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Longitudinal management and outcomes of acute coronary syndrome in persons living with HIV infection

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Aims Persons living with HIV (PLWH) have increased cardiovascular mortality, which may in part be due to differences in the management of acute coronary syndromes (ACS). The purpose of this study was to compare the in-hospital and post-discharge management and outcomes of ACS among persons with and without HIV.

Methods and results This was a retrospective cohort study using data from Symphony Health, a data warehouse. All patients admitted between 1 January 2014 and 31 December 2016 with ACS were identified by International Classification of Diseases billing codes. Multivariate logistic regression models were used to examine in-hospital, 30-day and 12-month event rates between groups. A total of 1 125 126 individuals were included, 6612 (0.59%) with HIV. Persons living with HIV were younger (57.4 ± 10.5 vs. 67.4 ± 12.9 years, $P< 0.0001$) and had more medical comorbidities. Acute coronary syndrome type did not differ significantly with HIV status. Persons living with HIV were less likely to undergo coronary angiography (35.2% vs. 37.2%, adjusted OR 0.87, 95% CI 0.83–0.92, $P < 0.0001$), and those with both HIV and STEMI underwent fewer drug-eluting stents (60.1% vs. 68.5%, adjusted OR 0.81, 95% CI 0.68–0.96, $P = 0.016$). Persons living with HIV had higher adjusted rates of inpatient mortality (OR 1.29, 95% CI 1.15–1.44; $P < 0.0001$), 30-day readmission (OR 1.18, 95% CI 1.09–1.27; $P < 0.0001$) and 12-month mortality (OR 1.32, 95% CI 1.22–1.44; $P < 0.0001$). Twelve months following discharge, PLWH filled cardiac medications at lower rates.

Conclusion In a contemporary cohort of persons hospitalized for ACS, PLWH received less guideline-supported interventional and medical therapies and had worse clinical outcomes. Strategies to optimize care are warranted in this unique population.

Keywords HIV • Acute coronary syndrome • Outcomes

Introduction

Though the introduction of highly active antiretroviral therapy (HAART) has led to a reduction in HIV-specific mortality,[1] persons living with HIV (PLWH) still have increased overall mortality compared to the general population.[2–4] Much of this excess mortality and morbidity is driven by cardiovascular disease (CVD), with CVD now representing an increasing proportion of overall mortality in this population over the past decade.[5] A recent meta-analysis of over 790 000 PLWH and 3.5 million person-years of follow-up reported that HIV-associated cardiovascular disease has tripled over the past 2 decades and accounts for 2.6 million disability-adjusted life-years worldwide.[6] The underlying mechanism for HIV-associated CVD is thought to be multifactorial, related to a complex interplay of traditional

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CVD risk factors, side effects from HAART, and chronic inflammation from HIV infection itself.[7,33,34] The CVD burden in PLWH is expected to increase dramatically as the current generation ages into their sixth and later decades of life.[8] Given these expected demographic changes, identifying areas in which CVD outcomes can be improved is of paramount importance.

One such area is the management of acute coronary syndrome (ACS) in PLWH. While studies from older practice periods demonstrated overall lower rates of coronary interventions and increased mortality following ACS in PLWH,[9,10] more recent studies have conflicted on whether these disparities persist.[11,12] Prior studies have also suggested that PLWH are at risk of long-term complications of ACS, though few studies have described post-discharge management and outcomes.[13–15] Most national-level studies based in the United States have utilized the National Inpatient Sample, a large all-payer inpatient healthcare database that does not include data on subsequent post-discharge follow-up or prescription data.[16] Overall, it remains unclear what differences in clinical presentation, inpatient management, or post-discharge care persist in PLWH with ACS.

Thus, the purpose of this study was to examine the contemporary inpatient and post-discharge management and outcomes of ACS in HIV using longitudinal claims and pharmacy data from a nationwide data warehouse. We hypothesized that PLWH hospitalized for ACS were less likely to receive percutaneous coronary interventions and cardiac medications and more likely to have greater short- and long-term mortality, as compared with uninfected individuals.

