The Use of Health Services by Women with HIV Infection

Fred J. Hellinger

Objective. The purpose of this study is to determine whether women who have been diagnosed with HIV utilize the same volume of medical care services as men who have been diagnosed with HIV.

Data Sources. This study uses data from the first wave of interviews of the AIDS Cost and Service Utilization Survey (ACSUS) conducted between May and July of 1991. The first wave of interviews involved 1,949 adults and adolescents, of whom 359 were women.

Study Design. The ACSUS sample was selected from 26 sites (hospitals, clinics, and physician offices) in ten cities chosen from the 25 cities with the most AIDS cases. Cities are located throughout the nation, and in low, medium, and high prevalence areas. The sites in each city are generally those that treat the highest number of persons with HIV infection. Patients at each site were chosen using disease stage (asymptomatic, symptomatic, and AIDS) and gender as the selection criteria. Utilization equations are estimated for AZT use, outpatient care, and hospitalization.

Data Collection. The ACSUS involves six in-person interviews over an 18-month period. Interviews include questions about the use of medical and support services, insurance status, functional status, and barriers to care during the prior three-month period.

Principal Findings. A male injection drug user (IDU) with AIDS is 20 percent more likely to be hospitalized than a woman with AIDS, and the hospital cost of treating a male IDU with AIDS is $9,180 more per year than the hospital cost of treating a woman with AIDS.

Conclusions. This study shows that, even after being diagnosed and after having accessed the medical care system, women with AIDS receive fewer services than men with AIDS.

Keywords. HIV, AIDS, women with HIV/AIDS, access

BACKGROUND

This study uses timely data from a national survey to examine the relationship between gender and the use of health services by persons with HIV infection. The use of medical services (AZT, outpatient care, and inpatient care) by HIV-infected women is compared to the use of medical services by HIV-infected men after adjusting for stage of illness (asymptomatic, symptomatic, and AIDS), race, exposure category, geographic location, insurance status, and income. Data on the use of health services during a three-month time period in the spring and early summer of 1991 for 1,949 persons with HIV infection, of whom 66 percent did *not* have AIDS, are examined in this study. The vast majority of research into the cost of treating persons with HIV infection relates only to persons who have AIDS.

This study uses data from the AIDS Cost and Service Utilization Survey (ACSUS). The purpose of ACSUS is to provide a comprehensive data base on the types and cost of medical care services used by persons with HIV infection. Almost all existing cost studies of persons with HIV infection are limited to services covered by a single insurer or provided in a single hospital. These studies have been unable to link services provided by other insurers or services received at other hospitals to a specific individual. In order to acquire information on all medical services consumed by persons with HIV infection, a patient-based survey such as ACSUS must be conducted. Two patient-based studies have been conducted that analyze the economic cost of AIDS. Bennett and colleagues acquired data from 36 persons with AIDS in Los Angeles during the years 1987 and 1988 (Bennett, Cvitanic, and Pascal 1991), and Bennett and colleagues conducted a study in New York City on 38 intravenous drug users with AIDS in 1989 (Bennett, Pascal, Cvitanic, et al. 1992).

There is considerable evidence that women who are diagnosed with HIV exhibit a higher rate of serious infections than do men at entry into the health care system (Schoenbaum and Webber 1991; American Public Health Association 1991; Stein, Piette, Mor, et al. 1991; Caschetta 1990; and Harvard AIDS Institute 1991). The American Public Health Association states that "there is growing evidence

---

Address correspondence and requests for reprints to Fred J. Hellinger, Ph.D., Director, Division of Cost and Financing, CGHSER, Agency for Health Care Policy and Research, Suite 502, 2101 E. Jefferson Street, Rockville, MD 20852. This article, submitted to *Health Services Research* on May 5, 1992, was revised and accepted for publication on May 20, 1993.

that many women with HIV are not being diagnosed correctly and are not receiving care . . . many physicians who treat women do not expect to see HIV disease and as a result HIV-infected women may go undiagnosed until late in their disease." (American Public Health Association 1991, 8). Educational efforts regarding HIV are often directed at internists; yet many women receive their primary care from their gynecologist (Harvard AIDS Institute 1991, 11).

The proportion of women with AIDS is increasing, and there is evidence that this trend will continue. Eleven percent of the 230,179 AIDS cases reported to the Centers for Disease Control (CDC) through June 1992 were women (Centers for Disease Control 1992b). Yet 13 percent of all AIDS cases reported between July 1990 and June 1991 were women, and 14 percent of all AIDS cases reported between July 1991 and June 1992 were women. Data through May 1992 from the 19 states that implemented HIV surveillance prior to January 1991 reveal that 8.2 percent of all AIDS cases reported were women but that 15.6 percent of all HIV cases without AIDS were women (Fleming, Ward, Morgan, et al. 1992).

There are differences between women and men with AIDS in racial composition and risk behaviors. Although most men with AIDS are white (56 percent), only about one-quarter of women with AIDS are white (Centers for Disease Control 1992b, 12). In addition, a much smaller proportion of men (21 percent) with AIDS include intravenous drug use (IDU) as a risk factor than women (45 percent) (Centers for Disease Control 1992b, 8).

