Patterns of HIV Service Use and Viral Suppression among Patients Treated in an Academic Infectious Diseases Clinic in North Carolina

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Background

- Effective management of HIV disease requires regular medication adherence, lab assessments and **medical care**
  - Over 20% patients lost-to-care at any time
- Poor care retention associated with:
  - Delay in achieving or poor maintenance of viral suppression (VS)
  - HIV-related comorbidities
  - Increased mortality
- Risk factors for poor retention:
  - Public insurance
  - HIV without AIDS diagnosis

Background

- No consensus on optimal frequency of medical visits needed to sustain viral suppression
- Varied measures of HIV care retention:
  - No. of missed visits
  - % of visits attended (adherence)
  - Longest length of time without a visit (gaps in care)
  - % of 6-month intervals within a time period with a visit (visit constancy)
- Varied treatment guidelines:
  - **US Public Health Service**: 1 visit every 3-4 months until VS, then every 4-6 months
  - **HIV AIDS/Bureau (HAB) performance measure**: at least 2 visits per year, 90 days apart

Study Aim

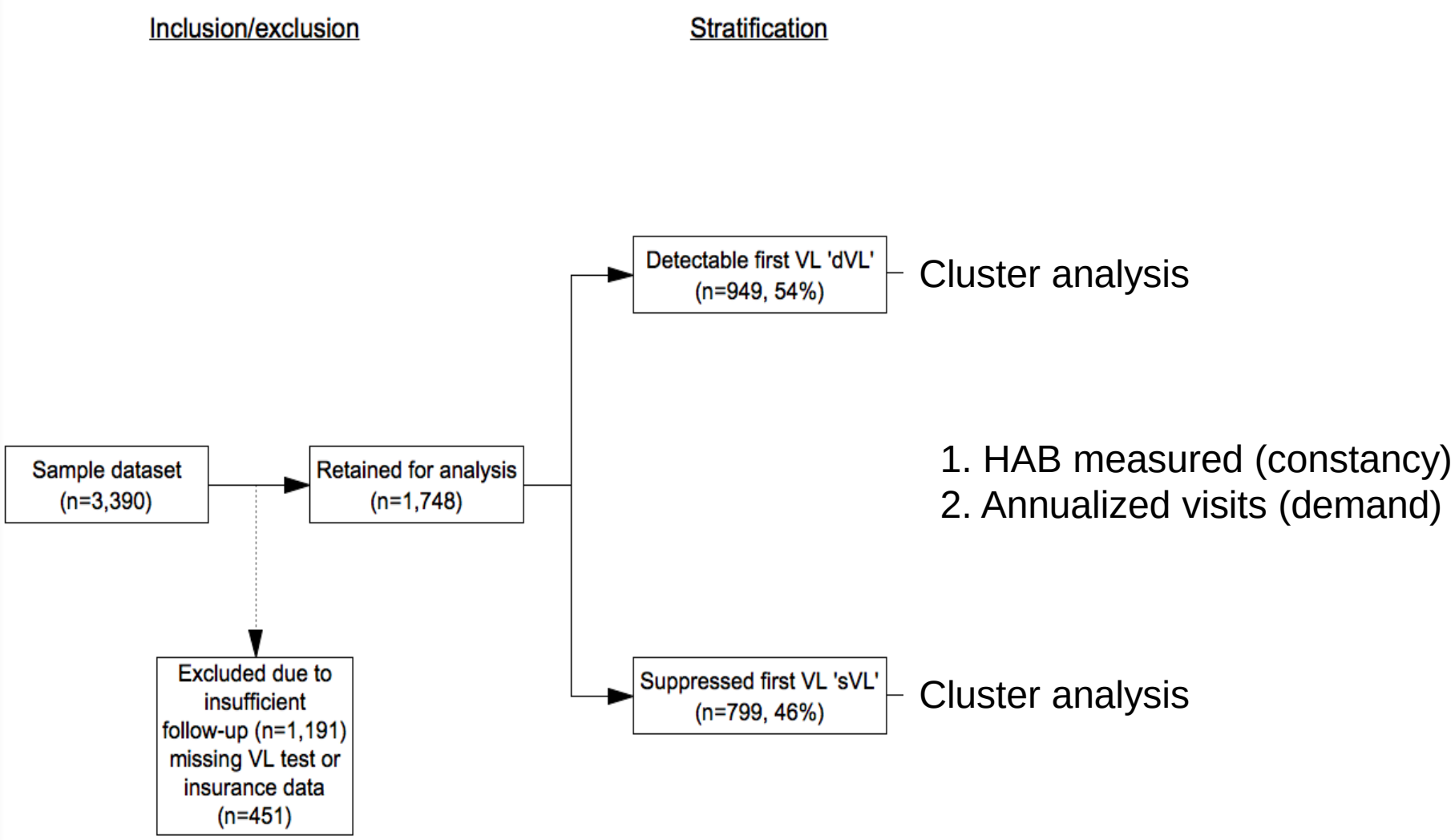
- To assess the influence of medical care use on patient outcomes in a clinic-based cohort

