

Human Immunodeficiency Virus (HIV) and Aging: Multimorbidity in Older People With HIV in One Nonurban Southeastern Ryan White HIV/AIDS Program Clinic

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Background. Age-related chronic conditions are becoming more concerning for people with human immunodeficiency virus (PWH). We aimed to identify characteristics associated with multimorbidity and evaluate for association between multimorbidity and human immunodeficiency virus (HIV) outcomes.

Methods. Cohorts included PWH aged 45–89 with ≥ 1 medical visit at one Ryan White HIV/AIDS Program (RWHAP) Southeastern HIV clinic in 2006 (Cohort 1) or 2016 (Cohort 2). Multimorbidity was defined as ≥ 2 chronic diseases. We used multivariable logistic regression to assess for associations between characteristics and multimorbidity and between multimorbidity and HIV outcomes.

Results. Multimorbidity increased from Cohort 1 ($n = 149$) to Cohort 2 ($n = 323$) (18.8% vs 29.7%, $P < .001$). Private insurance was associated with less multimorbidity than Medicare (Cohort 1: adjusted odds ratio [aOR] = 0.15, 95% confidence interval [CI] = 0.02–0.63; Cohort 2: aOR = 0.53, 95% CI = 0.27–1.00). In Cohort 2, multimorbidity was associated with female gender (aOR, 2.57; 95% CI, 1.22–5.58). In Cohort 1, black participants were less likely to be engaged in care compared with non-black participants (aOR, 0.72; 95% CI, 0.61–0.87). In Cohort 2, participants with rural residences were more likely to be engaged in care compared with those with urban residences (aOR, 1.23; 95% CI, 1.10–1.38). Multimorbidity was not associated with differences in HIV outcomes.

Conclusions. Although PWH have access to RWHAP HIV care, PWH with private insurance had lower rates of multimorbidity, which may reflect better access to preventative non-HIV care. In 2016, multimorbidity was higher for women. The RWHAP and RWHAP Part D could invest in addressing these disparities related to insurance and gender.

Keywords. aging; health insurance; HIV; multimorbidity; Ryan White HIV/AIDS Program.

The life expectancy of people with human immunodeficiency virus (PWH) is approaching that of those without human immunodeficiency virus (HIV), largely due to effective antiretroviral therapy (ART) [1]. In 2015, approximately half of PWH in the United States were estimated to be over age 50 [2]. It is predicted that by 2030, almost three quarters of PWH will be over age 50 [3]. Although morbidity and mortality related to acquired immune deficiency syndrome (AIDS)-related conditions have decreased, age-associated chronic conditions, such as cardiovascular disease (CVD), renal impairment, diabetes,

non-AIDS-defining malignancies, and osteoporosis, are becoming increasingly common in PWH [4].

Multimorbidity, or the accumulation of multiple serious chronic health conditions, is a major driver of hospitalizations in older people [5]. Studies have demonstrated that the multimorbidity burden among PWH is higher than expected based on age alone [6, 7]. There is evidence that the prevalence of comorbidities may be higher in PWH due to the inflammatory effects of chronic HIV infection, ART side effects, and a higher rate of behavioral risk factors, such as smoking and substance use disorders [8]. In 2016, Medicare, as the single largest source of federal financing for HIV care, spent \$10 billion caring for PWH [9]. As PWH age and as older people are diagnosed with HIV, Medicare will play an even larger role in funding the care of these individuals.

Given that much of the research on HIV and aging has been performed with urban cohorts [10, 11] and European cohorts [3, 6], little is known about older PWH in nonurban areas in the Southeastern United States. Understanding the comorbidities of older PWH at a nonurban Southeastern Ryan White HIV/AIDS Program (RWHAP) clinic will

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benefit the clinic's clients and providers and clinics that serve a similar population. Older PWH in 2006 and older PWH in 2016 could have a different prevalence of multimorbidity due to such factors as varying amounts of time with viremia before starting ART given changes in national ART initiation guidelines and exposures to different ART regimens [12, 13]. Therefore, we were interested in comparing the prevalence of multimorbidity between the 2 cohorts. For one Southeastern RWHAP clinic, we aimed to (1) compare the prevalence of multimorbidity in PWH in 2006 to 2016, (2) identify characteristics associated with multimorbidity, and (3) evaluate for an association between multimorbidity and HIV outcomes (engagement in care and viral suppression).