Methods

This was a retrospective, observational cohort study using the Symphony Health nationwide data warehouse. This data set includes > 220 million patients, links inpatient insurance claims, electronic medical records, and outpatient pharmacy claims, and includes Health Insurance Portability and Accountability Act (HIPAA) compliant patient-level data from the entire United States and from all payer types (including commercial, Medicare, and Medicaid). These data allow patients to be tracked over time across multiple healthcare providers and settings, and they have been utilized in other large-scale studies examining national patterns of practice and clinical outcomes.[17,18] As compared to the national databases used in prior large-scale studies,[12,16] this database includes patient data from both inpatient stays and post-discharge care, such as the need for hospital readmission and medication utilization. It also allows for longitudinal follow-up to evaluate for out-of-hospital survival.

Study inclusion criteria were patients ≥18 years of age who had any hospital admission between 1 January 2014 and 31 December 2016 for ACS. Hospital admissions were identified by the International Classification of Diseases Ninth and Tenth (ICD-9-CM and ICD-10-CM) codes for ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI) and unstable angina (UA) (Supplementary material online, *Table S1*). If a subject had multiple hospitalizations during the designated study period, a hospitalization was chosen at random as the index event. To be included, subjects also had to have at least one recorded healthcare encounter, including another hospital admission, outpatient encounter, or prescription filled, in the 12-month period following the index hospitalization for ACS. HIV infection status was defined by ICD-9-CM or ICD-10-CM diagnostic coding (Supplementary material online, *Table S1*). HIV disease-specific information such as CD4 counts and viral load were not available, and so patient AIDS status was not included. Age and sex were reported for all patients. Racial/ethnic data were only available for 240 189 (21.3%) of the entire group and so was not included in multivariate analysis. Comorbidities were collected using the Elixhauser Comorbidity Index. In addition, specific billing codes were used to identify tobacco and other substance use, whereas history of coronary artery disease was defined by hospitalization for ACS in the 12-month period prior to the index hospitalization. Claims codes were also used to identify inpatient procedures and complications during the index hospitalization. All patient-level records were linked via a HIPAA-compliant, de-identified unique patient ID.

The data were verified as meeting the deidentified standard under the HIPAA privacy rule Expert Determination §164.514(b)[1] by Scheuren Ruffner Consultants with a very low statistical risk of re-identification, and the certificate is on file at Symphony Health. Therefore, the study was not considered to be human subject research and the Institutional Review Board (IRB) review was not required. The Beth Israel Deaconess Medical Center and University of California San Francisco IRB agreed with this determination. The study authors had full access to all the data in this study and take responsibility for its integrity and analysis. The primary endpoints were inpatient and 12-month mortality. Secondary endpoints included inpatient cardiovascular procedures performed, inpatient complications, 30-day readmission rates, and rate of cardiovascular prescription filling at 12 months following hospital discharge. Inpatient cardiovascular procedures included: cardiac catheterization; percutaneous coronary intervention (PCI) either a bare-metal stent, drug-eluting stent, or balloon angioplasty alone; stress testing; and transthoracic echocardiography. Inpatient complications included: major bleeding; acute kidney injury; acute heart failure; and stroke. Twelve months post-discharge prescription filling was defined by a dispense date at 12 months following the index hospitalization, with medication filling defined as cumulative time up to the dispense date. Categories of cardiovascular medications assessed included P2Y12 inhibitors, beta-blockers, statin medications, nitrates, anticoagulants, Angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), and diuretics. Aspirin use was not included due to its availability over-the-counter. Prescription filling of antiretroviral (ARV) medications for HIV and Hepatitis C infection was also assessed. See Supplementary material online, *Table S2* for a comprehensive list of medications included. The data underlying this article are available in the article and in its online supplementary material.

Statistical analysis

Continuous variables were summarized by mean and standard deviation and compared by two-sample *t*-test between groups with and without HIV. Categorical variables were summarized by count and percentage and compared using χ^2 test. Multivariable logistic regression models were used to estimate adjusted odds ratios (ORs) for the primary and secondary outcomes. Receipt of inpatient procedures was adjusted for age, sex, medical comorbidities, and ACS sub-type in order to account for differences in the initial presentation of patients. In order to address potential confounding from type II myocardial infarction events, a stratified analysis limited to only those who had undergone coronary angiography and separately for those who presented with STEMI was then performed. Inpatient and post-discharge outcomes were adjusted for age, gender, medical comorbidities, and ACS sub-type. Patients were then stratified into only those who had undergone coronary angiography and then into those who underwent coronary angiography and stenting in order to better examine the effects of coronary interventions on outcomes. A two-sided *P*-value < 0.05 considered statistically significant. All statistical analyses were performed using SAS 9.4 (SAS Inc., Cary, NC, USA).

