, as described previously. We performed separate calculations for overall hospitalizations, hospitalizations for OIs, hospitalizations for prophylaxis-preventable OIs, in-hospital deaths, and each gender and racial/ethnic group. To generate a 95% CI around the rate, we performed propagation of the standard error (SE) of both the NIS and CDC estimates.

Missing data

Variables of interest were missing for <2% of hospitalizations in the NIS except for race, which was missing in 9.0% of hospitalizations, primarily because four states censor this variable. To allow inclusion of all data and to incorporate uncertainty around missing data, we performed a multistage multiple imputation procedure for all missing variables using methods suitable for large survey samples.^{27–31}

We included all variables in our imputation model that might predict missing information, including state- and county-level racial/ethnic proportions,³² state racial/ethnic proportions of prevalent AIDS cases from public health reporting data,³³ hospital characteristics (e.g., bed size, rural/urban location, census region, and teaching status), discharge-level characteristics (e.g., age, race, primary expected payer, whether the admission was elective, length of stay, and total charges), and characteristics of the survey sample design itself, including sampling stratum and discharge weight.^{27,34}

Five imputations were performed. Hospitalizations of people categorized as Asian or Native American, and those recorded in the NIS as being of other race, were combined into one category for imputation and analysis of demographic variables. Estimation of hospitalization rates was then limited to the racial/ethnic categories white, black, and Hispanic due to the low numbers of individuals and, therefore, high SEs of estimates among people classified as Asian, Native American, or other. The estimated number of hospitalizations (i.e., the national numerator) was found using the SAS® PROC SURVEYFREQ procedure for each of the five imputed datasets by gender and race/ethnicity, and then those results were combined using SAS PROC MIANALYZE to produce a final estimate.³⁵

Statistical analysis

First, we examined the characteristics of hospitalizations among people living with HIV; continuous variables are reported as means $\pm$ SEs, and dichotomous variables are reported as number (percent) with 95% CI. Next, to compare all-cause hospitalization rates, hospitalization rates with OIs, and in-hospital deaths by gender

and race/ethnicity, we used the two-sample Z-test. We considered $p \leq 0.05$ to be statistically significant. We did not adjust p -values for multiple comparisons, as the risk of type I error was deemed acceptable a priori given the exploratory nature of this work.

We performed all statistical calculations using SAS version 9.2.³⁵ Imputations were performed using IVEWare version 0.2.³⁶

RESULTS

In 2009, 249,743 hospitalizations in the NIS had a coded diagnosis of HIV. Characteristics of hospitalizations among people living with HIV are shown in Table 1. The mean age was 45.9 years (SE=0.24). Black people comprised 51.5% (95% CI 47.9, 55.0), white people comprised 28.6% (95% CI 25.0, 32.3), and Hispanic people comprised 12.9% (95% CI 10.1, 15.6) of hospitalizations. The majority of admissions were non-elective (89.8%, 95% CI 88.3, 91.2), with Medicaid the most common expected primary payer (39.9%, 95% CI 36.1, 43.7) followed by Medicare (28.7%, 95% CI 26.6, 30.9).

Population-based hospitalization rate

Hospitalization rates by gender and race/ethnicity are presented in Figure 1. The estimated nationwide hospitalization rate was 26.6 per 100 people (95% CI, 22.2, 30.9). Females had a 51% higher hospitalization rate than males (35.5 per 100 people, 95% CI 29.2, 41.9 vs. 23.5 per 100 people, 95% CI 19.5, 27.6, $p=0.002$). When excluding all hospitalizations with a code for pregnancy, labor, or delivery, the hospitalization rate for females (32.8 per 100 people, 95% CI 26.9, 38.8) remained significantly higher than the hospitalization rate for males ($p=0.01$). Black people (31.2 per 100 people, 95% CI 25.1, 37.4) had a 42% higher hospitalization rate than white people (22.1 per 100 people, 95% CI 18.8, 25.3, $p=0.01$). Hispanic people (18.2 per 100 people, 95% CI 12.7, 23.6) had an 18% lower rate than white people, but this difference was not significant ($p=0.23$).

