THE ECONOMIC BURDEN OF HIV-ASSOCIATED WASTING: A CLAIMS DATABASE STUDY

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Background

Advances in antiretroviral therapy (ART) and the care of people living with HIV have tremendously improved AIDS-associated morbidity and mortality[1,2]

As people living with HIV are living longer, they accumulate **risk and costs associated with age-related comorbidities,** including HIV-associated wasting (HIVAW)[2-5]

HIVAW increases morbidity, mortality, and healthcare-related costs,[5-7] but has received little attention in the era of modern antiretroviral therapy

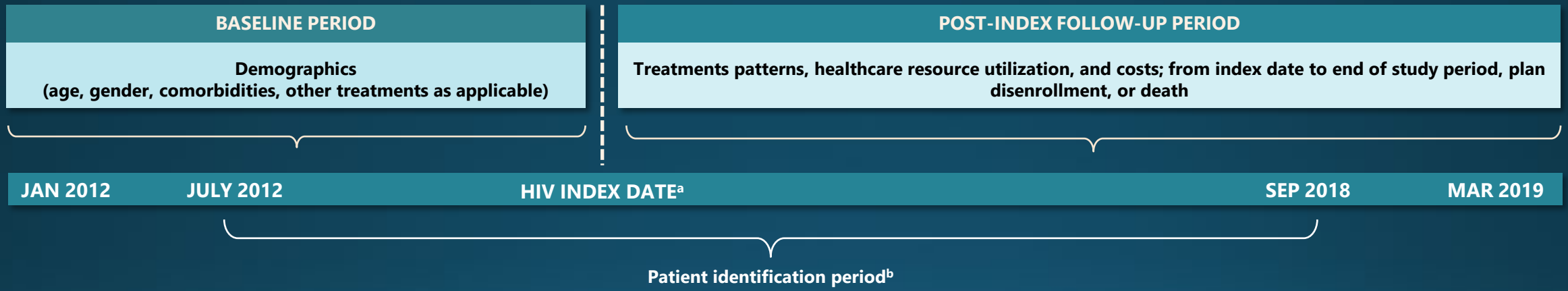
In 2009, Siddiqui et al found **HIVAW was associated with more than double the healthcare costs** compared to HIV patients who did not experience wasting[5]

Given the changing profile of people living with HIV, these **analyses evaluated the prevalence and economic burden** of HIVAW (2012–2018) using medical and pharmacy claims databases

Methods: Selection Criteria and Study Design

Medical and pharmacy claims study using the IBM® MarketScan® Commercial and Medicare Supplemental Database and Medicaid Database

Selection Criteria of the HIV+ Study Population



HIV population: Total patients with an HIV diagnosis between July 1, 2012–Sept 30, 2018; **N=196,297**

- **INCLUDED:** ≥2 outpatient claims (>30 days apart) or ≥1 inpatient claim for HIV (ICD-9/10: 042, V08, B20, Z21); **N=153,903**
- **INCLUDED:** ≥18 years old on the HIV index date; **N=152,256**
- **EXCLUDED:** Patients with any malignancies; **N=146,966**
- **INCLUDED:** Patients continuously enrolled ≥6 months pre- and post-HIV index; **N=42,587**

[a]Defined as first date that all criteria were met between July 1, 2012 and September 30, 2018
[b]2012–2013 includes Medicaid only; 2019 includes Commercial/Medicare through March only
ICD-9/10, International Classification of Diseases 9th/10th revision

Methods: Statistical Analysis

Prevalence of HIVAW

- Cumulative prevalence was estimated for the study period (2012–2018) and reported in terms of frequencies and percentages

Unadjusted bivariate analyses compared demographic, clinical characteristics, healthcare resource utilization (HCRU), and costs

- Student's *t*-tests or Wilcoxon rank-sum tests were used for continuous variables and reported in terms of means and standard deviations (SD)
- Chi-square tests were used for categorical variables and reported in terms of frequencies and percentages
- Total all-cause costs were the sum of payments for hospitalizations, emergency department (ED) visits, outpatient visits, and pharmacy use. Payments were inflated to 2018 US dollars

Correlates of HIVAW

- Multivariable logistic regression analyses were conducted to assess demographic and clinical correlates of HIVAW

