CLINIC CHARACTERISTICS ASSOCIATED WITH REDUCED HOSPITALIZATION OF DRUG USERS WITH AIDS

CRAIG J. NEWSCHAFER, PHD, CHRISTINE LAINE, MD, MPH,
WALTER W. HAUCK, PHD, THOMAS FANNING, PHD,
AND BARBARA J. TURNER, MD, MScD

ABSTRACT

Objective. To identify features of ambulatory care associated with reduced hospitalization among drug users with acquired immunodeficiency syndrome (AIDS).

Methods. A nonconcurrent prospective study of hospital use by 1,369 drug users with AIDS was conducted using data from New York State Medicaid research data files linked to telephone interview data from directors of ambulatory care clinics serving this group.

Results. Follow-up averaged 29 months, during which 88% of subjects were hospitalized at least once. On average, those hospitalized spent 14% of follow-up time as inpatients. Hospitalization was less likely for patients in clinics with case managers (adjusted odds ratio = 0.42, 95% confidence interval 0.25, 0.69) or high director's rating of coordination of care (adjusted odds ratio = 0.50, 95% confidence interval 0.29, 0.89). Multivariate analysis showed significantly less time in hospital for patients in clinics with methadone maintenance, case managers, high continuity ratings, and clinic physicians attending for hospitalized clinic patients.

Conclusions. Drug users with AIDS rely heavily on inpatient care, but those followed in clinics featuring greater coordination and offering special services, including methadone treatment and case management, appear to have significantly less hospital use.

KEY WORDS Acquired immunodeficient syndrome, Substance abuse, Hospitalization, Ambulatory care.

INTRODUCTION

The costs of caring for persons with AIDS are driven in large part by the amount of time spent in the hospital.¹ Among persons with acquired immunodeficiency

Drs. Newschaffer, Laine, Hauck, and Turner are from the Center for Research in Medical Education and Health Care and Division of Internal Medicine, Jefferson Medical College, Thomas Jefferson University, Philadelphia, Pennsylvania; Dr. Fanning is from the New York State Office of Medicaid Management, New York State Department of Health, Albany, New York.

The opinions of the authors do not reflect the views or policies of the New York State Department of Health.

Correspondence and reprints: Craig J. Newschaffer, Center for Research in Medical Education and Health Care, Jefferson Medical College, 1025 Walnut Street, Suite 119, Philadelphia, PA 19107-5083 (e-mail: newscha1@jefflin.tju.edu).

syndrome (AIDS), those who use illicit drugs use significantly more inpatient services than non-drug users.² Drug users have been reported to spend 2 to 3 weeks longer in hospital than non-drug users in the interval between AIDS diagnosis and death.³ Both health care and social factors underlie drug users' dependence on inpatient services. Because substance abuse treatment and medical care are usually delivered at separate sites, drug users' ambulatory care has been notoriously disjointed.⁴ This lack of coordination and accessibility may, in turn, lead to deficiencies in preventive care and delays in the diagnosis and treatment of complications related to human immunodeficiency virus (HIV).⁵ Social factors such as homelessness and absence of involved family or friends may also contribute to increased reliance on hospital care for conditions that might have been managed out of hospital had adequate social supports been present.⁶

In this study, we identify features of ambulatory clinic care associated with reduced inpatient utilization among drug users with AIDS enrolled in the New York State Medicaid program. Our analysis focuses on a broad array of medical, substance abuse, and social services that we hypothesized might affect hospital utilization by addressing problems in coordination, comprehensiveness, and accessibility of medical care or social support deficits in this population.

METHODS

DATA SOURCES

Patient Data. The New York State (NYS) Medicaid HIV/AIDS Research Data Base* offers demographic data and longitudinally linked inpatient and outpatient claims for Medicaid enrollees with advanced HIV infection in the years 1984 through 1992. Clinical data on NYS Medicaid claims are coded by the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM), with up to five diagnoses per inpatient stay and two per outpatient visit. Criteria for entry into the database have been tested against AIDS registry data⁶ and use specific patterns of AIDS-related diagnoses and HIV-specific treatments. The date of the first clinical AIDS diagnosis was specified according to the 1987 revision of the Centers for Disease Control and Prevention's (CDC) AIDS Surveillance Case Definition, which was operative in all the years of our study.⁷ Illicit drug use was identified from inpatient or outpatient coded diagnoses that indicated dependence or abuse of cocaine, heroin, or other illicit substances or from claims for drug treatment services such as methadone maintenance. The method-

*The NYS Medicaid HIV/AIDS Research Data Base was made available to the authors by special arrangement.

ologies for identifying illicit drug use and other key clinical and demographic elements in the database have also been evaluated rigorously.⁸

Clinic Data. We surveyed 197 clinics serving as the usual source of care for one or more Medicaid enrollees initially diagnosed with AIDS in 1990. The usual source of care was identified by analyses of ambulatory care visits listed in the HIV/AIDS Data Base. A provider had to have been visited at least twice and for more than 50% of a patient's ambulatory encounters around the time of the clinical diagnosis of AIDS.² Providers that do not typically deliver longitudinal ambulatory care, such as emergency rooms or surgicenters, were not considered in this process.