AZT

Existing studies suggest that women are less likely than men to receive AZT (zidovudine) even after controlling for a variety of factors (e.g., time since diagnosis, insurance status, exposure category, race, and disability status for Medicaid eligibility) (Moore et al. 1991; Solomon and Hogan, in press; Stein et al. 1991). Women with HIV infection who are pregnant may be less inclined to use AZT, and HIV-infected women are more likely to be poor and to use intravenous drugs than HIV-infected men (Minkoff and DeHovitz 1991). Both of these factors may contribute to lower rates of AZT use among women with HIV infection than among men with HIV infection.

A study based on persons with AIDS (PWAs) in Maryland indicates that women are less likely to receive AZT than men (Moore et al. 1991). Moore and colleagues used the Human Immunodeficiency Virus Information System (HIVIS) data set, which contains informa-

tion on Maryland residents with AIDS who were at least 17 years of age and were enrolled in Medicaid, Blue Cross and Blue Shield, the Maryland AIDS Drug Assistance Program, a clinical trial for AZT distribution sponsored by the Johns Hopkins University AIDS Clinical Trials Unit, or the Maryland Pharmacy Assistance Program. Of the 714 members of this cohort that were diagnosed with AIDS between April 1987 and June 1989, 53 percent of the men (313/596) and 33 percent of the women (39/118) received AZT.

Solomon and Hogan used Michigan Medicaid payment records generated between 1985 and 1989 to identify 783 people who were diagnosed with an HIV-related illness (Solomon and Hogan, in press). Payment records were merged with data from the Michigan Death and AIDS Surveillance registries. Of the 759 people identified, 59 percent of the males and 19 percent of the females had received at least one Medicaid paid prescription for AZT. This difference persisted even after eligibility criteria were taken into account. Women are more likely to be covered by Medicaid before an AIDS diagnosis. Most women qualify for Medicaid because they are on Aid to Families with Dependent Children (AFDC), and most men qualify for Medicaid because they are disabled. Thus, men on Medicaid are more likely than women to have AIDS and to be offered AZT. Of those who qualified for Medicaid in Michigan because they received AFDC payments, 38 percent of the men and 10 percent of the women had received AZT. Of those who qualified for Medicaid in Michigan due to a disability, 69 percent of the men and 46 percent of the women had received AZT.

The evaluation of the Robert Wood Johnson Foundation's AIDS Health Services Program (RWJF AHSP), conducted by researchers at Brown University, examined the use of health care services by women with HIV infection (Stein, Piette, Mor, et al. 1991; Mor et al. 1992). This evaluation used results from interviews of 939 clients of AHSP collected from November 1988 through April 1989 at ten hospital clinics and five affiliated community-based organizations (CBOs) in nine cities. Ninety percent of the 939 clients were male and 87 percent had AIDS. This sample provides some information about the use of services by women with AIDS, but it provides little information about the use of services by women with HIV infection without AIDS.

Using data from the evaluation of the AHSP, Stein and colleagues found that males were more likely to have been offered AZT than females (Stein, Piette, Mor, et al. 1991). This difference was most acute among the 87 persons with symptoms but without AIDS. In this population 65 percent of the men and 30 percent of the women were

offered AZT. This difference could not be explained by race (64 percent of white persons were offered AZT compared to 58 percent of nonwhite persons) or risk category (60 percent of IDUs were offered AZT compared to 61 percent of non-IDUs). Among persons with AIDS but without *Pneumocystis carinii* pneumonia (PCP), 88 percent of men and 68 percent of women were offered AZT. Among persons with PCP and AIDS, 95 percent of men and 89 percent of women were offered AZT. In a multivariate logit model that controlled for disease severity, IV drug use, insurance status, and race, men were three times as likely as women to be offered AZT.

OUTPATIENT AND INPATIENT CARE

In contrast to AZT use, existing studies indicate that most of the differences between women and men with HIV infection in their use of other health services may be explained by factors such as race, exposure category, insurance status, and stage of illness. These factors are important determinants of health service use, and their exclusion from studies of the relationship between gender and health service use may lead to biased estimates. For example, most studies have found that IDUs, once they have accessed the system, use more services than non-IDUs (Scitovsky 1989, 333; New York State Department of Health 1991, 147; Andrews et al. 1991, 1,046). Since the proportion of women with HIV infection who are IDUs is higher than the proportion of men with HIV infection who are IDUs, cost studies that do not adjust for exposure category may overestimate the impact of gender on the use of health care services.

Mor and colleagues explored the relationship between gender and the use of outpatient and inpatient care using data from the evaluation of the RWJF AIDS Health Services Program (Mor et al. 1992). The authors estimated a multivariate regression equation that controlled for gender, race, education, risk category, AIDS status, symptom intensity, and physical functioning. Dependent variables included the number of outpatient visits, use of the emergency room, and hospitalization during the three-month period prior to the interview. This study reports that white persons and non-IDUs were most likely to make outpatient visits, and black persons and IDUs were most likely to use the emergency room and to be hospitalized. Gender was not statistically significant in equations explaining the number of outpatient visits, use of the emergency room, or the likelihood of hospitalization.