  - 1) Characterize long-term patient **use of medical care appointments** using cluster analysis
  - 2) Identify demographic or early clinical characteristics (**predictors**) associated with these service use patterns
  - 3) Identify associated **outcomes**, such as subsequent viral suppression, immune recovery, and hospital or emergency department (ED) admissions

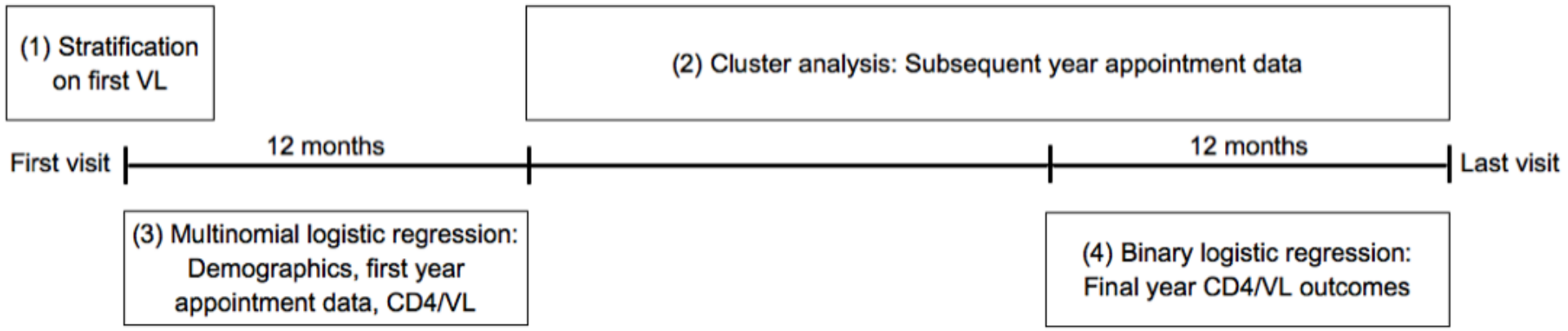
Data Source

- HIV medical visit dataset
  - University of North Carolina (UNC) Infectious Diseases Clinic
  - January 1st, 2005 – February 1st, 2012
  - linked with lab test (HIV VL, CD4 count) results, ED visits and hospitalizations
  - 43,195 unique HIV visits; n=3,390 patients