METHODS

Study Population and Cohort Definitions

The study population includes 2 cohorts of PWH ages 45–89. This age range was selected because it included PWH who were covered by Medicare as well as those who would age into Medicare eligibility within 20 years of the study period. Cohort 1 includes participants who received care at one Southeastern RWHAP-supported HIV Clinic between July 1, 2006 and June 30, 2007, and Cohort 2 includes those who received care between July 1, 2016 and June 30, 2017. To be included, participants were required to have ≥ 1 HIV medical visit during the period(s) studied and have data available for the following: age, race/ethnicity, gender, insurance coverage, income (Cohort 2), rural residence, AIDS diagnosis, HIV risk factor, and baseline viral suppression. Some participants were in both cohorts.

Covariates

Participant demographic information collected included age, race/ethnicity, self-reported gender, income, insurance coverage, and rural residence. When the number of participants in a category was < 5 , it was collapsed with another category. Income was reported as percentage of federal poverty level (FPL) [14]. Income data was not available for Cohort 1. Residence rurality was determined based on zip code and Rural-Urban Commuting Area Codes [15].

Participant HIV-specific information collected included HIV risk factor, time since HIV diagnosis, time since ART initiation, time attending the HIV clinic, Centers for Disease Control and Prevention-based AIDS diagnosis [16], and baseline HIV viral load. Baseline viral load was obtained within 6 months before enrollment with preference for the one closest to the study beginning. The number of unique prescription medications were obtained by standardized chart review. Polypharmacy was defined as 5 or more prescribed medications, and ART was included [17].

Patient Consent Statement

The design of the work was reviewed and approved by the University of Virginia Institutional Review Board for Health Sciences Research. Participant consent was not required because the University of Virginia Institutional Review Board for Health Sciences Research deemed that the project met the criteria of exempt research under 45CFR46.104(d)(4)iii.

Outcomes

Multimorbidity

Multimorbidity was defined as the presence of ≥ 2 age-associated conditions [18], which were selected based on higher occurrence among PWH and inclusion in other multimorbidity studies [19, 20]. Conditions included were hypertension, obesity, type 2 diabetes mellitus, hypercholesterolemia, CVD, chronic kidney disease, osteopenia and osteoporosis, chronic obstructive pulmonary disease, end-stage liver disease, and non-AIDS-related malignancy. After screening for these conditions using *International Classification of Diseases* (ICD) codes (see [Supplementary Table 1](#)), diagnoses were confirmed via chart review using standardized definitions based on other multimorbidity studies among PWH and specialty-specific guidelines (see [Supplementary Table 2](#)).

Viral Suppression

Viral suppression was defined as 2 viral loads < 200 copies/mL separated by 180 days [21]. Viral loads were collected for the study period and for 6 months after, and preference was given to the values closest to the end of the study period. Because some Cohort 1 participants were not on ART, viral suppression was not assessed for this cohort.

Engagement in Care

Engagement in care was defined as at least 1 HIV medical visit in each 6-month period during the time studied with a minimum of 60 days between visits [22].

Statistical Analysis

Descriptive statistics were used to report baseline characteristics, the prevalence of multimorbidity for each cohort, and the number of chronic medical conditions per participant. Demographics and HIV-specific characteristics were compared between cohorts using a generalized linear model fit using a generalized estimating equation that accounted for repeated measures.

Within each cohort, we used multivariable binary logistic regression to assess the association between characteristics (age, race/ethnicity, gender, insurance coverage, rural residence, AIDS diagnosis, and HIV risk factor) and multimorbidity. We evaluated for an association between multimorbidity and the HIV outcomes of viral suppression (controlled for baseline viral suppression) and engagement in care. We reported crude odds

ratios (ORs), adjusted odds ratios (aORs), and 95% confidence intervals (CIs).