HIVAW, HIV-associated wasting

Methods: Identification of HIVAW Wasting Cohort

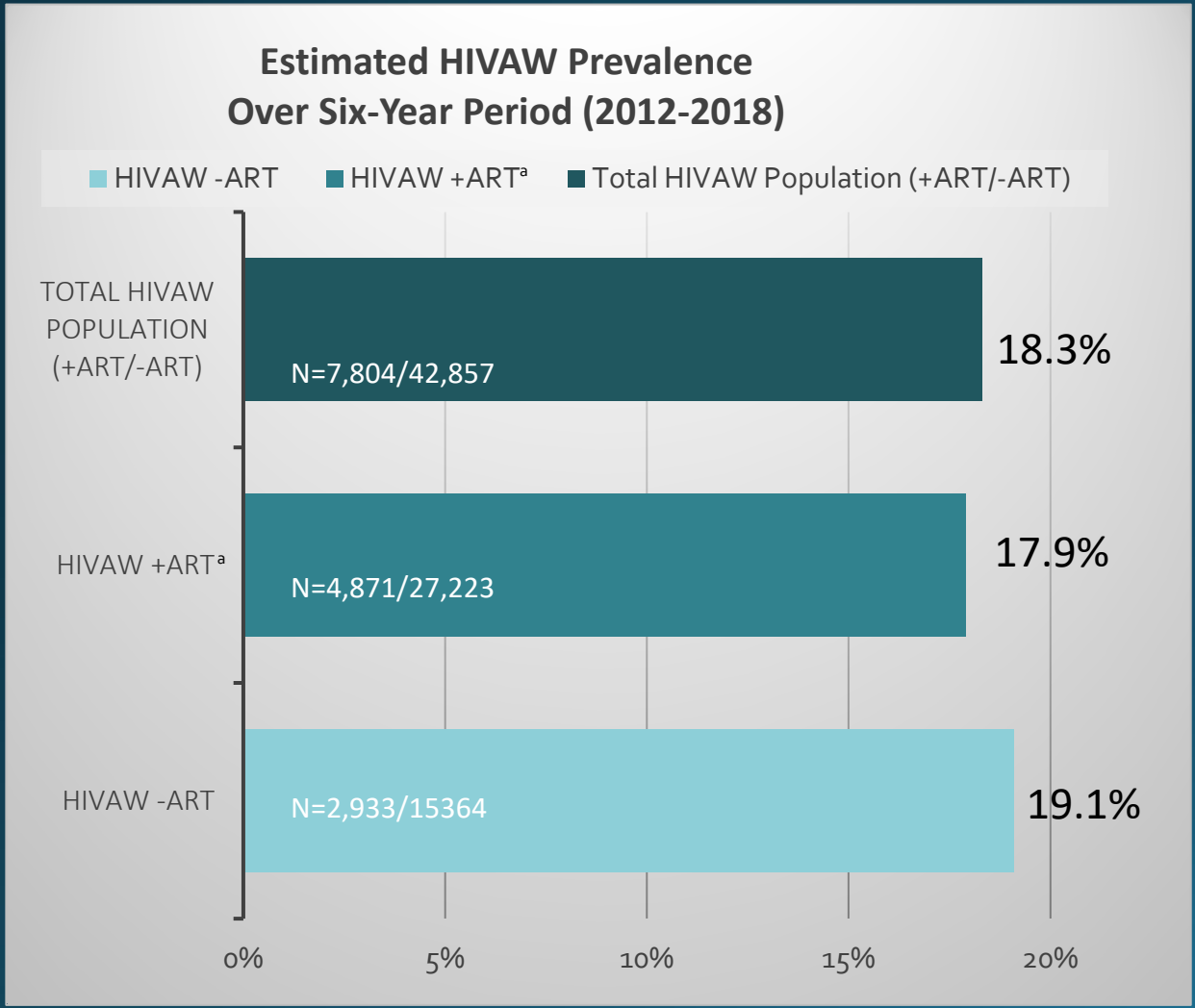
There is no specific and unique ICD-9-CM or ICD-10-CM code for HIVAW, thus a previously developed algorithm specific to claims data was used, with some minor modifications, to identify patients meeting a definition for HIVAW

Cohort: HIVAW[a] **Patients in the HIVAW cohort must meet at least one of A, B, C, or D criteria**		**HIV+ Study Population N=42,587 n (%)**	**Commercial HIV+ Study Population N=13,846 n (%)**	**Medicaid HIV+ Study Population N=28,741 n (%)**
A. ≥1 inpatient claim or ≥2 outpatient claim (with same diagnosis code on different service date or combination of any diagnosis below on different dates) with a diagnosis for weight loss	Nutritional marasmus, other protein-calorie malnutrition, anorexia nervosa, abnormal loss of weight and underweight (unintentional weight loss), feeding difficulties and mismanagement, failure to thrive, cachexia, effects of hunger, adult neglect (nutritional), BMI <19, adult	**6873 (16.1)**	**934 (6.7)**	**5939 (20.7)**
B. A claim for appetite stimulant or non-testosterone anabolic agent	Appetite stimulants (dronabinol, megestrol) and anabolic agents (oxandrolone, nandrolone, oxymetholone, DHEA, 7-oxo-DHEA, androstenedione)	**1644 (3.9)**	**158 (1.1)**	**1486 (5.2)**
C. Evidence of enteral or parenteral nutrition	Enteral infusion of nutritional substances, enteral nutrition home therapy, enteral feeding supplies, enteral nutrition formula/additives, enteral nutrition infusion pump, total parenteral nutrition home therapy, parenteral nutrition solution/additives, parenteral nutrition supplies, parenteral nutrition infusion pump, aminosyn, freamine, procalamine, travasol	**776 (1.8)**	**21 (0.1)**	**755 (5.5)**
D. At least two of the following:	Presence of only one medical claim for weight loss or wasting in the primary or secondary position, anorexia (≥1 inpatient claim or ≥ 2 outpatient claims at least 30 days apart), a claim for testosterone (and derivatives), growth hormone, thalidomide, or high-calorie nutritional supplements	**122 (0.3)**	**39 (0.3)**	**83 (0.3)**
Total HIVAW		**7804 (18.3)**	**1040 (7.5)**	**6764 (23.5)**