Sample selection and cluster analysis

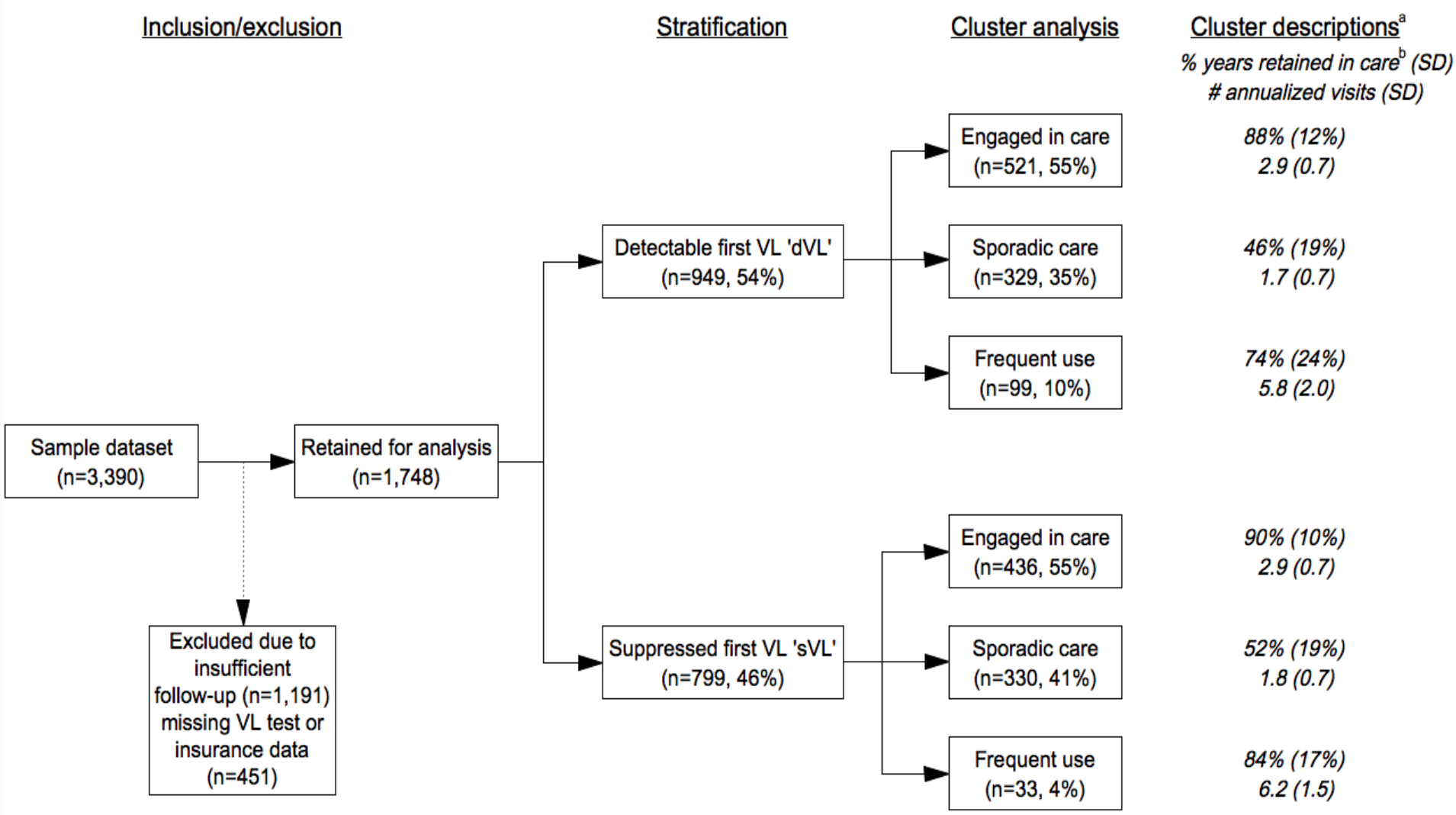


Methods: Analytic plan



1. **Stratification** – using first VL (400 copies/ml cut-point as proxy for in-care)
2. **Cluster analysis** – HAB performance measure and annualized visits (subsequent to first year)
3. **Multinomial regression** – predict service use clusters using early (first-year) predictors
4. **Binary logistic regression** – predict long-term outcomes using service use clusters

Results: Service use clusters



[a] Cluster descriptions show mean and standard deviations (SD) of variables used to construct clusters

[b] "% years retained in care" was defined as the mean percent of subsequent evaluation years (beginning 12 months after the first visit) meeting criteria for HAB-MV performance measure: at least 2 visits per year at least 90 days apart.