RESULTS

Older PWH, defined for our study as participants aged 45–89, represented 33% (n = 198) of the 2006 clinic population (n = 594) and 54% (n = 378) of the 2016 clinic population (n = 695). Forty-nine participants (24.7%) and 55 participants (14.6%) were excluded from Cohort 1 and 2, respectively, due to not having all the required covariates (see [Supplementary Tables 3 and 4](#)). Demographic and HIV-specific information for participants who were excluded can be found in [Supplementary Table 3](#). Cohort 1 included 149 participants; Cohort 2 included 323 participants ([Table 1](#)).

A large proportion of Cohort 1 were 45–54 years old (69.8%). Compared with Cohort 1, Cohort 2 had more participants ages 55–64 (40.6% vs 23.5%, $P < .001$). Approximately half of participants in both cohorts were black, and approximately three quarters of participants in both cohorts were male. In Cohort 2, 76.9% had incomes under 251% of the FPL. Fewer participants in Cohort 2 were uninsured (5.0% vs 20.8%, $P < .001$), and more participants in Cohort 2 had private insurance (47.4% vs 26.2%, $P < .001$). Approximately two thirds of participants from both cohorts lived in urban areas. Participants in Cohort 1 had an average time since HIV diagnosis of 7.9 (standard deviation [SD] 5.7) years compared with an average time of 14.5 (SD 7.4) years for Cohort 2 ($P < .001$). In terms of HIV risk factors, more participants in Cohort 2 reported heterosexual sexual contact (41.8% vs 28.9%, $P < .001$). All of the participants in Cohort 2 were on ART compared with 83.2% in Cohort 1 ($P < .001$). Ninety-six percent of participants in Cohort 2 had baseline viral suppression compared with 81.2% in Cohort 1 ($P < .001$). More participants in Cohort 2 had polypharmacy compared with Cohort 1 (86.4% vs 71.1%, $P < .001$).

The prevalence of multimorbidity was 18.8% in Cohort 1 compared with 29.7% in Cohort 2 ($P < .001$) ([Figure 1](#)). The number of chronic medical conditions per participant was calculated by cohort ([Figure 2](#)).

For Cohort 1's multivariable model ([Table 2](#)), multimorbidity was less likely for those with private insurance (aOR, 0.15; 95% CI, 0.02–0.63) compared with those with Medicare. There was no association in Cohort 1 between multimorbidity and age, race/ethnicity, gender, rural residence, AIDS diagnosis, HIV risk factor, or baseline viral suppression. In Cohort 2, participants with private insurance were less likely to have multimorbidity compared with those with Medicare (aOR, 0.53; 95% CI, 0.27–1.00). For Cohort 2, multimorbidity was more likely for those aged 55–64 (aOR, 2.27; 95% CI, 1.30–4.03) compared with those aged 45–54 and was more likely for females (aOR, 2.57; 95% CI, 1.22–5.58) compared with males. There was no association in Cohort 2 between multimorbidity and race/ethnicity,

Table 1. Baseline Characteristics of Cohorts

Characteristic ^a	Cohort 1 n (col%)	Cohort 2 n (col%)	P Value
All	149	323	
Age (Years)			<.001
45–54	104 (69.8)	154 (47.7)	
55–64	35 (23.5)	131 (40.6)	
65–74	10 (7.7)	34 (10.5)	
Over 75	NA	4 (1.2)	
Race/Ethnicity			.1
Non-Black	82 (55.0)	179 (55.4)	
Black	67 (45.0)	144 (44.6)	
Gender			.1
Male	115 (77.2)	233 (72.1)	
Female	34 (22.8)	90 (27.9)	
Income ^b			NA
>500% FPL	NA	22 (6.8)	
251%–500% FPL	NA	53 (16.4)	
101%–250% FPL	NA	126 (39.1)	
≤100% FPL	NA	122 (37.8)	
Health Insurance Status			<.001
Medicare	63 (42.3)	118 (36.5)	
Medicaid	5 (3.4)	36 (11.2)	
No insurance	31 (20.8)	16 (5.0)	
Private insurance	39 (26.2)	153 (47.4)	
Other	11 (7.4)	0	
Residence Rurality			.3
Urban	97 (65.1)	219 (67.8)	
Rural	52 (34.9)	104 (32.2)	
AIDS Diagnosis			.9
HIV diagnosis	47 (31.5)	133 (31.2)	
AIDS diagnosis	102 (68.5)	190 (58.8)	
HIV Risk Factor ^c			<.001
MSM	85 (57.1)	156 (48.3)	
Heterosexual	43 (28.9)	135 (41.8)	
IDU	24 (16.1)	36 (11.2)	
Taking ART			<.001
Yes	124 (83.2)	323 (100)	
No	25 (16.8)	0	
Baseline Viral Suppression			<.001
Yes	121 (81.2)	311 (96.3)	
No	28 (18.8)	12 (3.7)	
Polypharmacy			<.001
Yes	106 (71.1)	279 (86.4)	
No	43 (28.9)	44 (13.6)	
Time since HIV diagnosis (mean ± SD, years)	7.9 ± 5.7	14.5 ± 7.4	<.001
Time since linkage to care (mean ± SD, years)	2.7 ± 2.4	9.1 ± 4.4	<.001
Time since ART initiation (mean ± SD, years) ^d	0.7 ± 2.4	7.9 ± 4.0	<.001

