Health Services Use

Access and Use of Medications in HIV Disease

Scott R. Smith and Duane M. Kirking

Objective. To examine if measures of access to medical care are associated with outpatient use of antiretroviral and Pneumocystis carinii pneumonia (PCP) medications among a cohort of individuals with HIV disease.

Data Sources. Adults who participated in a series of up to six interviews as part of the AIDS Costs and Services Utilization Survey (ACSUS). ACSUS, a panel survey of persons with HIV disease, was undertaken from 1991 through 1992.

Study Design. The Andersen Behavioral Model of Health Services Use provided the conceptual framework for the study. Logistic regression analyses with generalized estimating equations were conducted to determine the effects of predisposing, enabling, and need-for-care factors on the odds of antiretroviral or PCP medication use. The analytic sample consisted of 1,586 respondents whose 7,652 interviews provided the data.

Principal Findings. The multivariate analysis showed that being female (OR = 0.76; 95% C.I. = 0.60–0.95), ages 15 to 24 years (OR = 0.64; 95% C.I. = 0.44–0.92), and having a hospitalization (OR = 0.73; 95% C.I. = 0.63–0.84) were associated with lower odds of using antiretrovirals. African American race (OR = 1.30; 95% C.I. = 1.04–1.62), having both public and private insurance (OR = 2.11; 95% C.I. = 1.47–3.03), attending counseling (OR = 1.17; 95% C.I. = 1.02–1.34), having a usual source of care (OR = 1.70; 95% C.I. = 1.38–2.11), and clinical trials participation (OR = 1.52; 95% C.I. = 1.23–1.87) were associated with a higher odds of use. Similar results were obtained for analyses of PCP medication use.

Conclusions. Sociodemographic differences exist in access and use of prescription drugs within the ACSUS cohort. The results suggest that women and those ages 15 to 24 years have poor access to some medications that improve survival in HIV disease.

Key Words. Access, HIV infection, drug utilization, longitudinal studies

Early detection of human immunodeficiency virus (HIV) infection and improved drug therapies have prolonged survival in a growing number of individuals. Over the past 15 years, the clinical course of HIV disease has shifted from short and rapidly lethal to chronic and episodic. Likewise, medical care for HIV-related conditions has broadened beyond merely supportive and palliative care to include the prevention of perinatal transmission (Centers for Disease Control and Prevention [CDC] 1994), prophylaxis of AIDS-opportunistic illnesses (CDC 1997a), and treatment with antiretroviral therapy (CDC 1998). As a result, substantial declines in the incidence of perinatally acquired HIV (CDC 1997b), AIDS-opportunistic illnesses, and AIDS-related deaths (CDC 1997c) have been associated with the increasing use of prenatal antiretroviral drugs and the market availability of highly active antiretroviral agents (Palella, Delaney, Moorman, et al. 1998). This trend suggests that the continued decline of AIDS incidence will largely be influenced by levels of access and adherence to medication regimens by individuals with HIV disease.

The first studies of the medication utilization patterns of HIV-infected individuals were predominantly conducted in cohorts of men who have sex with men (Graham, Zeger, Kuo, et al. 1991; Lang, Osmond, Samuel, et al. 1991; Holmberg, Conley, Buchbinder, et al. 1993). Among this group, investigators typically found that white males with higher educational attainment, health insurance, and HIV symptoms were the more frequent users of HIV-related drug therapies. One longitudinal study that examined access to therapy by homosexual and bisexual men found that previous HIV-related hospitalization, having a prior outpatient visit, insurance status, college education, and being white were all associated with antiretroviral use for persons without clinical AIDS (Graham, Jacobson, Kuo, et al. 1994).

Consistent with earlier research, other studies in more diverse samples of HIV-infected patients have indicated that racial differences exist in the

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This research was supported by Grant No. 30-P-90669/5 from the Health Care Financing Administration (HCFA) and by a Student Award program grant (Grant No. 179-SAP/95) from the Blue Cross Blue Shield of Michigan Foundation.

Address correspondence and requests for reprints to Scott R. Smith, R.Ph., M.S.P.H., Ph.D., Assistant Professor, University of North Carolina School of Pharmacy, Division of Pharmaceutical Policy and Evaluative Sciences, Campus Box #7360, Beard Hall, Chapel Hill, NC 27599-7360. Professor Smith is also a Research Fellow, Sheps Center for Health Services Research, UNC–Chapel Hill. Duane M. Kirking, Pharm.D., Ph.D. is Professor, University of Michigan College of Pharmacy. This article, submitted to *Health Services Research* on December 1, 1997, was revised and accepted for publication on September 19, 1998.

use of HIV-related medications. For example, Moore and colleagues (1994) found that African Americans were significantly less likely than whites to receive antiretroviral therapy or PCP prophylaxis. Correspondingly, the 1995 to 1996 national decline in AIDS-opportunistic illnesses and deaths have been proportionally less for African Americans and Hispanics than for whites (CDC 1997c). Taken together, these racial differences suggest that socioeconomic and cultural factors, which are often correlated with race (Schulman et al. 1995; Schechter, Hogg, Aylward, et al. 1994; Simon et al. 1995), may be especially influential in determining access and utilization of HIV-related drug therapy.