[a]Patients might have more than one criterion; criteria requiring ≥2 outpatient diagnosis claims were required to be on separate service dates

BMI, body mass index; DHEA, dehydroepiandrosterone; HIVAW, HIV-associated wasting; ICD-9/10, International Classification of Diseases 9th/10th revision

Results: Estimated HIVAW Prevalence During a Six-Year Period (2012–2018)



63.9% Among the HIV-positive study population (N=42,587), 63.9% were on ART (n=27,223); 36.1% were not on ART (n=15,364)

18.3% 18.3% of HIV-positive patients were identified as having HIVAW

17.9% 17.9% of HIV-positive patients on antiretroviral therapy had HIVAW

19.1% 19.1% of HIV-positive patients not on ART had HIVAW

Across the span of the 6-year respective medical and pharmacy claims analysis (2012-2018[b]); it was estimated that **greater than 1 in 6 people** living with HIV in medical care had a medical and/or pharmacy claim of HIVAW or cachexia

[a]ART is defined as ≥1 pharmacy claim of any ART 12 months post-HIV index
[b]2012–2013 includes Medicaid only
ART, antiretroviral therapy; HIVAW, HIV-associated wasting

Results: Baseline Demographics

	non-HIVAW N=34,783	Total HIVAW N=7,804	HIVAW +ART N=4,871	HIVAW -ART N=2,933
Male, n (%)	22,700 (65.3)	4,816 (61.7)	2,972 (61.0)	1,844 (62.9)
Age on HIV index date				
Mean (SD)	43.5 (12.5)	46.4 (12.0)	44.6 (11.6)	49.4 (12.3)
18–39 years of age, n (%)	12,805 (36.8)	2,100 (26.9)	1,521 (31.2)	579 (19.7)
40–64 years of age, n (%)	20,908 (60.1)	5,330 (68.3)	3,295 (67.7)	2,035 (69.4)
65+ years of age, n (%)	1,070 (3.1)	374 (4.8)	55 (1.1)	319 (10.9)
Age at first evidence of HIV-associated wasting				
Mean (SD)	-	48.1 (12.2)	46.2 (11.7)	51.4 (12.4)
18–39 years of age, n (%)	-	1,856 (23.8)	1,365 (28.0)	491 (16.7)
40–64 years of age, n (%)	-	5,451 (69.9)	3,384 (69.5)	2,067 (70.5)
65+ years of age, n (%)	-	497 (6.4)	122 (2.5)	375 (12.8)

