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Effects of recent Virginia AIDS Drug Assistance Program policy changes on diabetes and hyperlipidemia control in people living with HIV

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Abstract

Objectives: To describe the impacts of Virginia AIDS Drug Assistance Program's elimination of diabetes and hyperlipidemia medication on disease outcomes in people living with HIV.

Methods: Data were collected on two groups of people living with HIV who were prescribed medications for diabetes and/or hyperlipidemia; one group received medications from AIDS Drug Assistance Program (ADAP) and the other group received medications from another source. Data were collected for 13 months before and after the policy change. Diabetes, hyperlipidemia, and HIV control were compared using standard laboratory measures.

Results: During the pre-policy-change time period, non-ADAP patients had better diabetes control than ADAP patients, but with multivariate analysis, ADAP status was no longer a statistically significant predictor. Otherwise, no significant differences between groups were identified.

Discussion: ADAP patients had worse diabetes control compared to the non-ADAP group before the policy change. It is possible that this is due to the AIDS Drug Assistance Program population's poor access to non-HIV primary care, including care for diabetes. It is reassuring that, even during a time of flux in AIDS Drug Assistance Program resources, the AIDS Drug Assistance Program patients' co-morbid and HIV outcomes were not negatively impacted.

Keywords

HIV, AIDS Drug Assistance Program, ADAP, diabetes mellitus, hyperlipidemia, AIDS, health policy change

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Introduction

The Ryan White Comprehensive AIDS Resources Emergency (CARE) Act of 1990 established the AIDS Drug Assistance Program (ADAP). This program is the "payer of last resort" for people living with HIV (PLWH) whose income falls below a certain threshold (which varies by state) to obtain antiretroviral therapy (ART), medications for opportunistic infections, and medications for co-morbidities such as hypertension, diabetes, and hyperlipidemia. Each state ADAP determines its own formulary.[1,2] In the past few years, state ADAP programs have faced flat federal funding. In addition, demand for ART continues to increase for several reasons. Happily, PLWH are living longer; ART guidelines have been changed to recommend initiation of treatment for all, regardless of CD4 count; the United States continues to emphasize increasing HIV testing rates; and the recession continues.[3] The combination of limited funds and rising demand has led to ADAP formulary cuts and ADAP enrollment wait lists.[3,4] A study of patients with chronic illness in Oregon who received public insurance demonstrated that changes in public health-care insurance plans created interruptions in coverage that culminated in reduced quality of life and worsened disease outcomes.[5] Little research has assessed how cost-containment measures in publicly funded programs that support the care of PLWH affect disease outcomes.

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In December 2010, Virginia ADAP eliminated all medications from the formulary that were not ART or for opportunistic infection treatment or vaccines.[6] This cut eliminated all diabetes and hyperlipidemia medications. It is important to evaluate the consequences of constrained access to these medications since PLWH are living longer and control (or lack of control) of their co-morbid conditions will affect their well-being and perhaps their HIV outcomes. The need to manage co-morbidities, including diabetes, is highlighted by a recent study demonstrating the negative impacts of co-morbidities, of which diabetes was the most commonly identified, on the health-related Quality of Life of PLWH, particularly as they age.[7] In addition, life years gained through access to ART may be at risk due to inadequate management of metabolic and cardiovascular disease in PLWH.

Treating diabetes, hyperlipidemia, and hypertension is important for decreasing cardiovascular risk factors in PLWH. A recent study showed that men with HIV with ART exposure have more than four times the incidence of diabetes compared to men without HIV.[8] Moreover, studies have linked many ART drugs to hyperlipidemia, but no studies report a reliable incidence. It has been estimated that at least 10% of deaths in patients with HIV are due to cardiovascular disease.[9] This is thought to be due to side effects of ART, HIV infections itself, and the aging of the PLWH population.[10] Studies have shown that ART is associated with a 26% relative increase in the rate of myocardial infarction per year of exposure during the first 4 to 6 years of use.[11] A newer study shows that infection with HIV alone, after controlling for recognized cardiovascular risk factors, confers a 50% increase risk of acute myocardial infarction.[12] Of concern, another recent study demonstrated that while approximately 20% of patients have a 10-year cardiovascular risk greater than 20%, many patients who met criteria for initiation of pharmacologic treatment did not receive appropriate interventions and did not reach recommended treatment goals.[13]

This ADAP cut also eliminated psychiatric medications from the formulary. We did not study behavioral health issues due to the lack of objective markers to follow pre-policy change and post-policy change.