A multivariate analysis of Medicaid enrollees with AIDS in New York state and California who died between October 1985 and Septem-

ber 1986 (681 on MediCal and 2,371 in New York) showed that women had 3 percent lower expenditures than drug-using males with no prior Medicaid enrollment (Andrews et al. 1991). The authors controlled for the diagnosis of PCP and Kaposi's sarcoma, eligibility status (medically needy only, Supplemental Security Income, and AFDC), age, drug use, and state (California, New York).

In a multivariate analysis of inpatient hospitalizations of 733 adult clients enrolled in a Medicaid waiver program (the New Jersey AIDS Community Care Alternatives Program or ACCAP) for functionally impaired persons with HIV infection, gender did not have a statistically significant effect on the number of hospital admissions or the number of hospital days (Merzel, Sambamoorthi, and Crystal 1991). This analysis adjusted for differences in race, exposure category, history of PCP, and time in the program. The data were from Medicaid claims for the period March 1987 through August 1989.

METHODOLOGY

The ACSUS is a study of 1,949 adults and adolescents in ten cities (Baltimore, Chicago, Houston, Los Angeles, Miami, Newark, New York, Philadelphia, San Francisco, and Tampa) and is funded by the Agency for Health Care Policy and Research (AHCPR). The ACSUS sample includes 359 women and 1,590 men. Participants were enrolled at 26 sites (e.g., freestanding clinics, physician offices, and hospitals). Data from the first (March–July 1991) of six waves of ACSUS interviews are analyzed in this study. ACSUS includes 422 asymptomatic persons with HIV infection and 840 persons with HIV-symptomatic illnesses (swollen glands, persistent fever, diarrhea, or slight weight loss), as well as 675 persons with AIDS.

The ACSUS sample was obtained using a three-stage sampling design. Initially, ten cities were selected from the 25 cities with most AIDS cases. These ten cities were selected based on geographic location (an attempt to include cities from all regions of the nation was made), prevalence of AIDS (a mix of low, medium, and high prevalence areas was sought), and the availability of a sufficient number of women (cities with large numbers of women with AIDS were given preference).

The second stage involved the selection of sites within each of the ten cities. A list of providers in each city was obtained from the Centers for Disease Control and Prevention's (CDC's) National AIDS Information Clearinghouse and from the local health departments. Thirty-two

sites were selected from the ten cities, and 26 agreed to participate in the study. At each site, approval was obtained from the institutional review board. In general, the sites selected were those that treated the most HIV-infected patients in the area. Two sites were selected from each city except for New York City where five were selected, and Miami, Newark, and Tampa where three were selected in each city.

The third stage involved selecting patients with HIV infection from each site. A systematic probability sample was drawn at each site; this involved obtaining basic information from all patients that received care at a site over a two- to four-month period. Screening forms were distributed to 5,811 persons with HIV infection at the 26 provider sites. The sample was collected by hiring a coordinator at each site to distribute to all patients during specified time periods a self-administered screening form. The screening forms contained questions about HIV status, gender, insurance status, and symptoms. Patients who were not infected with HIV were automatically excluded from the sample. The screening form did not have any patient-identifying information other than a number that was given to each patient after he or she filled out the form; respective numbers could be used to call back patients in case they were selected for the sample.

An algorithm derived by statisticians at Westat, Inc. was used to select the sample. The algorithm used disease stage and gender (women were oversampled) as the sample criteria. Those patients selected by the algorithm were then asked by the site coordinator to participate in the study and to fill out the informed consent forms. Of the patients who were asked, 88 percent agreed to participate in the ACSUS. As part of the first interview participants were asked to identify all providers of health care, and at each subsequent interview participants were asked to identify new providers. The purpose of the short time period between interviews was to mitigate errors due to poor recall. Because persons with HIV may experience problems that affect memory, it is important for surveys of HIV-infected persons to interview patients as frequently as possible.

Participants in the ACSUS were interviewed every three months during an 18-month period from spring 1991 to fall 1992. The first interview included questions about the use of services during the time period between March 1, 1991 and the date of the first interview. Participants were asked to sign release forms for each health care provider (e.g., physicians, clinics, hospitals, pharmacies, and nursing homes) so that billing and medical record data could be obtained. (Data from billing and medical records were not available at the time of this study.) In this study, the values for the two dichotomous dependent

variables (used or did not use AZT; and was or was not hospitalized) are not standardized. However, the variable representing the number of outpatient visits is standardized to a three-month period. This was necessary because March 1, 1991 was used as the reference date for all respondents, and most respondents were not interviewed exactly three months after the reference date.

All respondents were asked to report their utilization of services between March 1, 1991 and the date of the interview. When possible the interviews were conducted at locations (e.g., the sample site, a public place such as a restaurant, the respondent's home) suggested by the respondent. Westat, Inc. hired and trained interviewers at each site, and the data processing of the interview data was performed at Westat's headquarters in Rockville, Maryland.