Telephone interviews with 179 (91%) clinic medical directors or their designates were conducted from December 1993 to April 1994. Respondents were asked about clinic setting (i.e., hospital or freestanding), specialty, and the proportions of HIV-infected patients and all clinic patients who were enrolled in Medicaid. Survey items also pertained to the following five dimensions of care: HIV/AIDS medical services (9 items); drug treatment services (4 items); social support services (6 items); mental health services (3 items); and service access and coordination (10 items). Details of the survey have been described previously.⁹

STUDY POPULATION

Approximately 17,000 individuals with AIDS diagnoses had data available in the Medicaid HIV/AIDS Data Base for their mid-AIDS interval. The mid-AIDS interval as defined in previous work³ excludes the 3 months after AIDS diagnosis and, among decedents, 2 months prior to the month of death. This is a logical period in the natural history of AIDS to examine associations between primary care and hospital use because there is variation in hospital utilization during this time, while utilization in the diagnostic and predeath intervals is consistently high.³

Subjects were included in the study population only if (1) they had a usual source of care, and their usual care provider was one of the clinics responding to the study survey; (2) they had a history of drug abuse; and (3) they survived at least 1 year after their AIDS diagnosis. Of the initial 17,000 individuals, 54% had a usual source of care during the mid-AIDS interval. Of those, 75% (6,820) had a usual care provider that responded to the survey. From these, 2,346 with a history of illicit drug use were identified. Of these illicit drug users, we studied 1,369 subjects who survived at least 1 year after AIDS diagnosis (i.e., at least 9 months into their mid-AIDS interval), to allow sufficient time under the care of a provider to influence inpatient utilization, and who had no more than a 3-month gap in their Medicaid enrollment. Persons with enrollment gaps of 3

months or less were included because Medicaid generally covers services delivered over short periods of discontinuous enrollment (Peter Gallagher, NYS Office of Medicaid Management, oral communication, November 1996).

STUDY VARIABLES

Hospital Utilization. We identified patients with any hospitalization in the mid-AIDS interval. Among those with at least one inpatient stay, we determined the proportion of all eligible mid-AIDS interval days spent in hospital.

Clinic Service Availability. Clinic directors reported the availability and initiation dates of specific services within the aforementioned five dimensions of care in their clinics. These data were used to determine if a particular service was available during each patient's mid-AIDS interval.

Clinic Service Ratings. Each medical director rated his or her clinic's performance on various dimensions of care according to a Likert-type scale. Ratings of specific clinic services on 10-point scales (with a high rating indicating better performance) were divided by tertile into "low," "medium," and "high." Because these ratings did not have smooth distributions, tertiles were approximated with cut points set to make the middle group the largest category.

Clinic AIDS Experience. For each study patient, we determined the cumulative number of Medicaid enrollees with AIDS managed by his or her clinic from 1986 through the date of his or her AIDS diagnosis. Cut points for this measure were based on the quartiles of the distribution in the patient population, forming four groups (0–10, 11–35, 36–80, and >80 patients). Therefore, the HIV experience measure reflects cumulative experience in serving Medicaid-enrolled AIDS populations. However, the majority of HIV/AIDS patients cared for in study clinics were enrolled in Medicaid (median 85%).

AIDS Clinical Severity. The date of each patient's initial AIDS diagnosis and clinical severity were established using the Severity Index for Adults with AIDS (SIAA).^{10,11} The SIAA identifies the first diagnosis consistent with the 1987 Centers for Disease Control AIDS case definition (operative during all the years of our study) and the most severe of over 70 complications occurring within the 3 months after the initial AIDS diagnosis. The SIAA has demonstrated greater prognostic discrimination than CD4 (cluster of differentiation 4) count at AIDS diagnosis.¹⁰ Categories A and B (least severe) were combined in our analyses because there were few in category A (AIDS diagnosis only without any complication within 3 months). The SIAA C and D categories represent moderate and high severity of illness, respectively.

Medical and Psychiatric Comorbidity. We used Medicaid claims to identify persons with a history of common chronic diseases unlikely to be related to HIV infection (e.g., diabetes mellitus, asthma, emphysema, hypertension, coronary artery disease) or psychiatric disease (i.e., anxiety or personality disorder, depression, schizophrenia, or other psychosis).

