

Evidence From a Multistate Cohort: Enrollment in Affordable Care Act Qualified Health Plans' Association With Viral Suppression

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Background. Healthcare delivery changes associated with viral suppression (VS) could contribute to the United States' "Ending the HIV Epidemic" (EtHE) initiative. This study aims to determine whether Qualified Health Plans (QHPs) purchased by AIDS Drug Assistance Programs (ADAPs) are associated with VS for low-income people living with HIV (PLWH) across 3 states.

Methods. A multistate cohort of ADAP clients eligible for ADAP-funded QHPs were studied (2014–2015). A log-binomial model was used to estimate the association of demographics and healthcare delivery factors with QHP enrollment prevalence and 1-year risk of VS. A number needed to treat/enroll (NNT) for 1 additional person to achieve viral suppression was calculated.

Results. Of the cohort ($n = 7776$), 52% enrolled in QHPs. QHP enrollment in 2015 was associated with QHP coverage in 2014 (adjusted PR [aPR], 3.28; 95% confidence intervals [CIs], 3.06–3.53) and engagement in care in 2014 (aPR, 1.16; 1.04–1.28). PLWH who were engaged in care ($n = 4597$) and had QHPs had a higher VS rate than those who received medications from Direct ADAP (86.0% vs 80.2%). QHPs' NNT for an additional person to achieve VS is 20 (14.1–34.5). Starting undetectable (adjusted risk ratio [aRR], 1.39; 1.28–1.52) and enrolling in QHPs in 2015 (aRR, 1.06; 0.99–1.14) was associated with VS.

Conclusions. Once enrolled in ADAP-funded QHPs, ADAP clients stay enrolled. Enrollment is associated with VS across states/demographic groups. ADAPs, especially in the South and in Medicaid nonexpansion states, should consider investing in QHPs because increased enrollment could improve VS rates. This evidence-based intervention could be part of EtHE.

Keywords. AIDS Drug Assistance Program; healthcare reform; HIV; insurance, health; Patient Protection and Affordable Care Act.

Given the UNAIDS 90-90-90 goals and the United States' goal of Ending the HIV Epidemic [1, 2], understanding whether certain healthcare delivery methods are associated with higher rates of human immunodeficiency virus (HIV) viral suppression (VS) is essential. Viral suppression is a key HIV outcome given that the individual achieving the outcome will benefit from improved immune function and that new HIV transmissions will be averted, benefiting population health [3–7]. Each averted HIV case saves up to \$402 000 [8].

Before the Patient Protection and Affordable Care Act (ACA), low-income people living with HIV (PLWH) who were uninsured or underinsured could receive antiretroviral therapy and other specified medications through state-run AIDS Drug Assistance Programs (ADAPs). These state-administered ADAPs are funded through federal Ryan White HIV/AIDS Program (RWHAP) Part B funds and state funds, and in 2015, the program spent \$2.24 billion to provide medications to approximately one-third of PLWH in care in the United States [9]. Given the large proportion of PLWH in the United States served by ADAPs, major changes in ADAP clients' healthcare delivery could have far-reaching effects.

With the ACA, many states decided to expand Medicaid, and by 2015, it is estimated that almost half of the PLWH in states with Medicaid expansion had health insurance coverage through Medicaid [10]. Many states that did not have Medicaid expansion, such as Nebraska, South Carolina, and Virginia, decided to give their ADAP clients the option to enroll in ADAP-funded Qualified Health Plans (QHPs). ADAP programs paid premiums, medication co-pays, and HIV medical visit

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co-pays. States with Medicaid expansion also offered these sorts of options to PLWH in their states who were not eligible for Medicaid. By 2015, almost all states offered this option to ADAP clients [9].

In individual states, shifting from direct ADAP medication provision (Direct ADAP) to ADAP-funded QHPs has been associated with improved VS rates for ADAP clients or low-income PLWH [11–13]. This study aims to assess whether this association is consistent in multiple states (Nebraska, South Carolina, Virginia) for 2015, the second year of the ACA implementation.

METHODS

The multistate cohort, cohort A, included all PLWH who were 18 to 64 years old on 1 January 2014; were ADAP clients in Nebraska, South Carolina, or Virginia by 1 July 2014; did not have Medicare; and were eligible for ADAP-funded QHPs according to state-specific guidelines. Cohort B is a subset of cohort A that includes participants who demonstrated consistent engagement in care over the study period, as defined by at least 1 HIV viral load (VL) recorded in 2014 and at least 1 VL in 2015 that were separated by at least 180 days. If a participant had more than 1 VL during the 6-month follow-up period (1 July 2015–31 December 2015), the last one was used for analysis.