We were concerned that dissatisfaction with the ADAP program might affect the patients' desire to engage in HIV care and their compliance with ART. A study examining predictors of poor ART outcomes in two South African HIV programs found that dissatisfaction with a program's services was strongly associated with poor ART outcomes.[14]

Our primary hypothesis was that the change in availability of diabetes and hyperlipidemia medications through ADAP would have a negative effect on diabetes and hyperlipidemia control in patients who previously received these types of medications from ADAP. Our secondary hypothesis was that HIV control would also be negatively affected by the ADAP changes and associated paperwork, which might have raised patient anxiety about ability to access medications and care.

Methods

Subjects

This was a cohort study. The cohort consists of PLWH who receive care at an academic medical center, were enrolled in ADAP, and were prescribed medications for diabetes and hyperlipidemia covered by ADAP (glipizide, glipizide/metformin, glyburide, glyburide/metformin, insulin, metformin, atorvastatin, pravastatin, and rosuvastatin). Patients with the International Classification of Diseases–Ninth Revision (ICD9) diagnosis codes of HIV and diabetes (250.*) and/or hyperlipidemia (272, 272.0, 272.2, 272.4, 272.9) as well as patients who had any lifetime laboratory values for glycosylated hemoglobin (HbA1c) greater than or equal to 6.5%, low-density lipoprotein (LDL) greater than or equal to 100, or total cholesterol greater than or equal to 200 were identified from the University of Virginia (UVa) Clinical Data Repository (CDR) database. Hypertriglyceridemia was not included.

To be eligible for the cohort, patients had to be 18 years or older, be seen by a health-care provider by November 2009, be prescribed one of the eliminated medications by August 2010, and be seen at least once in the UVa Ryan White Clinic during both the pre-policy-change time period and post-policy-change time period (Figure 1).

The cohort was compared to a group of patients with HIV who received care at the same clinic and who were prescribed the same medications but obtained them through a source other than ADAP. To be included in the control group, patients had to be seen by a health-care provider by November 2009, be prescribed one of the eliminated medications by August 2010, and be seen at least once in the pre-policy-change time period and post-policy-change time period.

This study was reviewed and approved by the UVa Institutional Review Board. A secure UVa Department of Medicine laptop computer was used to collect, store, and analyze data. Data were collected from a clinical database maintained at the UVa as well as the institution's electronic medical record. Data were stored in a Microsoft Access database.

Timeframe

The cohort and the controls were seen for the first time by a medical provider at the clinic at least 18 months before the policy change (Figure 1). Data on time from first visit at the clinic to start of data collection were measured as the time in care in years. Data were collected on the cohort and the controls for 13 months before the policy change and 13 months after the policy change (Figure 1). This number of months was chosen because during this time period, the patients would have between two and four lab values for HbA1c, LDL, absolute CD4 count, and HIV viral load, a number sufficient to allow for comparison. Also, ADAP only administers medications in single monthly allotments, and therefore, the patient would have been without medications for close to