ANALYTIC METHODS

From logistic regression models, we determined unadjusted associations of all independent variables with hospitalization (yes/no) during the mid-AIDS interval. Among persons with at least one hospitalization, ordinary least squares regression was used to determine unadjusted associations of independent variables with the proportion of time in the mid-AIDS interval spent in hospital.

Stepwise selection methods were used to determine patient characteristics associated with each outcome. These factors were included as background variables in all multivariable models. Next, we estimated separate stepwise models for the clinic variables categorized into five dimensions. A final stepwise model included all clinic characteristics chosen under each dimension. The *P*-value criteria for entry and retention in stepwise models were 0.10 and 0.15, respectively. To determine whether associations between clinic characteristics and outcomes shown in the final stepwise models were independent of clinic AIDS experience, this variable was added to each of the final stepwise models.

Finally, because groups of patients were treated by (and clustered within) the same clinic, we refit the final logistic and linear models using a general estimating equation algorithm with the independence working correlation matrix to account for clustering.¹² The standard errors estimated using a general estimating equation did not differ from those generated by standard logistic and linear modeling, so we present *P* values and confidence intervals from unclustered methods. A two-tailed *P* value less than .05 indicated statistical significance.

RESULTS

For the 1,369 drug users in the study population, we observed an average of 19.7 months eligible follow-up in the mid-AIDS interval. At least one acute-care hospitalization occurred in this time frame for 88% (Table I). The average amount of follow-up time spent in hospital for the full study population was 12%. For the 88% having at least one hospital stay, an average of 13.6% of follow-up time was spent as an inpatient. Over 40% of this group spent more than a tenth, and over 10% spent more than a quarter, of their follow-up time as inpatients in acute-care hospitals.

Also shown in Table I, over one-fourth of the study group was female, and the majority lived in New York City. Over half of the group was between 30 and 39 years old when diagnosed with AIDS. Most of the patients were in the

TABLE 1 Study Sample Characteristics

	No.	%
Observed length of mid-AIDS interval, months*		
10-15	574	41.9
16-21	344	25.1
22-27	220	16.1
28+	231	16.9
Hospitalization		
Yes	1203	87.9
No	166	12.1
Proportion of studied mid-AIDS interval spent as inpatient, %		
0	166	12.1
>0-5	357	26.1
>5-10	262	19.1
>10-25	400	29.2
>25	184	13.4
Age at defining diagnosis, years		
<21	8	0.6
21-29	223	16.3
30-39	779	56.9
40-49	311	22.7
50+	48	3.5
Sex		
Male	989	72.2
Female	380	27.8
Residence		
New York City	1205	88.0
Rest of state	164	12.0
Year of AIDS diagnosis		
1986-1987	173	12.6
1988-1989	507	37.1
1990-1991	216	50.2
Clinical AIDS severity†		
Low	264	19.3
Moderate	834	60.9
High	271	19.8
Chronic disease		
Yes	374	27.3
No	995	72.7
Psychiatric disease		
Yes	205	15.0
No	1164	85.0

*The mid-AIDS interval excludes the first 3 months after AIDS diagnosis and the last 2 months before death; study criteria excluded the first 9 months of the mid-AIDS interval.

†Severity Index for Adults with AIDS (SIAA).^{10,11}

moderate AIDS severity group according to the SIAA. This group includes persons with a low-severity AIDS defining diagnosis, such as esophagitis caused by *Candida*, and no or moderately severe complications, such as bacterial pneumonia, within 3 months. In addition, over 25% of study patients had another chronic medical condition, such as hypertension, and 15% had a psychiatric diagnosis.

CLINIC CHARACTERISTICS

As shown in Table II, many clinics had services or programs that were directed specifically toward care of HIV-infected patients. However, compared to the HIV-related services, drug treatment services were much less widely available. Of social support services, case management was the most commonly available. Psychiatric services were available in approximately one-third of clinics. Most clinics had features to accommodate acute-care needs.

Of surveyed clinics, 7% were in the highest quartile of cumulative AIDS experience, and these clinics served as the usual sources of care for nearly 25% of the study population. However, more than half of study patients received care at clinics with the lowest experience. Minimum and maximum cumulative AIDS experience values were 0 and 338, respectively.