The basic statistical techniques employed in this study are logistic multivariate analysis and linear multivariate analysis. The logistic model is used to examine a relationship where the dependent variable is binary (in this case, did or did not use AZT, and was or was not hospitalized). Coefficients in the logistic model are estimated using maximum likelihood techniques and are based on the assumption that the dependent variable equals one (i.e., the event occurred) only when an underlying response variable defined as $Y^* = a_0 + a_1x_1 + a_2x_2 + \ldots + x_n + u$ is greater than zero where u has a logistic distribution (Maddala 1983, 41-46).

Linear regression analysis is used to examine the relationship between outpatient visits and patient characteristics. Least-squares estimators are calculated for each coefficient in the linear model under the usual assumptions that the relationship between the dependent and independent variables is linear and that the error term is normally distributed with mean zero and constant variance (Johnston 1963, 107-142).

The coefficients presented further on (see Tables 2 and 4) for the logistic regression equations correspond to probabilities that the dependent variable is equal to one (i.e., that the event occurred). These coefficients are obtained by multiplying the logistic coefficients by $p(1 - p)$, where p is the average observed probability of the event occurring for persons in each equation (Kmenta 1971). Thus, the coefficient .19 for public insurance in Table 2 implies that a person with AIDS on public insurance (e.g., Medicaid) is 19 percent more likely than a person with AIDS without insurance (the reference category for this variable) to have used AZT during the three-month period covered by the first interview. Statistical significance is at the .05 level using a two-tailed t-test.

The utilization equations in this study include a combined gender and exposure variable. This variable has four categories (gay/bisexual, male IDU, women, and other). The gender and exposure categories are derived using information from the screening form, which asks the respondent to identify the most likely method by which he or she was infected (sex with gay/bisexual, intravenous drug use, sex with intravenous drug user, or other). Thus, persons with multiple risk factors are placed in only one category. About 7 percent of adults and adolescents with AIDS are identified as both gay/bisexual and intravenous drug users in CDC case reports (Centers for Disease Control 1992b, 8). Information about the date of a person's first positive test for HIV, race, ethnic background, medical history (e.g., whether he or she had PCP, Kaposi's sarcoma, herpes, or tuberculosis), and source of payment was also collected on the screener form.

The women category was not broken down by IDU status because in regression equations explaining AZT use, outpatient visits, and hospital admissions, the variable representing IDU status for women was not statistically significant. The "other" category includes men who acquired HIV through a blood transfusion or through heterosexual contact with a woman. The other category is the reference category for this variable. The AZT use variable is defined as one if the respondent reported taking AZT between March 1, 1991 and the date of the interview, and zero if the respondent did not take AZT during this period. The hospital use variable is similarly defined except that it is set at one if the respondent is hospitalized. The outpatient visits variable is defined as the number of ambulatory encounters with the medical care system between March 1, 1991 and the date of the interview.

The race variable has three categories (black, white, and other). The reference category for the race variable is the "other" category. The insurance variable is defined as public, private, and none. Those with no insurance constitute the reference category. The income variable represents before-tax income for 1990. Five income categories are defined ($0–$4,999; $5,000–$9,999; $10,000–$19,999; $20,000–$39,999; and $40,000 and above); and those with before-tax incomes between $0 and $4,999 constitute the reference category. In addition, there are dummy variables for each geographic location (i.e., providers were aggregated by city) except Baltimore. Baltimore is the reference category for the geographic variable.

RESULTS

Women in the ACSUS sample are poorer than men (see Table 1). Fifty-five percent of the women in the ACSUS sample had before-tax incomes of less than $5,000 in 1990, and only 1 percent had before-tax incomes greater than $40,000. Thirty-one percent of the men in the ACSUS sample had before-tax incomes of less than $5,000 in 1990, and 12 percent had before-tax incomes greater than $40,000.

Women in the ACSUS sample also are more likely to be black. Forty-eight percent of females in the ACSUS are black compared to 26 percent of the men. Alternatively, the proportion of females in the ACSUS who are white (21 percent) is lower than the proportion of males in the ACSUS who are white (47 percent). About the same

Table 1: Information on the Study Population

	Female	*Male*	*Total*
*Insurance**			
Private	29 (8)†	596 (38)	625
Public	279 (78)	706 (45)	985
None	51 (14)	258 (17)	309
*Income**			
<$5,000	194 (55)	474 (31)	668
$ 5,000-$ 9,999	89 (25)	331 (21)	420
$10,000-$19,999	44 (13)	297 (19)	341
$20,000-$39,999	21 (6)	264 (17)	285
>$40,000	4 (1)	187 (12)	191
*Race**			
White	74 (21)	733 (47)	807
Black	174 (48)	402 (26)	576
Other	113 (31)	440 (28)	553
Exposure Category			
Gay/Bisexual	—	1,059 (67)	1,059
IDU	134 (37)	354 (22)	488
Other	225 (63)	165 (10)	390
Disease Stage			
Asymptomatic	100 (28)	322 (20)	422
Symptomatic	154 (43)	686 (43)	840
AIDS	105 (29)	570 (36)	675

*The number of enrollees varies slightly among the three categories (insurance, income, race) because there were slightly different numbers of missing data fields for each question.