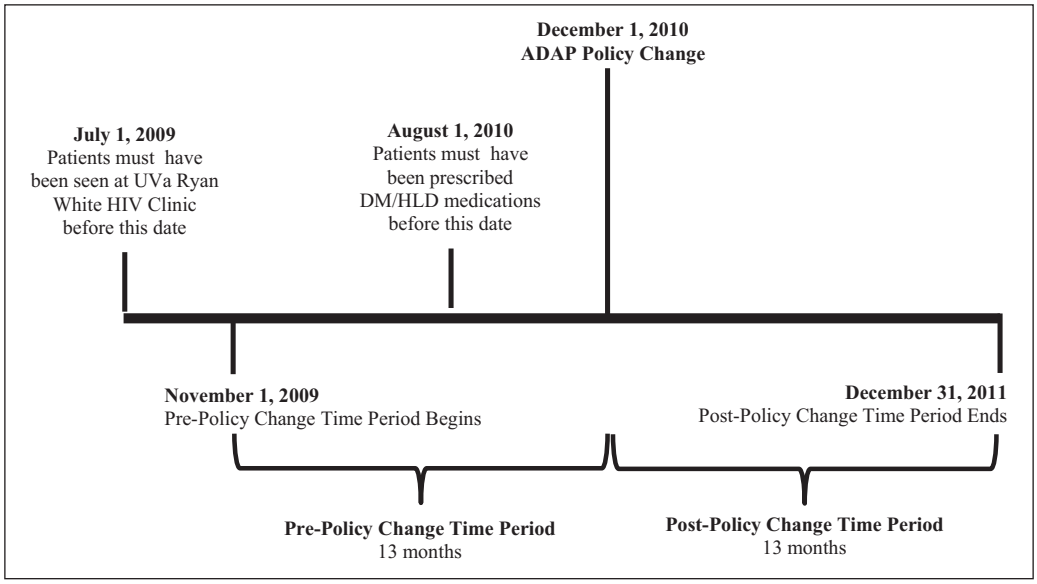

Figure 1. Timeline of patient entry to clinic, medication prescription, and policy change.

Table 1. Baseline characteristics of ADAP and non-ADAP patients.

Characteristic	ADAP (n = 32)	Non-ADAP (n = 82)	
Age (years ± *SD*)	49.2 (±8.3)	51.1 (±10.3)	$p = 0.344$
Time in care (years ± *SD*)	8.6 (±5.2)	9.8 (±5.2)	$p = 0.26$
Sex			
Male—no. (%)	25 (78.1)	68 (78.1)	$p = 0.552$
Female—no. (%)	7 (21.9)	14 (17.1)	
Race			
White—no. (%)	18 (56.3)	50 (61)	$p = 0.644$
Non-white—no. (%)	14 (43.8)	32 (39)	
Region			
Charlottesville/Albemarle—no. (%)	14 (43.8)	19 (23.2)	$p = 0.029$
Outer Regions—no. (%)	18 (56.3)	63 (76.8)	
UVa payscale			
Discount—no. (%)	20 (62.5)	38 (46.3)	$p = 0.121$
No discount—no. (%)	12 (37.5)	44 (53.7)	
Insurance status			
Insured—no. (%)	9 (28.1)	72 (87.8)	$p < 0.001$
Not insured—no. (%)	23 (71.9)	10 (12.2)	
Co-morbidities			
Hyperlipidemia	32 (100)	82 (100)	
Diabetes	14 (43.8)	32 (39)	$p = 0.644$
Hypertension	15 (46.9)	34 (41.5)	$p = 0.600$
Coronary artery disease	6 (18.8)	14 (17.1)	$p = 0.832$

ADAP: AIDS Drug Assistance Program; *SD*: standard deviation; UVa: University of Virginia.

12 months even if the patient had filled prescriptions immediately prior to the policy change in November 2009.