Another group that reportedly has had lower rates of medication use is women with HIV disease (Moore et al. 1991; Stein, Piette, Mor, et al. 1991; Hellinger 1993). Lower utilization is consistent with reports showing that survival for women is generally shorter than it is for men following an AIDS diagnosis (Blum, Sing, Gibbons, et al. 1994) and trends indicating that the incidence of AIDS-opportunistic illnesses in women continues to increase while in men it is declining (CDC 1997d). Turner, Markson, McKee, et al. (1994) studied Medicaid beneficiaries with AIDS and found that for those who were not injection drug users, men were twice as likely as women to receive zidovudine. However, the investigators were unable to evaluate whether men and women were at different stages of the disease. Disease severity is a particularly important confounder in a Medicaid population because women often qualify for benefits as a result of having dependent children. Hence, women can become eligible for Medicaid benefits at an earlier stage of disease whereas men are likely to become eligible at a more advanced stage. Since other patient populations of women typically gain access to the healthcare system more frequently than men do, reports of lower use of antiretrovirals seemingly reflect unique barriers to using medications by HIV-infected women. Although previous studies indicate that women with HIV disease have a pattern of antiretroviral use that differs from that of men, whether lower access is associated with differences specifically related to gender, socioeconomic factors, or disease stage has not been addressed.

This study examines a model of outpatient medication use by individuals with HIV disease. The conceptual framework for the study is the Andersen Behavioral Model of Health Services Use (Andersen and Newman 1973). We hypothesized that (a) predisposing, enabling, and need-for-care measures of access are associated with the use of outpatient prescription medications; (b) the association between measures of access and medication use differ according to disease stage; and (c) after controlling for medical need and

enabling factors, racial-ethnic minorities, injection drug users, and women would have lower access to HIV-related medications.

METHODS

Data Source

This study used data from the AIDS Costs and Services Utilization Survey (ACSUS). ACSUS is an observational panel survey of the costs and use of medical services by persons with HIV disease (Berk, Maffeo, and Schur 1993). An important strength of the ACSUS data is the survey's broad diversity of participants from different geographic areas, racial and ethnic backgrounds, routes of HIV exposure, and insurance status. In addition, the ACSUS data include predisposing, enabling, and need-for-care measures as hypothesized in the Behavioral Model. Similarly, the ACSUS data have been used by Fleishman, Hsia, and Hellinger (1994) to study medical service utilization with the Behavioral Model providing a conceptual framework.

In the ACSUS, a series of six personal interviews were conducted over an 18-month period, from 1991 to 1992. In addition to taking part in the interviews, participants signed consent forms that granted permission for the investigators to contact medical and nonmedical providers of services. The researchers examined medical records using a checklist of 75 conditions commonly found in HIV-infected patients. In addition, data collection included longitudinal information about the use of prescription drugs. In the current study, these data are linked to longitudinal information about the predisposing, enabling, and need-for-care characteristics of the participants. This link offers an analytical advantage over past drug utilization studies to assess important confounders and effect modifiers in examining drug utilization.

Disease Staging

In the current study, the date of AIDS diagnosis and occurrence of conditions as obtained from the ACSUS checklist were used to derive a disease stage of participants at each interview wave. Individuals were classified at each wave as asymptomatic, HIV-symptomatic, or having AIDS. This classification method was analogous to the approach used when the original ACSUS sample was drawn (Berk, Maffeo, and Schur 1993) and to the approach used by Fleishman, Hsia, and Hellinger (1994).

AIDS was defined using a slightly modified version of the 1987 CDC surveillance case definition (CDC 1987). Participants were considered to have

AIDS beginning with the date on which either an indicator disease or AIDS was diagnosed and appeared in their medical record. Participants who did not meet the 1987 case definition for AIDS, but who had conditions that could be attributable to HIV infection, were categorized as HIV-symptomatic. This classification scheme was based on a review of the literature and on information from the 1993 CDC revised classification for HIV infection (CDC 1992). All other participants whose medical records were reviewed but who did not meet the selection criteria for AIDS or HIV-symptomatic status were classified as asymptomatic.

Statistical Methods

To examine factors associated with prescription drug utilization over time, logistic regression analyses were conducted. The primary response variable was self-reported prescription medication use during each interview reference period. Utilization was coded as a binary variable depending on whether or not a respondent reported taking specific drugs during a reference period. Separate regression analyses were performed using two discrete categories of drugs—antiretrovirals and PCP medications—as the response variable. These categories of drugs were chosen because barriers (Hendrickson, Nevins, Chesnut, et al. 1993) and inequities (Stein, Piette, Mor, et al. 1991; Moore et al. 1994; Graham, Zeger, Kuo, et al. 1991) have been reported regarding access to these drugs. Moreover, these medications were the mainstays of drug therapy when the ACSUS data were collected, and they continue to be important components of the medication regimens used in treating HIV disease. Antiretroviral utilization was defined as self-reported use of zidovudine, didanosine, or zalcitabine. Similarly, PCP medication use was derived from a participant's report of using sulfamethoxazole-trimethoprim, pentamidine, dapsone, or pyrimethamine.

Because six consecutive interviews were conducted and, therefore, six responses were possible from one individual, responses from the same individual were correlated. Analyses using conventional regression methods could have provided erroneous variance estimates and loss of statistical efficiency because of the conventional assumption that each response is statistically independent (Liang and Zeger 1993). As a result, invalid conclusions could have been made if the conventional approach had been applied to these longitudinal data. Therefore, parameters of the regression models for both the bivariate and multivariate analyses were estimated using the generalized estimating equation (GEE) methods of Zeger and Liang (1986). The GEE approach specifies the likelihood of the marginal probability distribution of

a subject's response and a "working" covariance matrix for the observation vectors (Ware, Lipsitz, and Speizer 1988). Consequently, this approach models the regression of the response variable on the independent variables and also accounts for the correlated nature of the responses. The GEE method has been shown to give consistent and valid estimates of the regression parameters and of their variances for serial data (Liang and Zeger 1993).