†The numbers in the parentheses are percentages calculated for each gender within each category (insurance, income, and race). Due to rounding error the percentages for each category range from 99 to 101.

percentage of females (31 percent) as males (28 percent) in the ACSUS sample are neither black nor white.

AZT

The proportion of persons in the ACSUS sample that received AZT during the preceding three-month period is similar across disease categories. Sixty-seven percent of PWAs, 65 percent of symptomatic persons, and 59 percent of asymptomatic persons used AZT during the study period.

Table 2 presents results from three logistic multivariate regression equations explaining AZT use. The coefficient for the gender variable in the asymptomatic equation is statistically significant and equal to -.20. This coefficient implies that an asymptomatic women is 20 percent less likely to receive AZT than an asymptomatic man in the reference category.

Table 2 also indicates that an asymptomatic male IDU is 26 percent less likely to receive AZT than an asymptomatic man in the reference category. The variables for public and private insurance are significant and positive in the asymptomatic equation. The coefficients

Table 2: Probability of AZT Use Based on Logistic Regression Analyses

	Coefficient†	t-*Ratio*
AIDS		
Female*	-.03	0.3
Public insurance	.19	3.0
Income ($10,000-$19,999)	.13	2.1
Income ($20,000-$39,999)	.18	2.3
Income ($40,000-)	.23	2.4
Symptomatic		
Female*	-.04	0.6
Asymptomatic		
Female*	-.20	2.2
IDU (male)	-.26	2.4
Private insurance	.35	4.0
Public insurance	.22	3.0

*All coefficients and *t*-ratios for the variable representing Female are reported here. Coefficients and *t*-ratios for other variables are reported only if they are statistically significant.

†All statistics are calculated from patient level data. Probabilities were obtained by multiplying logistic coefficients by $P(1 - P)$ where P is the average observed proportion of persons who used AZT within each disease stage. Thus, coefficients were evaluated at the mean value for each disease stage.

reveal that an asymptomatic person with private insurance is 35 percent more likely to receive AZT than an asymptomatic person without insurance, and an asymptomatic person with public insurance is 22 percent more likely to receive AZT than an asymptomatic person without insurance.

The gender variable was not statistically significant in the equation explaining the use of AZT for symptomatic persons or for persons with AIDS (PWAs). This implies that women who are symptomatic or who have AIDS are not more or less likely to receive AZT than men who are symptomatic or who have AIDS. The equation explaining the use of AZT by symptomatic persons did not have any significant variables.

Public insurance was positively associated with the use of AZT by PWAs. The probability that a PWA with public insurance received AZT is 19 percent more than for a PWA without insurance. The private insurance variable was not statistically significant in either the symptomatic or PWA equation.

Income is a statistically significant determinant of AZT use for PWAs but not for asymptomatic and symptomatic persons with HIV. The probability of a PWA with a before-tax income between $10,000 and $19,999 of receiving AZT was 13 percent more than for a PWA with a before-tax income less than $5,000, while a PWA with before-tax income between $20,000 and $39,999 was 18 percent more likely to receive AZT than a PWA with a before-tax income less than $5,000. A PWA with a before-tax income of $40,000 or more was 23 percent more likely to receive AZT than a PWA with a before-tax income less than $5,000.

OUTPATIENT SERVICES

The average number of outpatient visits incurred by a PWA during the standardized three-month period was 7.7. Symptomatic persons averaged 6.2 outpatient visits and asymptomatic persons averaged 5.6 outpatient visits during a three-month period.

Table 3 presents the results of regression equations explaining the number of outpatient visits incurred during a three-month period in early 1991. Data from the ACSUS reveal that women who are symptomatic or who have AIDS are more likely to use outpatient services than men in the reference category. Outpatient visits include emergency room, hospital clinic, community clinic, and private doctor office visits.

The regression equation for PWAs indicates that women had 3.8

Table 3: Linear Regressions of the Number of Outpatient Visits During a Three-Month Time Period

	Coefficient (Mean)	t-*Ratio*
AIDS		
Female*	3.8 (11.5)	3.2
White	3.1 (10.8)	2.4
Symptomatic		
Female*	3.1 (9.3)	3.6
White	2.3 (8.5)	2.9
Miami	2.4 (8.6)	2.4
Asymptomatic		
Female*	0.9 (6.5)	0.6

*All coefficients and *t*-ratios for the variable representing Female are reported here. Coefficients and *t*-ratios for other variables are reported only if they are statistically significant.

more outpatient visits than men in the reference category, while the regression equation for symptomatic persons indicates that women had 3.1 more outpatient visits than men in the reference category. The male IDU variable and the gay/bisexual variable were statistically insignificant in each of the three outpatient visit equations.