Data were collected from 2014 through 2015. Data were de-identified and coded by the University of Nebraska Medical Center, the South Carolina Department of Health and Environmental Control, and the Virginia Department of Health before being sent to the University of Virginia for data analysis. This project was reviewed and approved by the University of Virginia Institutional Review Board (IRB), the University of Nebraska Medical Center IRB, and the South Carolina Department of Health and Environmental Control IRB.

Demographic characteristics included age on 1 January 2014; gender self-reported as male, female, or transgender; race/ethnicity; rurality of residence; HIV/AIDS diagnosis based on Centers for Disease Control and Prevention criteria using HIV surveillance data [14]; CD4 count; HIV risk factors; baseline VL status; and baseline engagement in HIV care. The number of transgender participants was too small to include in the larger models, and therefore they were omitted and self-reported gender (male, female) is reported throughout the analyses. Rurality of residence was categorized by using the Rural Urban Commuting Area approximations for the participant's zip code [15]. HIV risk factors included male-to-male sexual contact (MSM), injection drug use (IDU), heterosexual sexual contact, perinatal exposure, blood transfusion, other, unknown, and missing. A participant could report more than 1 risk factor. Viral loads under 200 HIV RNA copies/mL were categorized as undetectable [16]. If a participant had a VL in 2014, their baseline engagement in HIV care was categorized as engaged.

Healthcare delivery factors included financial status and baseline ADAP plan. For financial status, income was categorized

by the participant's Federal Poverty Level (FPL) percentage according to their annual household income and household size. QHP enrollees are eligible for federal subsidies for both premiums and cost shares for those with incomes between 101% and 250% of the FPL and premium-only subsidies for those between 251% and 400% of the FPL. The FPL was considered a healthcare delivery factor because ADAP clients with the largest federal tax credits were less expensive to insure. For baseline ADAP plans, patients were categorized as Direct ADAP or ADAP-funded QHP according to the plan that they used in 2014.

Statistical Methods

Two primary outcomes were evaluated: QHP enrollment by 1 January 2015 and maintaining/achieving VS by 31 December 2015. The frequencies of participants enrolling in ADAP-funded QHPs in 2015 were analyzed for cohort A. For cohort B, frequencies of participants who achieved/maintained VS in 2015 were reported.

For cohort A, we used a log-binomial model to estimate the prevalence ratios (PRs) for ADAP-funded QHP enrollment. The model estimated the association of enrollment with demographic characteristics (age, race/ethnicity, gender, AIDS, rurality, HIV risk factor baseline HIV care engagement) and healthcare delivery factors (income, baseline ADAP plan). For cohort B, we included the same demographic characteristics and healthcare delivery factors (except for baseline ADAP plan) with the addition of baseline VL status in a log-binomial model to estimate the 1-year risk of VS. For both outcomes, we controlled for state in the univariable and multivariable analyses. The Poisson approximation was used when the log-binomial models did not converge.

We estimated the marginal differences in VS between ADAP plans using the parametric g-formula and bootstrap with 1000 resamples for confidence intervals (CIs) [17–19]. Specifically, we used the estimated β -coefficients from a log-binomial model to predict the 1-year risk of VS for all participants under the index exposure (2015 ADAP-funded QHP) and again under the referent exposure (Direct ADAP). We estimated marginal risk differences by taking the difference of the mean predicted outcomes between the 2 groups.

We also estimated the number needed to treat (NNT) for the intervention to achieve VS in 1 additional person as the reciprocal of the risk difference. In this setting, the “treatment” or intervention would be enrolling an ADAP client in an ADAP-funded QHP rather than in Direct ADAP. Because the NNT is calculated from the risk difference, it is interpreted as the NNT for 1 additional person to achieve/maintain VS in the 1-year period following ADAP-funded QHP enrollment. We also assessed whether the standardized risk difference in VS was different based on state by conducting a homogeneity test. Specifically, we assessed the significance of an interaction term between ADAP-funded QHP and state.

In an exploratory analysis, we estimated standardized risk difference and NNTs and performed homogeneity tests for subgroups based on demographic characteristics (age, race/ethnicity, gender, income, HIV/AIDS diagnosis, rurality, specific HIV risk factors, and baseline VL status). This exploration was performed to assess if certain subsets of clients had a lower NNT than the cohort-average NNT, with the thought that this would be a helpful signal to share toward evaluating and targeting future QHP enrollment interventions to certain populations.

