A Longitudinal Analysis of Cardiovascular and Fracture Rates Among HIV-infected Patients in the USA with Commercial and Medicaid Insurance

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Abstract

◆ **Background:** Patients with HIV infection can present with or develop multiple comorbidities including risk factors for bone fracture and cardiovascular disease (CVD). This study compared age, gender, rates of fracture, CVD, and comorbid conditions in HIV patients in the US between commercial and Medicaid health plans in 2007-2013.

◆ **Methods:** Adults diagnosed with HIV (ICD-9 code: 042.xx, 795.71, V08) in 2006-2013 were selected from MarketScan Commercial and Medicaid Databases. All patients were continuously enrolled for ≥ 365 days in 2007-2013. Comorbidities, CVD, and fractures were examined using diagnosis and procedure codes.

◆ **Results:** A total of 31,229 HIV patients (mean age: 42.8; male: 77.9%) were selected from the Commercial database, and 10,190 (mean age: 42.9; male: 44.1%) from Medicaid. Prevalence and incidence of CVD and fractures were higher among Medicaid than Commercial patients. In 2007-2013, fracture prevalence (per 1000 patients) and incidence (per 1000 patient-years) were 83.1 and 22.1 in Commercial and 191.2 and 42.5 in Medicaid; CVD prevalence and incidence were 70.2 and 18.4 in Commercial, and 174.5 and 41.6 in Medicaid. Mean Deyo-Charlson comorbidity index was 6.0 for Commercial and 7.0 for Medicaid patients. The most common comorbidities were hypertension (Commercial: 32.5%, Medicaid: 55.5%), hyperlipidemia (30.6%, 33.8%), endocrine disease (including diabetes) (22.3%, 35.3%), (8.3%, 19.1%), and general CVD event (6.4%, 15.5%), all p<0.001. For both Commercial and Medicaid, HIV patients had more comorbidities, CVD and fractures in 2013 than in 2007.

◆ **Conclusions:** HIV patients can present with a number of comorbidities, including risk factors for CVD and bone fractures. These comorbidities have increased over time, and are consistently higher in Medicaid than in commercially insured patients. Additionally, Medicaid patients are more likely to be female and have a higher comorbidity and event/disease burden, further changing their risk profiles. Understanding these differing risk profiles is important when making optimal choices in treatment of HIV.

Background

◆ Significant advances in antiretroviral therapy (ART) have increased life expectancy of HIV patients.[1,2]

◆ HIV patients can have multiple comorbidities, including cardiovascular disease (CVD) and bone fractures/osteoporosis.

◆ Prolonged ART, along with aging, may increase risk of concurrent cardiovascular comorbidities and may increase risk of bone fractures.[3,4]

◆ Objectives: to compare age, gender, rates of fracture/osteoporosis, CVD, and comorbid conditions in HIV patients in US between commercial and Medicaid health plans in 2007-2013.

Methods

Study Design and Data Source

◆ Retrospective analysis: used de-identified U.S. administrative claims data in 2007-2013 from Truven Health MarketScan® Commercial Claims and Encounters and Multi-State Medicaid databases.

– Databases profile healthcare experience of >40 million individuals with employer-sponsored primary insurance and 8 million Medicaid enrollees from multiple, geographically dispersed states (based on database counts in calendar year 2014).

– Databases include medical claims for healthcare services performed in inpatient and outpatient settings as well as enrollment data, including demographic information and eligibility.

◆ Assessment of study variables based on inpatient and outpatient medical claims, and outpatient pharmaceutical claims data using *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis and procedure codes, *Healthcare Common Procedure Coding System* (HCPCS) codes; and *National Drug Codes* (NDCs), as appropriate.

Patient Selection Criteria

◆ Inclusion Criteria

– Adults with > 1 inpatient or outpatient claim for HIV (ICD-9-CM diagnosis codes 042.xx, 079.53 and v08.xx) between 7/1/02 – 12/31/13.

– Index Date: Date of first diagnosis of HIV.

– > 6 mos continuous medical and prescription coverage before and after earliest HIV diagnosis.

– Continuous enrollment for > 1 full calendar year during 2007-2013.