Abbreviations: AIDS, acquired immunodeficiency syndrome; ART, antiretroviral therapy; FPL, federal poverty level; HIV, human immunodeficiency virus; IDU, intravenous drug use; MSM, men who have sex with men; NA, not applicable; SD, standard deviation.

NOTE: Cohort 1 included all people with HIV (PWH) who were 45 to 89 years old who received care at the studied Ryan White HIV/AIDS Program clinic during July 1, 2006–June 30, 2007 and who had all the required variables. Cohort 2 included all PWH who were 45 to 89 years old who received care at the studied Ryan White HIV/AIDS Program clinic during July 1, 2016–June 30, 2017.

^aValues <5 were collapsed in the next category.

^bNo data available for participants in Cohort 1.

^cParticipants could report more than 1 HIV risk factor; totals for each cohort may be >100%.

^dData available for 124 participants in Cohort 1 and for 321 participants in Cohort 2. Viral Suppression: <200 copies of HIV ribonucleic acid per milliliter of blood.

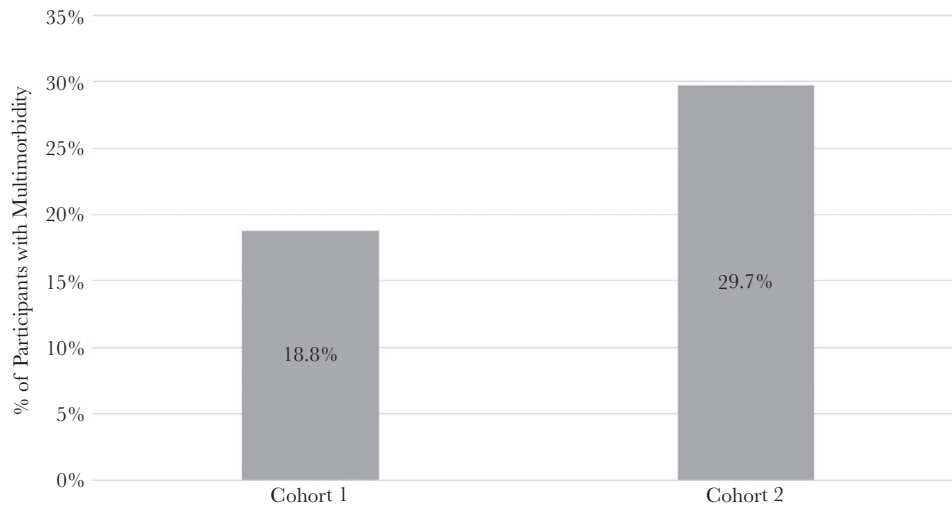


Figure 1. Multimorbidity prevalence by cohort.

income, rural residence, AIDS diagnosis, HIV risk factor, or baseline viral suppression (Table 3).

Almost all participants in Cohort 2 achieved viral suppression (95.7%) (Supplementary Table 5). Participants who had detectable viral loads at baseline were less likely to achieve viral suppression compared with those who were virally suppressed at baseline (58.3% vs 97.1%; aOR, 0.69; 95% CI, 0.61–0.77). There was no association in Cohort 2 between outcome viral suppression and multimorbidity when controlling for baseline characteristics and baseline viral suppression.

