Impact of Payer Type on HIV Stage of Illness at Time of Initiation of Antiretroviral Therapy in the United States

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INTRODUCTION

- Since its introduction in the mid-1990s, antiretroviral therapy (ART), defined as a regimen containing prespecified combinations of at least 3 antiretroviral drugs, has had a dramatic impact on public health, prolonging the lives of patients with HIV.
- The benefits of early ART initiation may include the preservation of immune function, reduction in chronic inflammation, prevention of HIV transmission, and prolonged survival. However, early initiation may also result in adverse effects and the development of drug resistance.
- Among health insurance payer types, Medicaid is the single largest source of coverage for people with HIV in the US, covering an estimated 40–44% of people receiving HIV-related medical care[1,2].
- People with HIV are 3–4 times more likely to be covered by Medicaid than the general US population, and many newly diagnosed HIV patients already have Medicaid coverage[2]. HIV medications are largely paid for by funds from Medicaid and other public funds such as AIDS Drug Assistance Programs, rather than commercial insurance[1,2].
- Medicaid coverage has been broadly associated with compromised access to medical care compared with other nonpublic insurance payers[3–6].
- Based on this general association, we hypothesized that HIV severity at initiation of ART may differ by health insurance payer type, and may provide insights into potential barriers to HIV care and development of interventions to overcome these barriers and improve patient care.

METHODS

Source Data

- Data were from the General Electric (GE) Healthcare Centricity Electronic Medical Record (EMR) database, comprising approximately 13.5 million patients contributed by 30,000 clinicians in 49 states.
- Clinical data include outpatient diagnoses, vital signs and physical findings, medications prescribed, and laboratory tests and results from GE-subscribing physicians. Lab results are populated directly into the EMR by specific laboratory facilities in the physicians' geographic locations[7]. Data are de-identified and Health Insurance Portability and Accountability Act compliant.
- Median time of patient enrolment is 3 years.
- Data were obtained for patients with an HIV diagnosis or evidence of ART use from January 1, 1997, through September 30, 2009.

Study Definitions

- HIV was defined as the presence of one or more ICD-9 diagnosis codes indicating HIV/AIDS. The cohort was antiretroviral-naïve. Antiretroviral medication use was determined by the appropriate Generic Product Identifier.
- Onset of combination ART was defined as initiation within a 14-day window of prescriptions for 3 or more antiretroviral drugs with an FDA-approved indication for HIV. Date of the first antiretroviral dispensed during the 14-day window served as the ART initiation date, provided there was no antiretroviral medication dispensing in the 90 days preceding this date. Finally, patients were required to have CD4+ laboratory tests within 90 days prior to ART initiation and be 18+ at ART initiation.
- Patients identified as ART initiators were classified according to clinical and demographic characteristics during the 90 days prior to antiretroviral use, including age, gender, race, smoking status, physician visit frequency, HIV-related comorbidities, opportunistic infections (OIs), and other selected comorbidities. Insurance payers were classified as commercial, Medicaid, Medicare, self-pay, or other/unknown.
- CD4 values were categorized as ≤200, 201–350, 351–500, and >500 cells/mm^3.

Analysis

- Distributions and descriptive statistics of all patient characteristics, including the study endpoint (HIV stage at initiation) and insurance payer type (the primary explanatory variable), were computed.
- Cumulative logistic mixed-regression models were used to analyze the ordinal-measured HIV stage (i.e., CD4+ value range) at ART initiation. Insurance payer type was forced into all models.
- Cumulative logit models were used to assess the relation between insurance payer type and HIV stage at initiation of ART. Univariate and multivariate models were constructed. Backward elimination was used starting with all potential independent variables, which were eliminated in order of decreasing statistical significance. Log-likelihood tests were used to compare model fit during the model reduction process.
- We computed odds ratios, 95% confidence intervals, and p values that blend strength of association and precision in a summary statistic.

RESULTS

Descriptive Statistics

- Descriptive information on patient characteristics for the overall population and by health insurance payer type is presented in Table 1.