RESULTS

The multistate cohort included 7776 participants, with 4.7% from Nebraska, 36.6% from South Carolina, and 58.7% from Virginia (Table 1). There were missing covariate data for 0.4% of participants, and they were not included in the analysis. Almost one-third of participants were in the 45- to 54-year age group. The majority of participants were black race/ethnicity (66.0%) and 71.4% had incomes under 138% of the FPL, meaning that they would have qualified for Medicaid if these states had expanded Medicaid at the time of the study. Most participants (83.7%) had urban residences. Just over half had a diagnosis of HIV rather than AIDS. In terms of HIV risk factors, about half reported MSM, 8% reported IDU, and about one-quarter reported heterosexual sexual contact. Almost two-thirds received direct medication provision from ADAP (Direct ADAP) in 2014. Almost one-quarter of participants had a detectable VL as their baseline VL status in 2014. About 10% of participants were not engaged in care in 2014.

Overall, 52% of the multistate cohort enrolled in ADAP-funded QHPs. Enrollment varied by state: 34% for South Carolina, 51% for Nebraska, and 63% for Virginia. Controlling for state, enrollment in ADAP-funded QHPs in 2015 was more likely for those who had ADAP-funded QHPs in 2014 (adjusted PR [aPR], 3.28; 95% CI, 3.06–3.53) and those who were engaged in care in 2014 (aPR, 1.16; 95% CI, 1.04–1.28) (Table 2). It was less likely for those with a rural residence (aPR, .91; 95% CI, .82–1.00). Age, race/ethnicity, gender, income, HIV/AIDS diagnosis, and specific HIV risk factors (MSM, IDU, and heterosexual sexual contact) were not associated with differences in QHP enrollment.

Viral suppression was assessed for those who were consistently engaged in care ($n = 4597$). Overall, for 2015, the VS rate for participants was 83.6%. For 2015, participants with ADAP-funded QHPs had a VS rate of 86.0%, and those who received medications from Direct ADAP had a VS rate of 80.2% (Table 3). Controlling for state, participants were more likely to achieve/maintain VS in 2015 if they achieved VS in 2014 (adjusted risk ratio [aRR], 1.39; 95% CI, 1.28–1.52) and enrolled in ADAP-funded QHPs in 2015 (aRR, 1.06; 95% CI, .99–1.14). Age, gender, race/ethnicity, financial status, AIDS diagnosis, rural residence, and specific HIV risk factors (MSM, IDU, and

heterosexual sexual contact) were not associated with differences in VS.

The standardized risk difference in VS between ADAP-funded QHP and Direct ADAP is 5.0% (95% CI, 2.9–7.1%). This corresponds to an NNT of 20 (95% CI, 14.1–34.5), which suggests that if 20 people are transitioned from Direct ADAP to an ADAP-funded QHP, 1 additional PLWH will maintain/achieve VS in 1 year after making the transition.

There was no significant difference in the effect of ADAP-funded QHP enrollment on VS between the 3 states (homogeneity test P value = .9). Nebraska's standardized risk difference was 2.2% (95% CI, –5.7% to 11.1%), which corresponds to an NNT of 46 (95% CI, 9–infinity). South Carolina's standardized risk difference was 6.8% (95% CI, 3.9–9.7%), which corresponds to an NNT of 14.7 (95% CI, 10.3–25.6). Virginia's state-specific standardized risk difference was 3.7% (95% CI, 3.2–7.0%), which corresponds to an NNT of 27.0 (95% CI, 14.3–31.3). There were no significant differences in NNT for subgroups defined by different demographic characteristics (all homogeneity test P values $>.05$). Values are reported in Table 4.

DISCUSSION

AIDS Drug Assistance Program–funded QHP enrollment varied between states. The high rate of enrollment seen in Virginia may have been due to coordinated state health department efforts, which we have previously described [20]. Across the 3 states, in 2015, there was no differential enrollment based on age, gender, race/ethnicity, income, HIV/AIDS diagnosis, and specific HIV risk factors. This is reassuring in terms of decreasing disparities in access to care and is a change from previous findings. Previous studies relative to the 2014 ADAP-funded QHP enrollment process in Nebraska and Virginia found that younger and black ADAP clients enrolled at lower rates [11, 13]. The Virginia study of the 2014 enrollment process also found that women and PLWH who would receive federal tax credits to enroll were enrolled at higher rates in 2014. When the 2015 Virginia data were analyzed alone, younger ADAP clients, black ADAP clients, and those with lower incomes (which made them ineligible for federal tax credits for insurance) were more likely to enroll [12]. This was hypothesized to be due to specific state efforts to enroll PLWH in 2015 who were enrolled at lower rates in 2014. These trends were not observed across the 3 states.