Most people in this study living with HIV were male

The HIVAW cohort was older at HIV index compared to the non-HIVAW cohort

ART, antiretroviral therapy; HIVAW, HIV-associated wasting

Results: Insurance Status

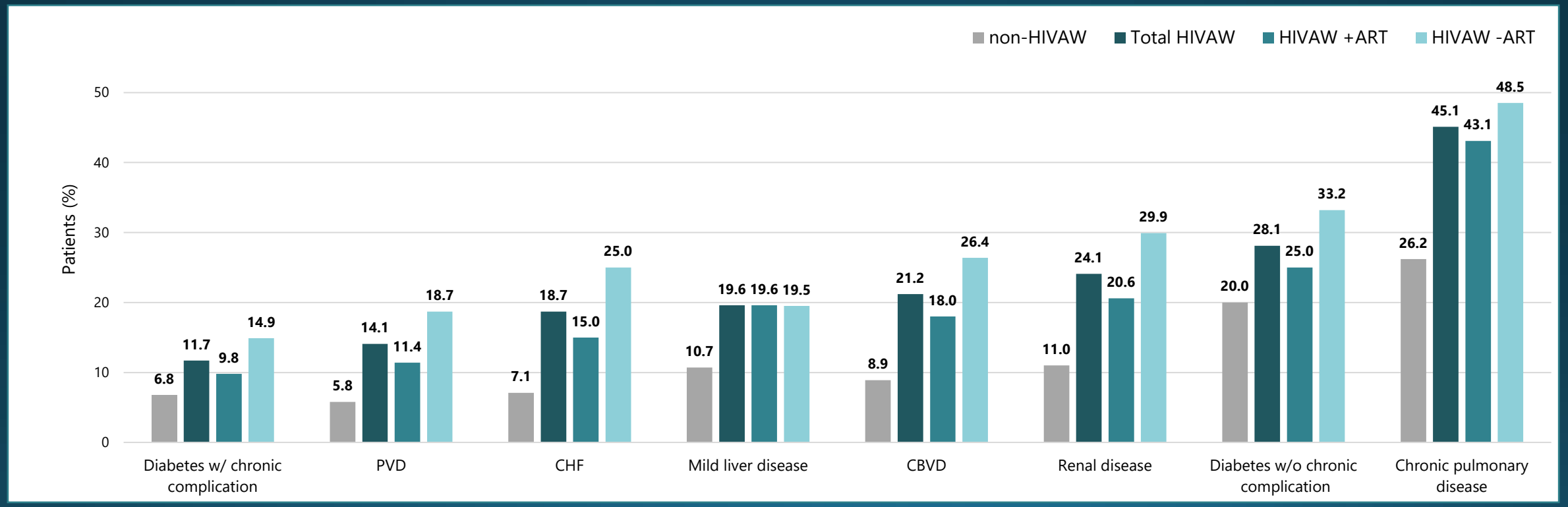
	non-HIVAW N=34,783	Total HIVAW N=7,804	HIVAW +ART N=4,871	HIVAW -ART N=2,933
Commercial, n (%)	**12,806 (36.8)**	**1,040 (13.3)**	**836 (17.2)**	**204 (7.0)**
Commercial and Medicare supplement Population Region, n (%)[a]	**n=12,806**	**n=1,040**	**n=836**	**n=204**
Northeast	2,367 (18.5)	166 (16.0)	112 (13.4)	54 (26.5)
North Central	1,530 (11.9)	127 (12.2)	97 (11.6)	30 (14.7)
South	7,184 (56.1)	612 (58.8)	505 (60.4)	107 (52.5)
West	1,706 (13.3)	133 (12.8)	120 (14.4)	13 (6.4)
Unknown	19 (0.2)	2 (0.2)	2 (0.2)	0 (0)
Medicaid, n (%)	**21,977 (63.2)**	**6,764 (86.7)**	**4,035 (82.8)**	**2,729 (93.0)**
Medicare Dual eligible[b], n (%)	9,090 (41.4)	2,597 (38.4)	536 (13.3)	2,061 (75.5)
Race for Medicaid Population, n (%)[a]	**n=19,248**	**n=5,960**	**n=3,468**	**n=2,492**
White	4,701 (24.4)	1,576 (26.4)	913 (26.3)	663 (26.6)
Black	14,066 (73.1)	4,274 (71.7)	2,477 (71.4)	1,797 (72.1)
Hispanic	286 (1.5)	61 (1.0)	49 (1.4)	12 (0.5)
Other	195 (1.0)	49 (0.8)	29 (0.8)	20 (0.8)

Most people living with HIV in this study were insured by Medicaid

P-values for non-HIVAW versus HIVAW were all <0.0001
[a]There were missing values in each group; region was only available in the Commercial and Medicare Supplemental databases and race was only available in the Medicaid database
[b]People who are dually eligible qualify for both Medicare and Medicaid benefits
ART, antiretroviral therapy; HIVAW, HIV-associated wasting

Results: Comorbidities

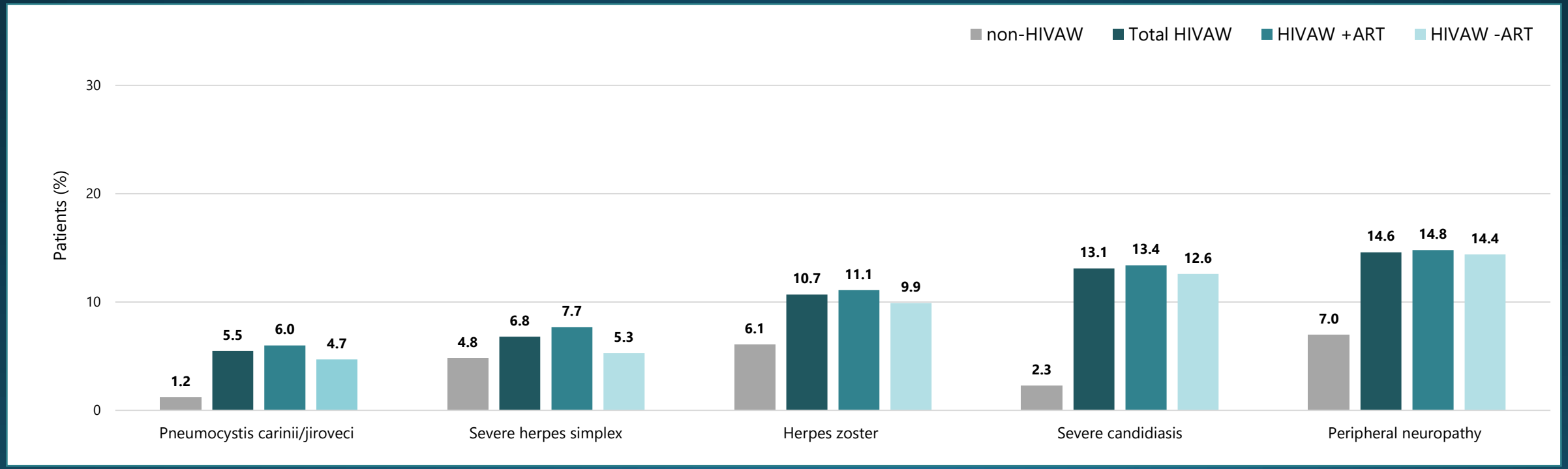
- The HIVAW cohort had a significantly higher comorbidity burden compared to the non-HIVAW cohort, as evidenced by Charlson Comorbidity Index (CCI)[a] scores (mean [SD]): 3.6 (3.0) vs. 2.0 (2.2)
  - Nearly all Charlson comorbidities were more common in the HIVAW cohort compared with the non-HIVAW cohort
- People living with HIV within the HIVAW cohort had higher proportions of metabolic disorders