Comparison of Respondents Included and Excluded from the Analyses

Only interviews with complete information for all variables of interest at a given interview wave were included in the analyses. In addition, 53 interviews (0.7 percent) were excluded from the analyses because the respondent was hospitalized for the entire period of observation. To compare respondent characteristics of those interviews that were excluded because of missing data with those that were included, logistic regression models were constructed using the GEE approach. The response was a binary variable indicating whether an interview was included in the analytic sample or excluded. Interviews by individuals who were nonwhite were more likely to be excluded (25 percent nonwhite versus 21 percent white, $p < .05$). A further examination of race/ethnicity showed that interviews by African Americans[1] were more likely to be excluded than those of whites (28 percent African American versus 21 percent white, $p < .05$). However, no statistical difference was found between whites and Hispanics or "other" races in terms of being excluded from the analyses. In addition, interviews by respondents who had AIDS at the time of the ACSUS screener questionnaire were also significantly more likely to be excluded as a result of missing data (32 percent AIDS versus 20 percent non-AIDS, $p < .05$). There were no statistical differences in interview status based on gender, injection drug using status, or level of education.

The most common reason for excluding an interview was missing information about CD4+ cell count. Of the 10,045 completed interviews, nearly 15 percent were excluded because there was no corresponding T-cell measurement. The second most common item of missing information was whether the respondent had a usual source of healthcare (4 percent). For each of the other variables examined, less than 2 percent of the information was missing. The final analytic sample consisted of 1,586 individuals who provided 7,652 interviews of panel data. Of the respondents included in the analyses, 67 percent provided five or six interviews, 19 percent provided three or four interviews, and 14 percent provided one or two interviews.

RESULTS

Sample Characteristics

Characteristics of the analytic sample are shown in Table 1. The sample was predominantly male (82 percent) but demographically diverse in race/ethnicity (42 percent white, 29 percent African American, and 27 percent Hispanic). Medical records indicated that injection drug use was a suspected mode of HIV exposure in approximately one-third of the respondents. Most of the sample reported public (52 percent), private (27 percent), or public and private (6 percent) insurance coverage. In addition, the distribution of individuals categorized at each disease stage was approximately equal (30 percent asymptomatic, 35 percent HIV-symptomatic, and 35 percent with AIDS). Notably, the sample characteristics were very similar to those reported in the study of the ACSUS cohort by Fleishman, Hsia, and Hellinger (1994).

Unadjusted Odds Ratios of Characteristics Associated with Medication Use

Unadjusted odds ratios, 95 percent confidence intervals, and significance tests are presented in Table 1 for the association between individual characteristics and outpatient medication use for all six interview waves. For predisposing characteristics, the odds for women using either antiretroviral or PCP medications were significantly lower than they were for men. Similarly, the odds that persons ages 15 through 24 years were using either drug category was significantly lower than for the 25 through 34–year-old age group. For each category of drug, having a college education was associated with increased odds of medication use. Individuals who were African American or Hispanic were significantly less likely to use PCP medications.

Of the enabling characteristics, health insurance was the variable most strongly associated with medication use. There was a twofold increase in the odds of using antiretrovirals and PCP medications for individuals who had both private and public insurance as compared to the uninsured. Having private health insurance increased the odds of use by more than 50 percent. Likewise, individuals with public health insurance were 47 percent more likely to use antiretrovirals and 57 percent more likely to use PCP medications. Finally, clinical trial participation (data not shown) and having a usual source of healthcare were significantly associated with the use of both drug categories.

Consistent with previous investigations that have applied the Behavioral Model of Health Services Use (Aday, Lee, Spears, et al. 1993; Nichol, Stimmel,

Table 1: Characteristics of the Analytic Sample, Unadjusted Odds Ratios, 95% Confidence Intervals, and Significance Tests for the Association Between Individual Characteristics and Outpatient Prescription Drug Use in the ACSUS, N=1,586

