

# Linkage to care impacts survival with HIV infection, but the entire spectrum of care determines survival: a national study of US Veterans

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## **Abstract #135**



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Supported by VA HSR&D grant IBB 09-033 and the facilities and resources of the Michael E. DeBakey VA Medical Center, Houston.

The views expressed in this presentation are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

None of the authors has any conflicts of interest related to the content of this presentation.



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# Background

- The National HIV/AIDS Strategy seeks to improve linkage to care in the US from 65% to 85% by 2015.<sup>1</sup>
- The VA system is one of the largest single providers of HIV care in the US.<sup>2</sup>
- While early HIV diagnosis, receipt of ART, adherence to ART, and retention in care are known to predict survival, the effect of timely linkage to care on survival is not well documented.
- We wanted to identify if linkage predicted survival, on its own, and once success or failure in the other steps of HIV care (receipt of ART, adherence to ART, and retention in care) were accounted for.



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<sup>1</sup> National HIV/AIDS Strategy for the US, available at [www.whitehouse.gov/onap](http://www.whitehouse.gov/onap).

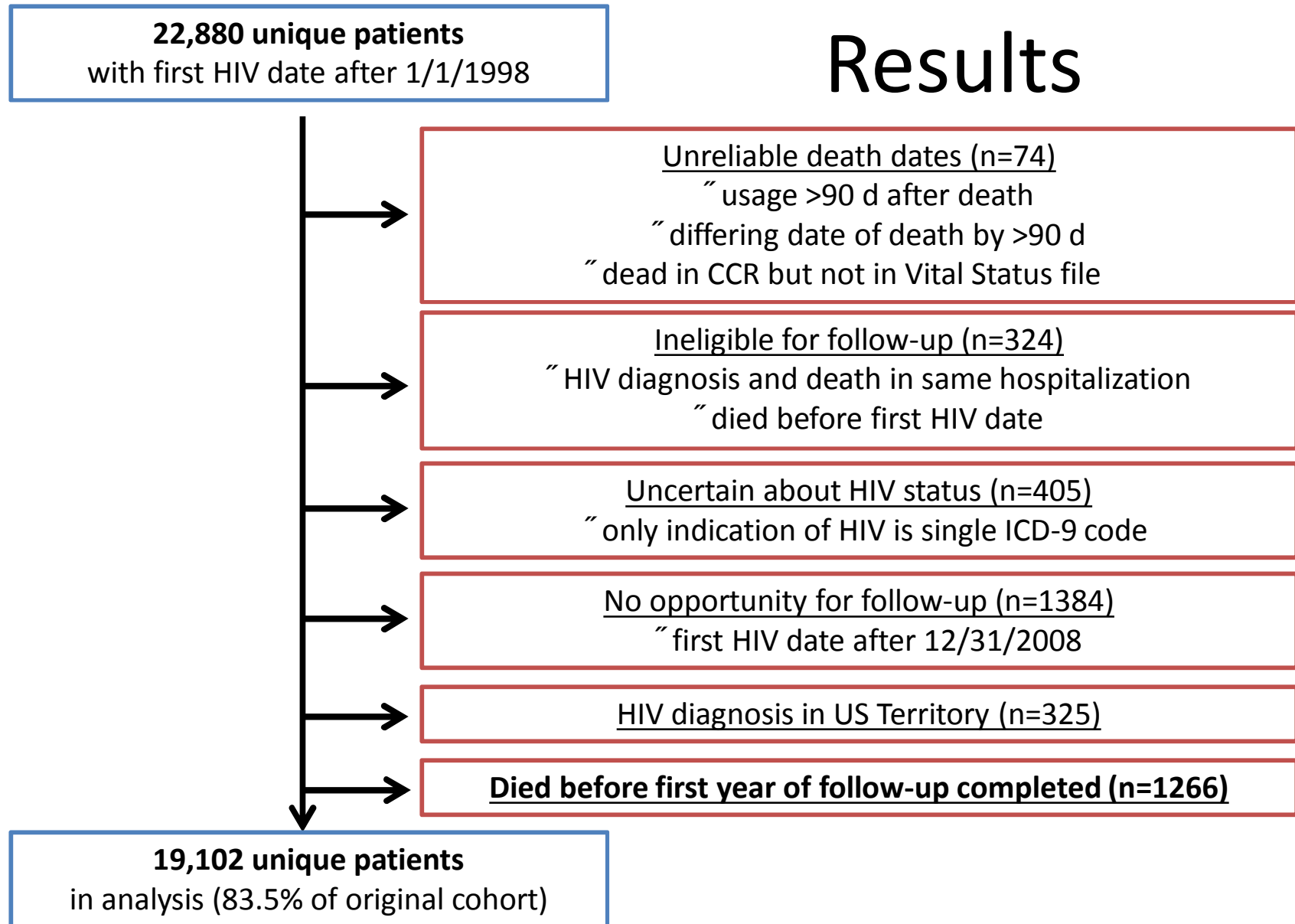
<sup>2</sup> Backus, *Arch Intern Med* 2010; 170:1239-1246.