The CCI is a validated health status assessment based on summary score of 17 comorbidities (rated from 1 to 6 for mortality risk and disease severity)
[a]Only those Charlson comorbidities with frequency >10% are presented in the bar chart; p-value <0.0001 for all comparisons
ART, antiretroviral therapy; HIVAW, HIV-associated wasting; PVD, peripheral vascular disease; CHF, chronic heart failure; CBVD, cerebrovascular disease

Results: Opportunistic Infections and Most Frequent HIV/AIDS Conditions

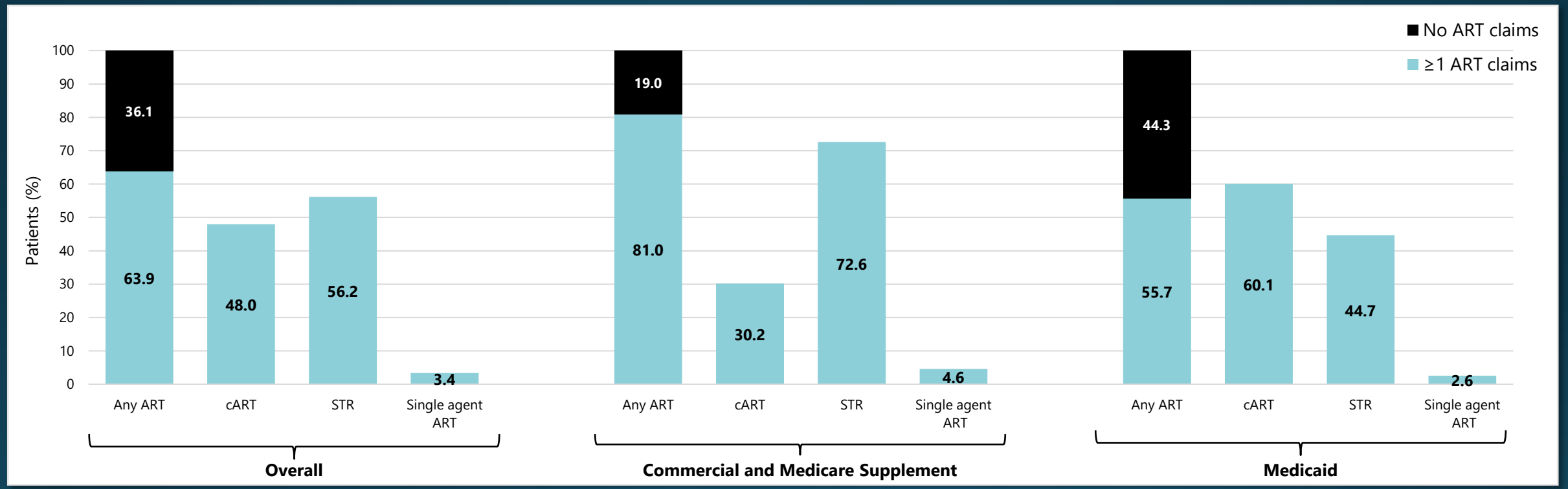
- The HIVAW cohort had higher proportions of opportunistic infections (OI) and HIV/AIDS-related conditions compared to the non-HIVAW cohort
  - 64.2% of the HIVAW cohort had ≥1 diagnosis of an OI vs. 38.6% in the non-HIVAW cohort; p<0.0001
- Within the HIVAW cohort, the HIVAW +ART cohort were more likely to have ≥1 diagnosis of an OI compared to the HIVAW –ART cohort (66.0% vs. 61.3%, respectively)



Only those conditions with proportion >5% are presented in the bar chart; p-value <0.0001 for all comparisons
ART, antiretroviral therapy; HIVAW, HIV-associated wasting