		Antiretrovirals			*PCP Medications*		
Characteristic:†No. (%)	*No. Interviews T1–T6*	*% User T1–T6*	*OR*	*95% C.I.*	*% User T1–T6*	*OR*	*95% C.I.*
Gender							
Male: 1295 (81.7%)	6225	73	1.00		49	1.00	
Female: 291 (18.3%)	1427	64	0.67***	0.54–0.83	38	0.63****	0.51–0.78
Race							
White, non-Hispanic: 673 (42.4%)	3321	72	1.00		52	1.00	
African American, non-Hispanic: 458 (28.9%)	2128	70	0.91	0.74–1.11	44	0.73**	0.60–0.89
Hispanic: 433 (27.3%)	2084	72	1.00	0.81–1.24	43	0.69***	0.56–0.84
Other: 22 (1.4%)	119	78	1.36	0.61–3.06	50	0.84	0.43–1.61
Age							
25 to 34 years: 660 (41.6%)	3243	70	1.00		46	1.00	
15 to 24 years: 88 (5.5%)	456	56	0.59**	0.40–0.85	27	0.41****	0.28–0.61
35 to 44 years: 620 (39.1%)	2912	73	1.19	0.98–1.44	52	1.20	1.00–1.44
45 to 54 years: 167 (10.5%)	818	79	1.62**	1.18–2.22	46	1.00	0.77–1.30
55 and over: 51 (3.2%)	223	82	1.77*	1.09–2.89	49	1.13	0.75–1.69
Education							
≤ High school: 849 (53.5%)	4028	69	1.00		43	1.00	
College+: 737 (46.5%)	3624	74	1.23*	1.03–1.46	52	1.44****	1.23–1.70
I.V. Drug Use							
None: 1088 (68.6%)	5291	72	1.00		49	1.00	
Yes: 498 (31.4%)	2361	70	0.93	0.78–1.13	44	0.83*	0.70–0.99
Insurance							
Uninsured: 222 (14.3%)	774	59	1.00		26	1.00	
Public only: 813 (52.3%)	4370	71	1.47**	1.21–1.80	49	1.57****	1.31–1.87
Private only: 424 (27.3%)	2080	76	1.68****	1.31–2.17	50	1.64****	1.32–2.03
Both types: 96 (6.2%)	428	77	2.09**	1.48–2.95	60	1.96****	1.47–2.62
Income							
0 to $350 a month: 447 (28.3%)	1380	61	1.00		34	1.00	
$351 to 1300 a month: 735 (46.5%)	4132	72	1.27***	1.12–1.44	50	1.20**	1.07–1.34
$1301 to 4001 a month: 398 (25.2%)	2140	77	1.58****	1.33–1.88	50	1.42****	1.22–1.64
Usual Source							
None: 93 (5.9%)	450	52	1.00		26	1.00	
Yes: 1484 (94.1%)	7202	73	1.76****	1.45–2.13	49	1.52****	1.29–1.78
Stage of Disease							
Asymptomatic: 462 (30.0%)	1732	61	1.00		26	1.00	
HIV-symptomatic: 533 (34.7%)	2861	74	1.66****	1.39–1.99	43	1.52****	1.30–1.80
AIDS: 543 (35.3%)	3059	74	1.31**	1.10–1.58	64	2.58****	2.15–3.10
CD4+ Cell Count							
> 500 cells/μl: 170 (12.7%)	882	29	1.00		9	1.00	
301 to 500 cells/μl: 292 (21.8%)	1572	72	4.09****	3.11–5.38	15	1.64**	1.17–2.30
50 to 300 cells/μl: 558 (41.6%)	3283	82	6.56****	5.02–8.56	60	8.08****	5.77–11.33
0 to 49 cells/μl: 321 (23.9%)	1915	73	3.79****	2.86–5.02	69	12.30****	8.57–17.63

* $p < .05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$.

†For characteristics that could change over time, the frequency reported is for the characteristic at time 1. Data on disease stage, insurance status, usual source of care, and monthly income were missing at time 1 for some participants.

and Lange 1995), need-for-care variables were among the strongest associated with drug utilization. As shown in Table 1, CD4+ cell count was strongly associated with the two categories of HIV-related drugs. Individuals with a low CD4+ cell count were significantly more likely to be taking antiretrovirals or PCP medications than were persons with a high CD4+ cell count. In almost every instance, this significance was at $p < .0001$ and the magnitude of the odds ratios was relatively large.

Multivariate Analysis of Access and Use of Antiretrovirals

Results from the multiple logistic regression analysis of outpatient antiretroviral use are presented in Table 2. After adjusting for medical need and enabling resources, women were significantly less likely to be taking antiretroviral drugs. Women, as compared to men, had only about three-quarters of the odds of using antiretrovirals. Similarly, adolescents and young adults ages 15 through 24 were also less likely than those ages 25 to 34 years to receive antiretroviral agents. After adjusting for other covariates, African Americans and Hispanics were more likely to be using antiretroviral agents than were whites.

Several enabling variables were also associated with antiretroviral use. Individuals who had public and private insurance were still twice as likely to be antiretroviral users even after adjusting for other variables in the model. Likewise, having an income of $1,301 or more a month increased the odds of using antiretrovirals. Those who attended a support group or received psychological counseling, clinical trial participants, and those with a usual source of healthcare were all more likely to be antiretroviral users.

In comparing the adjusted odds ratios of predisposing, enabling, and need-for-care variables found in Table 2 with the unadjusted odds ratios found in Table 1, there appears to be very little confounding, with the notable exception of race. Further, interactions between gender and injection drug use, racial-ethnic group, and insurance status were tested and found not to be statistically significant.

Analysis by Disease Stage

Other studies that have examined the use of antiretrovirals have found multiple interactions between several independent variables and the stage of HIV disease (e.g., Graham, Jacobson, Kuo, et al. 1994). This analysis of the ACSUS data also found similar interactions with variables such as gender, education, and race. To investigate these interactions further, separate analyses were conducted for the three stages of disease. Table 3 presents the results from three separate logistic regression models according to disease stage. At each

Table 2: Results From A Multiple Logistic Regression Analysis of Outpatient Antiretroviral Use in the ACSUS, 1991–1992 ($N = 1,586$)

	Variable	*OR*	*95% C.I.*	p-*Robust*
Gender	Male	1.00		
	Female	0.76	0.60–0.95	.0161
Age	25 to 34 years	1.00		
	15 to 24 years	0.64	0.44–0.92	.0155
	35 to 44 years	1.05	0.87–1.28	.6010
	44 to 54 years	1.54	1.12–2.13	.0079
	55 years and older	1.70	1.05–2.75	.0319
Race/Ethnic Group	White, non-Hispanic	1.00		
	African American, non-Hispanic	1.30	1.04–1.62	.0187
	Hispanic	1.38	1.11–1.72	.0044
	Other	1.30	0.60–2.81	.4982
Injection Drug Use	None	1.00		
	Yes	1.05	0.86–1.28	.6269
Insurance	Uninsured	1.00		
	Private only	1.42	1.08–1.88	.0134
	Public only	1.53	1.24–1.90	.0001
	Private and public	2.11	1.47–3.03	.0001
Income	$0 to $350 a month	1.00		
	$351 to $1300 a month	1.20	1.05–1.38	.0061
	$1301 or more a month	1.43	1.16–1.75	.0007
Receiving Home Help	No	1.00		
	Yes	0.81	0.71–0.93	.0024
Counseling or Group Support	No	1.00		
	Yes	1.17	1.02–1.34	.0211
Hospitalization	No	1.00		
	Yes	0.73	0.63–0.84	<.0001
Ambulatory Visits	None	1.00		
	1 to 2 visits	1.83	1.56–2.14	<.0001
	3 or more visits	2.09	1.78–2.45	<.0001
Usual Source of Care	No	1.00		
	Yes	1.70	1.38–2.11	<.0001
Participate in Clinical Trials	No	1.00		
	Yes	1.52	1.23–1.87	.0001
Perceived Health Status	Excellent or very good	1.00		
	Good	0.91	0.79–1.05	.2009
	Fair	0.78	0.65–0.93	.0050
	Poor	0.64	0.51–0.80	.0001
CD4+ Cell Count	> 500 cells/μl	1.00		
	301 to 500 cells/μl	4.52	3.40–6.01	<.0001
	50 to 300 cells/μl	7.10	5.36–9.40	<.0001
	0 to 49 cells/μl	4.32	3.18–5.89	<.0001