Results

A total of 1 125 126 individuals were included in this study, of whom 6612 (0.59%) had HIV. *Table 1* shows the baseline demographic characteristics. The PLWH group was significantly younger (57.4 ± 10.5 vs. 67.4 ± 12.9 years, $P < 0.0001$) and were less often women (28.81% vs. 40.29%, $P < 0.0001$). They also had a significantly greater burden of medical comorbidities at admission, including diabetes mellitus, peripheral vascular disease, chronic pulmonary disease, liver disease, renal disease, and hepatitis C infection ($P < 0.05$ for all comparisons). Persons living with HIV also had higher rates of pre-existing coronary artery disease (4.69% vs. 3.56%, $P < 0.001$) along with higher rates of smoking, alcohol, and substance abuse ($P < 0.05$ for all comparisons). Most patients in the cohort were admitted with NSTEMI (52.72%), followed by unstable angina (33.00%) and STEMI (14.28%), with no significant differences between the HIV infected and uninfected groups ($P > 0.05$) (*Table 1*).

During the index hospitalization, inpatient procedures were compared between the HIV infected and uninfected groups and adjusted for age, gender, medical comorbidities, and ACS sub-type. Persons living with HIV were less likely to receive invasive coronary procedures (defined as receiving any left heart catheterization, balloon angioplasty, bare-metal stent, or drug-eluting stent) (35.31% vs. 37.22%, adjusted OR 0.87, 95% CI 0.83–0.92, $P < 0.0001$). Other inpatient procedures are summarized (*Table 2*).

A separate analysis was performed on subjects who presented with STEMI (160 643 or 14.28% of the total cohort). In this subgroup, patients with and without HIV underwent invasive coronary procedures at similar rates [59.38% vs. 59.67%, adjusted OR 0.93 (95% CI 0.81–1.07), $P = 0.29$].

Among the STEMI cohort undergoing angiography, PLWH were less likely to receive drug-eluting stents [60.11% vs. 68.54%, adjusted OR 0.81 (95% CI 0.68–0.96), $P = 0.016$], with trends towards increased balloon angioplasty alone [7.4% vs. 6.93%, adjusted OR 1.03 (95% CI 0.75–1.42), $P = 0.86$] and bare metal stent placement [17.51% vs. 14.14%, adjusted OR 1.11 (95% CI 0.89–1.39), $P = 0.36$] (Supplementary material online, *Table S3*).

In the overall group, persons living with and without HIV had similar rates of inpatient and 12-month mortality. However, after adjusting for demographic factors, medical comorbidities, ACS sub-type, and inpatient procedures, PLWH had statistically significantly greater all-cause inpatient mortality (adjusted OR 1.29, 95% CI 1.15–1.44, *P*

Table 1 Baseline demographic characteristics by HIV status

	HIV+ ($n = 6612$)	HIV− ($n = 1\,118\,514$)	*P*-value
Age, years (±SD)	57.4 ± 10.5	67.4 ± 12.9	<0.0001
Sex			
Men	4707 (71.19%)	667 910 (59.71%)	<0.0001
Women	1905 (28.81%)	450 604 (40.29%)	
Race/ethnicity			
White	474 (7.17%)	159 429 (14.25%)	<0.0001
African American	464 (7.02%)	27 520 (2.46%)	
Hispanic	544 (8.23%)	42 247 (3.78%)	
Other	108 (1.63%)	9403 (0.84%)	
Unknown	5022 (75.95%)	879 915 (78.67%)	
Comorbidities			
Alcohol abuse	1304 (19.72%)	63 087 (5.64%)	<0.0001
Drug abuse	2229 (33.71%)	77 281 (6.91%)	<0.0001
Tobacco use	4133 (62.51%)	478 460 (42.78%)	<0.0001
Coronary artery disease	310 (4.69%)	39 862 (3.56%)	<0.001
Obesity	1,719 (26.00%)	291 032 (26.02%)	0.9685
Hypertension	5774 (87.33%)	970 711 (86.79%)	0.1958
Diabetes	3355 (50.74%)	524 640 (46.91%)	<0.0001
Peripheral vascular disease	2281 (34.5%)	344 987 (30.84%)	<0.0001
Chronic pulmonary disease	3612 (54.63%)	463 514 (41.44%)	<0.0001
Congestive heart failure	3556 (53.78%)	540 535 (48.33%)	<0.0001
Valvular disease	2087 (31.56%)	323 236 (28.90%)	<0.0001
Liver disease	2405 (36.37%)	135 748 (12.14%)	<0.0001
Renal disease	2356 (35.63%)	286 096 (25.58%)	<0.0001
History of hepatitis C	1163 (17.59%)	14 956 (1.34%)	<0.0001
ACS sub-type			
STEMI	933 (14.11%)	159 710 (14.28%)	0.4218
NSTEMI	3447 (52.13%)	589 753 (52.73%)	
Unstable angina	2232 (33.76%)	369 051 (32.99%)	