Baseline demographics

Baseline demographics of the patients were compared (Table 1). Age was compared using student's t-test. Mean time in care was compared using a Mann–Whitney U test. Sex, race, region, payscale, insurance status, and co-morbidities were compared using chi square tests. Institutional payscale category, which determines how much financial assistance the patient receives from the medical center, was used as a surrogate for economic status. This payscale takes gross annual household income and assets into account. It

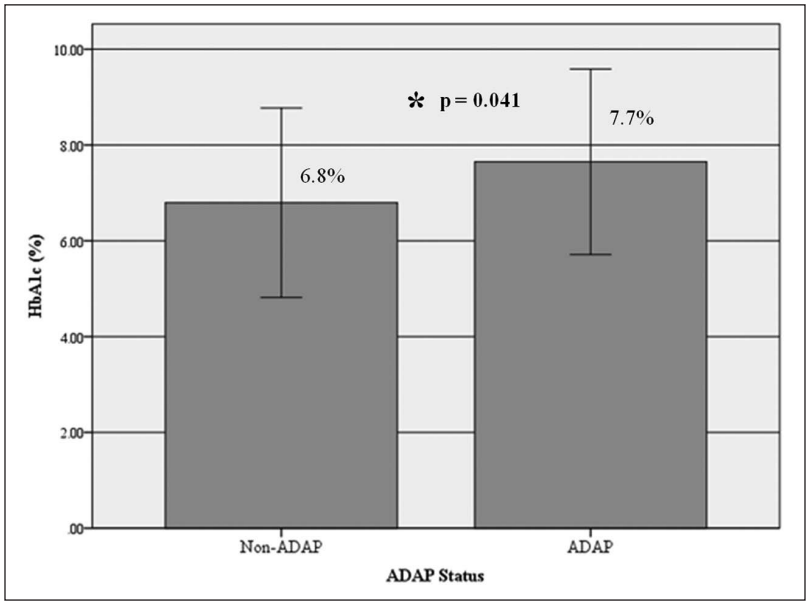

Figure 2. Comparison by group of diabetes control before the ADAP policy change.
ADAP: AIDS Drug Assistance Program.

was classified as a group that receives a reduced rate and a group that does not receive a discount. These calculations were performed using SPSS and SAS.

Primary and secondary outcomes

The primary outcomes assessed were diabetes and hyperlipidemia control in the ADAP and non-ADAP groups. For diabetes control, ADAP and non-ADAP groups' average HbA1c was calculated for the pre-policy-change time period and the post-policy-change time period. Linear and multivariate regressions were used to assess the effect of ADAP status on these average values. Due to the small sample size, for multivariate regression, ADAP was tested with each covariate individually.

We also categorized each patient's diabetic outcome as positive or negative. Maintaining an average HbA1c below 7.0% from pre-policy-change time period to post-policy-change time period or achieving an average HbA1c below 7.0% for the post-policy-change time period was classified as positive diabetic outcomes. We used logistic regression to compare ADAP and non-ADAP groups in terms of positive diabetic outcomes.

For hyperlipidemia control, ADAP and non-ADAP groups' average LDL was calculated for the pre-policy-change time period and post-policy-change time period. Linear regression was used to assess ADAP status's effect on these outcomes.

Secondary outcomes examined included changes in HIV control through absolute CD4 count and HIV viral load. For CD4 counts, average values for pre-policy and post-policy time period were computed. Linear regression was used to assess ADAP status's effect on these average values.

HIV viral loads were considered undetectable if the number was less than 48 viral copies/mL. We categorized each patient's virologic outcome as positive or negative. Staying undetectable and going from detectable to undetectable were positive HIV viral load outcomes. Staying detectable or going from undetectable to detectable were negative HIV viral load outcomes. We used logistic regression to compare ADAP and non-ADAP groups in terms of positive HIV viral load outcomes.

Results

The study cohort contained 32 ADAP patients and 82 patients without ADAP. In terms of baseline characteristics and comorbidities, the ADAP and non-ADAP groups were similar except for region and insurance status (Table 1).

Diabetes

During the 26 months, 46 patients had their HbA1c evaluated. Not all patients had it evaluated during both the pre-policy- and post-policy-change time periods. Nine out of 14 ADAP patients with diabetes and 19 out of 32 non-ADAP patients with diabetes had it drawn during both time periods and the analysis was performed on these patients. The diabetic patients with HbA1c values drawn before and after the policy period did not differ from the diabetic patients without these data based on ADAP status, mean age, mean time in care, gender, race, payscale, or insurance status.