of the three stages, a significant association is found between CD4+ cell count, having a usual source of healthcare, and ambulatory healthcare visits, and the use of antiretrovirals. These results are consistent with those found in Table 2, which included the entire ACSUS sample. However, the association of other independent variables from the Behavioral Model varies in significance depending on the disease stage.

At the asymptomatic stage of HIV disease, none of the predisposing conditions were associated with use of antiretrovirals. Instead, use was associated with enabling and need-for-care factors. In addition to the factors named earlier, high income and clinical trial participation were also associated with antiretroviral use among those who were asymptomatic.

At the HIV-symptomatic stage, several factors were significantly associated with antiretroviral use that were not found to be associated with use in the other two disease stages. These factors were the predisposing or enabling characteristics of gender, young age, income, insurance status, and counseling/group support attendance.

For individuals with AIDS, the only predisposing characteristic associated with medication use was race. Individuals who were not white were 60 percent more likely than whites to use antiretrovirals. Moreover, race was significantly associated with antiretroviral use only among those with AIDS and not among participants at the other two disease stages. Receiving help at home, past hospitalization, and an excellent health perception were all factors that reduced the odds of medication use and were found to be uniquely associated only at the AIDS stage. As with individuals who were asymptomatic, clinical trial participation was associated with antiretroviral use for people with AIDS.

Multivariate Analysis of Access and Use of PCP Medications

Table 4 shows the results, from multiple logistic regression analyses, of factors associated with medications used to treat and prevent PCP. The middle columns show factors associated with use in the entire sample, and the last columns show factors associated with use in the subset of individuals who had CD4+ cell counts of less than 200 cells/μl or had a history of PCP. Both models produced similar results.

In comparing PCP medications with antiretrovirals, there are several factors associated with use of both medication categories. In both models, gender, young age, insurance status, income, receiving help at home, counseling/group support, ambulatory visits, usual source of care, perceived health, and CD4+ cell count were associated with use. The main differences between

Table 3: Results from Separate Logistic Regression Analyses of Outpatient Antiretroviral Use for ACSUS Interviews Classified as Asymptomatic, HIV-Symptomatic, or AIDS

	Asymptomatic				*HIV-Symptomatic*				*AIDS*			
	No. Person Interviews = 1,732 N = *461*				*No. Person Interviews = 2,861* N = *704*				*No. Person Interviews = 3,059* N = *826*			
	No. Interviews	*OR*	*95% C.I.*	p-*Robust*	*No. Interviews*	*OR*	*95% C.I.*	p-*Robust*	*No. Interviews*	*OR*	*95% C.I.*	p-*Robust*
*Gender**												
Male	1357	1.00			2226	1.00			2642	1.00		
Female	375	0.86	0.55–1.34	.4924	635	0.62	0.43–0.90	.0108	417	0.86	0.59–1.24	.4165
*Age**												
25 to 34 years	769	1.00			1309	1.00			1165	1.00		
15 to 24 years	162	0.75	0.39–1.42	.3707	163	0.52	0.29–0.94	.0303	131	0.71	0.39–1.28	.2549
35 to 44 years	567	1.13	0.76–1.67	.5414	1041	1.09	0.78–1.53	.6050	1304	1.02	0.78–1.35	.8728
44 to 54 years	191	1.39	0.75–2.55	.2946	282	1.57	0.95–2.59	.0756	345	1.34	0.85–2.11	.2122
55 years and older	43	2.68	0.66–10.97	.1700	66	1.72	0.64–4.61	.2820	114	1.25	0.70–2.21	.4485
*Race**												
White, non-Hispanic	667	1.00			1333	1.00			1321	1.00		
Nonwhite	1065	1.09	0.75–1.58	.6419	1528	1.11	0.80–1.54	.5252	1738	1.60	1.21–2.11	.0010
*Education**												
≤ High school	882	1.00			1514	1.00			1632	1.00		
College+	850	0.93	0.62–1.39	.7116	1347	1.40	0.98–2.01	.0647	1427	0.87	0.66–1.15	.3180
*Injection Drug Use**												
No	1269	1.00			1999	1.00			2023	1.00		
Yes	463	1.34	0.88–2.06	.1774	862	0.92	0.66–1.30	.6526	1036	0.98	0.74–1.31	.8964
Income†												
$0 to $350 a month	375	1.00			594	1.00			411	1.00		
$351 to $1300 a month	749	1.23	0.95–1.58	.1150	1392	1.29	1.05–1.59	.0169	1991	1.15	0.89–1.49	.2777
$1301 or more a month	608	1.44	1.02–2.04	.0377	875	1.76	1.20–2.57	.0036	657	1.32	0.92–1.90	.1291
Insurance†												
Uninsured	291	1.00			314	1.00			169	1.00		
Private only	574	1.67	0.98–2.84	.0586	828	1.26	0.76–2.08	.3647	678	1.16	0.71–1.89	.5500
Public only	781	1.38	0.97–1.98	.0759	1588	1.93	1.28–2.89	.0016	2001	1.10	0.74–1.64	.6284
Private and public	86	1.74	0.95–3.17	.0728	131	4.07	1.87–8.84	.0004	211	1.34	0.78–2.31	.2894
Clinical Trials†												
No	1532	1.00			2316	1.00			2668	1.00		
Yes	200	1.79	1.32–2.44	.0002	545	1.35	0.92–1.98	.1293	391	1.53	1.11–2.12	.0098