Importantly, across the 3 states, once ADAP clients are enrolled in ADAP-funded QHPs, they stay enrolled. Given this, low-income PLWH seem to find value in their ADAP-funded QHP and elect to continue using that method of receiving state-supported HIV healthcare delivery. On the other hand, with only one-quarter of those on Direct ADAP shifting to ADAP-funded QHPs, one wonders what barriers, such as social determinants of health, may be playing a role in keeping ADAP clients from

Table 1. Cohort Characteristics

| | Cohort A (n = 7776) | Cohort B (n = 4597) |
|--|------------------------|------------------------|
| State, n (%) | | |
| Nebraska | 367 (4.7) | 223 (4.9) |
| South Carolina | 2846 (36.6) | 1902 (41.4) |
| Virginia | 4563 (58.7) | 2472 (53.8) |
| Age, n (%) | | |
| 18–24 years | 583 (7.5) | 318 (6.9) |
| 25–34 years | 1650 (21.2) | 903 (19.6) |
| 35–44 years | 1841 (23.7) | 1107 (24.1) |
| 45–54 years | 2537 (32.6) | 1553 (33.8) |
| 55–64 years | 1165 (15.0) | 716 (15.6) |
| Gender, n (%) | | |
| Male | 5679 (73.0) | 3290 (71.6) |
| Female | 2097 (27.0) | 1307 (28.4) |
| Race/ethnicity, n (%) | | |
| White | 1964 (25.3) | 1105 (24.0) |
| Black | 5135 (66.0) | 3065 (66.7) |
| Hispanic | 516 (6.6) | 334 (7.3) |
| Other | 161 (2.1) | 93 (2.0) |
| Income, n (%) | | |
| <100% FPL | 4609 (59.3) | 2674 (58.2) |
| 101–138% FPL | 939 (12.1) | 555 (12.1) |
| 139–250% FPL | 1701 (21.9) | 1033 (22.5) |
| >251% FPL | 527 (6.8) | 335 (7.3) |
| Rurality, n (%) | | |
| Urban | 6506 (83.7) | 3807 (82.8) |
| Rural | 1270 (16.3) | 790 (17.2) |
| HIV/AIDS diagnosis, n (%) | | |
| HIV diagnosis | 4383 (56.4) | 2448 (53.3) |
| AIDS diagnosis | 3393 (43.6) | 2149 (46.7) |
| CD4 count, cells/μL | | |
| Mean (SD) | 583 (332) ^a | 578 (328) ^b |
| Median [min, max] | 545 [0, 3600] | 540 [1, 3600] |
| HIV risk factors, ^c n (%) | | |
| MSM | 3927 (50.5) | 2291 (49.8) |
| IDU | 654 (8.4) | 399 (8.7) |
| Heterosexual sexual contact | 1927 (24.8) | 1262 (27.5) |
| Perinatal | 49 (0.6) | 30 (0.7) |
| Blood | 11 (0.1) | 8 (0.2) |
| Other | 12 (0.2) | 7 (0.2) |
| Unknown | 888 (11.4) | 554 (12.1) |
| Missing | 521 (6.7) | 172 (3.7) |
| Baseline ADAP plan, n (%) | | |
| Direct ADAP | 4955 (63.7) | 2924 (63.6) |
| ACA-funded ACA | 2821 (36.3) | 1673 (36.4) |
| Baseline HIV viral load status, ^d n (%) | | |
| Detectable | 1796 (23.1) | 1043 (22.7) |
| Undetectable | 5237 (67.3) | 3554 (77.3) |
| Baseline engagement in HIV care, n (%) | | |
| Not engaged | 743 (9.6) | 0 (0) |
| Engaged | 7033 (90.4) | 4597 (100) |

Cohort A included all people living with HIV who were 18 to 64 years old on 1 January 2014; were ADAP clients in Virginia, Nebraska, or South Carolina by 1 July 2014; and did not have Medicare. Virginia ADAP clients had to have a Social Security Number. Cohort B included members of cohort A who demonstrated consistent engagement in care, as defined by at least 1 HIV viral load recorded in 2014 and at least 1 HIV viral load between 1 July 2015 and 31 December 2015.

Abbreviations: ACA, Affordable Care Act; ADAP, AIDS Drug Assistance Program; FPL, Federal Poverty Level; HIV, human immunodeficiency virus; IDU, injection drug use; MSM, male-to-male sexual contact; QHP, Qualified Health Plan.

^aCD4 counts available for 7424 participants of cohort A.

^bCD4 counts available for 4587 participants of cohort B.

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

^dBaseline HIV viral load status available for 7033 participants of cohort A.