Table 2 Inpatient procedures by HIV status

	HIV+ (n =6612)	HIV− (n = 1 118 514)	Unadjusted	Adjusted[a]	
			P-value	OR (95% CI)	*P*-value
Invasive coronary procedures	2335 (35.31%)	416 346 (37.22%)	0.0014	0.87 (0.83–0.92)	<0.0001
Left heart catheterization	930 (39.82%[b])	166 724 (40.04%[b])	0.8489	0.94 (0.86–1.03)	0.1922
Balloon angioplasty	120 (5.14%[b])	17 583 (4.22%[b])	0.0303	1.16 (0.96–1.4)	0.1250
Bare metal stent	218 (9.34%[b])	32 222 (7.74%[b])	0.0059	1.12 (0.97–1.29)	0.137
Drug-eluting stent	1074 (46%[b])	201 848 (48.48%[b])	0.0169	0.98 (0.9–1.07)	0.713
Right heart catheterization	155 (2.34%)	23 578 (2.11%)	0.1832		
IABP	105 (1.59%)	20 440 (1.83%)	0.1533		
Impella	17 (0.26%)	3314 (0.3%)	0.6497		
ECMO	4 (0.06%)	482 (0.04%)	0.3774		
ICD	13 (0.2%)	3499 (0.31%)	0.0966		
Temporary pacemaker	17 (0.26%)	5201 (0.46%)	0.0107		
Permanent pacemaker	13 (0.2%)	5363 (0.48%)	0.0003		
Nuclear stress	29 (0.44%)	3358 (0.3%)	0.054	1.33 (0.91–1.92)	0.138
Stress echo/ETT	15 (0.23%)	1860 (0.17%)	0.2236	1.12 (0.67–1.88)	0.6591
Transthoracic echocardiography	347 (5.25%)	41 803 (3.74%)	<0.0001	1.37 (1.23–1.52)	<0.0001

[a]Adjusted for age, sex, medical comorbidities, ACS sub-type.
[b]Fraction of patients undergoing invasive coronary procedures.
Invasive coronary procedures refer to the group including left heart catheterization alone, balloon angioplasty, bare metal stent, drug-eluting stent
IABP, intra-aortic balloon pump. ECMO, extra-corporeal membrane oxygenation; ETT, exercise treadmill testing.

Table 3 Inpatient and post-discharge outcomes by HIV status

	HIV+ (n = 6612)	HIV− (n = 1 118 514)	Unadjusted	Adjusted	
			P-value	OR (95% CI)	*P*-value
Inpatient mortality	372 (5.63%)	59 935 (5.36%)	0.3378	1.29 (1.15–1.44)	<0.0001
Acute heart failure	1302 (19.69%)	259 695 (23.22%)	<0.0001	0.79 (0.74–0.85)	<0.0001
Acute kidney injury	1073 (16.23%)	175 755 (15.71%)	0.2493	1.02 (0.95–1.1)	0.5842
Major bleed	175 (2.65%)	39 242 (3.51%)	0.0001	0.76 (0.66–0.89)	0.0005
Stroke	160 (2.42%)	33 993 (3.04%)	0.0028	0.99 (0.85–1.16)	0.9062
12 month mortality	724 (10.95%)	114 933 (10.28%)	0.0739	1.32 (1.22–1.44)	<.0001
30 day readmission	869 (13.14%)	99 718 (8.92%)	<0.0001	1.18 (1.09–1.27)	<.0001

Adjusted for age, sex, medical comorbidities, ACS sub-type, inpatient procedures undergone.