In terms of engagement in care (Supplementary Table 6A and B), more participants were engaged in care in Cohort 1 compared with Cohort 2 (63.1% vs 51.1%, $P < .001$). In Cohort 1, black participants were less likely to be engaged in care compared with non-black participants (aOR, 0.72; 95%

CI, 0.61–0.87). There was no association in Cohort 1 between engagement in care and multimorbidity when controlling for baseline characteristics. In Cohort 2, those with rural residence were more likely to be engaged in care compared with those with urban residence (aOR, 1.23; 95% CI, 1.10–1.38). There was no association in Cohort 2 between engagement in care and multimorbidity when controlling for baseline characteristics.

DISCUSSION

In our studied population of PWH who are covered by Medicare and who will age into Medicare eligibility within 20 years, we found that the proportion of older PWH with ≥ 2 chronic medical conditions increased from 2006 to 2016. This trend is consistent with findings in another study done by Wong et al

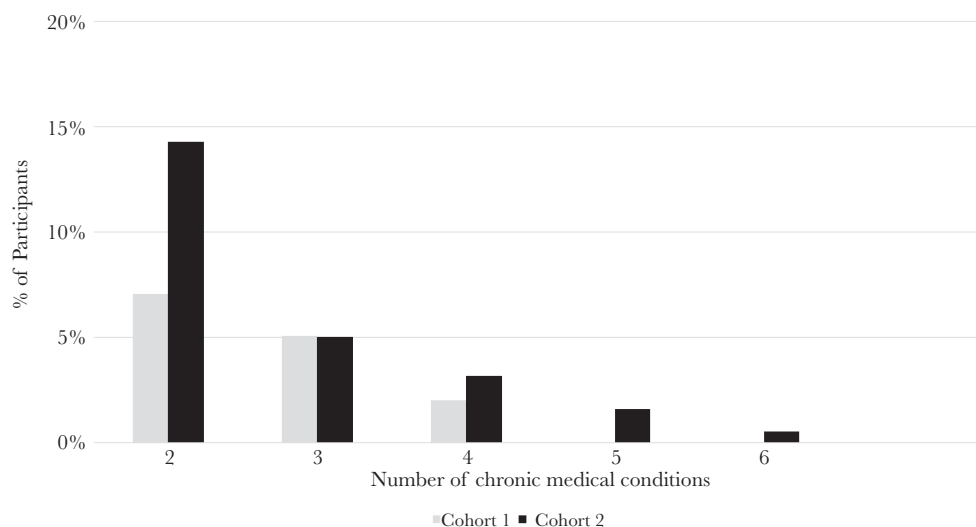


Figure 2. Number of chronic medical conditions per participant by cohort.

Table 2. Multimorbidity Prevalence in Cohort 1: Frequencies and Results of Univariable and Multivariable Logistic Regression Model (N = 149)

Characteristic	Multimorbidity, n (row %)	OR (95% CI)	PValue	Adjusted OR (95% CI) ^a	PValue
All	28 (18.8)	NA	NA	NA	NA
Age (Years)			.6		.2
45–54	19 (18.3)	Reference		Reference	
55–64	5 (14.3)	0.75 (0.23–2.05)		0.66 (1.88–2.05)	
65–74	4 (40.0)	2.98 (0.71–11.5)		2.59 (0.54–11.9)	
Race/Ethnicity			.5		.4
Non-Black	17 (20.7)	Reference		Reference	
Black	11 (16.4)	0.75 (0.32–1.72)		0.66 (0.22–1.88)	
Gender			.8		.9
Male	22 (19.1)	Reference		Reference	
Female	6 (17.7)	0.91 (0.31–2.34)		1.01 (0.25–4.13)	
Health Insurance Status			.01		.01
Medicare	18 (25.6)	Reference		Reference	
Medicaid	1 (20.0)	0.63 (0.03–4.59)		0.64 (0.03–5.45)	
No insurance	5 (16.1)	0.48 (0.15–1.37)		0.71 (0.20–2.24)	
Private insurance	2 (5.1)	0.14 (0.02–0.5)		0.15 (0.02–0.63)	
Other	2 (18.2)	0.56 (0.08–2.43)		0.55 (0.07–2.57)	
Residence Rurality			.6		.9
Urban	17 (17.5)	Reference		Reference	
Rural	11 (21.2)	1.26 (0.53–2.92)		0.87 (0.33–2.23)	
AIDS Diagnosis			.2		.2
HIV diagnosis	6 (12.8)	Reference		Reference	
AIDS diagnosis	22 (21.6)	1.88 (0.74–5.43)		2.28 (0.79–7.54)	
MSM HIV Risk Factor			.9		.9
Absent	12 (18.8)	Reference		Reference	
Present	16 (18.8)	1.00 (0.44–2.35)		1.68 (0.12–21.5)	
Heterosexual HIV Risk Factor			.9		.9
Absent	20 (18.9)	Reference		Reference	
Present	8 (18.6)	0.98 (0.38–2.37)		2.35 (0.17–33.8)	
IDU HIV Risk Factor			.8		.7
Absent	23 (18.4)	Reference		Reference	
Present	5 (20.8)	1.17 (0.36–3.26)		2.42 (0.22–20.8)	
Baseline Viral Suppression			.2		.2
Yes	33 (27.3)	Reference		Reference	
No	5 (17.9)	0.40 (0.13–1.01)		0.34 (0.05–1.40)	