Results: ART Utilization at HIV Index

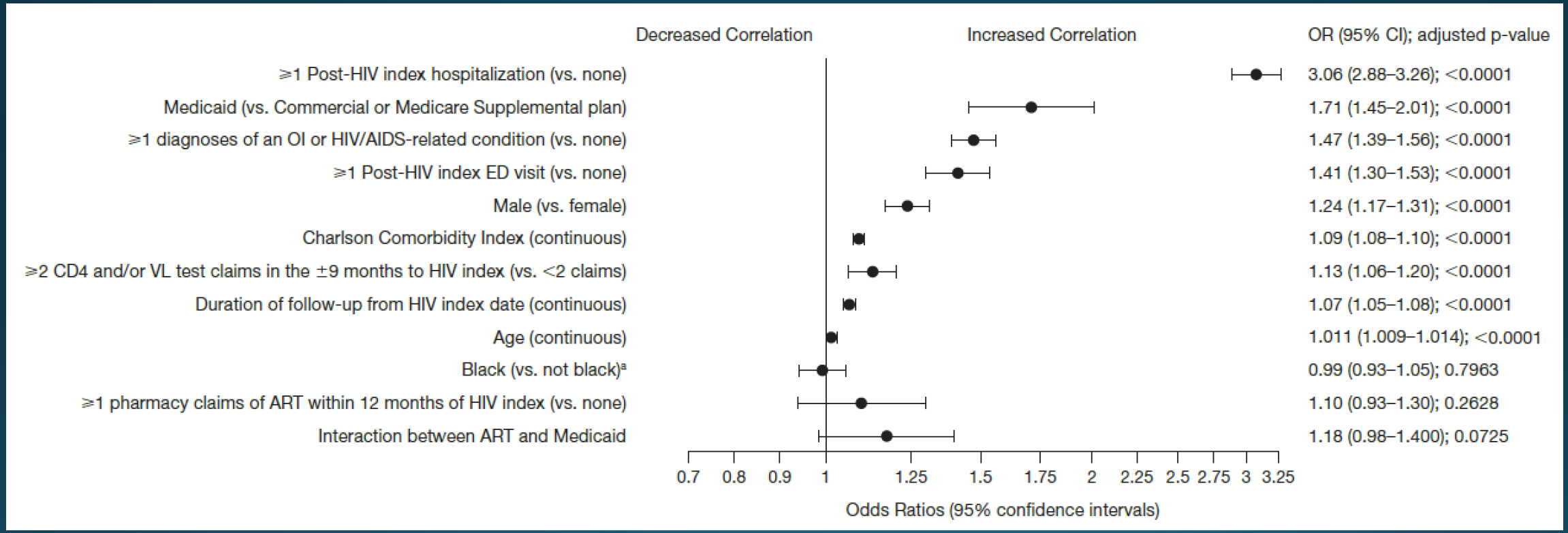
- At HIV index[a], >36% of people living with HIV had no evidence of a pharmacy claim and >44% of people living with HIV in the Medicaid population had no evidence of a pharmacy claim for ART
- cART was the most common treatment overall, within the Medicaid population and HIVAW cohort; STR was most common in the Commercial and Medicare Supplement population and non-HIVAW cohort



[a]At HIV index includes medications used 12 months post-HIV index; cART is defined as any fixed-dose combinations or >2 single agents
ART, antiretroviral therapy; cART, combination antiretroviral therapy; HIVAW, HIV-associated wasting; STR, single tablet regimen

Results: Correlates of HIVAW

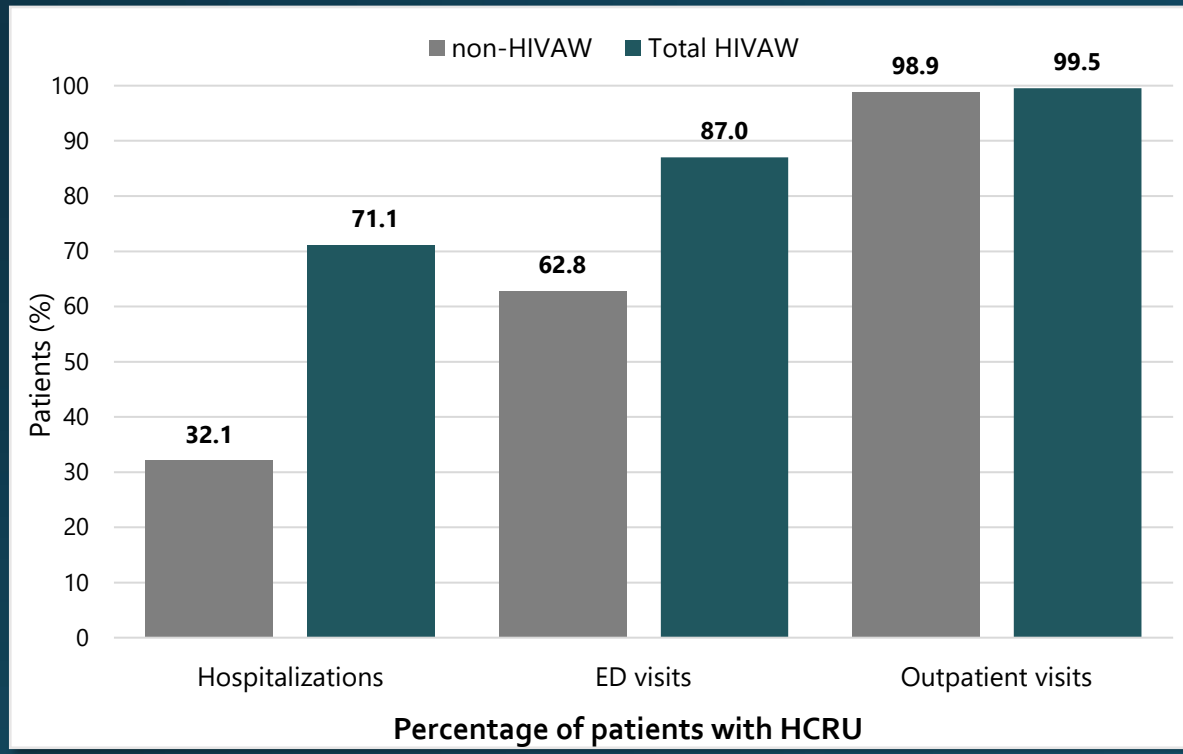
- In logistic regression analysis, race and ART status were not found to be correlates of HIVAW
- The strongest correlates of HIVAW were Medicaid insurance and hospitalization(s) post-HIV index