White persons with AIDS had 3.1 more outpatient visits than persons in the reference category (i.e., persons who are not white or black), and white persons with symptoms had 2.3 more outpatient visits than persons in the reference category. Symptomatic persons in Miami had 2.4 more outpatient visits than symptomatic persons in Baltimore. The variable representing black persons was not statistically significant in any of the equations explaining outpatient visits.

INPATIENT SERVICES

Table 4 presents results of the logistic equations explaining hospital admissions by PWAs and symptomatic persons with HIV. There is no logistic equation for asymptomatic persons with HIV because the SAS algorithm to estimate this logistic equation did not converge in 25 iterations. It is unclear exactly why the algorithm did not converge, but the fact that relatively few asymptomatic persons were hospitalized may have contributed to this problem. (Only about 8 percent of asymptomatic persons were hospitalized between March 1, 1991 [the reference date] and the first interview.)

Table 4 indicates that women with AIDS are less likely to be hospitalized than men with AIDS in the reference category. The coefficient for the gender variable is statistically significant and implies that

Table 4: Probability of a Hospital Admission Based on Logistic Regression Analyses

	Coefficient†	*t-Ratio*
AIDS		
Female*	-.05	2.0
IDUs (Male)	.15	2.8
Black	.08	2.1
Symptomatic		
Female*	-.05	1.2
Black	.09	2.9
Gay/Bisexual	-.10	2.7
Private insurance	.13	2.8
Public insurance	.11	2.7
Tampa	-.17	3.1

*All coefficients and *t*-ratios for the variable representing Female are reported here. Coefficients and *t*-ratios for other variables are reported only if they are statistically significant.

†All statistics are calculated from patient-level data. Probabilities were obtained by multiplying logistic coefficients by $P(1 - P)$ where P is the average observed proportion of persons who were hospitalized within each disease stage. Thus, coefficients were evaluated at the mean value for each disease stage.

the probability of hospitalization for a woman with AIDS during the observation period was 5 percent less than for a man with AIDS in the reference category. The coefficient for male IDUs is statistically significant and implies that the probability of hospitalization for a male IDU with AIDS is 15 percent greater than for a man with AIDS in the reference category.

The variable representing gay/bisexual men is not statistically significant in the logistic equation explaining hospitalization for PWAs. Yet the variable representing gay/bisexual men is negative and statistically significant in the logistic equation explaining hospitalization for symptomatic persons. The probability of hospitalization for a symptomatic gay/bisexual man during the observation was 10 percent less than for a symptomatic man in the reference category.

Both insurance variables are positive and statistically significant in the logistic equation explaining hospitalization for symptomatic persons. The probability of hospitalization for a symptomatic person with private insurance during the observation period was 13 percent higher than for an asymptomatic person without insurance, and the probability of hospitalization for a symptomatic person with public insurance during the observation period was 11 percent higher than for a symptomatic person with no insurance. The only statistically significant geo-

graphic variable was for symptomatic persons in Tampa. The probability of hospitalization for a symptomatic person in Tampa was 17 percent less than for a symptomatic person in Baltimore (the reference city in this category).

COST IMPLICATIONS

The probability of hospitalization for a woman with AIDS is 5 percent less than for a man with AIDS in the reference category (Table 4). In results not presented here, none of the gender/exposure category variables (i.e., gay/bisexual, male IDU, female, and other) was statistically significant in the regression equation explaining the average length of stay for a PWA. Thus, we deduce that a woman consumes $2,295 less for hospital services per 12-month period (.05 × $45,900) than a man in the reference category.[1] A woman with AIDS has an average of 15.2 (3.8 × 4) more outpatient visits per 12 months of life than a man with AIDS in the reference category (Table 4). A recent study indicates that the average cost of an outpatient visit for a PWA is $138 (New York State Department of Health 1991, 142). Using this figure for the cost of an outpatient visit implies that the annualized cost of outpatient care is $2,098 (15.2 × $138) higher for a woman with AIDS than a man with AIDS in the reference category. These calculations suggest that the annualized cost of treating a woman with AIDS is comparable to the annualized cost of treating a man with AIDS in the reference category—women with AIDS consume $2,295 less for hospital services and $2,098 more for outpatient services over 12 months. Our results also reveal that the difference in costs between treating a man in the reference category with AIDS and a gay/bisexual man with AIDS is *not* statistically significant.

Data from this study reveal that the probability of a woman with AIDS being hospitalized is 20 percent less than the probability of a male IDU with AIDS being hospitalized. (The female variable in the AIDS equation in Table 4 has a statistically significant coefficient equal to -.05 and the male IDU variable has a statistically significant coefficient equal to .15.) This suggests that a woman with AIDS incurs $9,180 (.20 × $45,900) less for hospital services than a male IDU with AIDS during 12 months of life. A woman with AIDS consumes $1,711 (3.1 × 4 × $138) more in outpatient expenses than a man with AIDS in the reference category, and the difference in outpatient use between a man with AIDS in the reference category and a male IDU with AIDS is not statistically significant. Thus, our findings suggest that the cost

of treating a male IDU with AIDS is substantially greater than the cost of treating a woman with AIDS.