Abbreviations: AIDS, acquired immunodeficiency syndrome; ART, antiretroviral therapy; CI, confidence interval; FPL, federal poverty level; HIV, human immunodeficiency virus; IDU, intravenous drug use; MSM, men who have sex with men; NA, not applicable; OR, odds ratio.

NOTE: Viral suppression: <200 copies of HIV ribonucleic acid per milliliter of blood.

^aAdjusted ORs are adjusted for all the variables in the table.

[23] that studied changes in multimorbidity prevalence over time in PWH from 2000 to 2009. It was similar to our study in that it did not rely upon ICD codes alone, but it also utilized standardized definitions of each comorbidity assessed using chart reviews. This study was different in that it looked at all adult PWH, not just older PWH. Other cross-sectional studies of PWH in North America have shown multimorbidity rates between 34.4% and 69.0% [19, 20, 24]. These studies differed somewhat in their definition of multimorbidity, and only one of these studies focused on older individuals [19]. Given that we confirmed all ICD-coded diagnoses with chart review, our lower rate of multimorbidity could be explained by a more accurate capture of true diagnoses as opposed to only relying on ICD codes. Recognizing, treating, and hopefully preventing the

complications associated with multimorbidity will be essential to ensure that PWH live long healthy lives. It will also reduce preventable utilization and associated costs, which will help to control healthcare spending and resource utilization for PWH.

The prevalence of multimorbidity was lower for individuals in both cohorts with private insurance compared with those with Medicare, even after adjusting for demographics and healthcare delivery factors. A similar finding was observed for PWH of all ages in another study looking at participants who received care between 1997 and 2015 [25]. Factors that may have contributed to differences in multimorbidity by insurance include access to preventative measures aimed at early detection of chronic conditions and services such as counseling and pharmacotherapy for smoking cessation and weight

Table 3. Multimorbidity Prevalence in Cohort 2: Frequencies and Results of Univariable and Multivariable Logistic Regression Model (N = 323)