# Methods

- “ Design: Retrospective cohort study.
- “ Data source: Clinical Case Registry (CCR), a national VA database of all HIV-infected veterans who received care at all VA facilities; each case is locally validated as HIV-positive.<sup>3</sup>
- “ Time frame: Persons identified in VA with HIV between January 1998 and December 2008, with follow-up through December 2009.
- “ VA HIV date: The date of identification of HIV-positive status in the VA, using laboratory, pharmacy, and ICD-9 data.
- “ Exposure Period: One year after VA HIV date (“Year 1”); persons who died during Year 1 were excluded.
- “ Linkage to care: Completed clinic visit in the Infectious Disease, Internal Medicine or Primary Care Clinic within 90 days of VA HIV date.
- “ Retention in care: Completed  $\geq 1$  visit per 4-month block in Year 1.
- “ Prescription of ART: Prescribed any ART during Year 1.
- “ Adherence to ART: Medication possession ratio during Year 1, using pharmacy data.
- “ Analysis: Kaplan-Meier curves and Cox proportional hazards regression models of death after Year 1.
- “ Missing Data: Because missing initial laboratory data were not uncommon, and are related to linkage and retention in care, we conducted 2 sets of analyses: first, where persons with missing data were included, and second, where such persons were excluded.



# Results



# Table 1: Baseline Characteristics

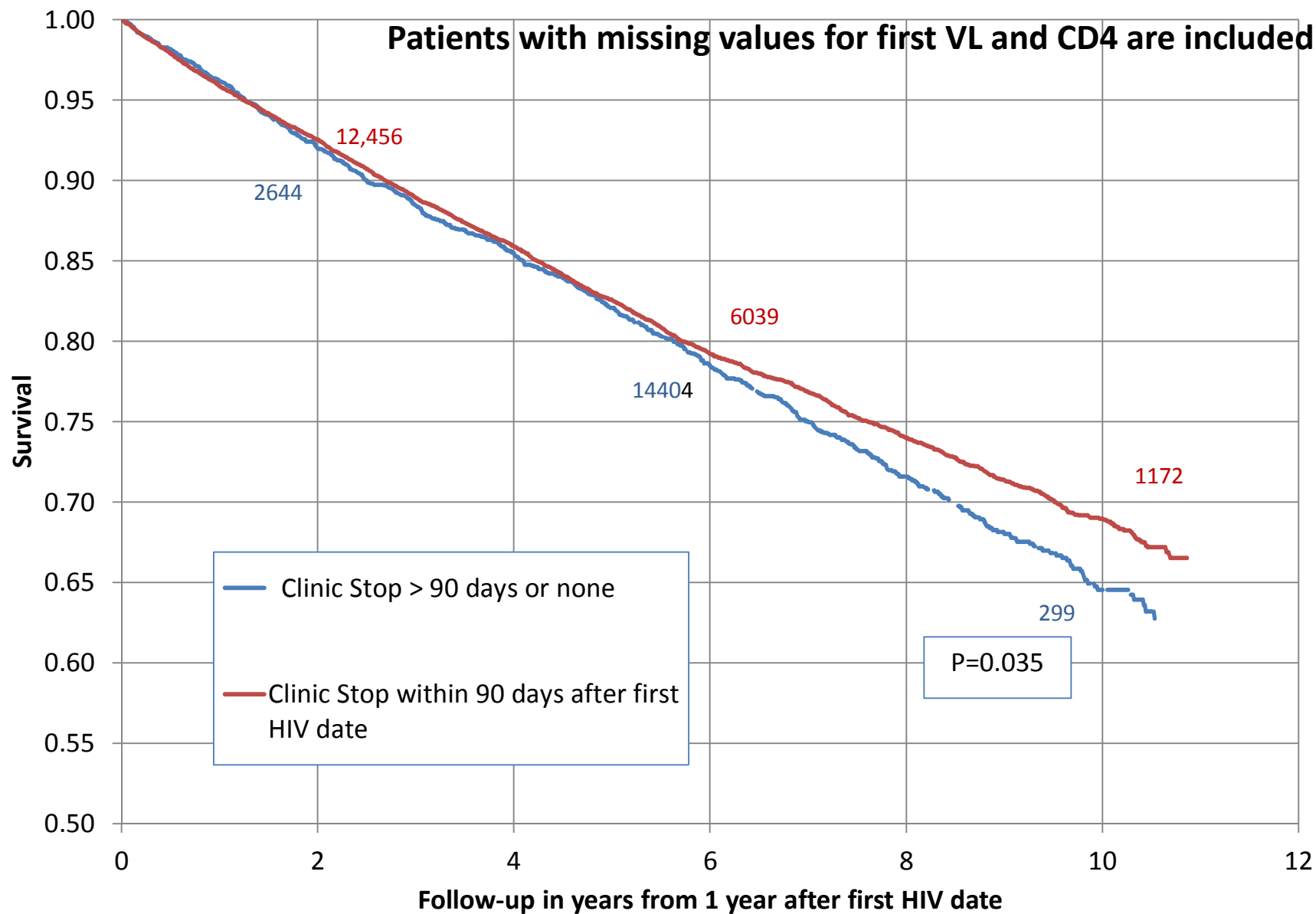
	%
<b>Sex</b>	
Females	2.9
Males	97.1
<b>Race</b>	
Black	50.8
White	35.3
Hispanic	5.3
Other, unk.	8.7
<b>Age</b>	
<40	23.1
40-49	37.8
50+	39.1
Mean (SD)	46.9 (10.4)

	%
<b>CD4 cell count (first)</b>	
≤ 200	28.5
200-500	34.0
> 500	24.2
Missing	13.3
Mean (SD)	370 (290)
<b>HIV viral load (first)</b>	
< 500	24.3
500-100,000	40.1
> 100,000	18.4
Missing	17.3
<b>Year of first HIV</b>	
1998-2000	31.1
2001-2008	68.9
Follow-up after first yr (yrs)	5.1 (3.1)