CLINIC ATTRIBUTES AND OCCURRENCE OF HOSPITALIZATION

Also shown in Table II are bivariate associations between clinic attributes and odds of hospitalization. No statistically significant association was observed between any of the HIV/AIDS services and odds of hospitalization. Interestingly, the odds of hospitalization increased with higher director rating of AIDS service comprehensiveness, perhaps because clinics with more comprehensive services established these to meet the care demands of patients whose illness was more severe. The odds of hospitalization were lower for drug treatment services, but no significant associations appeared. On the other hand, the odds of hospitalization were significantly lower for patients in clinics with several of the social support services. A particularly strong association was observed for patients in clinics with HIV/AIDS case managers, with a 65% reduction in the odds of hospitalization. Specific access and coordination of care features were not associated with the risk of hospitalization, but high director ratings for coordination of care and availability of medical services were associated with significantly decreased odds of hospitalization. Last, decreasing unadjusted odds of hospitalization were observed with increasing clinic AIDS experience levels.

In multivariable analyses of the odds of hospitalization (Table III), the adjusted risk was increased for patients who were younger or were diagnosed with AIDS before 1991. Patient clinical characteristics associated with greater odds of hospitalization included increased clinical AIDS severity and the presence of another chronic disease, and a trend for greater hospitalization appeared for patients

TABLE II Clinical Characteristics and Distribution Among Study Clinics and Patients. Unadjusted Associations of Clinic Characteristics to Hospitalization (Any and Proportion of Time in Hospital) During the Mid-AIDS Interval

Characteristic	Clinics (n = 101)		Patients (n = 1,369)		Odds of any Hospitalization*		Association with the Proportion of the Interval Spent in Hospital*	
	n	%	n	%	Ratio	95% CI	b	95% CI
Clinic HIV/AIDS medical services	81	80.2	1157	84.5	1.30	0.85, 1.98	0.005	-0.015, 0.026
Standard protocol for initial HIV evaluation	63	62.4	829	60.6	0.99	0.71, 1.34	-0.002	-0.017, 0.013
Multidisciplinary conferences on HIV care	59	58.4	930	67.9	0.85	0.59, 1.21	-0.001	-0.016, 0.015
Clinic HIV/AIDS director	58	57.4	675	52.3	0.85	0.61, 1.17	0.016†	0.001, 0.031
Nutritionists	42	41.6	758	55.4	1.24	0.90, 1.72	-0.005	-0.020, 0.010
Participation in clinical trials	38	38.0	700	51.1	0.84	0.61, 1.17	-0.006	-0.021, 0.009
Infectious disease specialty physicians	36	36.7	627	46.2	0.95	0.69, 1.32	-0.004	-0.018, 0.011
Infusion or inhalation therapy								
Ambulatory aspects of HIV complications typically managed without consulting experts outside clinic	10	9.0	154	11.3	0.97	0.59, 1.63	0.007	-0.017, 0.030
Director-rated comprehensiveness of HIV/AIDS care								
Low	24	24.5	162	12.0	1.0			
Medium	50	51.0	777	57.5	1.58†	1.01, 2.47	0.022	-0.003, 0.046
High	24	24.5	413	30.5	2.24†	1.34, 3.77	0.008	-0.018, 0.034
Clinic drug treatment services								
Substance abuse counselors	21	21.0	245	18.0	0.75	0.50, 1.12	-0.001	-0.021, 0.018
Other substance abuse treatment	9	9.2	68	5.3	0.68	0.35, 1.33	-0.006	-0.025, 0.037
Methadone maintenance	3	3.0	10	0.7	∞	†	-0.097†	-0.178, -0.016
Director-rated availability of drug treatment services								
Low	40	39.6	366	26.7	1.0			
Medium	35	34.7	583	42.6	0.72	0.48, 1.08	0.015	-0.003, 0.034
High	26	25.7	420	30.7	0.92	0.59, 1.45	-0.001	-0.020, 0.019

TABLE II Continued

Characteristic	Clinics (n = 101)		Patients (n = 1,369)		Odds of any Hospitalization*		Association with the Proportion of the Interval Spent in Hospital*	
	n	%	n	%	Ratio	95% CI	b	95% CI
Clinic director-rated accessibility of clinic								
Low	36	35.6	448	32.7	1.00			
Medium	47	46.5	707	51.6	0.68	0.47, 1.00	-0.002	-0.018, 0.015
High	18	17.8	214	15.6	0.71	0.43, 1.17	-0.006	-0.029, 0.017
Clinic director-rated availability of clinic services								
Low	38	37.6	509	37.2	1.00			
Medium	32	31.7	495	36.2	0.76	0.51, 1.13	0.005	-0.012, 0.022
High	31	30.7	365	26.7	0.63†	0.42, 0.95	0.008	-0.011, 0.027
Cumulative clinic AIDS experience								
1st quartile (0–10 patients)	53	52.5	344	26.0	1.00			
2nd quartile (11–35 patients)	30	29.7	356	25.4	0.64	0.40, 1.05	0.002	-0.018, 0.023
3rd quartile (36–80 patients)	11	10.9	348	25.4	0.66	0.40, 1.08	0.010	-0.011, 0.030
4th quartile (>80 patients)	7	6.9	321	23.4	0.57	0.35, 0.93	0.009	-0.012, 0.030

*Effective sample size for analysis varies by characteristic.