Characteristic	Multimorbidity, n (row %)	OR (95% CI)	PValue	Adjusted OR (95% CI) ^a	PValue
All	96 (29.7)	NA	NA	NA	NA
Age (Years)			.003		.01
45–54	33 (21.4)	Reference		Reference	
55–64	49 (37.4)	2.19 (1.30–3.72)		2.27 (1.30–4.03)	
65–74	12 (35.3)	2.0 (0.88–4.42)		1.80 (0.71–4.40)	
75 or older	2 (50.0)	3.67 (0.42–31.5)		3.56 (0.38–33.2)	
Race/Ethnicity			.006		.1
Non-Black	42 (23.5)	Reference		Reference	
Black	54 (37.5)	1.96 (1.21–3.18)		1.58 (0.89–2.80)	
Gender			.003		.003
Male	58 (24.5)	Reference		Reference	
Female	38 (42.2)	2.20 (1.32–3.68)		2.57 (1.22–5.58)	
Income			.2		.4
≤100% FPL	45 (36.9)	Reference		Reference	
101%–250% FPL	35 (27.8)	0.66 (0.38–1.12)		0.58 (0.30–1.12)	
251%–500% FPL	12 (22.6)	0.51 (0.23–1.03)		0.56 (0.22–1.36)	
>500% FPL	4 (18.2)	0.38 (0.11–1.10)		0.58 (0.14–2.01)	
Health Insurance Status			.01		.02
Medicare	43 (36.4)	Reference		Reference	
Medicaid	16 (44.4)	1.40 (0.65–2.97)		0.93 (0.36–2.35)	
No insurance	2 (12.5)	0.25 (0.04–0.95)		0.27 (0.04–1.17)	
Private insurance	35 (22.9)	0.52 (0.30–0.88)		0.53 (0.27–1.00)	
Residence Rurality			.6		.7
Urban	67 (30.6)	Reference		Reference	
Rural	29 (27.9)	0.88 (0.52–1.46)		0.97 (0.55–1.72)	
AIDS Diagnosis			.8		.5
HIV diagnosis	39 (29.3)	Reference		Reference	
AIDS diagnosis	57 (30.0)	1.03 (0.64–1.68)		0.98 (0.57–1.72)	
MSM HIV Risk Factor			.2		.3
Absent	55 (32.9)	Reference		Reference	
Present	41 (26.3)	1.38 (0.85–2.24)		0.52 (0.09–2.33)	
Heterosexual HIV Risk Factor			.3		.3
Absent	52 (27.7)	Reference		Reference	
Present	44 (32.6)	1.26 (0.78–2.05)		0.34 (0.06–1.51)	
IDU HIV Risk Factor			.5		0.1
Absent	87 (30.3)	Reference		Reference	
Present	9 (25.0)	0.77 (0.33–1.64)		0.27 (0.05–1.08)	
Baseline Viral Suppression			.1		.1
Yes	95 (30.6)	Reference		Reference	
No	1 (8.3)	0.21 (0.01–1.08)		0.59 (0.14–2.01)	

Abbreviations: AIDS, acquired immunodeficiency syndrome; CI, confidence interval; FPL, federal poverty level; HIV, human immunodeficiency virus; IDU, intravenous drug use; MSM, men who have sex with men; NA, not applicable; OR, odds ratio.

NOTE: Viral suppression: <200 copies of HIV ribonucleic acid per milliliter of blood.

^aAdjusted ORs are adjusted for all the variables in the table.

loss. Private insurance coverage of preventative measures changed between 2006 and 2016, because, starting in 2014, the Affordable Care Act (ACA) mandated that Essential Health Benefits be covered. Previously, individual insurance companies selected what to cover [26]. For PWH without private insurance, the RWHAP should consider increasing its support for and coverage of preventative non-HIV care to help bridge the gap in access. An investment in preventative care could help reduce the gap in comorbidity-free years between PWH and people without HIV [1]. This would improve the quality

of life of PWH and have positive economic ramifications by decreasing Medicare expenditures for PWH who are over the age of 65.

Compared with Cohort 1, Cohort 2 participants had more insurance coverage, specifically by private insurance and Medicaid. The increase in PWH with private insurance from 2006 to 2016 was due to a state-led initiative after the 2014 ACA implementation. Because the state did not expand Medicaid, the state AIDS Drug Assistance Program purchased ACA Qualified Health Plans for PWH with low incomes [27]. Between 2006

and 2016, there was also a small increase in Medicaid eligibility from 31% FPL to 39% FPL [28], which could explain the increase in participants covered by Medicaid. For those with chronic medical conditions, gaining insurance coverage allows for better access to care for those conditions [29]. Therefore, a higher prevalence of multimorbidity in Cohort 2 may not necessarily reflect a more ill group but rather a group with more robust insurance coverage who received more diagnoses. More studies are needed to determine the relationship between multimorbidity and insurance coverage, especially as it relates to aging PWH.