OIs

As shown in Table 2, the rate of hospitalization with an OI was 3.8 per 100 people (95% CI 3.2, 4.4). Of hospitalizations with an OI, 45% (1.7 per 100 people, 95% CI 1.4, 2.0) had a prophylaxis-preventable OI. Of all OIs, *Pneumocystis jirovecii* pneumonia was the most frequent (1.2 per 100 people, 95% CI 1.0, 1.4), followed by *Herpes simplex* infections (0.8 per 100 people, 95% CI 0.7, 1.0) and *Candida* esophagitis (0.7 per 100 people, 95% CI 0.6, 0.8) (data not shown).

Women had a significantly higher rate of hospitalization with any OI diagnosis than men (5.0 per 100 people, 95% CI 4.1, 6.0 vs. 3.4 per 100 people, 95% CI 2.8, 3.9, $p=0.003$) and a significantly increased rate for prophylaxis-preventable OIs (2.1 per 100 people, 95% CI 1.7, 2.6 vs. 1.6 per 100 people, 95% CI 1.3, 1.9, $p=0.05$) (Table 2). Black people had significantly higher rates of hospitalization with any OI than white people (4.7 per 100 people, 95% CI 3.7, 5.7 vs. 2.7 per 100 people, 95% CI 2.3, 3.1, $p<0.001$) and significantly higher rates of prophylaxis-preventable OIs (2.1 per 100 people, 95% CI 1.6, 2.5 vs. 1.3 per 100 people, 95% CI 1.1, 1.5, $p=0.001$). Compared with white people, Hispanic people had similar rates of hospitalization with any OI (2.9 per 100 people, 95% CI 2.0, 3.8) and prophylaxis-preventable OIs (1.4 per 100 people, 95% CI 0.9, 1.9) (Table 3).

Table 1. Sociodemographic and clinical characteristics of people with HIV who were hospitalized^a in the U.S. (n=249,743), 2009

Characteristic	Percent (95% CI)
Age (in years)	
Mean (SE)	45.9 (0.24)
13–24	3.0 (2.6, 3.4)
25–49	59.0 (57.5, 60.0)
≥50	38.0 (36.4, 39.3)
Gender	
Female	33.6 (31.6, 35.7)
Race/ethnicity	
Black	51.5 (47.9, 55.0)
White	28.6 (25.0, 32.3)
Hispanic	12.9 (10.1, 15.6)
Other, multiple races, unspecified race	7.0 (3.9, 10.2)
Location	
Urban	95.6 (94.5, 97.8)
Rural	4.4 (2.2, 6.5)
Primary payer	
Medicaid	39.9 (36.1, 43.7)
Medicare	28.7 (26.6, 30.9)
Private	15.3 (13.4, 17.2)
Self-pay/no charge	12.7 (9.4, 15.9)
Other	3.4 (2.3, 4.5)
Non-elective admission	89.8 (88.3, 91.2)
Length of stay, in days: mean (SE)	6.3 (0.13)
Charges: mean (SE)	\$41,594 (\$2,584)

^aNo patient-level identifier was available; therefore, multiple hospitalizations of the same patient were counted individually.

HIV = human immunodeficiency virus

CI = confidence interval

SE = standard error

Figure 1. Rates of hospitalization for any illness per 100 people living with HIV in the U.S., by gender and race/ethnicity, 2009

Note: P-values indicate the results of pair-wise testing using a two-sample Z-test, with the reference group being males and white people, respectively. Error bars denote the 95% CIs around the point estimate (labeled).

^aExcluding all hospitalizations with a diagnosis code for pregnancy, labor, or delivery, the hospitalization rate for females was 32.8 per 100 population (95% CI 26.9, 38.8); this rate remained significantly higher than the rate for males ($p=0.01$).

HIV = human immunodeficiency virus

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In-hospital death rate

In-hospital death occurred at an estimated rate of 0.8 per 100 people (95% CI 0.7, 0.9). Females had a 17% higher in-hospital death rate (0.9 per 100 people, 95% CI 0.7, 1.1) than males (0.8 per 100 people, 95% CI 0.7, 0.9), but the difference was not significant ($p=0.23$). Black people had a 53% higher in-hospital death rate (0.9 per 100 people, 95% CI 0.8, 1.1) than white people (0.6 per 100 people, 95% CI 0.5, 0.7, $p=0.002$). Hispanic people had a similar rate (0.6 per 100 people, 95% CI 0.4, 0.8) to white people (data not shown).