Table 3: Continued

Usual Source of Care†												
No	156	1.00			183	1.00			111	1.00		
Yes	1576	1.60	1.13–2.25	.0075	2678	1.77	1.23–2.55	.0021	2948	1.48	1.02–2.13	.0377
Receive Home Help†												
No	1532	1.00			2403	1.00			2020	1.00		
Yes	200	0.90	0.67–1.22	.5139	458	1.11	0.86–1.42	.4233	1039	0.67	0.55–0.81	<.0001
Counsel/Group Support†												
No	1370	1.00			2137	1.00			2282	1.00		
Yes	362	0.90	0.71–1.14	.3952	724	1.32	1.05–1.65	.0163	777	1.21	0.96–1.51	.1006
Hospitalization†												
No	1627	1.00			2613	1.00			2193	1.00		
Yes	105	1.22	0.75–1.98	.4185	248	0.78	0.58–1.05	.1006	866	0.65	0.54–0.78	<.0001
Ambulatory Visits†												
None	244	1.00			265	1.00			232	1.00		
1 to 2 visits	730	1.72	1.33–2.23	<.0001	1016	2.01	1.50–2.68	<.0001	768	1.65	1.26–2.16	.0003
3 or more visits	758	2.14	1.60–2.87	<.0001	1580	2.17	1.63–2.88	<.0001	2059	1.92	1.48–2.50	<.0001
Perceived Health‡												
Fair or poor	822	1.00			937	1.00			494	1.00		
Good	528	0.87	0.69–1.11	.2708	936	0.77	0.60–0.99	.0420	885	1.00	0.76–1.30	.9749
Very good	312	0.91	0.65–1.26	.5555	787	0.66	0.49–0.89	.0068	1059	0.76	0.57–1.01	.0599
Excellent	70	0.96	0.48–1.91	.9072	201	0.73	0.46–1.15	.1766	621	0.59	0.43–0.81	.0012
CD4+ Cell Count‡												
Above 500 cells/μl	420	1.00			327	1.00			135	1.00		
301 to 500 cells/μl	550	3.78	2.50–5.72	<.0001	736	5.73	3.65–8.98	<.0001	286	2.67	1.40–5.09	.0029
50 to 300 cells/μl	636	9.55	5.95–15.33	<.0001	1383	6.98	4.47–10.91	<.0001	1264	3.87	2.23–6.73	<.0001
0 to 49 cells/μl	126	3.26	1.45–7.33	.0042	415	6.14	3.58–10.54	<.0001	1374	2.49	1.45–4.29	.0010

*Predisposing characteristic.

†Enabling characteristic.

‡Need-for-care factor.

Table 4: Results from a Multiple Logistic Regression Analysis of PCP Medication Use Among ACSUS Participants, 1991–1992

		All Participants (N = 1586)		*Only Participants with CD4+ Cell Counts < 200 cells/μl or a History of PCP Pneumonia (N = 1029)*	
		OR	*95% C.I.*	*OR*	*95% C.I.*
Gender	Male	1.00		1.00	
	Female	0.71**	0.56–0.89	0.74*	0.56–0.98
Age	25 to 34 years	1.00		1.00	
	15 to 24 years	0.54**	0.37–0.78	0.75	0.45–1.25
	35 to 44 years	0.99	0.82–1.18	0.88	0.71–1.10
	44 to 54 years	0.86	0.66–1.12	0.73	0.52–1.02
	55 years and older	0.81	0.52–1.27	0.64	0.40–1.02
Race/Ethnic Group	White, non-Hispanic	1.00		1.00	
	African American, non-Hispanic	0.87	0.70–1.07	0.83	0.65–1.06
	Hispanic	0.82	0.67–1.01	0.83	0.65–1.06
	Other	1.11	0.59–2.08	0.78	0.29–2.10
Injection Drug Use	None	1.00		1.00	
	Yes	0.89	0.74–1.07	0.89	0.71–1.12
Insurance	Uninsured	1.00		1.00	
	Private only	1.44**	1.09–1.90	1.55*	1.03–2.32
	Public only	1.61****	1.30–2.00	1.48***	1.07–2.05
	Private and public	1.94***	1.40–2.70	2.42*	1.49–3.94
Income	$0 to $350 a month	1.00		1.00	
	$351 to $1300 a month	1.14	1.00–1.31	1.29**	1.09–1.54
	$1301 or more a month	1.44***	1.19–1.76	1.71***	1.29–2.25
Receiving Home Help	No	1.00		1.00	
	Yes	1.25***	1.10–1.41	1.28**	1.09–1.50
Counseling or Group Support	No	1.00		1.00	
	Yes	1.25***	1.11–1.42	1.35**	1.13–1.61
Hospitalization	No	1.00		1.00	
	Yes	1.05	0.92–1.20	0.98	0.84–1.16
Ambulatory Visits	None	1.00		1.00	
	1 to 2 visits	1.55****	1.31–1.84	2.02****	1.59–2.57
	3 or more visits	2.01****	1.70–2.39	2.52****	1.98–3.19
Usual Source of Care	No	1.00		1.00	
	Yes	1.46***	1.17–1.82	1.39*	1.04–1.87
Participate in Clinical Trials	No	1.00		1.00	
	Yes	1.07	0.92–1.26	1.13	0.90–1.41
Perceived Health Status	Excellent or very good	1.00		1.00	
	Good	1.32****	1.15–1.51	1.22	1.00–1.50
	Fair	1.46****	1.25–1.71	1.26*	1.01–1.55
	Poor	1.16	0.94–1.41	0.89	0.70–1.15
CD4+ Cell Count	> 500 cells/μl	1.00		–	–
	301 to 500 cells/μl	1.59*	1.11–2.27	–	–
	50 to 300 cells/μl	8.08****	5.66–11.52	–	–
	0 to 49 cells/μl	11.05****	7.53–16.22	–	–

