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End-Stage Renal Disease From Human Immunodeficiency Virus–Associated Nephropathy in the United States, 2001 Through 2010

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ESRD From HIV-Associated Nephropathy

Before the advent of effective antiviral therapy, AIDS was associated with extremely high mortality.[1] Human immunodeficiency virus (HIV)–associated nephropathy (HIVAN) emerged as a common cause of progressive kidney disease in inadequately treated patients predominantly of African descent, characterized by an increasingly evident genetic predisposition.[2,3]

With access to optimal care, the outlook for HIV-infected individuals has changed substantially in the past 2 decades.[4] However, temporal trends in end-stage renal disease (ESRD) from HIVAN in the United States have not been defined systematically.

Methods

The main objectives of this study were to enumerate trends in incidence ratios, standardized to 2001-2002, of ESRD from HIVAN treated with renal replacement therapy (RRT) in the United States for 2001 through 2010. In this retrospective study, we used United States Renal Data System standard analysis files to study US patients who initiated maintenance

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Author Contributions: Dr Foley had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Foley, Sexton, Collins.
Acquisition of data: Foley, Sexton, Collins.
Analysis and interpretation of data: Foley, Sexton, Reule, Solid.
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RRT between 2001 and 2010 (N = 1 048 867). Cases of ESRD from HIVAN were those with the primary cause listed as "AIDS nephropathy" on the ESRD Medical Evidence Report.

US census data were used to determine population denominators for each year examined, with race or ethnicity classified as non-Hispanic white, non-Hispanic black, Hispanic, and other.[5] The Poisson distribution was applied to calculate incidence rates of RRT-requiring ESRD due to HIVAN. For standardized incidence ratios, expected incidence rates were calculated by applying incidence rates in 2000 for each of the 168 possible combinations of age (21 subgroups), sex (2 subgroups), and race or ethnicity (4 subgroups) to the corresponding subgroup of the US population for each year. Binary logistic regression was used for adjusted between-era comparisons of patients at initiation of RRT. SAS version 9.1.3 (SAS Institute), was used for data analysis. Specific IRB approval was not sought for this retrospective registry-based study.

Results

Table 1 shows characteristics at the time of RRT initiation in patients with HIVAN in 2 eras, 2001-2005 and 2006-2010. Age 45 to 64 years and 65 years or older, white race, diabetes mellitus, drug abuse, glomerular filtration rate of more than 15 mL/min/1.73 m^2, and body mass index of 25 or higher (calculated as weight in kilograms divided by height in meters squared) were more prominent from 2006-2010.

In 2001-2002, the rate of RRT-requiring ESRD due to HIVAN was 2.9 cases per million per year (Table 2). Standardized incidence ratios declined for the overall population between the 2001-2002 and 2009-2010 biennia, with a stepwise decline from 2005 through 2006. However, standardized incidence ratios increased for patients 65 years and older and those of non-Hispanic white race or ethnicity.

Discussion

Our study of ESRD from HIVAN suggests both meaningful progress and challenges for the future, with declining overall incidence contrasted by an emergence in older populations and non-Hispanic white race or ethnicity.

This retrospective and registry-based study lacks desirable data elements that a prospective design could provide. While a true tissue diagnosis in all patients would be desirable, this aspiration is likely utopian.[6] Questions about HIV positivity and AIDS as a comorbid illness at dialysis initiation were removed from the 2005 Medical Evidence Report. Thus, it is not possible to refute with certainty the hypothesis that the apparently salutary trends for HIVAN reflect changing fashions in labeling the cause of renal disease in patients living with HIV and not an alteration in the incidence of HIVAN.

If death rates from causes other than ESRD have declined, competing risk considerations might suggest that incidence rates of HIVAN could increase. In this scenario, a decline in HIVAN rates would be more impressive since survival rates improved during the timeframe

studied. The availability of aggregated census data (as opposed to longitudinal data for individuals) precludes accurate quantification of the true size of a competing death effect.

Despite its limitations, this study may provide some worthwhile information about two important domains of public health, chronic kidney disease and living with HIV.

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Table 1

Baseline Characteristics of 7988 Patients at Initiation of Renal Replacement Therapy[a]

Characteristic	Patients With HIVAN		
	2001-2005	2006-2010	AOR 2006-2010
No. of patients	4161	3827	
Age, y			
<45	37.8	30.4	1 [Reference]
45-64	60.2	65.8	1.34 (1.22-1.48)
≥65	2	3.8	2.26 (1.71-3.00)
Sex			
Male	66.4	66.8[b]	1 [Reference][b]
Female	33.6	33.2	1.04 (0.95-1.15)
Race			
Black	88.5	86.1	1 [Reference]
White	9.5	13	1.42 (1.20-1.67)
Other	2	0.9	0.51 (0.34-0.78)
Ethnicity			
Non-Hispanic	93.4	93.3[b]	1 [Reference][b]
Hispanic	6.6	6.7	0.83 (0.67-1.03)
Ischemic heart disease			
No	96.7	96.1[b]	1 [Reference][b]
Yes	3.3	3.9	1 (0.79-1.27)
Diabetes mellitus			
No	90.9	87.7	1 [Reference][c]
Yes	9.1	12.3	1.25 (1.08-1.44)
Alcohol abuse			
No	95.7	95[b]	1 [Reference][b]
Yes	4.3	5	1.12 (0.9-1.38)
Drug abuse			
No	88.2	84.5	1 [Reference]
Yes	11.8	15.5	1.36 (1.20-1.55)
Mode of dialysis			
Hemodialysis	96.4	97.4[d]	1 [Reference][d]
Peritoneal dialysis	3.6	2.6	0.71 (0.55-0.92)
Hemodialysis access			
Fistula	4.2	7.1[d]	1 [Reference][b]
Graft	2.7	2.3	0.51 (0.25-1.05)
Catheter	93.1	90.6	0.61 (0.39-0.95)

