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**Should Patient Characteristics Be Included  
in a Severity of Need Index for Ryan White  
Program, Part A Services?**

**An Evaluation Based on the Medical  
Expenditure Panel Survey**

Prepared for

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## Abstract

**Background.** In response to congressional legislation, the Ryan White Comprehensive AIDS Resources Emergency (CARE) Act is developing a quantitative index to measure individual grantee needs for Part A services. Differences in patient characteristics, including demographics, exposure category, and disease stage, may represent an important driver of variations in need.

**Methods.** This study evaluated the relationship between outpatient service utilization and five patient characteristics that can be measured in Centers for Disease Control and Prevention (CDC) surveillance data: patient age, gender, race/ethnicity, injection drug use exposure category, and HIV or AIDS current status designation. Injection drug use exposure was measured in the Medical Expenditure Panel Survey (MEPS) using a proxy variable of a viral hepatitis diagnostic code. For all analyses, we used 2002–2004 MEPS data. We estimated a traditional two-part health expenditure regression model of outpatient expenditures as a function of these variables and ran regression analyses for both the total population of patients in MEPS (controlling for HIV or AIDS infection status) and for the subset of data that contained only patients with a diagnostic code of HIV or AIDS.

**Results.** We found no significant association between any of the five patient characteristics and outpatient costs. This result was robust to a wide range of model specifications, as well as to the inclusion of additional (prior) years of data. We found no difference between the proportion of patients who used services in the MEPS data and those in the CDC surveillance data by age, gender, race/ethnicity, or HIV/AIDS designation.

**Conclusions.** As measured in this study and in the CDC surveillance data, the patient characteristics of age, gender, race/ethnicity, IDU exposure category, and HIV or AIDS current status designation were not related to variations in outpatient costs as captured by MEPS. These characteristics also did not appear to be related to differential rates of outpatient care access.

**Implications for the Development of a Severity of Need Index.** These findings do not support the inclusion of patient characteristics in a severity of need algorithm for Ryan White Program Part A services or Ryan White Program nonprescription-related Part A services. Their impact on prescription drug consumption was not tested. Additional research should examine the role of injection drug use exposure category on demand for services, because this variable was imprecisely measured in this study. Policy makers should revisit these issues in the future to account for potential changes in the utilization of health services and to incorporate newer sources of data.

## 1. INTRODUCTION

The Health Resources and Services Administration's (HRSA's) HIV/AIDS Bureau is investigating the development of quantitative indexes to adjust Ryan White Comprehensive AIDS Resources Emergency (CARE) Act funding for differences in local variations in need. In this study, we evaluated the relationship between characteristics of patients infected with HIV/AIDS and variations in outpatient costs seen in the Medical Expenditure Panel Survey (MEPS). Previous empirical research has not identified a significant relationship between HIV patient characteristics and outpatient costs. However, previous research also has not measured patient characteristics in precisely the manner of Centers for Disease Control and Prevention (CDC) surveillance data.

Currently, CDC HIV/AIDS Reporting System (HARS) surveillance data deliver measures of patient demographics, exposure category, and a simple measure of disease progression (age, gender, race/ethnicity, injection drug use risk behaviors, and whether a patient has ever been diagnosed with AIDS as opposed to simply HIV). This work attempted to relate five variables measured by the HARS data (patient age, gender, race/ethnicity, IDU exposure category, and HIV/AIDS status) to outpatient medical costs.

These five variables were suggested by a selected panel of experts in HIV health policy and the Ryan White Ryan White Program. Outpatient costs were selected because they were the category of service measured by MEPS that was most similar to the services purchased by Part A of the Ryan White Program.

## 2. DATA

We conducted the majority of analyses using 2002–2004 MEPS data. MEPS is a nationally representative survey of the U.S. civilian, noninstitutionalized population administered by the Agency for Healthcare Research and Quality (AHRQ). MEPS includes components for households, medical providers, and source of insurance. The Household Component contains information reported by household participants, including demographic information, self-reported medical conditions, medical expenditures, and resource utilization for specific medical events. The Medical Provider Component contains information gathered from hospitals, physicians, home health providers, and pharmacies and is used to supplement expenditure data reported by household. The Insurance Component contains data from private and public sector employers about the types of insurance plans they offer their employees, the benefits provided in these plans, how the plans are financed, the eligibility requirements of the plans, and the characteristics of the firms themselves.