< 0.0001) and 12-month mortality [adjusted OR 1.32 (95% CI 1.22–1.44), $P < 0.0001$]. They also had an increased risk of 30-day re-admission [adjusted OR 1.18 (95% CI 1.09–1.27), $P < 0.0001$) (*Table 3*). Conversely, this group had fewer in-hospital cardiovascular and adverse events, including acute heart failure, stroke, or bleeding, as compared with those without HIV (*Table 3*). These differences were attenuated after restricting to only those patients who underwent coronary angiography (Supplementary material online, *Table S4*) or stenting (Supplementary material online, *Table S5*).

In the 12-month period following hospital discharge, 813 591 patients (74.36%) of the total study cohort filled any prescription, of whom 4893 (0.6%) had HIV. Persons living with HIV filled core cardiac medications at lower rates compared to uninfected individuals. This includes rates of use of statins (66.77% vs. 73.68%, $P < 0.0001$), beta-blockers (67.91% vs. 73.91%, $P < 0.0001$), nitrates (31.78% vs. 35.9%, $P < 0.0001$), and antiplatelet agents (46.76% vs. 51.77%, $P < 0.0001$) (*Figure 1*). The percentage of patients receiving at least one prescription for these medications increased in both groups over time from hospital discharge to 12 months follow-up (Supplementary material online, *Table S6A–D*). After restricting to patients who underwent coronary angiography during their index hospitalization, post-discharge filling rates of statins (80.36% vs. 84.11% $P = 0.0033$), antiplatelet agents (84.00% vs. 88.96%, $P <$ 0.0001), beta-blockers (78.55% vs. 82.12%, $P = 0.0076$), ARBs

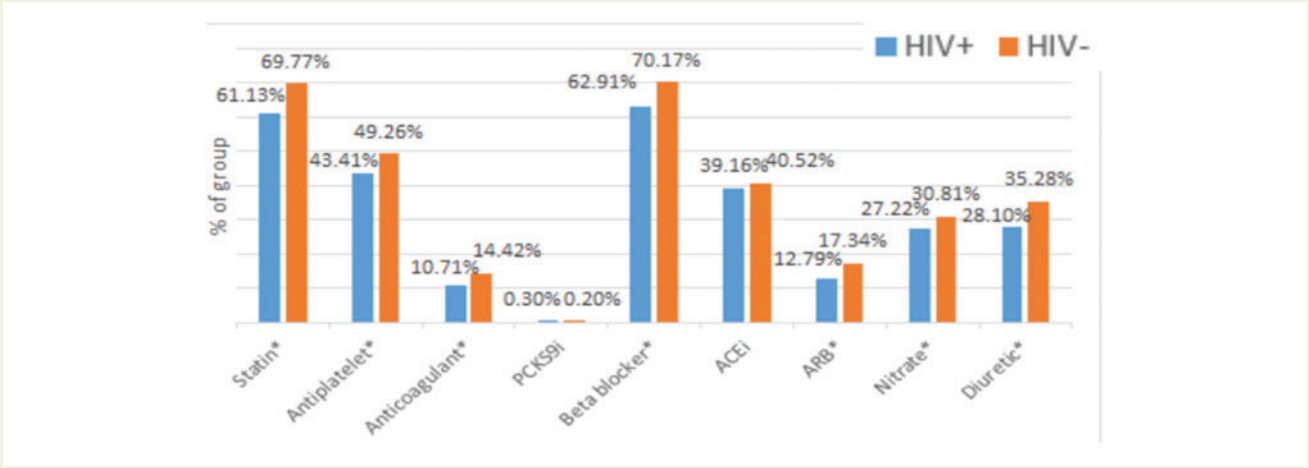

Figure 1 Outpatient pharmacy prescription filling data at 12 months following discharge showing reduced filling of cardiac medications among HIV-infected adults. ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; PCSK9i, Proprotein Convertase Subtilisin/Kexin Type 9 inhibitor.