DISCUSSION

In this study using nationally representative data, we found hospitalization rates among people living with HIV to be higher than rates that have previously been reported. In addition, we found that females are at

significantly higher risk of hospitalization than males, and that black people are at significantly higher risk of hospitalization than white people. The increased risk for females and black people was seen in all hospitalizations, hospitalizations for OIs, and in-hospital mortality. Because our analysis included all people living with HIV rather than just those engaged in HIV care, we were able to report estimates of hospitalization rates and disparities unbiased by differential rates of medical care. Our findings suggest that, despite recent efforts to reduce disparities in HIV care, women have worse HIV outcomes than men, and black people have worse HIV outcomes than white people in the U.S.

Despite increasingly advanced treatments, people living with HIV in the U.S. are hospitalized at high rates and high cost. Compared with three other recent HIV cohorts (Figure 2), the rate estimated from our data (26.6 per 100 people) is 2.6 and 2.4 times that

Table 2. Rates of hospitalizations for opportunistic infections among people with HIV in the U.S., by gender, 2009

Type of OI	Gender	Rate per 100 people (95% CI)	Rate ratio (95% CI)	P-value ^a
Any OI	All	3.8 (3.2, 4.4)	NA	NA
	Female	5.0 (4.1, 6.0)	1.50 (1.12, 1.88)	0.003
	Male	3.4 (2.8, 3.9)	Ref.	
Prophylaxis-preventable OI ^b	All	1.7 (1.4, 2.0)	NA	NA
	Female	2.1 (1.7, 2.6)	1.33 (1.00, 1.69)	0.05
	Male	1.6 (1.3, 1.9)	Ref.	
Non-prophylaxis-preventable OI	All	2.1 (1.7, 2.4)	NA	NA
	Female	2.9 (2.3, 3.5)	1.65 (1.22, 2.08)	<0.001
	Male	1.8 (1.5, 2.1)	Ref.	

^aCalculated for pair-wise comparisons using a two-sample Z-test

^bProphylaxis-preventable OIs are defined as *Pneumocystis jiroveci* pneumonia, *Mycobacterium avium* complex infections, and toxoplasmosis. If a discharge contained a code for both a prophylaxis-preventable OI and a non-prophylaxis-preventable OI, it was counted only once as prophylaxis-preventable.

HIV = human immunodeficiency virus

OI = opportunistic infection

CI = confidence interval

NA = not applicable

Ref. = referent group

of two other studies,^{3,37} and comparable with a third study.³⁸ Study cohorts were heterogeneous, and the two studies with lower hospitalization rates had more white people, more males, and more privately insured people than the remaining cohort study, as well as the current study. Additionally, the higher hospitalization

rate we found may be due to our cross-sectional design using hospital discharge data, which allowed inclusion of people not engaged in HIV care.

Racial/ethnic and gender disparities in hospitalization rates likely arise from multifactorial origins. Previous work has shown that women and those in racial/

Table 3. Rates of hospitalizations for opportunistic infections among people with HIV in the U.S., by race/ethnicity, 2009

Type of OI	Race/ethnicity	Rate per 100 people (95% CI)	Rate ratio (95% CI)	P-value ^a
Any OI	All	3.8 (3.2, 4.4)	NA	NA
	Hispanic	2.9 (2.0, 3.8)	1.05 (0.68, 1.42)	0.78
	Black	4.7 (3.7, 5.7)	1.72 (1.28, 2.17)	<0.001
	White	2.7 (2.3, 3.1)	Ref.	
Prophylaxis-preventable OI ^b	All	1.7 (1.4, 2.0)	NA	NA
	Hispanic	1.4 (0.9, 1.9)	1.09 (0.68, 1.51)	0.65
	Black	2.1 (1.6, 2.5)	1.62 (1.20, 2.04)	0.001
	White	1.3 (1.1, 1.5)	Ref.	
Non-prophylaxis-preventable OI	All	2.1 (1.7, 2.4)	NA	NA
	Hispanic	1.5 (1.0, 1.0)	1.01 (0.67, 1.37)	0.41
	Black	2.6 (2.1, 3.2)	1.82 (1.32, 2.32)	<0.001
	White	1.5 (1.2, 1.7)	Ref.	