Table 2. Affordable Care Act Qualified Health Plan (QHP) Enrollment of AIDS Drug Assistance Program (ADAP) Clients Who Were Eligible for ADAP-funded QHPs (Cohort A): Frequencies and Results of Univariable and Multivariable Log-binomial Model

| Characteristic | Enrollment (N = 7776), n (%) | Crude PR (95% CI) ^a | P value | Adjusted PR (95% CI) ^b | P value |
|--|------------------------------|--------------------------------|---------|-----------------------------------|---------|
| Age | | | .02 | | .1 |
| 18–24 years | 261 (44.5) | .94 (.82–1.09) | | .94 (.81–1.08) | |
| 25–34 years | 804 (48.7) | Ref | | Ref | |
| 35–44 years | 984 (53.3) | 1.11 (1.01–1.22) | | 1.09 (.99–1.20) | |
| 45–54 years | 1402 (55.1) | 1.11 (1.01–1.21) | | 1.07 (.97–1.17) | |
| 55–64 years | 605 (51.8) | 1.01 (.91–1.12) | | 1.00 (.89–1.11) | |
| Race/ethnicity | | | .2 | | .9 |
| Other | 99 (60.7) | 1.11 (.91–1.36) | | 1.03 (.84–1.27) | |
| Hispanic | 254 (49.1) | .91 (.80–1.03) | | .97 (.85–1.10) | |
| White | 1085 (55.0) | 1.03 (.96–1.10) | | .98 (.91–1.05) | |
| Black | 2618 (50.9) | Ref | | Ref | |
| Gender | | | .08 | | .4 |
| Female | 1136 (54.0) | 1.06 (.99–1.14) | | 1.04 (.95–1.14) | |
| Male | 2920 (51.3) | Ref | | Ref | |
| Income | | | .2 | | .2 |
| >251% FPL | 261 (49.4) | .92 (.81–1.04) | | .90 (.80–1.03) | |
| 139–250% FPL | 879 (51.4) | .97 (.89–1.05) | | .94 (.87–1.01) | |
| 101–138% FPL | 528 (56.2) | 1.06 (.97–1.17) | | 1.00 (.91–1.10) | |
| <100% FPL | 2387 (51.7) | Ref | | Ref | |
| HIV/AIDS diagnosis | | | .05 | | .2 |
| AIDS diagnosis | 1584 (46.5) | .94 (.88–1.00) | | .96 (.90–1.02) | |
| HIV diagnosis | 2471 (56.2) | Ref | | Ref | |
| Baseline ADAP plan | | | <.001 | | <.001 |
| ADAP-funded QHP | 2681 (94.6) | 3.29 (3.07–3.54) | | 3.28 (3.06–3.53) | |
| Direct ADAP | 1375 (27.7) | Ref | | Ref | |
| Residence rurality | | | .006 | | .05 |
| Rural | 505 (39.7) | .88 (.80–.97) | | .91 (.82–1.00) | |
| Urban | 3536 (54.3) | Ref | | Ref | |
| HIV risk factors: MSM | | | .7 | | .8 |
| MSM HIV risk factor | 2094 (53.2) | 1.01 (.95–1.08) | | .99 (.91–1.08) | |
| HIV risk factor other than MSM | 1962 (50.8) | Ref | | Ref | |
| HIV risk factors: IDU | | | .6 | | .9 |
| IDU HIV risk factor | 357 (54.3) | 1.03 (.92–1.15) | | 1.00 (.89–1.11) | |
| HIV risk factor other than IDU | 3699 (51.8) | Ref | | Ref | |
| HIV risk factor: heterosexual sexual contact | | | 1.0 | | .6 |
| Heterosexual sexual contact HIV risk factor | 993 (51.3) | 1.00 (.93–1.07) | | .97 (.89–1.06) | |
| HIV risk factor other than heterosexual sexual contact | 3063 (52.2) | Ref | | Ref | |
| Baseline engagement in HIV care | | | .002 | | .006 |
| Engaged | 3648 (51.7) | 1.17 (1.06–1.30) | | 1.16 (1.04–1.28) | |
| Not engaged | 408 (54.6) | Ref | | Ref | |

Abbreviations: CI, confidence interval; FPL, Federal Poverty Level; HIV, human immunodeficiency virus; IDU, injection drug use; MSM, male-to-male sexual contact; PR, prevalence ratio; Ref, reference.

^aCrude PRs and adjusted PRs are adjusted for the variable of interest and state.

^bAdjusted PRs are adjusted for all variables in the table and state.

enrolling in QHPs. For example, in the Nebraska study, unstable housing was associated with lower QHP enrollment rates in 2014 [13]. Additionally, a recent study in Virginia found that the most common experienced and perceived barriers for ADAP clients enrolling in ADAP-funded QHPs were concerns about privacy, computer and Internet access/literacy, insufficient assistance, difficulty understanding information, mental health issues, substance use, and physical barriers, such as transportation or living

in a rural area [21]. Many of these systems-level and individual-level barriers to enrolling in QHPs were also highlighted in recent focus groups with PLWH in urban settings [22, 23]. Interventions targeting these barriers would be necessary to increase the percentage of ADAP clients shifting to QHPs.