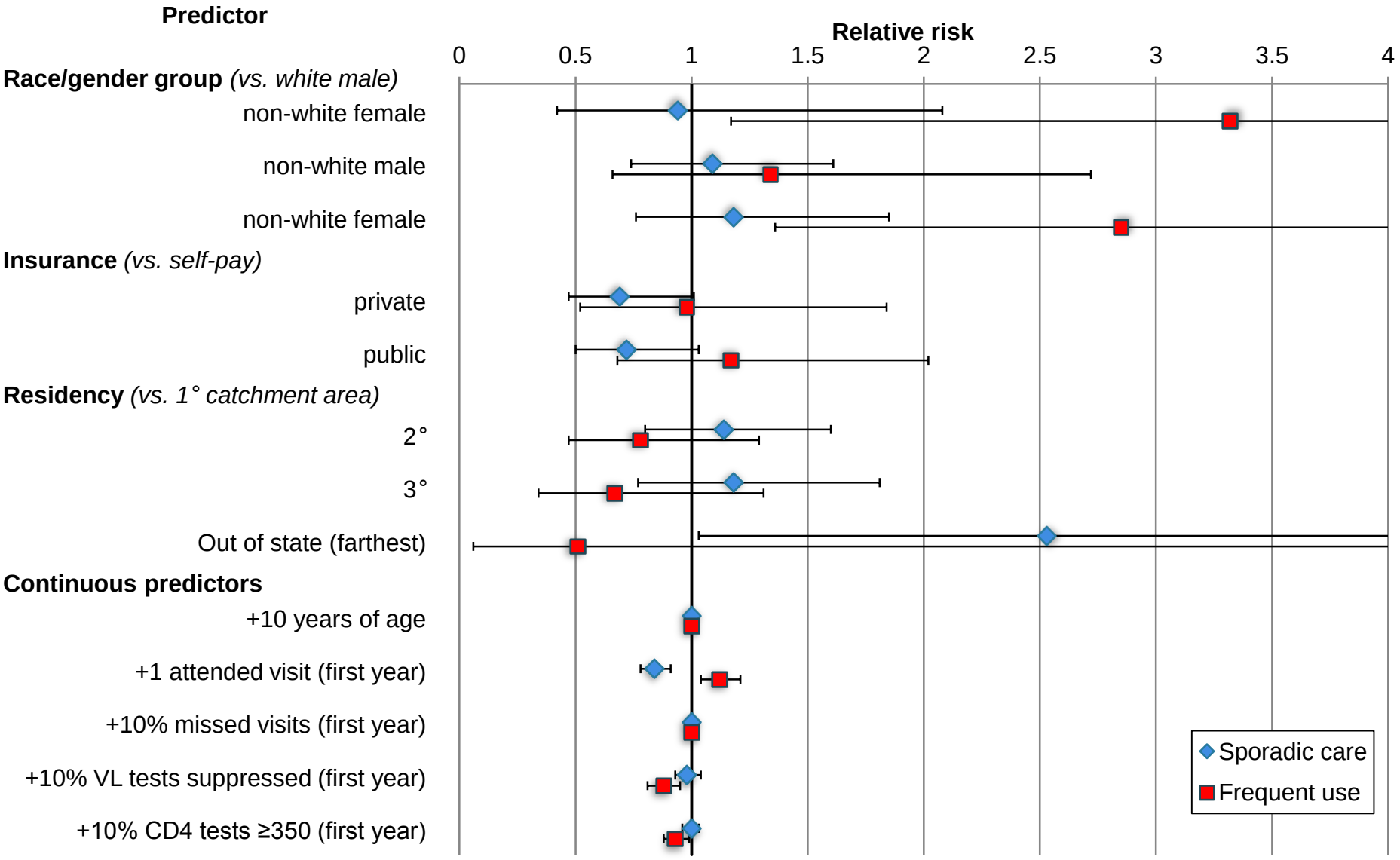
Cluster demographic characteristics

	Stratum Service use cluster		Detectable first VL (dVL) n=949 Engaged in care n=521	 Sporadic care n=329	 Frequent use n=99	p-value	Suppressed first VL (sVL) n=798 Engaged in care n=435	 Sporadic care n=330	 Frequent use n=33	p-value
Race/gender group	white male	n=197	61%	33%	6%	.013	60%	35%	5%	.196
	non-white male	n=44	55%	36%	9%		53%	38%	8%	
	white female	n=460	52%	30%	18%		51%	46%	4%	
	non-white female	n=248	50%	35%	15%		55%	41%	4%	
Insurance status	self-pay	n=332	50%	40%	9%	.017	50%	45%	5%	.020
	private	n=255	59%	33%	8%		57%	42%	1%	
	public	n=362	56%	31%	13%		55%	39%	6%	
Distance to clinic (by county)	1st (nearest)	n=292	56%	31%	13%	.155	58%	37%	5%	.408
	2nd	n=448	55%	35%	10%		53%	44%	4%	
	3rd	n=185	56%	36%	8%		56%	41%	3%	
	4th (farthest)	n=24	42%	54%	4%		47%	41%	12%	
Age at entry, mean (SD)			41 (11)	38 (11)	39 (10)	<.001	44 (11)	42 (10)	45 (10)	.036