†Effect estimates (OR or b) statistically significant at $\alpha = .05$.

‡No confidence limits provided; odds ratio undefined.

TABLE III Adjusted Odds of Any Hospitalization by Clinic and Patient Factors*

Variable	Adjusted Odds Ratio	95% CI	P Value
Patient characteristics			
Age, years	0.96	0.94, 0.98	<0.001
Diagnosed in 1991	0.54	0.37, 0.80	0.002
New York City residence	0.59	0.31, 1.13	0.111
Clinical AIDS severity†			
Moderate	1.97	1.32, 2.95	<0.001
High	2.21	1.30, 3.77	0.003
Chronic disease	1.59	1.05, 2.41	0.027
Major psychiatric disease	1.64	0.93, 2.87	0.087
Clinic characteristics			
HIV/AIDS-related services			
Director-rated HIV services			
Medium	1.60	0.98, 2.62	0.063
High	2.46	1.40, 4.32	0.002
Social support services			
HIV/AIDS case manager			
Director-rated availability of social support services	0.42	0.25, 0.69	<0.001
Medium	0.69	0.44, 1.08	0.105
High	0.95	0.56, 1.61	0.845
Coordination of care			
Director-rated medical care coordination			
Medium	0.87	0.53, 1.45	0.595
High	0.50	0.29, 0.89	0.014
Cumulative AIDS experience			
2nd quartile (11–35 patients)	0.74	0.45, 1.24	0.257
3rd quartile (36–80 patients)	0.71	0.42, 1.21	0.211
4th quartile (>80 patients)	0.75	0.43, 1.32	0.325

*Adjusted for all other variables in the model. Reference groups: Diagnosed 1986–1990, residence out of New York City, low clinical severity, no chronic disease, no major psychiatric disease, low director self-rating on HIV/AIDS medical services no case manager, low director self-rating on social support services, low director self-rating on coordination of care, cumulative AIDS experience in first quartile.

†Severity Index for Adults with AIDS (SIAA).^{10,11}

with psychiatric illness. Even after adjusting for patient clinical factors, we still observed greater odds of hospitalization for patients in clinics that the director rated comprehensiveness of HIV services highly. On the other hand, we observed a 60% reduction in the odds of hospitalization for patients in clinics with an HIV/AIDS case manager. Although directors' rating of social support services met criteria for inclusion in the model, no clear adjusted association with the outcome was observed. Conversely, directors' coordination of care ratings did show a consistently favorable association with lower odds of hospitalization, with patients in clinics with the highest tertile of ratings having 50% lower odds of hospitalization. We forced the cumulative AIDS experience measure into the

final model as shown, but it was not associated with the outcome or substantively change the estimates or *P* values observed for the other variables. This suggests that the other clinic attributes were independent of clinic AIDS experience.

CLINIC ATTRIBUTES AND AMOUNT OF HOSPITALIZATION AMONG THOSE WITH AT LEAST ONE ADMISSION

Returning to Table II, we display bivariate associations between clinic characteristics and the proportion of the mid-AIDS interval spent in hospital for those with at least one inpatient stay. Of the HIV/AIDS-related services, only having a nutritionist was significantly associated with a greater proportion of the mid-AIDS interval spent in hospital. We observed a very strong association between patients being followed in a clinic that also provides methadone treatment and the proportion of the mid-AIDS interval that study drug users spent as inpatients. The presence of a case manager was associated with nearly a 3% drop in the proportion of the mid-AIDS interval in hospital.

Appointments within 48 hours and higher ratings of continuity of HIV care were respectively associated with nearly 3% and 4% reductions in the proportion of time spent in hospital. Conversely, small but significant increases in the proportion of time in hospital were observed for patients in clinics that had to increase their hours since 1986 and in clinics with physicians on call. The highest quartile of provider AIDS care experience was associated with a significant 43% reduction in proportion of time in hospital.

The results of the multivariate analysis of factors associated with the proportion of time spent in hospital are shown in Table IV. Overall, the associations of patient and clinic factors with this outcome are weaker than those related to the risk of any hospitalization. Patients with more months in their mid-AIDS interval were hospitalized for a lower proportion of this time. Increased AIDS severity is still strongly associated with more time in hospital. Even after adjustment for multiple patient and clinic factors, we still observe a very strong association of methadone maintenance services with a lower proportion of the mid-AIDS interval spent in hospital. The effect estimate from the multivariate analysis changed only marginally from the unadjusted estimate (9.2% versus 9.9%). Thus, for the average study patient with at least one hospitalization, care at a clinic providing methadone was associated with a reduction of 55 inpatient days over a typical mid-AIDS interval of 596 days.