While the lower QHP enrollment of PLWH with rural residences did not result in lower rates of VS, the decreased enrollment in QHPs is concerning because QHPs are essential for access

Table 3. Viral Suppression Outcomes of AIDS Drug Assistance Program Clients Who Demonstrated Engagement in Care in 2014 and 2015 (Cohort B): Frequencies and Results of Univariable and Multivariable Log-binomial Model

| Characteristic | Viral Suppression (N = 4597), n (%) | Crude RR (95% CI) ^a | P value | Adjusted RR (95% CI) ^b | P value |
|--|-------------------------------------|--------------------------------|---------|-----------------------------------|---------|
| Age | | | .2 | | .5 |
| 18–24 years | 243 (75.9) | .97 (.86–1.10) | | .98 (.85–1.14) | |
| 25–34 years | 717 (79.2) | Ref | | Ref | |
| 35–44 years | 931 (83.9) | 1.04 (.96–1.13) | | 1.05 (.95–1.16) | |
| 45–54 years | 1307 (84.0) | 1.04 (.96–1.13) | | 1.04 (.95–1.14) | |
| 55–64 years | 647 (89.9) | 1.11 (1.01–1.22) | | 1.10 (.98–1.22) | |
| Race/ethnicity | | | .4 | | .9 |
| Other | 80 (86.0) | 1.05 (.86–1.29) | | 1.05 (.84–1.31) | |
| Hispanic | 295 (88.1) | 1.06 (.95–1.19) | | 1.04 (.92–1.18) | |
| White | 965 (86.8) | 1.05 (.98–1.13) | | 1.02 (.94–1.10) | |
| Black | 2505 (81.6) | Ref | | Ref | |
| Gender | | | .7 | | .8 |
| Female | 1082 (82.5) | .99 (.92–1.06) | | .99 (.90–1.08) | |
| Male | 2763 (83.8) | Ref | | Ref | |
| Income | | | .03 | | .2 |
| >251% FPL | 306 (91.3) | 1.15 (1.03–1.27) | | 1.11 (.99–1.23) | |
| 139–250% FPL | 913 (88.0) | 1.1 (1.02–1.18) | | 1.07 (.99–1.15) | |
| 101–138% FPL | 482 (86.8) | 1.08 (.98–1.18) | | 1.04 (.94–1.14) | |
| <100% FPL | 2143 (79.9) | Ref | | Ref | |
| HIV/AIDS diagnosis | | | .2 | | .1 |
| AIDS diagnosis | 1757 (81.5) | .96 (.91–1.02) | | .95 (.89–1.01) | |
| HIV diagnosis | 2087 (85.0) | Ref | | Ref | |
| Residence rurality | | | .4 | | .4 |
| Rural | 679 (85.8) | 1.03 (.96–1.11) | | 1.04 (.95–1.13) | |
| Urban | 3157 (82.9) | Ref | | Ref | |
| HIV risk factor: MSM | | | .5 | | .3 |
| MSM HIV risk factor | 1936 (84.2) | 1.02 (.96–1.08) | | 1.05 (.95–1.15) | |
| HIV risk factor other than MSM | 1909 (82.6) | Ref | | Ref | |
| HIV risk factor: IDU | | | .8 | | .7 |
| IDU HIV risk factor | 339 (84.5) | 1.02 (.92–1.12) | | 1.02 (.91–1.15) | |
| HIV risk factor other than IDU | 3506 (83.3) | Ref | | Ref | |
| HIV risk factor: heterosexual sexual contact | | | .7 | | .3 |
| Heterosexual sexual contact HIV risk factor | 1072 (84.7) | 1.01 (.95–1.08) | | 1.04 (.96–1.14) | |
| HIV risk factor other than heterosexual sexual contact | 2773 (82.9) | Ref | | Ref | |
| Baseline HIV viral load status | | | <.001 | | <.001 |
| Undetectable | 3193 (89.5) | 1.33 (1.23–1.43) | | 1.39 (1.28–1.52) | |
| Detectable | 652 (62.5) | NA | | NA | |
| 2015 ADAP plan | | | .06 | | .08 |
| ADAP-funded QHP | 2190 (86.0) | 1.06 (1.00–1.12) | | 1.06 (.99–1.14) | |
| Direct ADAP | 1655 (80.2) | Ref | | Ref | |

Abbreviations: ADAP, AIDS Drug Assistance Program; CI, confidence interval; FPL, Federal Poverty Level; HIV, human immunodeficiency virus; IDU, injection drug use; MSM, male-to-male sexual contact; QHP, Qualified Health Plan; Ref, reference; RR, risk ratio.

^aCrude RRs are adjusted for the variable of interest and state.