DISCUSSION

In any discussion of the findings from this study, it is essential to underscore the study's limitations. First, the information used here was obtained through interviews and is self-reported. Although some responses were verified during the interviews (e.g., persons who indicated that they received Medicaid benefits were asked for their Medicaid cards), most responses were not verified. Second, the data may not reflect patterns of care outside the ten cities in which the ACSUS was conducted. And third, a relatively small number of women (359) were interviewed. In order to derive better estimates, it is necessary to collect data from more women in more geographic locations (including rural areas), and to verify as many responses as possible using information obtained from other sources (e.g., provider bills, medical records, and insurance records).

As noted above, the generalizability of the ACSUS sample is limited because it includes only respondents from ten cities and excludes persons with HIV infection who receive all of their health services in places other than these urban areas. Thus, the ACSUS data base is not nationally representative, and data from ACSUS are best suited to explore the relationships between variables. This study uses data from ACSUS to examine the relationship between characteristics of persons with HIV infection (with special attention to gender) and the utilization of medical services.

This study used data obtained at sites that treat the highest number of HIV-infected patients in their geographic region. Undoubtedly, the use of services by patients at sites that have extensive experience treating persons with HIV infection differs from the use of services by patients at sites that provide care to few persons with HIV infection. Existing studies have found that sites with more experience in treating HIV-positive people often produce better outcomes and use fewer resources (Bennett, Garfinkle, Greenfield, et al. 1989; Stone et al. 1992).

Multivariate analyses of naturally occurring phenomena in the social sciences often are confounded by serious problems with multicollinearity (i.e., strong interrelationships among the independent variables) (Maddala 1977, 183–200). Serious multicollinearity problems result in few statistically significant coefficients for the independent variables. In this study, it is difficult to separate the effects of income,

race, and insurance status from the effects of gender because of the close relationship among these variables. Women with HIV infection are more likely to be poor, nonwhite, and uninsured than men with HIV infection. In addition, the income variable may be picking up some health effects. Higher-income PWAs may constitute a subset of PWAs who are in better health, are more likely to be employed, and are better able to tolerate AZT. The close relationship between health status and income makes it difficult to disentangle their effects.

Our findings are biased to the extent that the women in our sample are sicker than the men. This might not be a notable problem if the disease stages in our study had been narrowly defined and had included only persons who manifested the same clinical conditions. However, our disease categories are broad, and it is certainly possible that the women with AIDS in our sample are more seriously ill than the men with AIDS.

It is unclear why women with AIDS use fewer health services than men with AIDS after adjusting for income, race, insurance, and geographic differences. To some extent, this finding may simply reflect the fact that women have more child care and other family-related responsibilities. Or to some extent, this may result from a situation where women are healthier than men in the reference category or where discrimination occurs against women with HIV infection.

One unanticipated finding of this study is that geographic variations in the use of AZT, outpatient care, and inpatient hospital care were rarely statistically significant in the multivariate analyses. Only the variable representing Miami in the symptomatic outpatient equation and the variable representing Tampa in the symptomatic hospital admission equation were statistically significant.

CONCLUSIONS

This study shows that, even after they have been diagnosed and have gained access to the medical care system, women receive fewer medical care services than men. In particular, women with AIDS receive fewer services than male IDUs with AIDS, and asymptomatic women with HIV infection are less likely to receive AZT.

This study focuses only on persons who have access to the health care system. Yet there are increasing indications that many HIV-infected women are not being diagnosed accurately and are at elevated risk of having a primary health care provider who knows little about HIV (American Public Health Association 1991; Harvard AIDS Institute

1991). Issues about access to care are not addressed in this study, and research is needed to examine patterns of utilization of services by women with HIV infection before the time they are diagnosed.

NOTE

1. My derived estimate for the annualized cost of hospital care for a PWA in 1991 is $45,900. I estimated that the calendar year cost of inpatient care for a PWA was $28,700, and that the average PWA who is alive during any part of a calendar year lives 7.5 months during that calendar year—so that the annualized cost (i.e., the cost for 12 months of life) of inpatient care is ($28,700/7.5) × 12 = $45,900 (Hellinger 1992).

REFERENCES

American Public Health Association. *Women and HIV Disease.* Washington, DC: APHA, 1991.

Andrews, R. M., M. A. Keyes, T. R. Fanning, and K. W. Kizer. "Lifetime Medicaid Service Utilization and Expenditures for AIDS in New York and California." *Journal of Acquired Immune Deficiency Syndromes* 4, no. 10 (1991): 1046–58.

Bennett, C. L., M. Cvitanic, and A. Pascal. "The Cost of AIDS in Los Angeles." *Journal of Acquired Immune Deficiency Syndromes* 4, no. 2 (1991): 197–203.

Bennett, C. L., J. B. Garfinkle, S. Greenfield, D. Draper, W. Rogers, W. C. Mathew, and D. E. Kanouse. "The Relation between Hospital Experience and In-Hospital Mortality for Patients with AIDS-Related PCP." *Journal of the American Medical Association* 261, no. 20 (26 May 1989): 2975–79.