Patients at sites with a case manager, greater director-rated continuity of care, and clinic physicians who followed patients in hospital had lower proportions of time spent in hospital during the mid-AIDS interval. Adverse associations with the proportion of time spent as an inpatient were observed for patients receiving care in clinics with nutritionists, on-call clinic physicians, or more clinic hours since 1986. As with the final model of odds of hospitalization, the addition

TABLE IV Clinic and Patient Characteristics Associated, After Adjustment, With a Change in Proportion of Interval Spent in Hospital Among Patients With at Least One Hospitalization*

Variable	<i>b</i>	95% CI	<i>P</i> Value
Patient characteristics			
Diagnosis in 1991	-0.017	-0.037, 0.002	0.075
Residence in New York City	0.0195	-0.003, 0.043	0.097
Duration of mid-AIDS interval (months)	-0.035	-0.044, -0.026	<0.001
Clinical AIDS severity†			
Moderate	0.027	0.025, 0.029	0.006
High	0.052	0.029, 0.075	0.001
Clinic characteristics			
HIV/AIDS medical services			
Nutritionists	0.025	0.009, 0.040	0.002
Drug treatment services			
Methadone maintenance	-0.092	-0.172, -0.012	0.024
Social support services			
HIV/AIDS case manager	-0.020	-0.038, -0.002	0.021
Access to, and coordination of, services			
Director-rated physician care continuity			
Medium	-0.017	-0.034, 0.001	0.057
High	-0.038	-0.059, -0.017	<0.001
Clinic physicians scheduled to be on call during off hours	0.028	0.010, 0.046	0.002
Clinic hours increased since 1986	0.030	0.012, 0.048	0.001
Clinic physicians usually attend for hospitalized clinic patients	-0.022	-0.039, -0.005	0.013
Cumulative AIDS experience			
2nd quartile (11–35 patients)	-0.008	-0.029, 0.012	0.424
3rd quartile (36–80 patients)	-0.006	-0.027, 0.015	0.558
4th quartile (>80 patients)	-0.012	-0.034, 0.010	0.295

*Adjusted for all other variables in the model. Reference groups: Diagnosed 1986–1990, residence out of New York City, low clinical severity, no nutritionists, no methadone maintenance, no case manager, low director self-rating on continuity of care, clinic physicians not scheduled to be on call, clinic hours decreased or stayed the same since 1986, clinic physicians do not usually serve as attendings for hospitalized clinic patients cumulative AIDS experience in first quartile.

†Severity Index for Adults with AIDS (SIAA).^{10,11}

of the cumulative HIV experience measures did not change substantively the magnitude of the effect estimates or *P* values.

DISCUSSION

A key component of containing expenditures for persons with AIDS is reducing the amount of time spent in hospital. The problem of frequent and prolonged hospitalizations is particularly great for illicit drug users with AIDS. In our analysis, nearly 90% of the population was hospitalized at some point during their mid-AIDS interval, which spans from 4 months after AIDS diagnosis to the 2 months before death.³ For our study population, the mid-AIDS interval averaged slightly more than 2 years. Among the large group hospitalized, the average

duration of inpatient time was approximately 14% of this interval, or about 80 days. While we are unable to calculate costs attributable to hospital care based on data available to us, it has been estimated¹³ that average daily hospitalization costs for drug users are \$640. Based on this, over \$50,000 per person was likely spent on inpatient care for this population of drug users during the mid-AIDS interval alone.

Our results point to social support and drug-use-related services and greater continuity/coordination of care as important factors related to lower incidence of hospital use by drug users with AIDS. HIV/AIDS case management and high director-rated coordination of ambulatory care were each associated with at least a 50% reduction in the adjusted odds of hospitalization of study drug users. Among persons who were hospitalized, we also observed a significantly reduced amount of time hospitalized for persons in clinics with case managers or with greater continuity of care between doctors and their HIV-infected patients.

Other studies have suggested that case management can have favorable outcomes for persons with AIDS. McCormick and colleagues reported that case managers were more accurate in their predictions of patients' long-term care needs than were physicians.¹⁴ In a National Institute on Drug Abuse demonstration project, patients with more case management received more ambulatory services.¹⁵ Case managers may decrease hospital use by encouraging regular follow-up and keeping patients from slipping through cracks in the system. Our data do not elucidate the mechanism by which case management might decrease hospital use, which should be pursued with primarily collected data.