## Table 2: Linkage, Retention in Care, ART Use, and Adherence

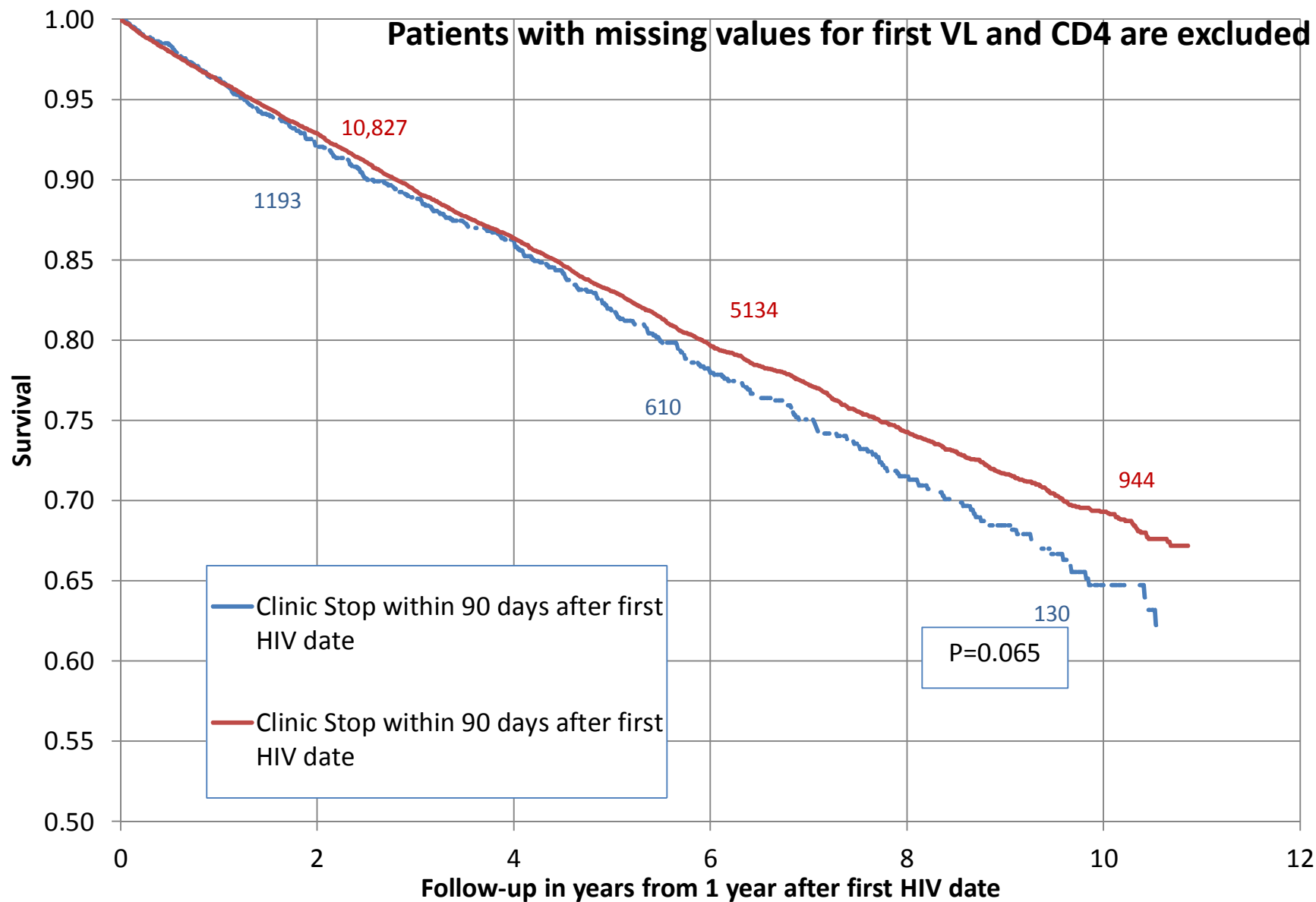
	Including Persons with Missing CD4 and/or VL	Excluding Persons with Missing CD4 and/or VL
<b>Step 1: Linkage to Care</b>		
Linked	83.2	90.4
Not linked	16.8	9.6
<b>Step 2: Retention in Care</b>		
3/3 blocks with appt	63.5	72.4
2/3 blocks with appt	17.7	17.2
1/3 blocks with appt	12.2	8.4
0/3 blocks with appt	6.6	2.1
<b>Step 3: ART Use and Adherence</b>		
No ART use in year 1	35.2	27.7
81-100% adherence	33.5	38.3
61-80% adherence	11.7	13.2
41-60% adherence	8.8	9.8
21-40% adherence	6.1	6.6
>0%-20% adherence	4.7	4.5