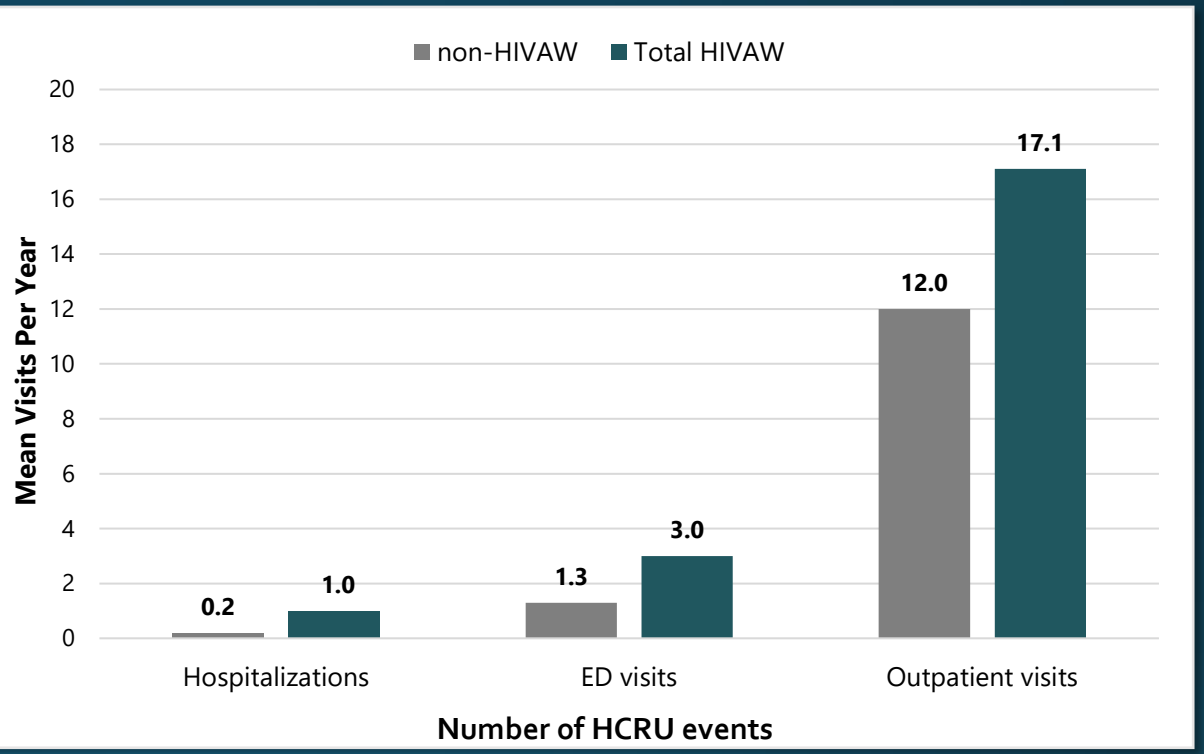


Claims for CD4 and viral load tests were surrogate markers for being in care
ART, antiretroviral therapy; ED, emergency department; HIVAW, HIV-associated wasting; OR, odds ratio; VL, viral load

Results: Annualized All-cause Healthcare Resource Utilization

- Post-HIV index, the HIVAW cohort were **more than twice as likely to be hospitalized** compared to the non-HIVAW cohort (71.1% vs. 32.1%, respectively)
- Additionally, the HIVAW cohort experienced more than two times the number of hospitalizations (1.0 [SD 1.7] vs. 0.2 [SD 0.8]) and ED visits (3.0 [SD 6.0] vs. 1.3 [SD 3.1]) per year post-HIV index compared with patients without HIVAW; both p<0.0001