MEPS uses a complex survey design, which includes stratification; clustering; multiple stages of selection; and oversampling of African-Americans, Hispanics, Asians, and families with incomes below 200% of the federal poverty level. The population sampling weights account for survey nonresponse and use U.S. Census Bureau data to create nationally

representative estimates for the civilian, noninstitutionalized population. Taking advantage of the nationally representative nature of the MEPS data, many recent studies have used MEPS to estimate national-level cost estimates for various conditions (Finkelstein, Fiebelkorn, and Wang, 2003; Finkelstein et al., 2004; Cohen and Krauss, 2003; Yelin et al., 2001; Newacheck and Kim, 2005).

MEPS is designed as an overlapping panel data set, following each respondent over 2 years. Each year can be analyzed separately, but users can also concatenate multiple years of data to create a larger cross-sectional data set with observations drawn from a number of years. Because of the potentially low numbers of people reporting HIV or AIDS in each year, we created such a data set, pooling observations from 2002, 2003, and 2004 (AHRO, 2000). We also ran other variations of these analyses using a wider range of years (from 1998 to 2004) to test the sensitivity of our results to the years we selected and the resulting sample size. However, including these additional years did not ultimately alter the results. We therefore focused on the most recent data available to best match recent service utilization trends while still generating a sample large enough to support statistically significant results.

## **2.1 Defining HIV/AIDS Patients**

Using 2002–2004 MEPS data, we defined people who had HIV or AIDS based on each patient’s self-reported conditions listed in the MEPS conditions file. Respondents could report medical conditions as the reason for a specific medical event to occur or as a general condition that might not be directly attributable to a specific medical event. MEPS assigned each condition an appropriate International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code. MEPS then combined sets of ICD-9-CM codes into more general clinical classification codes. We used the MEPS clinical classification code of “005” to define individuals with HIV/AIDS.

## **2.2 Defining Patient Characteristics**

We defined the five HARS patient characteristics in the MEPS data as follows. For age, we tested the impact of a continuous measure, as well as a dichotomous measure indicating if the patient was under or over 40. Gender was coded with a dichotomous indicator for females, and race/ethnicity was divided into a set of dichotomous indicators measuring African-American non-Hispanic, white non-Hispanic, Hispanic, and other race/ethnicity. We used the ICD-9 code of “043” to define the subpopulation who reported having AIDS in addition to HIV infection, and we used the MEPS clinical classification code of “006” to indicate the presence of viral hepatitis. Our measure of viral hepatitis was intended as a proxy to measure patients with an injection drug use risk exposure because such a high proportion of injection drug users (IDUs) are infected with hepatitis B, hepatitis C, or both. However, we concede that it is at the least an imprecise measure of IDU exposure risk.

### 3. ANALYSES

Our analyses modeled outpatient costs as a function of patient characteristics, while controlling for underlying HIV/AIDS diagnosis. These analyses were designed to estimate if statistically significant incremental differences in outpatient expenditures existed between patients infected with HIV with different characteristics.

We modeled outpatient expenditures using a classic two-part health expenditure model (Manning and Mullahy, 2001). The two-part model first uses logistic regression to assess the probability of consuming any outpatient services and then uses log-linear ordinary least squares (OLS) regression to estimate the amount of outpatient services consumed given that a patient consumed at least \$1 worth.

Our dependent variable measure of outpatient costs included the costs of emergency room, hospital outpatient, and office-based physician visits. Outpatient pharmacy or inpatient admission costs were not included. Expenditures represent MEPS attempt to recreate what was actually paid for (as opposed to charged for) a specific medical event using standard reimbursement rates.

Our logistic regression model (the first part of our model) estimated the probability of any outpatient service use as a function of our five patient characteristic variables (age, gender, race/ethnicity, IDU exposure category, presence of HIV/AIDS status designation) and controlling for region (Northeast, Southeast, Midwest, and West). Similarly, our OLS regression model (the second part of our two-part model) estimated the natural log of outpatient expenditures as a function of our five patient characteristics variables: age, gender, race/ethnicity, IDU exposure category, presence of HIV/AIDS status designation. Log-transformation of the dependent variable was necessary to enable the use of OLS because of the non-normal distribution of the MEPS outpatient health care expenditures (Manning and Mullahy, 2001). To account for the complex survey design of MEPS, we conducted all analyses using Stata's survey (svy) commands (Stata version 9.2, College Station, Texas, 2006).