During the pre-policy-change time period, ADAP patient's average HbA1c was 7.7% (±1.0) and non-ADAP patient's average HbA1c was 6.8% (±1.0). When tested with linear regression analysis, ADAP status was statistically significant in predicting pre-policy average HbA1c ($p = 0.041$, Figure 2). When mean age, mean time in care, gender,

payscale, and region were added individually as covariates, ADAP status remained a statistically significant predictor. When race and insurance status were added individually, ADAP status became a non-significant predictor of pre-policy average HbA1c ($p = 0.059$ and 0.325). However, in their individual multivariate regressions with ADAP status, neither of these covariates had a statistically significant effect. Also, in linear regression, insurance status was not a statistically significant predictor of pre-policy average HbA1c ($p = 0.064$). Race was also not a statistically significant predictor of pre-policy HbA1c ($p = 0.358$).

During the post-policy time period, ADAP patient's average HbA1c was 7.7% (±0.9) and non-ADAP patient's average HbA1c was 7.6% (±2.3). When tested with linear regression analysis, ADAP status was not statistically significant in predicting post-policy average HbA1c ($p = 0.916$).

Logistic regression did demonstrate a trend for ADAP patients to have less good diabetes outcomes over the study time period ($p = 0.07$) meaning that they were less likely to have maintained or achieved an average HbA1c less than 7.0% over the course of the study time period.

Hyperlipidemia

A total of 95 patients had a lipid panel checked during both the pre-policy and post-policy time period. This group consisted of 27 ADAP patients and 68 non-ADAP patients.

During the pre-policy-change time period, ADAP patients' average LDL was 120.6 (±33.6) and non-ADAP patients' average LDL was 112.9 (±30.5). When tested with linear regression analysis, ADAP status was not statistically significant in predicting pre-policy average LDL ($p = 0.285$). During the post-policy-change time period, ADAP patients' average LDL was 115.0 (±31.1) and non-ADAP patients' average LDL was 116.1 (±42.7). When tested with linear regression analysis, ADAP status was not statistically significant in predicting post-policy average LDL ($p = 0.899$).

Absolute CD4 count

A total of 114 patients had absolute CD4 cell counts ordered before and after the policy change. This accounted for 32 ADAP patients and 82 non-ADAP patients.

During the pre-policy time period, ADAP patients' average CD4 count was 711.7 (±345.8), and non-ADAP patients' average CD4 672.9 (±273.6). When tested with linear regression analysis, ADAP status was not statistically significant in predicting pre-policy average CD4 count ($p = 0.531$). During the post-policy time period, ADAP patients' average CD4 count was 762.4 (±369.8), whereas non-ADAP patients' CD4 count was 702.2 (±285.6). When tested with linear regression analysis, ADAP status was not statistically significant in predicting pre-policy average CD4 count ($p = 0.356$).

HIV viral load

A total of 32 ADAP patients and 82 non-ADAP patients had HIV viral load measurements during the pre-policy time period and post-policy time period.

In the ADAP group, 24 (75%) had good outcomes, and in the non-ADAP group, 54 (66%) had good outcomes, as defined above. Logistic regression demonstrated no statistically significant differences between the ADAP groups in terms of achieving a good HIV viral load outcome in terms of maintaining an undetectable HIV viral load or achieving an undetectable HIV viral load ($p = 0.345$).

Discussion

This is an ecologic study that examines an understudied area of state-level policy change effects on PLWH. It is limited by the small numbers and thus has reduced power. It is notable that, compared to the pre-policy period, we found no negative effects in the post-policy period on diabetes or hyperlipidemia control for the ADAP group when compared to the non-ADAP group.