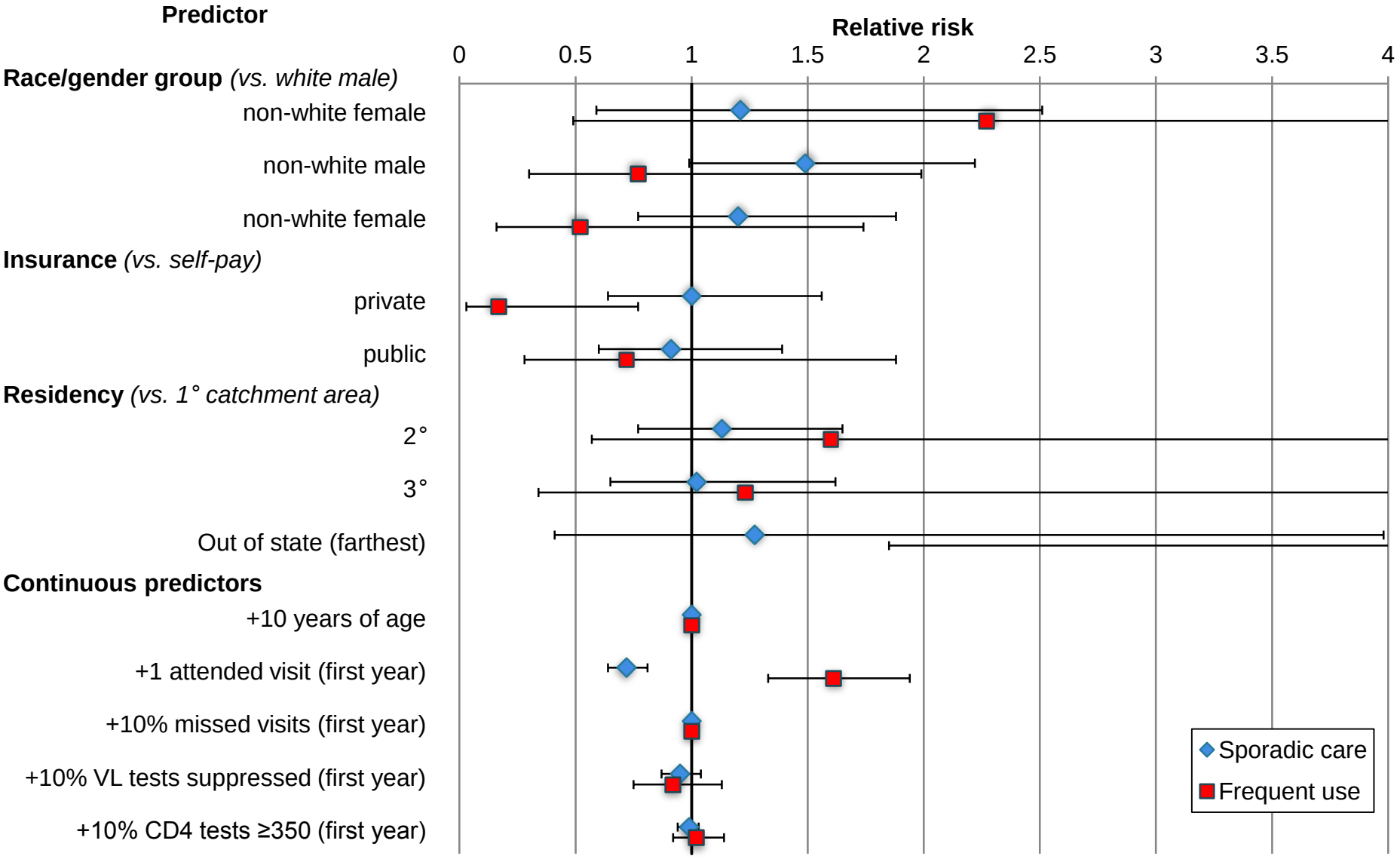
Cluster clinic use characteristics

Stratum / Cluster	Detectable first VL: Engaged in care	Detectable first VL: Sporadic care	Detectable first VL: Frequent use	p-value	Suppressed first VL: Engaged in care	Suppressed first VL: Sporadic care	Suppressed first VL: Frequent use	p-value
First year								
Attended visits (no.), mean (SD)	4.9 (2.4)	4.0 (2.4)	5.7 (3.7)	<.001	3.8 (1.4)	3.1 (1.5)	6.1 (3.3)	<.001
Missed visits (%)	8%	15%	10%	<.001	4%	8%	10%	<.001
HIV RNA <400c/mL (%)	28%	23%	23%	.021	93% (17)	92%	88%	.140
CD4 ≥350 c/μL (%)	48%	53%	35%	<.001	75%	74%	68%	.542
Subsequent years								
Missed visits (%)	26%	35%	24%	<.001	23%	31%	18%	<.001
HIV RNA <400c/mL (%)	73%	56%	58%	<.001	91%	84%	86%	<.001
CD4 ≥350 c/μL (%)	68%	63%	45%	<.001	82%	79%	73%	.190
All years								
Observation (years), mean (SD)	4.6 (1.7)	3.6 (1.8)	4.5 (1.8)	<.001	5.5 (1.5)	4.5 (1.9)	4.6 (1.8)	<.001
Ever visited ED? (%)	34%	29%	69%	<.001	30%	24%	64%	<.001
Ever hospitalized? (%)	48%	39%	71%	<.001	37%	27%	64%	<.001

Predictors: Risk ratios for service use clusters compared with “engaged in care”
Stratum: Detectable first VL (dVL)