^bAdjusted RRs are adjusted for all variables in the table and state.

to non-HIV care and control of other chronic illnesses. Additional efforts should be made to reach rural PLWH for QHP enrollment as expanded access to private insurance has been found to increase access to care for those with chronic conditions [24, 25] and to decrease medical financial hardship [26]. The VS rate of 86% for participants with rural residences matches a recent Health Resources and Services Administration (HRSA) report [27].

AIDS Drug Assistance Program–funded QHP enrollment is associated with a higher rate of VS (86.0%) than Direct ADAP

(80.2%). From a recent qualitative study on the experience of Virginia ADAP clients who shifted from Direct ADAP to ADAP-funded QHPs, we have hypotheses about how QHPs may facilitate this higher VS rate. The study demonstrated that clients had mixed feelings about changes in medication access, whereas feelings about changes in provider access were mostly positive [21]. Based on the participants' interviews, we hypothesize that a PLWH with a QHP may have experienced improved VS due to one (or a combination) of the following:

Table 4. Standardized Risk Difference and Number Needed to Treat/Enroll by Subgroup for 1 Additional Person to Achieve/Maintain Viral Suppression in the 1-Year Period Following AIDS Drug Assistance Program–Funded Qualified Health Plan Enrollment

| Characteristic | Standardized Risk Difference, % (95% CI) | NNT (95% CI) |
|---|--|-------------------|
| Overall | 5.0 (2.9–7.1) | 20 (14.1–34.5) |
| State | | |
| Nebraska | 2.2 (–5.7 to 11.1) | 46 (9.0–inf) |
| South Carolina | 6.8 (3.9–9.7) | 14.7 (10.3–25.6) |
| Virginia | 3.7 (3.2–7.0) | 27.0 (14.3–31.3) |
| Age | | |
| 18–24 years | –1.7 (–11.3 to 7.1) | inf (14.1–inf) |
| 25–34 years | 9.2 (4.2–14.2) | 10.9 (7.0–23.8) |
| 35–44 years | 8.9 (4.6–13.0) | 11.2 (7.7–21.7) |
| 45–54 years | 2.6 (–.9 to 6.0) | 38.5 (16.7–inf) |
| 55–64 years | 2.1 (–2.4 to 6.4) | 47.6 (15.6–inf) |
| Race/ethnicity | | |
| White | 5.1 (.9–9.0) | 19.6 (11.1–111.1) |
| Black | 5.3 (2.8–8.1) | 18.9 (12.3–35.7) |
| Hispanic | –2.8 (–9.8 to 4.2) | inf (23.8–inf) |
| Other | 18.7 (4.5–32.8) | 5.3 (3.0–22.2) |
| Gender | | |
| Male | 4.9 (2.5–7.3) | 20.4 (13.7–40.0) |
| Female | 5.3 (1.3–9.1) | 18.9 (11.0–76.9) |
| Income | | |
| <100% FPL | 8.5 (5.7–11.5) | 11.8 (8.7–17.5) |
| 101–138% FPL | –1.6 (–7.2 to 3.7) | inf (27.0–inf) |
| 139–250% FPL | 0.7 (–3.1 to 4.3) | 142.9 (23.3–inf) |
| >251% FPL | 1.9 (–4.2 to 7.6) | 52.6 (13.2–inf) |
| HIV/AIDS diagnosis | | |
| HIV diagnosis | 3.4 (.7–6.2) | 29.4 (16.1–142.9) |
| AIDS diagnosis | 6.8 (3.8–9.9) | 14.7 (10.1–26.3) |
| Rurality | | |
| Urban | 4.7 (2.4–7.0) | 21.3 (14.3–41.7) |
| Rural | 6.6 (1.9–11.2) | 15.2 (8.9–52.6) |
| HIV risk factor: MSM | | |
| MSM HIV risk factor | 4.6 (1.7–7.6) | 21.7 (13.2–58.8) |
| HIV risk factor other than MSM | 5.4 (2.5–8.3) | 18.5 (12.0–40.0) |
| HIV risk factor: IDU | | |
| IDU HIV risk factor | 3.6 (–2.7 to 11.4) | 27.8 (8.8–inf) |
| HIV risk factor other than IDU | 5.1 (2.9–7.3) | 19.6 (13.7–34.5) |
| HIV risk factor: heterosexual | | |
| Heterosexual HIV risk factor | 5.0 (1.6–9.0) | 20.0 (11.1–62.5) |
| HIV risk factor other than heterosexual | 5.0 (2.5–7.4) | 20.0 (13.5–40.0) |
| Baseline HIV viral load status | | |
| Detectable | 10.5 (4.8–16.2) | 9.5 (6.2–20.8) |
| Undetectable | 3.4 (1.1–5.5) | 29.4 (18.2–90.9) |

Abbreviations: CI, confidence interval; FPL, Federal Poverty Level; HIV, human immunodeficiency virus; IDU, injection drug use; inf, infinity; MSM, male-to-male sexual contact; NNT, number needed to treat.