We specified several models to determine the effect of various demographic characteristics on outpatient expenditures within the HIV/AIDS population. We estimated our fully specified model on the entire MEPS population, including age, gender, race/ethnicity, IDU exposure category, presence of HIV/AIDS status designation, an indicator for HIV/AIDS, and interaction terms between each of the above indicators and HIV/AIDS to determine the effect of these demographic variables on expenditures for the HIV/AIDS population. We also estimated an additional model using only individuals with HIV/AIDS. All costs are in 2005 dollars, adjusted using the medical component of the Consumer Price Index (CPI). We present only the results from the second model, because it is easier to interpret than the first, and because the results from the two models did not differ in any meaningful way.

## 4. RESULTS

In the 2002–2004 MEPS, we identified a total of 125 patients with HIV (42 individuals) or AIDS (83 individuals) (Table 1). After applying sampling weights, these individuals corresponded to 313,606 patients (131,245 with reported HIV and 182,361 with reported AIDS) in the entire U.S. civilian, noninstitutionalized population. Approximately two-thirds of MEPS patients (66%) were aged 40 or older, 23% were female, 46% were white, 33% were African-American, 18% were Latino, 2.4% were other race/ethnicity, and 4% had a code for hepatitis (Table 2). Regionally, 20% of patients were from the Northeast, 4% from the Midwest, 35% from the West, and 40% from the Southeast.

**Table 1. Prevalence of HIV or AIDS in the 2002–2004 MEPS Population, and HIV Only and AIDS Distribution of Prevalent Conditions**

Condition	Prevalence (%)	95% Confidence Interval
HIV or AIDS	0.13	(0.09, 0.17)
HIV only	41.8	(27.0, 56.5)
AIDS	58.2	(43.5, 73.0)

**Table 2. Descriptive Distribution of Patients with HIV/AIDS in MEPS**

Characteristic	Percentage (%)	95% Confidence Interval
Over age 40	66.1	(51.7, 80.5)
Under age 40	33.9	(19.5, 48.3)
Female	22.8	(13.0, 32.6)
Male	77.2	(67.4, 87.0)
White	46.0	(30.0, 61.9)
African-American	33.4	(20.7, 46.1)
Latino	18.1	(8.5, 27.7)
Hepatitis (IDU Proxy)	4.0	(–0.6, 8.7)
No hepatitis	96.0	(91.3, 100.0)
Northeast	20.2	(9.0, 31.3)
Midwest	4.0	(–0.8, 8.9)
West	34.5	(18.8, 50.2)
South	39.5	(24.5, 54.3)

The mean outpatient expenditures for all patients with HIV or AIDS was \$2,885 (Table 3). These mean costs appeared to vary somewhat by patient characteristics. For example, the mean costs for females were approximately \$500 less than for males, the mean costs for

Latinos were approximately \$900 less than for whites or African-Americans, and the mean costs for those with a viral hepatitis code were approximately \$5,500 greater than for those without. However, the standard errors on each of these estimates are relatively high, and mean costs are not significantly different across values within the demographic variables (e.g., mean costs are not significantly different between whites and African-Americans).

**Table 3. Mean Outpatient Costs of HIV/AIDS Patients by Patient Characteristic Group**

Variable	Mean Costs (\$)	95% Confidence Interval
Total	2,885	(1,892, 3,877)
Over age 40	3,076	(1,834, 4,318)
Under age 40	2,512	(886, 4,137)
Female	2,485	(703, 4,268)
Male	3,002	(1,821, 4,183)
White	3,124	(1,457, 4,792)
African-American	3,087	(1,475, 4,700)
Latino	2,020	(76, 3,964)
Hepatitis (IDU Proxy)	8,175	(-1,977, 18,326)
No hepatitis	2,664	(1,731, 3,596)
HIV only	2,214	(998, 3,430)
AIDS	3,365	(1,970, 4,760)
Northeast	3,601	(1,198, 6,005)
Midwest	2,833	(324, 5,342)
West	2,806	(744, 4,869)
South	2,721	(1,361, 4,080)

Results from the regression conducted using the full MEPS population indicated that no factors significantly affect outpatient spending attributable to HIV/AIDS. Although several variables are related to increased costs in the overall population (for example, females in the general population consumed more outpatient services than males), no characteristic influenced expenditures related to HIV/AIDS. For example, controlling for the increases in outpatient costs attributable to all females in the population and for the increase in outpatient costs attributable to all patients with HIV or AIDS, being female with HIV/AIDS did not relate to any independent cost difference compared to males with HIV/AIDS. This same pattern was found with other patient characteristics.