In Cohort 2, women were more than twice as likely as men to have multimorbidity. Other studies have documented a higher prevalence of obesity among women, particularly in those on ART regimens containing tenofovir alafenamide and integrase strand inhibitors, especially dolutegravir and bictegravir [30, 31]. We did not collect data on the specifics of the ART regimen for the participants; however, it is possible that participants in Cohort 2 were prescribed regimens associated with increases in weight that disproportionately affect women. The RWHAP Part D grants have been integral to providing primary and specialty medical care and psychosocial services to women with HIV. In recent years, the President's budget has proposed eliminating Part D and consolidating its funds into Part C, but this proposal has not been implemented by Congress [32]. Given our finding of increased multimorbidity in older women with HIV, it is essential to continue Part D funding and to consider expanding access to preventative and therapeutic services for conditions potentially related to HIV and its treatment.

We found no association with the outcome of viral suppression and multimorbidity in Cohort 2. It is reassuring to see that the presence of multimorbidity was not associated with lower rates of viral suppression. Furthermore, there was no association between the outcome of engagement in care and multimorbidity in either cohort. Additional research on older PWH's control of comorbidities and attendance at non-HIV medical appointments may be beneficial.

We found that black participants in the earlier cohort were less likely to be engaged in care compared with non-black participants. This finding is likely multifactorial and could be a reflection of larger racial disparities in the healthcare system stemming from both systemic racism and individual experiences of discrimination. It has been noted that older African Americans are less likely to be engaged in care compared with older populations of other races [33]. This disparity is concerning because engagement in care is associated with improvement in quality of life, increased longevity, and decreased HIV transmission [34]. Older African Americans in the United States face a disproportionate risk of acquiring HIV and have higher rates of morbidity and mortality compared with non-black older adults [35]. A recent systematic review about older African Americans' engagement in the HIV care continuum

highlighted some obstacles to engagement and retention in care as societal and structural barriers such as stigma, poverty, and lack of access to transportation and healthcare [33]. The presence of multimorbidity was also cited as a barrier to engagement and retention in HIV care [33, 36]. This relationship between engagement in care and race was not present in the later cohort. Between 2006 and 2016, the clinic increased its number of case managers from 1 to 6 and also implemented a peer coach program. These interventions, which focus on helping PWH with social determinants of health, may have improved engagement in care for many PWH in the clinic, including black participants.

In Cohort 2, participants who resided in rural areas were more likely to be engaged in care compared with those living in urban areas. This was an unexpected finding, because rural residence has been shown to be a risk factor for lower rates of HIV testing, later diagnoses of HIV, and later adoption of advances in ART [37]. One explanation for these findings could be distance to care. Some participants with urban residences may be geographically further away from the clinic and have to travel further to receive care than those with rural residences. In addition, between 2006 and 2016, the studied RWHAP clinic implemented PositiveLinks, a clinic-affiliated mHealth intervention for PWH. This mobile application has improved the clinic patients' engagement in care [38]. Our findings suggest that those in urban areas may also benefit from such services that expand access to HIV care such as mHealth and telehealth, and that these services should not be restricted based on residence rurality.

Limitations of the study should be noted. We did not have access to data regarding all social determinants of health that influence multimorbidity. Missing data was an issue, particularly for Cohort 1. Comparing people who met inclusion criteria and those who did not, due to missing data, they had similar characteristics except for baseline viral suppression (see [Supplementary Tables 3 and 4](#)). Multimorbidity in people with detectable viral loads could be an area for future research. We used ICD codes to screen for the presence of each chronic medical condition studied, so it is possible that we missed chronic medical conditions in individuals if a clinician did not code for a diagnosis. This would result in underreporting multimorbidity.

CONCLUSIONS

Given the lower rate of multimorbidity for those with private insurance, which was likely related to better access to non-HIV preventative care, the RWHAP should consider a targeted investment to deliver more preventative care in RWHAP clinics with the goal of reducing multimorbidity prevalence in PWH. This is especially important given the growing evidence about the impact of HIV and ART on cardiovascular risk and weight gain [4, 30, 31]. The higher rate of multimorbidity in women in

the aging PWH population should be investigated further, and RWHAP Part D should consider expanding their support for this population's non-HIV care. Older women with HIV may need more targeted approaches at chronic disease prevention and management. Although there is a federal plan to "End the HIV Epidemic," the United States and the RWHAP must also continue to prevent, diagnose, and treat PWH's comorbidities to ensure that PWH continue to thrive.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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