# Survival by Linkage Status





# Survival by Linkage Status



### Table 3: Steps and Mortality

	Adjusted Hazard Ratio (95% CI)	
	Including Persons with Missing CD4 and/or VL	Excluding Persons with Missing CD4 and/or VL
Model 1: Linkage to Care (adjusted for race, sex, age, CD4, VL, and era)		
Linked	Referent	Referent
Not linked	1.08 (0.99, 1.18)	1.19 (1.06, 1.34)*
Model 2: Retention in Care (adjusted for race, sex, age, CD4, VL, and era)		
3/3 blocks with appt	Referent	Referent
2/3 blocks with appt	1.29 (1.18, 1.41)*	1.30 (1.18, 1.43)*
1/3 blocks with appt	1.44 (1.30, 1.59)*	1.51 (1.34, 1.71)*
0/3 blocks with appt	1.45 (1.27, 1.65)*	1.77 (1.46, 2.15)*
Model 3: ART Use and Adherence (adjusted for race, sex, age, CD4, VL, and era)		
No ART use in year 1	Referent	Referent
81-100% adherence	0.48 (0.44, 0.53)*	0.46 (0.41, 0.51)*
61-80% adherence	0.72 (0.64, 0.80)*	0.72 (0.63, 0.81)*
41-60% adherence	0.95 (0.85, 1.07)	0.96 (0.85, 1.09)
21-40% adherence	1.22 (1.08, 1.38)*	1.16 (1.01, 1.33)*
>0%-20% adherence	1.34 (1.18, 1.52)*	1.22 (1.04, 1.42)*

# Table 4: Linkage to Care and Mortality: Single Model

	Adjusted Hazard Ratio (95% CI)	
	Including Persons with Missing CD4 and/or VL	Excluding Persons with Missing CD4 and/or VL
Linkage to Care		
Linked	Referent	Referent
Not linked	0.90 (0.80, 1.02)	0.93 (0.81, 1.08)
Retention in Care		
3/3 blocks with appt	Referent	Referent
2/3 blocks with appt	1.05 (0.96, 1.15)	1.05 (0.95, 1.16)
1/3 blocks with appt	1.07 (0.96, 1.20)	1.10 (0.96, 1.26)
0/3 blocks with appt	1.16 (0.97, 1.38)	1.35 (1.05, 1.74)*
ART Use and Adherence		
No ART use in year 1	Referent	Referent
81-100% adherence	0.49 (0.44, 0.54)*	0.48 (0.43, 0.54)*
61-80% adherence	0.73 (0.65, 0.83)*	0.75 (0.66, 0.86)*
41-60% adherence	0.97 (0.86, 1.09)	1.00 (0.88, 1.14)
21-40% adherence	1.23 (1.09, 1.39)*	1.19 (1.04, 1.37)*
>0%-20% adherence	1.33 (1.17, 1.51)*	1.22 (1.04, 1.42)*

# Discussion

- “ Linkage to HIV care in the VA, where both HIV care and medications are readily available, is generally adequate (83%-90%).
- “ Linkage to care within 90 days predicts decreased hazards of death, even after adjusting for demographics and HIV disease severity at entry.
- “ The effect of delayed linkage is overwhelmed by very poor retention in care and adherence to ART.
  - “ The difference between delayed linkage and very poor retention in this study may be considered semantic, as 0/3 retention is comprised of persons with delayed linkage (though not all persons with delayed linkage had 0/3 retention)
- “ Limitations:
  - “ No clinical data, so some persons were likely deliberately not started on ART.
  - “ Cannot distinguish newly diagnosed in the VA, newly diagnosed outside the VA but initiating care in the VA, and transferring from outside care to VA care.
  - “ Care outside the VA system is not accounted for.
  - “ There is a correlation between missing baseline lab data and linkage/retention in care, making interpretation of models including “missing” categories difficult.



# Conclusions

- “ Timely linkage to care predicts survival independent of initial disease severity.
- “ All of the steps of HIV care influence survival with HIV infection.
- “ Delayed linkage’s impact can be overcome by adherence to ART and retention in care.



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