Table 1. Patient Characteristics at Baseline by Health Insurance Payer Type

		Health Insurance Payer Type				
	Total	Commercial	Medicaid	Medicare	Self-pay	Other/ Unknown
N patients (%)	1,885 (100)	538 (28.5)	218 (11.6)	330 (17.5)	159 (8.4)	640 (34.0)
CD4 category, N (%)						
≤200 cells/mm^3	406 (21.5)	113 (21)	67 (30.7)	95 (28.8)	26 (16.4)	105 (16.4)
>200–350 cells/mm^3	580 (30.8)	162 (30.1)	72 (33)	84 (25.5)	62 (39.0)	200 (31.3)
>350–500 cells/mm^3	379 (20.1)	102 (19)	35 (16.1)	65 (19.7)	38 (23.9)	139 (21.7)
>500 cells/mm^3	520 (27.6)	161 (29.9)	44 (20.2)	86 (26.1)	33 (20.8)	196 (30.6)
Age: mean (SD),	44.5 (10.7),	43.8 (10.4),	46.9 (9.1),	50.8 (10.2),	35.7 (11.1),	43.1 (9.6),
median (range)	45 (18, 80)	45 (20, 80)	47.5 (18, 75)	50 (26, 80)	35 (19, 64)	44 (19, 70)
Race, N (%)						
White/Caucasian	610 (32.4)	231 (42.9)	46 (21.1)	112 (33.9)	58 (36.5)	163 (25.5)
African American	761 (40.4)	193 (35.9)	115 (52.8)	144 (43.6)	39 (24.5)	270 (42.2)
Hispanic	181 (9.6)	39 (7.2)	29 (13.3)	30 (9.1)	38 (23.9)	45 (7)
Other/Unknown	333 (17.7)	75 (13.9)	28 (12.8)	44 (13.3)	24 (15.1)	162 (25.3)
Gender, N (%)						
Male	1427 (75.6)	429 (79.7)	112 (51.4)	255 (77.3)	151 (95)	478 (74.7)
Female	461 (24.4)	109 (20.3)	106 (48.6)	75 (22.7)	8 (5)	162 (25.3)
Smoking status, N (%)						
Current	550 (29.2)	127 (23.6)	94 (43.1)	121 (36.7)	24 (15.1)	184 (28.8)
Past	300 (15.9)	94 (17.5)	45 (20.6)	51 (15.5)	10 (6.3)	100 (15.6)
Never	376 (19.9)	114 (21.2)	17 (7.8)	48 (14.5)	35 (22)	162 (25.3)
Unknown	659 (35)	203 (37.7)	62 (28.4)	110 (33.3)	90 (56.6)	194 (30.3)
Comorbidities						
Previously diagnosed HIV-related conditions, N (%)						
Category B (symptomatic conditions)	107 (5.7)	32 (5.9)	17 (7.8)	18 (5.5)	10 (6.3)	30 (4.7)
Category C (AIDS-indicator conditions)	164 (8.7)	49 (9.1)	22 (10.1)	30 (9.1)	18 (11.3)	45 (7)
Opportunistic infections, N (%)	176 (9.3)	47 (8.7)	36 (16.5)	22 (6.7)	18 (11.3)	53 (8.3)
Non-HIV-specific comorbidities, N (%)						
Anemia	31 (1.6)	7 (1.3)	8 (3.7)	3 (0.9)	4 (2.5)	9 (1.4)
Chronic obstructive pulmonary disease	23 (1.2)	6 (1.1)	6 (2.8)	7 (2.1)	0 (0)	4 (0.6)
Diabetes	28 (1.5)	6 (1.1)	6 (2.8)	8 (2.4)	2 (1.3)	6 (0.9)
Hypertension	42 (2.2)	12 (2.2)	8 (3.7)	12 (3.6)	0 (0)	10 (1.6)
Mental health disorders (depression, anxiety)	104 (5.5)	31 (5.8)	22 (10.1)	19 (5.8)	8 (5)	24 (3.8)
Mental illness	47 (2.5)	13 (2.4)	15 (6.9)	11 (3.3)	2 (1.3)	6 (0.9)
Renal or hepatic dysfunction	8 (0.4)	1 (0.2)	2 (0.9)	4 (1.2)	0 (0)	1 (0.2)
Substance use disorders	82 (4.4)	19 (3.5)	20 (9.2)	19 (5.8)	4 (2.5)	20 (3.1)

Results from Multivariate Analysis

- Covariates had minimal influence on the association between health insurance payer type and CD4 category at ART initiation. Thus, attention was focused on the adjusted, reduced model.
- In the reduced multivariate model, when compared with Medicaid, the odds of initiating ART at higher CD4 counts were similar for Medicare and significantly greater for commercial, self-pay, and other/unknown health insurance payer types (Figure 1).
- The odds of initiating ART at higher CD4 counts were significantly greater for patients whose most recent CD4 measurements were more distant from ART initiation, who were older, white, and had fewer pre-initiation office visits (Table 2).
- The absence of certain baseline comorbidities (HIV category B, HIV category C, OIs, and anemia) was also associated with increased odds of a higher CD4 category at ART initiation.