◆ Study Period

– Study period spanned 1/1/07 through 12/31/13

Methods (cont'd)

Outcome Measures

◆ Demographic characteristics included age, gender, and race (Medicaid patients only) and reported as of Index Date and during calendar years 2007 and 2013.

◆ Clinical characteristics evaluated during calendar years 2007 and 2013 and included Deyo-Charlson Comorbidity Index score (CCI) and proportions with certain comorbid conditions, including CV events, fractures/osteoporosis, metabolic, renal, and fracture-related risk factors. Comorbid conditions identified using ICD-9-CM diagnosis codes and, where applicable (i.e., coronary artery surgery), ICD-9-CM and CPT procedure codes. Medications identified using NDC codes.

◆ Prevalence and incidence of fracture/osteoporosis and CVD event by calendar year. CVD events: MI, coronary artery surgery (CABG and PTCA/PCI), peripheral vascular disease, ischemic stroke, DVT.

Statistical Analysis

◆ This was a descriptive analysis. Continuous variables summarized as means and standard deviations (SD). Categorical measures reported by counts and percentages.

◆ Statistical tests conducted comparing Commercial and Medicaid populations. A p-value of <0.05 was statistically significant.

Results

Study Sample and Overall 2007-2013 Patient Characteristics

◆ 31,229 HIV patients from Commercial database and 10,190 from Medicaid database included in analyses from 2007-2013(Table 1).

◆ Cohorts similar in age (41.8 vs. 41.1 yrs) at earliest HIV diagnosis, but Commercial cohort had larger proportion of males compared to Medicaid cohort (77.9% vs 44.1%, p<0.001). Medicaid had 68.0% of African American race.

◆ Most common comorbidities in both the cohorts: hypertension (Commercial: 32.5%; Medicaid: 55.5%), hyperlipidemia (30.6%, 33.8%), endocrine disease (including diabetes) (22.3%, 35.3%), (8.3%, 19.1%), renal impairment (8.3%, 19.1%), and CVD event (6.4%, 15.5%)

◆ Patients in Medicaid cohort had higher rates for all common comorbities, all p<0.001).

Trends in Clinical Comorbidities from 2007 to 2013

◆ Between 2007 and 2013, mean age and proportion of patients with hypertension, hyperlipidemia, endocrine disease, obesity, and renal impairment increased significantly across both patient populations (all p<0.001).

◆ In Commercial cohort, mean age was 45.3 in 2007 and 45.9 in 2013 (p<0.001); proportion of male patients increased from 76.9% to 78.6% (p=0.004).Most prevalent condition, hypertension, increased from 17.2% in 2007 to 25.0% in 2013 (p<0.001). Similarly, rates of hyperlipidemia rose from 13.5% to 21.9%, endocrine disease from 12.4% to 17.0%, obesity from 1.4% to 5.1%, and renal impairment from 3.1% to 5.0% (all p<0.001) (Table 2).

◆ In Medicaid cohort, mean age increased from 44.3 in 2007 to 45.6 in 2013 (p<0.001); proportion of Black race unchanged 70.0% to 71.5%). As with Commercial patients, rates of hypertension, hyperlipidemia, obesity, endocrine disease, and renal impairment increased (all p<0.001) (Table 3).

Trends in Prevalence and Incidence of CVD and Fracture Over Time

◆ Across both patient populations, prevalence of CVD and fracture/osteoporosis increased; larger increases observed among Medicaid patients for all 3 conditions.(Figures 1-2)

◆ Among Commercially-insured patients,

– Prevalence of CVD and fracture/osteoporosis increased steadily. CVD prevalence (per 1,000 persons) rose from 63.8 in 2007 to 74.3 in 2013 and fracture/osteoporosis prevalence rose from 69.9 to 95.2 over same period.

– Fracture/osteoporosis incidence (per 1,000 p-y) decreased from 22.2 in 2007 to 21.0 in 2013, but peaked at 24.7 in 2010.

◆ Among Medicaid patients,

– Prevalence of CVD and fracture/osteoporosis showed similar trend to Commercial cohort, with prevalence higher in Medicaid cohort. CVD prevalence increased from 118.6 in 2007 to 168.0 in 2013; fracture prevalence increased from 167.7 to 199.8.