Bennett, C. L., A. Pascal, M. Cvitanic, V. Graham, A. Kitchens, and J. A. DeHovitz. "Medical Care Costs of Intravenous Drug Users with AIDS in Brooklyn." *Journal of Acquired Immune Deficiency Syndromes* 5, no. 1 (1992): 1–6.

Caschetta, M. B. "Clinical Manifestations of HIV Infection in Women." *Treatment Issues* 5, no. 1 (10 January 1990): 3.

Centers for Disease Control. *AIDS/HIV Surveillance Report,* Atlanta, GA: CDC, July 1992.

Corby, N., R. Wolitskik, S. Thornton-Johnson, and W. Tanner. "AIDS Knowledge and Behavior of Female Sex Partners of IVDUs." Seventh International Conference on AIDS, Florence, Italy, 19 June 1991, *Abstract W.D. 4137.*

Farizo, K., J. Buehler, M. Chamberland, B. M. Whyte, E. S. Froelicher, S. G. Hopkins, C. M. Reed, E. D. Mokotoff, D. L. Cohn, S. Troxler, A. F. Phelps, and R. L. Berkelman. "Spectrum of Disease in Persons with Human Immunodeficiency Virus Infection in the United States." *Journal of the American Medical Association* 26, no. 13 (1 April 1992): 1798–1805.

Fleming, P. J., J. W. Ward, M. W. Morgan, I. C. Hanson, J. W. Buehler, and R. L. Berkelman. "HIV Surveillance: Implementing Reporting of HIV in the United States." Eighth International Conference on AIDS, Amsterdam, Netherlands, 19 July 1992, *Abstract PoC 4454.*

Harvard AIDS Institute. "AIDS Drug Development and Testing: A Roundtable Discussion." *The AIDS Report* May/June 1991, pp. 5-12.

Hellinger, F. J. "Forecasts of the Costs of Medical Care for Persons with HIV: 1992-1995." *Inquiry* 29, no. 3 (Fall 1992): 356-65.

Johnston, J. *Econometric Methods.* New York: McGraw-Hill Book Company, 1963.

Kmenta, J. *Elements of Econometrics.* New York: Macmillan Publishing Company, Inc., 1971.

Maddala, G. S. *Econometrics.* New York: McGraw-Hill Book Company, 1977.

———. *Limited-Dependent and Qualitative Variables in Econometrics.* New York: Cambridge University Press, 1983.

Merzel, C., U. Sambamoorthi, and S. Crystal. "Predictors of Inpatient Utilization in an HIV Medicaid Waiver Population." Seventh International AIDS Conference, Florence, Italy, 17 June 1991, *Abstract M.D. 4191.*

Minkoff, H. L., and J. A. DeHovitz. "Care of Women Infected with the Human Immunodeficiency Virus." *Journal of the American Medical Association* 266, no. 16 (23/30 October 1991): 2253-58.

Moore, R. D., J. Hidalgo, B. Sugland, and R. Chaisson. "Zidovudine and the Natural History of the Acquired Immunodeficiency Syndrome." *New England Journal of Medicine* 324, no. 20 (16 May 1991): 1412-16.

Mor, V., J. A. Fleishman, M. Dresser, and J. Peitte. "Variations in Health Service Use among HIV-Infected Patients." *Medical Care* 30, no. 1 (January 1992): 17-29.

New York State Department of Health. *AIDS in New York State through 1990.* Albany, NY, 1991.

Schoenbaum, E. E., and M. Webber. "Underdetection of HIV Infection in Females Seeking Care at an Inner City Emergency Room in the Bronx, New York City." Seventh International Conference on AIDS, Florence, Italy, 17 June 1991, *Abstract W.C. 3093.*

Scitovsky, A. A. "Studying the Cost of HIV-Related Illnesses: Reflections on a Moving Target." *The Milbank Quarterly* 67, no. 2 (1989): 318-44.

Solomon, D. J., and A. J. Hogan. "Analysis of the Cost of Treatment for HIV Infection through the Michigan Medicaid Program." In press.

Stein, M. D., J. Piette, V. Mor, T. J. Wachtel, J. Fleishman, K. H. Mayer, and C. J. Carpenter. "Difference in Access to Zidovudine (AZT) among Symptomatic HIV-Infected Persons." *Journal of General Internal Medicine* 6 (January/February 1991): 35-40.

Stone, V. E., G. R. Seage, T. Hertz, and A. Epstein. "The Relation between Hospital Experience and Mortality for Patients with AIDS." *Journal of the American Medical Association* 268, no. 19 (18 November 1992): 2655-61.

Turner, B. J., L. E. Markson, L. McKee, and T. Fanning. "Survival Patterns of Women and Men with AIDS: Impact of Health Care Use Prior to AIDS." Seventh International AIDS Conference, Florence, Italy, 18 June 1991, *Abstract TU.D.112.*