Hyperlipidemia and HIV control were comparable between the ADAP and non-ADAP groups before and after the policy change. ADAP patients had slightly worse diabetes control before the policy change. We also saw a trend indicating that ADAP patients were less likely to achieve a positive diabetes outcome over the time period of the study. It is possible that this is because the ADAP group typically lacks other insurance coverage and relies on Ryan White funding for provision of HIV-related health care. Few other resources are available for primary care, including care for diabetes and its complications, for PLWH whose income falls below a specified threshold, unless a patient qualifies for Medicare or Medicaid. In the clinic studied, 30% of the total client population was uninsured at the time of the study. In Virginia, the Medicaid eligibility is stringent with low income eligibility caps; many Virginians would qualify for Medicaid in other states. With the passage of the Affordable Care Act (ACA), there may be opportunities to build on the infrastructure created through the Ryan White Care Act to improve outcomes for other chronic diseases which are prevalent in PLWH and which account for increasingly large proportions of the morbidity and mortality in this population. The Ryan White–supported clinics provide excellent HIV care to qualifying PLWH and should be leveraged to provide additional primary care for co-morbidities.

Baseline characteristics of the ADAP and non-ADAP populations only differed in terms of geographic location ($p = 0.029$) and whether or not the patients had insurance ($p < 0.001$). We expected that this would be the case because insurance status and ADAP status are not independent variables. Patients with insurance are likely to have medication coverage and not qualify for ADAP. Other demographic features including age, time in care, sex, race, and economic status were statistically similar. In addition, prevalence of

co-morbidities, including hyperlipidemia, diabetes, hypertension, and coronary artery disease, was similar between the ADAP and non-ADAP groups. In the general population, 13.4% of people with hypertension, hyperlipidemia, or diabetes mellitus have more than one of these conditions, so the prevalence of multiple co-morbidities was not surprising.[15]

There are limitations to our analysis. The main one is the small number of patients included in our analysis. It is possible that we could have missed an effect of the policy change. Additionally, we did not have access to pharmacy pick-up records and cannot be sure that patients who were prescribed medications for their diabetes and hyperlipidemia through ADAP actually did procure them as prescribed. Moreover, we reviewed patients' charts to determine which patients were enrolled in ADAP, but it is possible that we missed some patients who were enrolled in ADAP, if this information was not captured in their clinic notes.

It is also possible that the patients who lost access to their diabetes and hyperlipidemia medications only experienced a short gap in access to their medications because the UVa Ryan White Clinic staff made great efforts to enroll patients in drug company prescription assistance programs. Also, while we chose a 13-month period before and after the policy change in order to attempt to collect slightly more than a year of data on each side of the change, the gap in access may have been too small to detect a change in diabetes control. Similarly, lipid panels are only measured every 6 months, and the length of study may have been insufficient to detect a change. Additionally, we may have missed data given that some of our patients could have had their lab values checked at non-affiliated primary care offices.

Conclusion

State ADAP programs have instituted cost-containment measures to keep within their budgets in recent years because there is an expanding population of PLWH in need of ADAP support and a fixed national budget.[2] However, there is little research on how the cost-containment measures affect PLWH who rely on ADAP. Our study shows that even in the face of eliminated medications, the ADAP group is comparable to the non-ADAP group in terms of diabetes and hyperlipidemia control. This finding may speak to the efforts of the clinic staff to find alternative sources of medications. We did not collect information about time spent per client to manage the changes in prescription coverage and to seek new medication access after the cost-containment measures went into effect. More comprehensive coverage for PLWH should become available through the ACA. However, it is likely that a subgroup of PLWH will still rely on ADAP and Ryan White funding for access to care, especially in states that do not expand Medicaid. Future evaluations should include cost analysis to assess the true cost of maintaining access to medications for co-morbidities in times of cost containment. In addition, as other policies are implemented to contain costs for ADAP, which is expected to continue despite the advent of the ACA, larger observational studies should be planned, so that the effects of these policies can be prospectively assessed with larger numbers of patients.

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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