Among patients hospitalized for some time during their mid-AIDS interval (90% of the cohort), usual care at a clinic with methadone treatment available on site was associated with a striking 10% drop in the proportion of time spent in hospital, a far stronger effect than was observed for any other clinic characteristic. The fact that this significant association was found with methadone availability, not methadone utilization, is potentially important. It is certainly possible that this association is driven by the subjects who were opioid abusers, the most likely candidates for methadone use. Other research has shown greater receipt of ambulatory services when methadone maintenance is linked to primary care services.⁴ Receipt of needed therapies such as zidovudine and tuberculosis prophylaxis and treatment have been reported to be greater when methadone treatment and medical care are delivered at the same site.^{16,17} Batki and colleagues analyzed hospital use by injection drug users pre-enrollment and postenrollment in a methadone program that also offered some HIV care.¹⁸ A significant reduction was observed in hospitalizations related to substance abuse, as was a trend toward fewer HIV-related hospitalizations. Associations between methadone treatment and adherence with improved prenatal care¹⁹ and increased survival

of HIV-infected women²⁰ have also been reported previously. However, it is also possible that methadone availability at a clinic is a marker for clinics better suited to manage care for drug users, both opioid users and abusers of other drugs, in ways not captured by other clinic characteristic variables. Unfortunately, we did not have sufficient data available on the type or types of illicit drugs used by patients to stratify analyses by substance(s) abused.

Factors such as coordination of services and continuity of care by the patients' usual source of care may be particularly beneficial for drug users, who frequently experience disrupted home lives and other social stresses. These factors show benefits in relation to reducing both the risk of hospitalization and the amount of time spent in hospital. In addition, having an attending from the patient's ambulatory care clinic oversee care when the patient is hospitalized was associated with a small but significant reduction in the proportion of time spent as an inpatient. We can only postulate that clinic attendings may have a better idea of the patients' needs for social support and possibly a better grasp of factors contributing to the medical problems requiring inpatient care.

Increased clinic hours since 1986, the presence of on-call physicians, the provision of nutritional services on site, and higher director ratings on availability of HIV/AIDS services were unexpectedly related to higher use of hospital care. While AIDS severity and comorbidity were controlled in our analysis, clinics with these characteristics may serve patients with more-complex health problems not fully captured by the severity and comorbidity measures we used.

Although we have previously reported that AIDS care experience is associated with longer survival of women,²⁰ this analysis did not find a significant adjusted association of this characteristic with hospitalization. Our experience measure is based on total numbers of Medicaid AIDS patients followed at study sites. The median proportion of AIDS patients in study clinics who were enrolled on Medicaid was 85%, and since Medicaid is expected to be more prevalent among drug-using AIDS patients, it is unlikely that we are underestimating by a substantial degree the total number of drug-using AIDS patients followed at these sites. Larger clinics may be treating patients with more-complex problems and with greater social needs; this was not measured in our study. Alternatively, the AIDS care experience may be a less important factor in preventing hospitalization of drug users than specific features of care that promote adherence and continuity of care.

Several other limitations of this study deserve mention. We did not evaluate actual receipt of specific services by particular patients, only services available from the clinic serving as the usual source of care. Further, not all relevant provider characteristics were considered. For example, with the recent advent of highly active antiretroviral therapy associated with reductions in hospitaliza-

tion,²¹ provider characteristics that promote use of and compliance with these medications should have significant indirect benefits on hospitalization. We did not examine use of antiretroviral therapy in this analysis; our study time frame preceded the use of these more powerful drug combinations. Although we found a strong association of the availability of methadone treatment with reduced hospitalization, this estimate was imprecise because it was based on few clinics with a relatively small number of subjects. This provocative association should be pursued in other, larger-scale investigations. In addition, certain patient and environmental factors not available for consideration in our analysis were likely to have an impact on hospital use, such as homelessness,²² imprisonment, and the availability of nursing home beds. Last, we studied only patients who had a usual source of care and who had insurance for care; thus, our results are not generalizable to drug users, who have more fragmented receipt of ambulatory services and no coverage for care.

The strength of this study accrues from the Medicaid population base from which it is drawn, as Medicaid is the dominant payer for persons with AIDS.^{23,24} We have augmented the comprehensive data on health care service use available on the HIV/AIDS Medicaid Data Base with detailed information about the specific services offered by over 100 diverse sites of care for drug users with AIDS. These data point to the benefits of social services such as case management, addiction services such as methadone maintenance, and the maintenance of good provider-patient continuity of care on use of the hospital for care. Relatively small outlays of financial resources toward providing these services may reap substantial benefits in relation to reducing expensive inpatient care for drug users with AIDS.

ACKNOWLEDGEMENT

Funding was provided by the Agency for Health Care Policy and Research (R01 HS06465-04). The authors are grateful for the contributions made to this work by Leona Markson, PhD.