* $p < .05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$.

the two utilization models were in the predisposing and enabling factors associated with use.

For antiretrovirals, the predisposing conditions include older age groups and race, whereas for PCP medications these factors were not significantly associated with use. Likewise, previous hospitalization and participation in clinical trials were enabling variables associated with the use of antiretroviral drugs but not with PCP medications. Another difference was in the direction of the association of the perceived health variable. Although perceived health was associated with medication use in both models, those who perceived their health to be less than "very good" were more likely to take PCP medications and less likely to take antiretrovirals. Similarly, receiving help at home decreased the odds of using antiretrovirals but increased the odds of using PCP medications.

DISCUSSION

An important finding of this study is that the odds that women use antiretrovirals and PCP medications are significantly less than the odds that men use them, even after adjusting for socioeconomic and health status differences. This finding is consistent with the low use of antiretrovirals and prophylactic medications by women in the HIV Epidemiology Research Study (HERS) (Solomon, Stein, Flynn, et al. 1998) and corroborates the results of others (Stein, Piette, Mor, et al. 1991; Turner, Markson, McKee, et al. 1994). If it is borne out by further studies in today's era of highly active antiretroviral therapy, this finding has important implications for health policy and planning. In particular, the identification of ways to improve access and the use of medications by women with HIV disease is needed.

It is interesting that the female participants had a lower use of antiretrovirals and PCP medications, because in non-HIV patient groups women generally have a higher use of prescription drugs. This finding is not easily explained. It is possible that the women in the ACSUS were healthier than the men were. However, since the analyses controlled for CD4+ cell count, this does not seem likely. Others have also suggested that differences in gender roles, social conditions, and AIDS-related medical care may affect the access of HIV-infected women to treatment (Ickovics and Rodin 1992). Because women in the ACSUS sample were more likely to be African American and poorer than the men were (Hellinger 1993), unmeasured factors associated with poverty and culture may be affecting a woman's use of HIV-related

medications. Alternatively, it should be acknowledged that providers in this time period might have had concerns about the potential effects on the fetus of antiretroviral drugs if a woman were to become pregnant. Thus, providers might less likely have prescribed these medications to women because of these medical concerns.

A limitation of the current study was that the ACSUS data did not contain belief and attitudinal variables. One investigation has shown that some women with HIV experience unique psychological or social barriers to using antiretroviral medications (Siegel and Gorey 1997). Because AIDS was first diagnosed in gay and bisexual men, early studies were predominantly conducted in this group, so less is known about the natural history and psychosocial mechanisms influencing the course of HIV infection in women (Ickovics and Rodin 1992). Further, social service organizations began their outreach efforts in communities of gay and bisexual men. As a result, women may be less connected with community or patient information groups that provide educational materials on these medications (Jeffe et al. 1998). Hence, more research is needed on the psychosocial characteristics of medication use by women with HIV disease. Although health beliefs were not included in the ACSUS study, this does not limit the central finding that gender differences exist in the use of HIV-related medications.[2]

Another important result was the finding of a significantly lower use of medications by young persons ages 15 through 24 years in the ACSUS. Other studies that have examined access to drug therapy in HIV disease either have not considered age (Stein, Piette, Mor, et al. 1991) or have modeled age as a dichotomous variable (Graham, Jacobson, Kuo, et al. 1994; Moore et al. 1994). Because the use of most medications changes with age, the finer gradations of age used in the current study provide a more meaningful examination of its effect on the odds of use. The lower use of prescription medications by younger respondents with HIV may be related to the behavioral, psychological, and social factors that put adolescents and young adults at increased risk for HIV infection. These include the tendency to engage in high-risk behavior, a sense of invulnerability, less well developed coping styles, and less access to age-appropriate social and medical services (Hein 1989; Ickovics and Rodin 1992). Vermund, Hein, Gayle, et al. (1989) have proposed that adolescents most likely to be infected with HIV include "disenfranchised" youths such as runaways, injection drug users, and sex workers. Inexperience with the healthcare system and with taking prescription medications (especially those with frequent side effects) may further contribute to a lower use of antiretrovirals by young people. The

results of this study point to a need to develop age-appropriate medical and pharmaceutical care services for youths with HIV disease.