(1) either perceived or actual improved medication coverage, (2) improved method of obtaining medication for those who preferred receiving medications by mail, and (3) increased access to overall healthcare leading to improved engagement in healthcare, including HIV care.

The higher rate of VS for QHPs was seen across states and demographic groups. Viral suppression did not vary based on age, gender, race/ethnicity, financial status, AIDS diagnosis, rural residence, or specific HIV risk factors. State ADAPs,

especially those in the South and those in states without Medicaid expansion, could consider investing in purchasing QHPs as an evidence-based intervention for PLWH. Increased QHP enrollment could improve VS rates. Using ADAP funds to purchase QHPs could be a component of the “Ending the HIV Epidemic” initiative as it has been shown to be associated with improved HIV VS and could lead to decreased transmission given that undetectable equals untransmittable [28]. When PLWH have access to QHPs, this could also have implications

for access to non-HIV care and control of chronic medical illnesses. As the population of PLWH age, it is going to be essential to ensure that patients have access to preventive care and cancer screenings that are not covered by the RWHAP.

In terms of the high overall VS rate in the study, the VS rate of 83.6% for the participants who were engaged in care in 2014 and 2015 in this study mirrors the VS rate of 83.4% reported in the HRSA's RWHAP report for 2015 [29]. This likely reflects that most study participants who received medication assistance through RWHAP-funded state ADAPs also received robust HIV medical care through the RWHAP-funded clinics.

To our knowledge, this is the first study to determine an NNT for a change in HIV healthcare delivery to result in an additional person maintaining or achieving VS. The NNT was consistent across states and demographic groups. If 20 PLWH are shifted from Direct ADAP to ADAP-funded QHPs during open enrollment in the fall, we expect that 1 additional person will maintain or achieve VS in the upcoming year. This could translate into benefits for the individual in terms of living longer and healthier lives and for public health in terms of decreasing HIV transmission [3–7]. While this takes either individual patient initiative or effort at the state health department or clinic level, many other interventions that have demonstrated the NNT for VS have been more labor intensive over a longer period of time. The WelTel Kenya1 intervention consisted of weekly text messages and required a nurse response in 48 hours for a total of 12 months. The authors reported an NNT to achieve VL suppression of 11 with a 95% CI of 5.8–227.3 [30]. This weekly intervention is more time intensive than the structural intervention of shifting ADAP clients from Direct ADAP to ADAP-funded QHPs.

An estimate of the cost to enroll 20 additional PLWH in ADAP-funded QHPs is \$107 980, based on the average cost per Virginia ADAP client's QHP in 2015 of \$5399 [20]. If all 114 394 Direct ADAP clients in the United States in 2017 shifted to ADAP-funded QHPs, an additional 5719 PLWH would achieve VS [31]. If enrollment in QHPs directly leads to improvements in VS, then this would translate to an additional 2.4% of ADAP patients achieving VS nationally. This could also avert 103 HIV infections and avoid more than \$41 million dollars in healthcare costs. This is calculated with the estimates that each time a PLWH is prescribed antiretroviral therapy and becomes virally suppressed, 1.8 transmissions per 100 person-years are averted [32], and that each averted infection saves \$402 000 in lifetime healthcare costs [8].

In terms of limitations, this work is a retrospective cohort study limited to 3 states that did not have Medicaid expansion at the time of the study. The VS outcomes are limited to the ADAP clients who were engaged in care in 2014 and 2015. In terms of additional limitations, there could be unmeasured differences between those who enrolled in QHPs and those who stayed on Direct ADAP in terms of barriers faced. We could not adjust for

differences in social determinants of health (housing, alcohol use, education, Internet access/literacy, mental health, transportation, stigma, language barriers) due to lack of availability of those data at the state level. While we did not have current data on substance use, we were able to examine whether having an HIV risk factor of IDU was associated with our primary outcomes, and there was no difference in QHP enrollment or VS.

State ADAPs, especially those in the South and those in states without Medicaid expansion, could consider investing in purchasing QHPs for PLWH because increased enrollment could improve VS rates. This evidence-based intervention could contribute to Ending the HIV Epidemic. The association of ADAP-funded QHP coverage and VS was not different based on demographic factors, including race/ethnicity. This is a key finding showing that this structural system-level intervention benefited PLWH across demographic groups and was not found to be contributing to disparities in outcomes. Future work should examine whether health system-level interventions can reduce disparities for PLWH.

Notes

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