Figure 1. Odds Ratio Estimates (with 95% Confidence Intervals) of Higher CD4 Category by Health Insurance Payer Type (Reference Group = Medicaid)

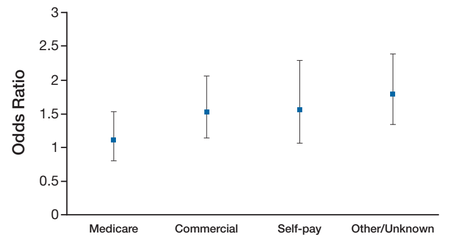

Table 2. Odds Ratio Estimates of Higher CD4 Category at ART Initiation

Parameter	Odds Ratio (95% Confidence Interval)	Parameter	Odds Ratio (95% Confidence Interval)
Payer type:		Race:	
Medicaid	Reference	White/Caucasian	Reference
Medicare	1.111 (0.805–1.532)	African American	0.581 (0.476–0.709)
Commercial	1.529 (1.137–2.057)	Hispanic	0.616 (0.455–0.833)
Self-pay	1.559 (1.063–2.287)	Other/Unknown	0.786 (0.615–1.004)
Other/Unknown	1.787 (1.341–2.382)		
Days since last CD4	1.005 (1.001–1.008)	Comorbidities in 90-day pre-ART interval:	
Age (per year)	1.011 (1.003–1.019)	HIV category B	0.586 (0.374–0.92)
Office visits	0.959 (0.932–0.986)	HIV category C	0.489 (0.334–0.715)
		Opportunistic infections	0.676 (0.499–0.917)
		Anemia	0.311 (0.15–0.645)

DISCUSSION

- HIV patients insured by Medicaid initiate ART at later stages of the disease process than HIV patients with nongovernment health insurance payer types.
- After adjustment for other factors, patients with commercial, self-pay, and other/unknown health insurance payer types were 53%, 56%, and 79% more likely, respectively, to be in a higher CD4 category at ART initiation than Medicaid patients.
- These results are consistent with recent reports that certain health insurance payer types, particularly Medicaid, are associated with suboptimal access to and quality of medical care[3–6].
- The characteristics of the Medicaid population include experiencing disproportionately high barriers to care, such as access or transportation to medical care, lack of or limited knowledge regarding HIV, language and literacy obstacles, HIV-related stigmatization, distrust of the system, drug addiction, and mental illness[8].
- The latter two factors were captured in these analyses as non-HIV-specific comorbidities; although they were among the most common comorbidities and approximately two-fold more common in the Medicaid subgroup than the other insurance payer subgroups, these factors were not statistically significant in adjusted models. Likewise, the visit frequency among the Medicaid subgroup was lower than for other insurance subgroups despite a substantially more severe comorbidity history, thereby suggesting a problem with access to medical care.
- The odds of being in a higher CD4 category increased by approximately 5% for every 10-day increase from the most recent CD4 test to ART initiation. This association was likely the result of less urgency to initiate treatment among patients who had higher CD4 counts.
- A higher CD4 category was also associated with older patients. This result is inconsistent with increasing age as a general risk factor for compromised health. However, in this population of HIV patients, older patients may be more likely to seek medical care more frequently and at an earlier disease stage than younger patients.
- The absence of comorbidities (HIV category B, HIV category C, OIs, and anemia), each of which had the highest prevalence among Medicaid patients, was associated with increased odds of being in a higher CD4 category.
- Last, white HIV patients were more often in higher CD4 categories than non-white HIV patients.

LIMITATIONS

- Limitations of this analysis relate mainly to missing data for health insurance payer type and CD4 values.
- CD4 values were unavailable for many patients; patients for whom CD4 values were unavailable may therefore differ from those included in the analysis.
- Data on health insurance payer type were unavailable for about one-third of patients, and these patients had higher CD4 values than patients with known health insurance payer types. If these patients were largely Medicaid patients, the observed heterogeneity of health insurance payer types and CD4 categories would be attenuated.

CONCLUSIONS

- HIV patients with publicly funded insurance, particularly Medicaid, initiate ART at a more advanced stage of HIV than patients with commercial insurance and other insured patients.
- Inclusion of socioeconomic, demographic, and comorbid disease factors had little influence on these results, suggesting that differences in HIV medical care provided by insurance payers cannot be fully explained by the underlying demographic profiles of the competing insurance payers.

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