Characteristic	Patients With HIVAN		
	2001-2005	2006-2010	AOR 2006-2010
Prior nephrology care, mo			
>12	7.7	9.3[b]	1 [Reference][b]
≤12	92.3	90.7	0.86 (0.62-1.20)
GFR, mL/min/1.73 m^2			
≤15	94.5	91.3	1 [Reference]
>15	5.5	8.7	1.61 (1.35-1.93)
BMI			
<18.5	56.3	50.7	1.07 (0.93-1.24)
18.5-24.9	12.3	11.8	1 [Reference]
25.0-29.9	19.5	20.8	1.19 (1.06-1.33)
≥30	11.9	16.7	1.61 (1.41-1.85)
Serum albumin, g/dL			
<3.5	3.6	4.6[b]	0.86 (0.64-1.16)
3.5-3.9	8.9	9.5	0.83 (0.65-1.08)
≥4.0	87.6	85.9	1 [Reference][b]
Hemoglobin, g/dL			
<9.0	47	45.3[b]	1 [Reference][b]
9.0-10.9	38	38.3	1.01 (0.91-1.12)
≥11.0	15	16.4	1.08 (0.95-1.24)

Abbreviations: AOR, adjusted (for age, sex, race, and ethnicity) odds ratio; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); GFR, glomerular filtration rate; HIVAN, human immunodeficiency virus–associated nephropathy.

SI conversion factors: To convert serum albumin and hemoglobin to grams per liter, multiply by 10.

[a] Parameter estimates are presented as column percentages or odds ratios (95% CIs). Since 2005 was the first complete year incorporating data fields for predialysis vascular access for hemodialysis and predialysis nephrology care on the Medical Evidence Report, the denominators for these variables consisted of patients initiating dialysis from 2005 through 2010 (58.6% of the study population). Missing data: GFR, 0.6%; BMI, 1.4%; serum albumin, 24.9%; and hemoglobin, 8.4%.

$P < 0.001$ unless otherwise indicated.

[b] $P \geq .05$.

[c] $0.01 \leq P$ value < 0.05 (vs. 2001-2002)

[d] $0.001 \leq P$ value < 0.01 (vs. 2001-2002)

Table 2

Standardized Incidence Ratios of RRT-Requiring ESRD Due to HIV-Associated Nephropathy, 2001 Through 2010[a]

	Rate	Standardized Incidence Ratio, vs 2001-2002			
Subgroup	**2001-2002**	**2003-2004**	**2005-2006**	**2007-2008**	**2009-2010**
Cases/million population	1669/286	1680/291	1709/297	1573/303	1359/308
All	2.9	0.98 (0.93-1.03)	0.97 (0.92-1.02)	0.87 (0.83-0.91)[b]	0.74 (0.70-0.78)[c]
Age, y					
0-44	2.9	0.91 (0.85-0.97)	0.91 (0.86-0.97)	0.71 (0.66-0.76)[c]	0.59 (0.55-0.64)[c]
45-64	4.5	1.08 (1.00-1.16)	1.02 (0.94-1.09)	1.06 (0.99-1.14)	0.89 (0.82-0.95)
≥65	0.4	1.41 (0.95-1.88)	1.85 (1.33-2.36)	1.84 (1.34-2.34)	1.99 (1.49-2.49)[d]
Sex					
Male	4	0.96 (0.90-1.01)	0.93 (0.87-0.98)	0.85 (0.80-0.90)[b]	0.73 (0.68-0.78)[c]
Female	1.8	1.03 (0.94-1.11)	1.06 (0.98-1.15)	0.92 (0.84-1.00)	0.76 (0.69-0.83)[b]
Race or ethnicity					
Non-Hispanic white	0.2	1.29 (1.03-1.56)	1.37 (1.10-1.63)	1.49 (1.21-1.77)	1.86 (1.54-2.18)[b]
Non-Hispanic black	21.2	0.96 (0.91-1.01)	0.96 (0.91-1.01)	0.85 (0.80-0.89)[b]	0.69 (0.65-0.73)[c]
Hispanic	1.4	1.02 (0.84-1.21)	0.87 (0.70-1.03)	0.78 (0.63-0.93)	0.67 (0.54-0.81)[d]
Other	0.3	1.15 (0.41-1.89)	1.18 (0.46-1.90)	1.11 (0.43-1.79)	1.06 (0.41-1.70)

Abbreviations: ESRD, end-stage renal disease; HIV, human immunodeficiency virus; RRT, renal replacement therapy.

[a] Parameter estimates are either rates per million per year or standardized incidence ratios (95% CIs) (standardized to 2001-2002). $P \geq .05$ unless otherwise indicated.

Standardized incidence ratios were calculated and reported as [PE_{Obs}/PE_{Exp}] ([5% CL_{Obs}/PE_{Exp}] – [95% CL_{Obs}/PE_{Exp}]), with PE denoting the point estimate; CL, confidence limit; Obs, observed incidence rate; and Exp, expected incidence rate from rates seen in 2001 through 2002. *P* values refer to comparisons of observed rates and those expected when those seen in 2001 through 2002 were applied to the years under consideration.

[b] $0.01 \leq P < 0.05$ (vs, 2001-2002)

[c] $0.001 \leq P$ (vs. 2000) < 0.01 (vs. 2001-2002)

[d] P (vs. 2000) ≤ 0.001(vs. 2001-2002)