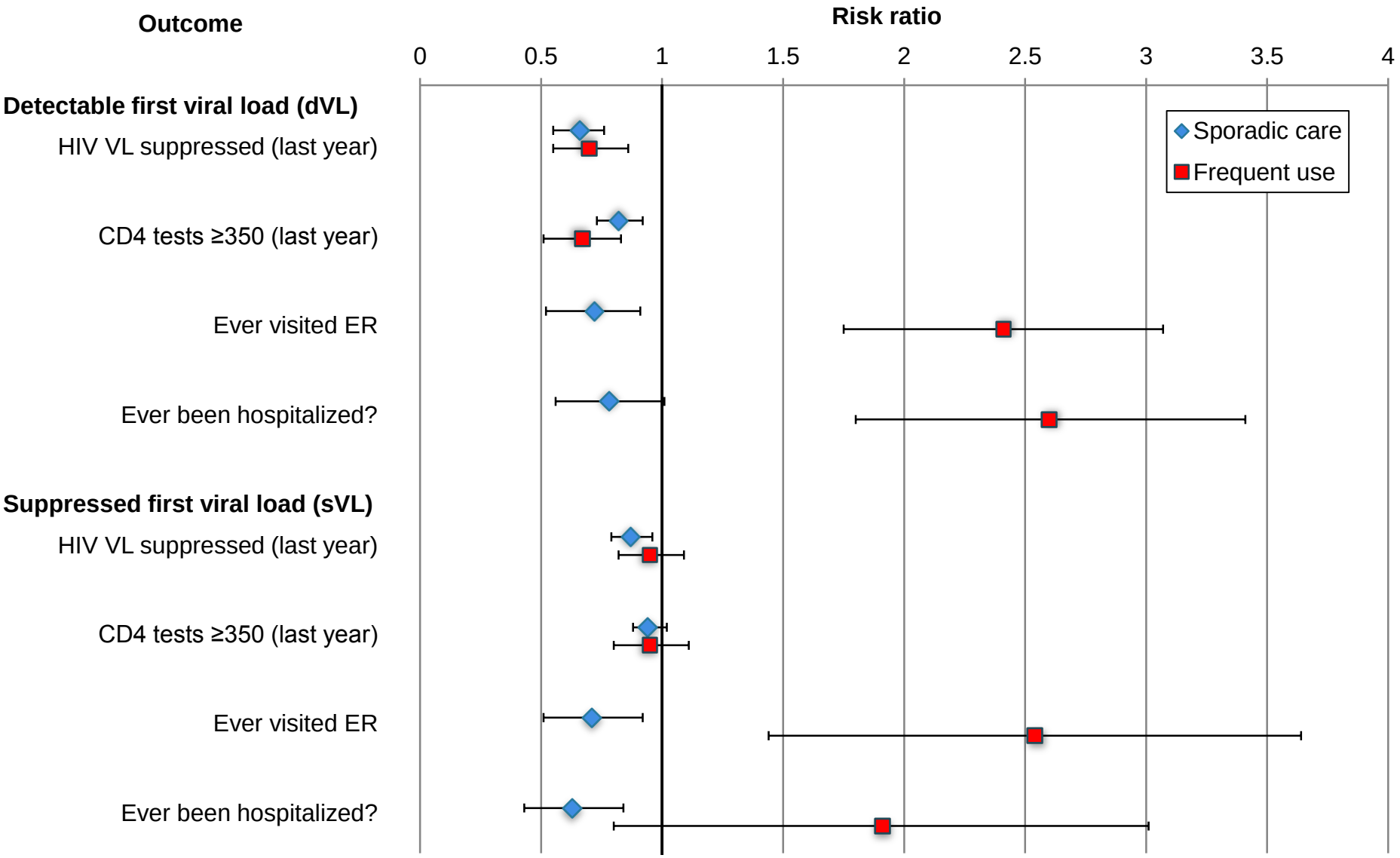


Predictors: Risk ratios for service use clusters compared with “engaged in care”