REFERENCES

1. Hellinger FJ. The lifetime cost of treating a person with HIV. *JAMA*. 1993;270:474-478.
2. Turner BJ, McKee L, Fanning T, Markson LF. AIDS specialist versus generalist ambulatory care for advanced HIV infection and impact on hospital use. *Med Care*. 1994;32:902-16.
3. Markson LF, McKee L, Mauskopf J, Houchens R, Fanning TR, Turner BJ. Patterns of Medicaid expenditures after AIDS diagnosis. *Health Care Financing Rev*. 1994;15:1-17.
4. Selwyn PA, Feingold AR, Iezza A, et al. Primary care for patients with human immunodeficiency virus (HIV) in a methadone maintenance program. *Ann Intern Med*. 1989;110:761-763.
5. Levin SM, Trumble JG, Edmunds M, Statman JM, Peterson RC. Perspectives on linkage of primary health care and substance abuse treatment. *J Addict Dis*. 1993;12:1-8.
6. Keyes M, Andrews R, Mason ML. A methodology for building an AIDS research file

- using Medicaid claims and administrative data bases. *J Acquir Immune Defic Syndr.* 1991;4:1015-1024.
7. Centers for Disease Control. Revision of the CDC surveillance case definition for acquired immunodeficiency syndrome. *MMWR Morb Mortal Wkly Rep.* 1987;36:1s-15s.
 8. Fanning TR, Turner BJ, Cosler LE, et al. Quality of Medicaid data for HIV/AIDS examination of a statewide database. *AIDS Public Policy J.* 1995;10:39-47.
 9. Markson LE, Turner BJ, Cocroft J, Houchens R, Fanning TR. Clinic services for persons with AIDS: experience in a high prevalence state. *J Gen Intern Med.* 1997;12:141-149.
 10. Turner BJ, Markson LE, Taroni F. Estimation of survival after AIDS diagnosis: CD4 T-lymphocyte count versus clinical severity. *J Clin Epidemiol.* 1996;49:59-65.
 11. Turner BJ, Markson LE, McKee L, Houchens R, Fanning T. The AIDS-defining diagnosis and subsequent complications: a survival-based severity index. *J Acquir Immune Defic Syndr.* 1991;4:1059-1071.
 12. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika.* 1986;73:13-22.
 13. Fleishman JA, Hsia DC, Hellinger FJ. Correlates of medical service utilization among people with HIV infection. *Health Serv Res.* 1994;29:527-548.
 14. McCormick WC, Inui TS, Wood RW. The central role of case managers in early discharge planning for hospitalized persons with AIDS. *J Case Manage.* 1994;3:56-61.
 15. Schlenger WE, Krout LA, Roland EJ. Case management as a mechanism for linking drug abuse treatment and primary care: preliminary evidence from the ADAMHA/HRSA linkage demonstration. *NIDA Research Monograph.* 1992;127:316-330.
 16. Crystal S. Health-care barriers and utilization patterns among intravenous-drug users with HIV disease. *AIDS Public Policy.* 1992;7:187-198.
 17. Turner BJ, Markson LE, Hauck W, Cocroft J, Fanning T. Prenatal care of HIV-infected women: analysis of a large New York State cohort. *J Acquir Immune Defic Syndr.* 1995;4:371-378.
 18. Laine CA, Markson LE, McKee LJ, Hauck W, Turner BJ. The relationship of clinic experience with the survival of women with AIDS. *AIDS* 1998;12:417-424.
 19. Selwyn PA, Alcabes P, Hartel D, et al. Clinical manifestations and predictors of disease progression in drug users with human immunodeficiency virus infection. *New Engl J Med.* 1992;327:1697-1703.
 20. Gourevitch MN, Wasseman W, Panero MS, Selwyn PA. Successful adherence to observed prophylaxis and treatment of tuberculosis among drug users in a methadone program. *J Addict Dis.* 1996;1593-1604.
 21. Batki SL, Sorenson JL, Young V. Hospitalization by HIV+ and HIV- injection drug users before and during methadone treatment. Paper presented at: XI International Conference on AIDS, Vancouver, Canada, July 7-12, 1996.
 22. Ruane PJ, Ida J, Zakowski PC, Sokolov RJ, Ulman SJ, Daly R. Impact of newer retroviral therapies on inpatient and outpatient resources in patients with HIV. Paper presented at: Fourth Conference on Retroviruses and Opportunistic Infections, January 22-27, 1997; Washington, DC.
 23. Arno PS, Bonuck KA, Fleishman J, et al. The impact of housing status on health care utilization among persons with HIV disease. *J Health Care Poor Underserved.* 1996;7:36-49.
 24. Green J, Arno PS. The "Medicaidization" of AIDS: trends of financing of HIV-related medical care. *JAMA.* 1990;264:1201-1206.