– Incidence of CVD increased over time, although not steadily. CVD incidence rose from 32.1 in 2007 to 36.1 in 2013, but peaked at 45.6 in 2009. Fracture incidence, decreased from 42.0 in 2007 to 41.0 in 2013, but rose to 47.0 in 2010.

Results (cont'd)

Table 1. Overall Patient Demographics by Data Source

	Commercial N=31,229	Medicaid N=10,190	p-value
Age, Mean (SD)	41.8 (10.8)	41.1 (11.1)	<0.001
Male Gender (%)	77.9%	44.1%	<0.001
Race (%)			
White	--	18.3%	
Black	--	68.0%	N/A
Other/missing	--	13.7%	
US Census Geographic Region (%)[1]			
Northeast	16.1%	--	
North Central	15.8%	--	
South	47.3%	--	N/A
West	19.6%	--	
Unknown	1.1%	--	
Population density (%)[1]			
Urban	92.6%	--	N/A
Rural/unknown	9.4%	--	
Insurance Plan Type (%)			
Comprehensive/Indemnity	3.4%	47.0%	
Exclusive Provider/Preferred Provider	56.5%	0.0%	
Organization			
Point of Service	10.9%	23.0%	
Health Maintenance Organization	20.8%	28.9%	<0.001
Consumer-driven or High Deductible Health	4.6%	0.0%	
Plan			
Unknown	3.9%	1.1%	
Length of follow-up (days), Mean (SD)	1,270 (992)	1,645 (1,194)	<0.001

Table 2. Patient Characteristics Among Commercial Patients, 2007 vs. 2013

	2007 N = 7,879	2013 N = 14,638	p-value
Age, Mean (SD)	45.3 (10.3)	45.9 (11.6)	<0.001
Ages 50+, %	26.9	27.4	0.405
Male, %	76.9	78.6	0.004
Deyo-Charlson Comorbidity Index, Mean (SD)	4.5 (3.0)	4.3 (3.1)	0.000
Conditions of Interest, %			
Cardiovascular and renal risk factors			
Chronic kidney disease	2.1	3.6	<0.001
Diabetes mellitus	7.9	9.4	<0.001
Fracture/osteoporosis	2.9	3.0	0.596
Hepatitis C	2.8	2.6	0.625
Hyperlipidemia	13.5	21.9	<0.001
Hypertension	17.2	25.0	<0.001
Obesity/overweight	1.4	5.1	<0.001
Renal impairment	3.1	5.0	<0.001
Cardiovascular events (any)*	2.9	2.8	0.461
Myocardial infarction	0.6	0.5	0.172
Coronary artery surgery	0.6	0.2	<0.001
Peripheral vascular diseases	0.6	0.9	0.005
Ischemic stroke	0.6	0.6	0.879
Deep vein thrombosis	1.0	1.0	0.879
Other conditions of interest			
Alcoholism	1.0	1.5	0.001
Cancer	4.6	4.5	0.735
Endocrine disease§	12.4	17.0	<0.001
Thyroid disease	2.9	4.0	0.002
Liver disease	1.9	2.5	0.002
Rheumatoid arthritis	0.4	0.4	0.841

* Cardiovascular event included myocardial infarction, coronary artery surgery (i.e., CABG, PTCA/PCI), peripheral vascular diseases, ischemic stroke, and deep vein thrombosis.
§ Includes diabetes and thyroid disease.

Table 3. Patient Characteristics Among Medicaid Patients, 2007 vs. 2013

	2007 N = 4,418	2013 N = 4,869	p-value
Age, Mean (SD)	44.3 (9.8)	45.6 (11.2)	<0.001
Ages 50+, %	18.4	25.3	<0.001
Male, %	42.7	42.5	0.832
Black Race, %	70.0	71.5	0.101
Deyo-Charlson Comorbidity Index, Mean (SD)	4.5 (3.0)	4.3 (3.1)	0.000
Conditions of Interest, %			
Cardiovascular and renal risk factors			
Chronic kidney disease	4.0	6.7	<0.001
Diabetes mellitus	15.5	19.4	<0.001
Fracture/osteoporosis	5.2	6.1	0.068
Hepatitis C	15.3	12.6	<0.001
Hyperlipidemia	15.1	27.3	<0.001
Hypertension	30.4	48.2	<0.001
Obesity/overweight	4.3	13.5	<0.001
Renal impairment	6.2	10.5	<0.001
Cardiovascular events (any)*	5.3	6.9	0.001
Myocardial infarction	1.2	1.2	0.886
Coronary artery surgery	0.4	0.3	0.422
Peripheral vascular diseases	1.7	2.3	0.067
Ischemic stroke	1.2	2.4	<0.001
Deep vein thrombosis	1.8	1.5	0.310
Other conditions of interest			
Alcoholism	6.8	9.7	<0.001
Cancer	4.6	4.8	0.660
Endocrine disease§	20.8	26.3	<0.001
Thyroid disease	4.4	7.1	<0.001
Liver disease	3.9	4.7	0.077
Rheumatoid arthritis	0.4	1.6	<0.001