Stratum: Suppressed first VL (sVL)



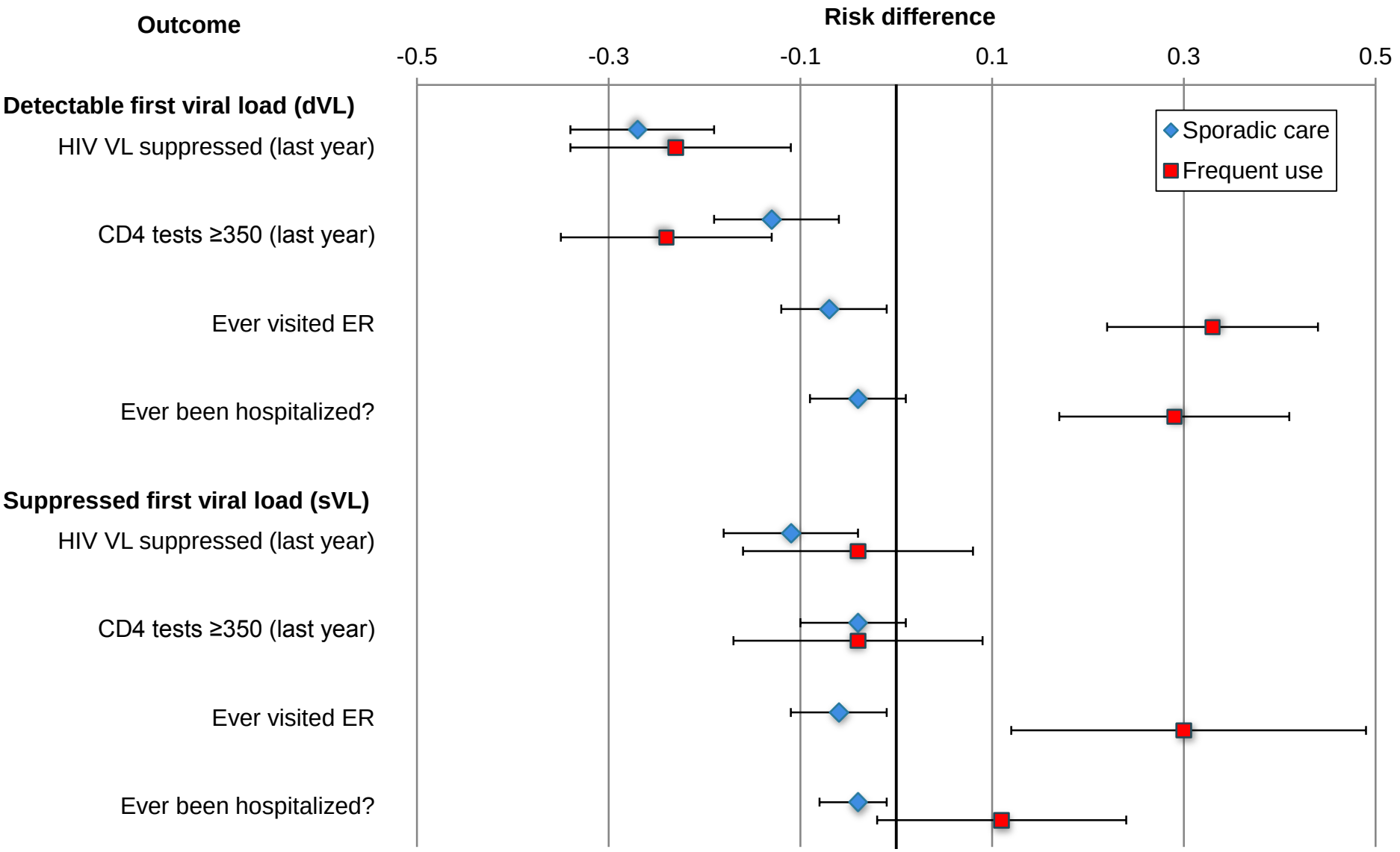
Outcomes: Risk ratios compared with “engaged in care” cluster