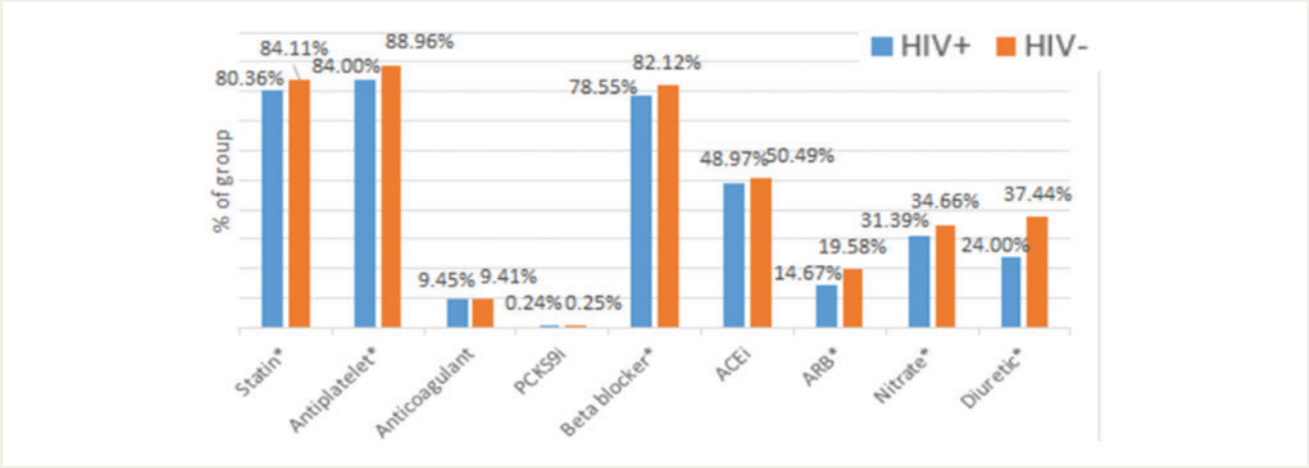

Figure 2 Outpatient pharmacy prescription filling data at 12 months following discharge showing reduced filling of cardiac medications among HIV-infected adults after restricting to only those who underwent coronary stenting during index hospitalization. ACEi, angiotensin-converting enzyme inhibitor. ARB, angiotensin receptor blocker; PCSK9i, Proprotein Convertase Subtilisin/Kexin Type 9 inhibitor.

(14.67% vs. 19.58%, $P = 0.0004$), and nitrates (31.39% vs. 34.66%, $P = 0.049$) were increased in both groups compared to the entire cohort. However, PLWH continued to fill prescriptions for statins, antiplatelet agents, beta-blockers, ARBs, and nitrates at lower rates compared to those without HIV, though the difference in filling rates between the two groups was reduced in this restricted population as compared to the entire cohort (*Figure 2*).

Discussion

In this nationwide retrospective cohort of patients hospitalized with acute coronary syndrome between 2014 and 2016, individuals with HIV infection underwent fewer inpatient coronary interventions and suffered higher inpatient and long-term mortality as well as hospital readmission. Persons living with HIV presenting with ACS were less likely to undergo invasive coronary procedures during hospital admission or to fill prescriptions for cardiovascular medications including statins, antiplatelet agents and beta-blockers, which are all Class I indications for therapy per AHA/ACC guidelines following ACS.[19,37] This is the largest and most contemporary study to date that describes both the inpatient and post-discharge management and outcomes of ACS in PLWH, including data on prescription filling after discharge. Our findings are strengthened by the large sample size, representative population across the US and different insurance payers, a contemporary study period reflective of present-day