* Cardiovascular event included myocardial infarction, coronary artery surgery (i.e., CABG, PTCA/PCI), peripheral vascular diseases, ischemic stroke, and deep vein thrombosis.
§ Includes diabetes and thyroid disease.

Figure 1. Prevalence (per 1,000 patients) & Incidence (per 1,000 patient-years) of CVD in 2007-2013
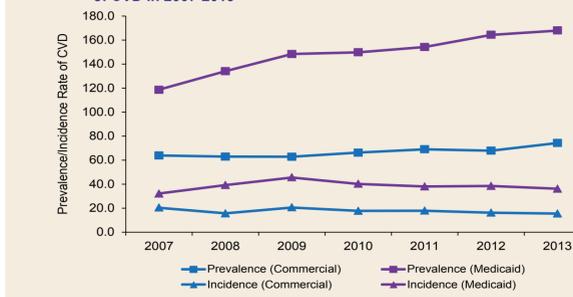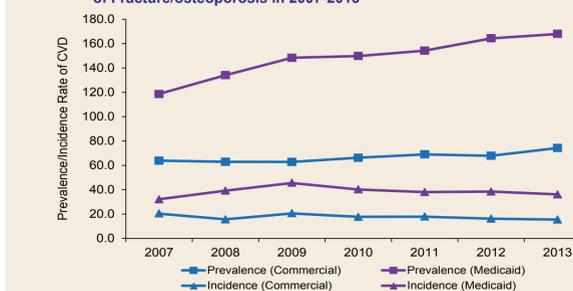

Figure 2. Prevalence (per 1,000 patients) & Incidence (per 1,000 patient-years) of Fracture/osteoporosis in 2007-2013

Conclusions

◆ This real-world retrospective study of HIV patients found that patients present with a number of comorbid conditions, including CVD and bone fractures. These comorbid conditions have increased over time across both Commercial and Medicaid patients

◆ Incidence and prevalence of these comorbid conditions were consistently higher in Medicaid compared to the Commercial population despite similarities in age

◆ Medicaid patients more likely to be female and have higher comorbidity and event/disease burden, further changing risk profiles. Compared to those in 2007, HIV patients in 2013 had higher prevalence of hypertension, hyperlipidemia, endocrine disease (including diabetes), renal impairment, and CVD event in both Commercial and Medicaid populations

◆ Between 2007 and 2013, prevalence of CVD and fracture events/osteoporosis increased significantly for commercial and Medicaid patients. Incidence of CVD and fractures decreased over time among commercially insured patients. In Medicaid patients, incidence of CVD increased whereas incidence of fracture decreased slightly during same time period

◆ Continuous advances in ART have increased longevity of HIV patients potentially exposing them to combined consequences of aging and multiple comorbidities. Understanding these differing risk profiles is important when making optimal choices in treatment of HIV

◆ Further analyses should be conducted to compare these trends with HIV-negative patients in order to understand these trends in context of the broader population. Similar comparisons between HIV patients on treatment vs. untreated HIV patients and by ART regimen are also recommended

Limitations

◆ There is potential for inaccuracies in the coding of diagnoses or procedures, missing information on relevant risk factors such as smoking, disease factors and severity, as well as missing information on drugs dispensed in an inpatient setting. Changes in use of electronic health records during study period may result in temporal changes in coding practices.

◆ Analysis limited to individuals with Commercial health or Medicaid coverage. Results may not be applicable to HIV patients with other insurance or without health insurance coverage.

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