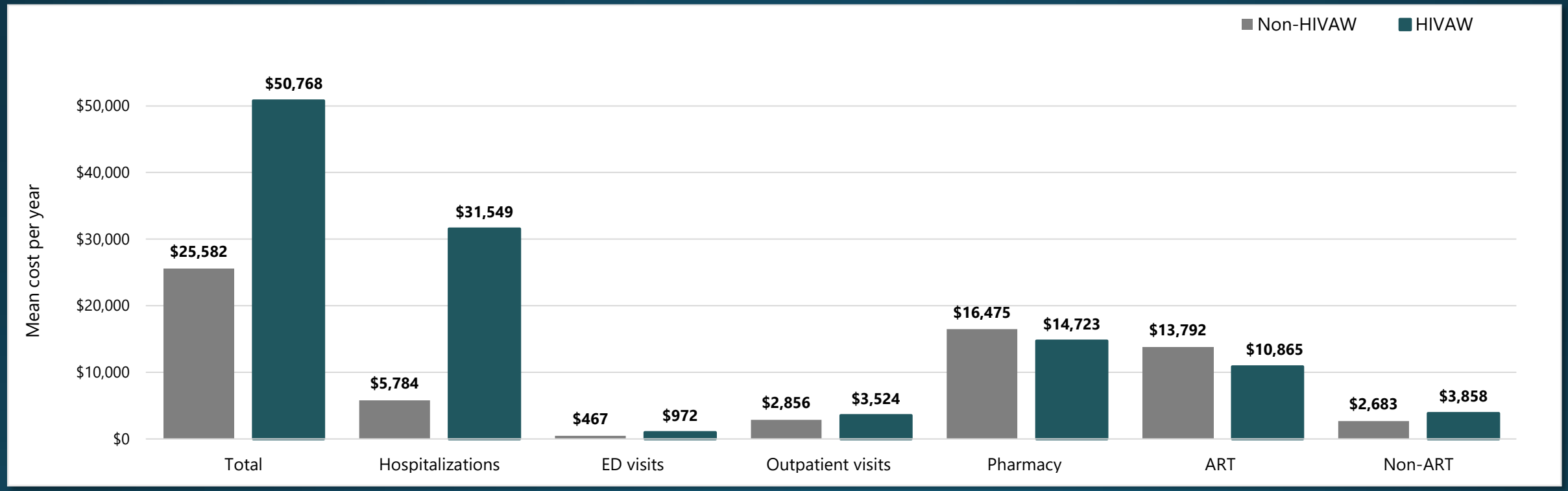




Claims for CD4 and VL tests were surrogate markers for being in care; p-value <0.0001 for all comparisons
ED, emergency department; HCRU, healthcare resource utilization; HIVAW, HIV-associated wasting; VL, viral load

Results: Annualized All-cause Costs

- Post-HIV index, the HIVAW cohort had **nearly double the mean (SD) annualized total all-cause costs per patient** compared to the non-HIVAW **cohort**: $50,768 ($109,065) vs. $25,582 ($38,627), respectively
- Post-HIV index all-cause hospitalization costs were five times higher for the HIVAW cohort than the non-HIVAW cohort: $31,549 ($102,815) vs. $5,784 ($27,607), respectively



All annualized cost is adjusted to 2018 US dollars based on Medical care consumer price index; p-value <0.0001 for all comparisons
ART, antiretroviral therapy; ED, emergency department; HIVAW, HIV-associated wasting; OR, odds ratio; VL, viral load

Conclusions

- **Modern antiretroviral therapy was not associated with** HIVAW
- **Greater than one in six people** living with HIV in medical care had evidence of HIVAW
- Individuals with HIVAW experienced **more than two times the number of hospitalizations** compared to those with no evidence of HIVAW
- This evidence suggests **there is a need for continuous assessment of weight loss in people living with HIV,** as well as a need for better understanding around high utilizers among those with evidence of HIVAW
- The **lack of a unique ICD-10-CM code for HIVAW** creates barriers for tracking healthcare/disease burden, quality outcomes, mortality statistics, and billing

HIVAW, HIV-associated wasting; ICD-10, International Classification of Diseases 10th revision

Strengths and Limitations

Strengths

Claims databases allow for analysis of large numbers of patients over time and are generally representative of the US patient population

Pharmacy claims provide an understanding of a patient's intent to take a prescribed medication, whereas a medication order would only show what medication a prescriber is proposing for treatment

This study design offers the **ability to better understand underserved populations,** which wasn't possible in previous clinical studies with traditional designs

Limitations

Claims data are not specifically collected for research purposes, and diagnostic and drug use information cannot always be validated. As such, there may be missing information, which limits the inferences that can be drawn from this data

As an analysis of administrative health care claims data, this study **does not take all clinical information into account**

As there is no ICD code specifically for HIVAW, a proxy definition based on weight loss–related codes and treatments was used as the algorithm

HIVAW, HIV-associated wasting; ICD, International Classification of Diseases

References

1. Teeraananchai S et al. HIV Med 2017;18(4):256–66
2. Marcus JL et al. JAMA Netw Open 2020;3(6):e207954
3. HIV.gov. https://www.hiv.gov/hiv-basics/staying-in-hiv-care/other-related-health-issues/other-health-issues-of-special-concern-for-people-living-with-hiv [Accessed January 27, 2021]
4. Sutton S et al. J Int Assoc Provid AIDS Care 2019;18:1–9
5. Siddiqui J et al. Curr Med Res Opin 2009 May;25(5):1307–17
6. Erlandson KM et al. AIDS 2016;30(3):445–54
7. Tang AM et al. J Acq Immuno Defic Syndr 2002;31(2):230–36

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