^aCalculated for pair-wise comparisons using a two-sample Z-test with the referent group noted

^bProphylaxis-preventable OIs are defined as *Pneumocystis jiroveci* pneumonia, *Mycobacterium avium* complex infections, and toxoplasmosis. If a discharge contained a code for both a prophylaxis-preventable OI and a non-prophylaxis-preventable OI, it was counted only once as prophylaxis-preventable.

HIV = human immunodeficiency virus

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CI = confidence interval

NA = not applicable

Ref. = referent group

Figure 2. Rates of hospitalization per 100 people living with HIV in the U.S. (2009) compared with three large cohort studies (2003–2007)

Note: Error bars denote the 95% confidence intervals around the point estimate (labeled), when available.

^aBuchacz K, Baker RK, Moorman AC, Richardson JT, Wood KC, Holmberg SD, et al. Rates of hospitalizations and associated diagnoses in a large multisite cohort of HIV patients in the United States, 1994–2005. *AIDS* 2008;22:1345–54.

^bCrum-Cianflone NF, Grandits G, Echols S, Ganesan A, Landrum M, Weintrob A, et al. Trends and causes of hospitalizations among HIV-infected persons during the late HAART era: what is the impact of CD4 counts and HAART use? *J Acquir Immune Defic Syndr* 2010;54:248–57.

^cYehia BR, Fleishman JA, Hicks PL, Ridore M, Moore RD, Gebo KA, et al. Inpatient health services utilization among HIV-infected adult patients in care 2002–2007. *J Acquir Immune Defic Syndr* 2010;53:397–404.

HIV = human immunodeficiency virus

HOPS = HIV Outpatient Study

U.S. military = U.S. military personnel and beneficiaries

HIVRN = HIV Research Network

ethnic minority groups are less likely to be linked to and retained in care; therefore, they are less likely to reap the benefits of ART.^{11,14,15} Even when in care, women and those in racial/ethnic minority groups have been shown to be less often prescribed ART or prophylactic antibiotics when indicated.^{39–47} However, several previous studies of cohorts with equal access to care or that adjust for factors such as adherence and stage of disease have not found outcomes disparities, suggesting that delays in diagnosis, access to treatment, and adherence to medication may mediate gender and racial/ethnic disparities.^{48–53} Further work is urgently needed to design and evaluate programs aimed at these potentially intervention-sensitive factors to improve HIV care and outcomes for all groups. Two of the stated goals of the National HIV/AIDS Strategy, released by the White House on July 13, 2010, include (1) increasing access to care and improving health outcomes for people living with HIV and (2) reducing HIV-related health disparities by improving access to prevention and care services for all Americans.⁵⁴

Limitations

This study was subject to several limitations. First, we may not have captured all hospitalizations of people living with HIV due to the diagnosis code not appearing in administrative data. As a result, our estimates of hospitalization rates were likely conservative. In addition, we could not estimate hospitalizations among people living with undiagnosed HIV infection. Second, data from the NIS are provided on a per-discharge basis, so it cannot be determined if higher hospitalization rates in a certain group reflect a small number of individuals being hospitalized frequently or a more generalized increase in hospitalizations across the group. Among a cohort of people with HIV, 63% of patients who were hospitalized in 2007 were hospitalized once, 19% were hospitalized twice, and 18% were hospitalized three or more times.³⁸ Third, adjusted analyses were not possible with our data given that only summary statistics are known about prevalent HIV cases. The differences between gender and racial/ethnic groups that would remain after adjusting for all variables, such as CD4

lymphocyte counts or duration of HIV diagnosis, could not be determined. Finally, determination of racial/ethnic category was not standardized across hospitals, may not have been by self-report, and was imputed for 9.0% of discharges; as such, misclassification could have biased our estimation of disparities in either direction.

CONCLUSIONS

Despite reductions in hospitalization rates associated with widespread use of ART, people with HIV are still hospitalized at high rates, and substantial gender and racial/ethnic disparities persist. Previous work has shown that women and those in racial/ethnic minority groups are less likely to be engaged and retained in HIV care.^{9,11,14,15} This finding may explain, at least in part, disparities in hospitalization rates. Efforts to systematically remove barriers to care and to find, engage, and retain all people living with HIV in care are urgently needed to realize the full benefits of ART for all groups.

This study was deemed exempt by the Montefiore Medical Center Institutional Review Board.

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