Similarly, in our regression models conducted in a sample restricted to only those with HIV and AIDS, no characteristic was related to either the probability of seeking service or the cost of outpatient services for those who received them (Tables 4 and 5).

**Table 4. Logistic Regression Results on Having Any Outpatient Expenditures for the HIV/AIDS Population**

Variable	Odds Ratio	95% Confidence Interval
Over age 40	0.19	(< 0.01, 5.4)
Female	0.22	(0.61, 128.9)
African-American	5.49	(0.85, 35.3)
Latino	5.26	(0.13, 215.1)
AIDS	10.4	(0.76, 143.6)
Northeast	0.19	(< 0.01, 20.5)

Note: Hepatitis, Midwest, and West are not included because they are perfectly predicted in the logistic model. Stata drops them from the estimation so the model will run.

The presence of viral hepatitis was potentially related to higher outpatient costs in the HIV/AIDS population but only at the  $p < .10$  level. However, the HARS database does not contain information on viral hepatitis, only injection drug use exposure category. Because of the weakness of the relationship between our proxy measure and costs and because our proxy indicator does not measure IDU status directly, we do not recommend that IDU exposure category be used to adjust funding allocations based on our results. Several other model specifications were run (results not shown) that provided similar. No models produced compelling evidence that patient characteristics were significantly related to outpatient costs in the HIV/AIDS population.

**Table 5. Ordinary Least Squares Regression Results on the Natural Log of Outpatient Expenditures for the HIV/AIDS Population**

Variable	Coefficient	95% Confidence Interval
Constant	7.37	(6.96, 7.79)
Over age 40	0.07	(-0.58, 0.72)
Female	-0.09	(-0.88, 0.71)
African-American	-0.46	(-1.20, 0.28)
Latino	-0.70	(-1.32, -0.07)
Hepatitis (IDU Proxy)	1.08	(-0.81, 2.25)
AIDS	0.14	(-0.55, 0.83)
Northeast	0.16	(-0.78, 1.10)
Midwest	-0.17	(-1.09, 0.74)
West	-0.30	(-0.97, 0.36)

Note: For the population that has positive outpatient expenditures.

## 5. DISCUSSION

None of the patient characteristics led to a statistically significant increase in costs, but this may be because of the relatively low number of people with HIV or AIDS in our sample. Even when adding in additional years of data, there were only 220 people with HIV or AIDS (compared with 125 using 2002–2004 MEPS). Unadjusted mean costs seem to differ by patient characteristics (see Table 3), although the standard errors are too large to reject the possibility that mean costs across characteristics are the same. Especially for hepatitis, the difference between mean costs for those with and without hepatitis is almost \$5,500. With additional observations, we might find that this characteristic leads to significantly greater costs.

The sample size is also limited because MEPS conditions are based on self-reports. Many people with HIV or AIDS may not be aware they have it or may not disclose it to MEPS survey personnel because of stigmatization of the condition. A related issue is the relatively high percentage of people with AIDS relative to HIV in our sample, which is probably also because of self-reporting of conditions in MEPS. Because AIDS is a more advanced stage than HIV, it is more likely to lead to a medical event and therefore be reported than HIV. Similarly, because AIDS is more likely to lead to a medical event, it is less likely to go undiagnosed than HIV.

Although our regression results do not show any characteristic that has a statistically significant impact on outpatient costs, our study is limited by the sample available. Larger samples might allow the identification of significant differences in costs between conditions. Additionally, cost data that include HIV viral load information and/or T-Lymphocyte cell counts would be useful in helping distinguish HIV from AIDS populations.

Because we found no strong and obvious relationship between patient characteristics and outpatient expenditures among patients with HIV/AIDS, we recommend excluding these characteristics from an initial Ryan White Program severity of need algorithm. We recommend that this issue be revisited no later than 5 years in the future to determine if new data or evidence could support their inclusion in an index

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