The association of access to the use of antiretroviral drugs appears to differ by stage of the disease. The findings indicate that, at the early stages, access to antiretrovirals is equitable with the possible exception of access for those with very high incomes relative to those with very low incomes. However, several unique differences in predisposing and enabling measures appeared at the HIV-symptomatic stage. Hence, problems with access seem to occur after individuals show symptoms of the HIV infection but before they are diagnosed with AIDS. Since government assistance programs sometimes impose medical eligibility requirements related to CD4+ cell counts or AIDS diagnoses (Buchanan and Smith 1996), symptomatic individuals may have trouble obtaining assistance and consequent access to medications. This finding is especially provocative in the current era of highly active antiretroviral therapy, because early treatment is now recommended for most people with detectable plasma HIV RNA (CDC 1998).

The separate analysis where respondents had AIDS revealed that nonwhite individuals were significantly more likely to use antiretrovirals. This finding was unanticipated and was contrary to our hypothesis, which was based on previous studies (e.g., Stein, Piette, Mor, et al. 1991; Moore et al. 1994; Crystal, Sambamoorthi, and Merzel 1995). However, racial differences may depend on the stage of disease, which is often related to the time at which an individual initially presents for medical care. Therefore, these results should be interpreted with caution in that the sample consists of patients who were receiving medical care during the recruitment phase of the ACSUS study. As a result, participants had some level of access to the healthcare system. In addition, African Americans were more likely to be excluded from the analysis because of missing data. Thus, the African American participants included in the analyses might have been atypical in their outpatient use of antiretrovirals.

Notably, there was a significant increase in medication use among those who attended a support group or who received psychological counseling. Not only was this result consistent for both drug categories in analyses that predicted medication use, but also in other analyses that examined the intensity of use (results not shown). In contrast, the use of alternative therapies (defined broadly as therapies such as holistic medicine or biofeedback) was not related to medication use in any of the multivariate analyses. Possibly, individuals who attend support groups or receive psychological counseling are more inclined to use medications or to report medication use. Alternatively,

social-psychological factors such as social support and reinforcement, observation of role models, normative pressure to use medications, and diffusion of information may be influencing support group attendees and individuals in counseling to ultimately use prescription medications. More research is needed to understand this association.

This study is one of only a few that include clinical trial participation and usual source of healthcare as measures of access to drug therapy in HIV disease. The significant association of these two enabling measures with the use of antiretroviral drugs underscores the importance of these measures in predicting antiretroviral use. Because clinical trials tend to enroll persons with particular sociodemographic characteristics (Diaz, Chu, Sorvillo, et al. 1995; Cunningham, Bozzette, Hays, et al. 1995), it is important to adjust for the effects of participation when one assesses the association of access measures with medication utilization. The results from the current study suggest that clinical trial participation is an important factor related to access to antiretrovirals and that the magnitude of the association is about the same as having health insurance coverage.

A central limitation of the study was that information about prescription drug benefits (as compared to overall health insurance coverage) was unavailable. Although all Medicaid programs provide prescription drug benefits (Buchanan and Smith 1994), utilization limits, copayments, and prior authorization policies often weaken Medicaid prescription drug benefits. Furthermore, Medicaid payment levels for drugs related to HIV infection are more often below the payment levels of private health insurance companies. Likewise, private health insurance plans do not always provide prescription drugs as a covered benefit. Since Medicaid programs vary in medication coverage, a direction for future research is to examine State variations in HIV medication utilization rates. To the extent that prescription drugs are not covered by the health insurance plans of the respondents, the results of this study underestimate the effects of health insurance coverage on medication use.

Finally, this study is limited by the ACSUS sampling frame, which consisted of patients receiving medical care during the recruitment phase of the study. Rural areas and regions of the country with low incidence of HIV were excluded from the ACSUS sample (Berk, Maffeo, and Schur 1993). For these reasons, participants are not representative of the U.S. population with HIV infection (Berk, Maffeo, and Schur 1993). However, researchers are collecting information on a nationally representative sample of people receiving care for HIV infection as part of the HIV Cost and Services Utilization Study (HCSUS). Information from the HCSUS study holds the

potential for a further assessment of the differences in access and medications use found in this disease.

Although new antiretroviral medications have been developed since the time of the ACSUS, the medications examined in this study continue to be important components of the combination regimens recommended for HIV infection (CDC 1998) and for the prevention of PCP (CDC 1997a). As more potent and effective medication regimens become available, the importance of access to drug therapy will become increasingly crucial in enabling people with HIV disease to live longer and to suffer fewer complications. The results from this study indicate that factors other than medical need are important determinants of medication use in contending with this life-threatening disease.

ACKNOWLEDGMENTS

The authors would like to acknowledge the helpful comments of Frank Ascione, Sioban Harlow, and Xihong Lin. In addition, Ken Guire provided invaluable computer programming assistance.

NOTES

1. *Editor's note*: References to the black race have been changed to "African American" in keeping with the policy of *Health Services Research.*
2. Hellinger (1993) found that asymptomatic women were less likely to receive zidovudine but that there were no gender differences among individuals who were symptomatic or who had AIDS. In the current study, the separate analysis of interviews by asymptomatic respondents indicated that women were no more or less likely to receive antiretrovirals than were men. Similarly, responses by those with AIDS at the time of the interview showed no likelihood differences between men and women. However, a difference in medication use was found at the HIV-symptomatic stage of disease. HIV-symptomatic women in the current study were significantly less likely to use antiretrovirals than were HIV-symptomatic men. These results differ from those of Hellinger for two main reasons. First Hellinger controlled only for type of health insurance, income, and intravenous drug use in his analysis. Hence, the multivariate regression equations explaining zidovudine use were different from those modeled in the current study. Second, the response variable in Hellinger's work was zidovudine use. The current study considered three antiretrovirals that reportedly were used. As a result, differences may exist as a consequence of including the use of the three antiretrovirals that were available at the time of the study instead of including just zidovudine.

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