practice, and the ability to track patients longitudinally and to link pharmacy claims to inpatient stays. In this study, there were several important differences in the initial presentation and management of PLWH with ACS that may account for their worsened outcomes. As compared to those without HIV infection, PLWH presenting with ACS were significantly younger yet carried a markedly increased burden of medical comorbidities. These findings are consistent with prior studies examining ACS and HIV.[13,14] These results further support the conclusion that these patients have a distinct clinical presentation as compared to those without HIV. Their inpatient management also differed significantly from those without HIV. PLWH presenting with ACS had significantly reduced odds of being referred for any invasive coronary procedure (*Table 2*), even after adjusting for demographics, medical comorbidities, or ACS sub-type. This is a notable difference in practice that may have multiple explanations. One reason is that PLWH may have presented more often with type 2 myocardial infarction (MI) (demand-related) for which angiography and coronary stenting would not have been indicated. In PLWH, approximately half of MIs are categorized as type 2 due to sepsis, bacteraemia, and drug use in the Center for AIDS Research Network of Integrated Clinical System (CNICS) cohort.[20,21] We considered multiple approaches to reduce the impact of confounding from type 2 MI in our study, including propensity matching subjects with and without HIV, which was limited by marked differences in these groups' demographics and medical comorbidities (*Table 1*). Given our limited ability to distinguish type 2 MI in this retrospective and observational study, we chose to address this confounder through stratified analysis into a separate STEMI-only subgroup. Persons living with HIV presenting with STEMI were referred for invasive procedures at similar rates but were less likely to undergo drug-eluting stent placement with trends towards more bare-metal stents or balloon angioplasty alone (Supplementary material online, *Table S3*). While type 2 MI or other confounding STEMI presenters could still be present in this subgroup, we also must consider the possibility that PLWH with true STEMI are not receiving appropriate drug-eluting stent placement. This is a concerning finding, as multiple prior studies have demonstrated the safety and efficacy of drug-eluting stents in patients with HIV.[15,22–27] We next evaluated inpatient outcomes and found increased in-hospital mortality in PLWH, though this difference was reduced after restricting the analysis to only those who underwent coronary angiography or stenting (Supplementary material online, *Tables S4* and *S5*). There are several potential implications of this finding. One is that PLWH benefitted from PCI and stenting as found in previous studies,[11,24–26] and that lower rates of these interventions contributed to worsened outcomes. It is also possible that restricting our analysis to only those who underwent angiography helped to remove confounding among individuals with type 2 MI.

In addition to these inpatient endpoints, we also found that PLWH with ACS had increased hospital readmission, 12-month mortality and reduced use of cardiovascular medications after discharge. Our findings are consistent with prior studies looking at longitudinal outcomes in HIV,[13,14] suggesting that PLWH living in the US continue to have poorer long-term outcomes following ACS even in contemporary practice. One potential explanation for these worsened outcomes may be differences in medical therapy following discharge. We demonstrated that medications that are known to improve outcomes after ACS in the general population, including antiplatelet agents, beta-blockers, and statins, were less likely to be filled among PLWH. It is noteworthy that only 48.93% of PLWH (Supplementary material online, *Table S6D*) were filling prescriptions for HAART at 12 months following discharge. However, medication non-adherence is a well-studied barrier to care in PLWH, with underlying reasons including medical literacy and poor integration into healthcare systems,[28–30,35,36] and it is likely that patient non-adherence was present as well. In this study, disparities inequality of care and outcomes persisted not just during the index hospitalization, but up to a year following hospital discharge in PLWH.

There are several limitations to this study. Though this was a large study cohort, there only 6,612 (0.59%) patients had HIV, suggesting that small absolute differences in our measured outcomes could be statistically but not necessarily clinically significant. In addition, though many medical comorbidities were evaluated, there was a marked difference in age and medical comorbidities between the HIV-infected and uninfected groups, and thus unmeasured confounding may still account for some of the study findings. The dataset also did not include CD4 counts or HIV viral loads, nor did it include the specific results of cardiac imaging and angiographic findings, which have previously been associated with poor outcomes after ACS.[31] Prior studies have suggested that AIDS status may drive reduced coronary procedures among PLWH presenting with ACS,[37] but we could not perform a similar analysis in this study. This cohort also had limited data on racial/ethnic and socioeconomic status of the subjects, and so we could not account for these factors in multivariate analysis. This cohort was also limited to the US, and so its results cannot necessarily be extrapolated to other settings where HIV infection is endemic. The dataset used could not differentiate lower rates of prescription vs. lower rates of adherence to prescriptions. Finally, a notably low rate of ARV prescription filling was seen in this population, which could in part drive differences in clinical outcome. Regardless, this study is one of the largest and most recent analyses to date examining contemporary inpatient management of PLWH hospitalized for ACS, including short- and long-term outcomes as well as discharge medications.

In conclusion, in this large, national study of PLWH hospitalized for ACS between 2014 and 2016, HIV infection was associated with fewer coronary interventions and increased short- and long-term death. In addition, PLWH with ACS experienced increased hospital readmissions and lower use of optimal medical therapy. Targeted interventions and care strategies to improve the outcomes of HIV-infected individuals hospitalized with ACS are needed. Further investigation with prospective data collection is needed to evaluate and identify areas for improvement in the patient, provider, and systemic factors in the management of ACS in HIV.

Supplementary material

Supplementary material is available at European Heart Journal – Quality of Care and Clinical Outcomes online.

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Data availability

The data underlying this article are available in the article and in the online supplementary material.

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