*estimated for each cluster, adjusting for race/gender group, insurance status, age



Outcomes: Risk differences compared with “engaged in care” cluster

*estimated for each cluster, adjusting for race/gender group, insurance status, age



Limitations

- Ryan White clinic
- Observational study – potential truncation of observation time for each patient
- Information from other care sites - not available
- Pregnancy information was not available
- No information regarding barriers that limited retention or suppression

Conclusions

- Long-term HIV medical care behaviors, represented by three outpatient medical care use patterns: routine (engaged), sporadic and frequent
- Sporadic care patients had lower viral loads than patients with regular care
- A small group of patients in each strata had a high use of medical appointments but the viral load suppression was similar to those with sporadic care

Conclusions

- No association with race and ethnicity in patients with more than 2 visits
  - Inclusion/exclusion was associated with race/ethnicity
  - This may explain prior difference in literature – some analyses race is associated with retention in care
- Supported use of HAB retention measure
- Used visit data typically available
  - Can be constructed for prediction

Thank you

Table: Risk ratios of outcomes compared with "engaged in care" cluster

Stratum	Detectable first viral load (dVL)		Suppressed first viral load (sVL)	
	Sporadic care	Frequent use	Sporadic care	Frequent use
Outcome	Risk ratio (95% CI)		Risk ratio (95% CI)	
HIV VL suppressed (last year)	0.66 (0.55, 0.76)*	0.70 (0.55, 0.86)*	0.87 (0.79, 0.96)*	0.95 (0.82, 1.09)
CD4 tests ≥350 (last year)	0.82 (0.73, 0.92)*	0.67 (0.51, 0.83)*	0.94 (0.88, 1.02)	0.95 (0.80, 1.11)
Ever visited ER	0.72 (0.52, 0.91)*	2.41 (1.75, 3.07)*	0.71 (0.51, 0.92)*	2.54 (1.44, 3.64)*
Ever been hospitalized?	0.78 (0.56, 1.01)	2.60 (1.80, 3.41)*	0.63 (0.43, 0.84)*	1.91 (0.80, 3.01)
	Risk difference (95% CI)		Risk difference (95% CI)	
HIV VL suppressed (last year)	-0.27 (-0.34, -0.19)*	-0.23 (-0.34, -0.11)*	-0.11 (-0.18, -0.04)*	-0.04 (-0.16, 0.08)
CD4 tests ≥350 (last year)	-0.13 (-0.19, -0.06)*	-0.24 (-0.35, -0.13)*	-0.04 (-0.10, 0.01)	-0.04 (-0.17, 0.09)
Ever visited ER	-0.07 (-0.12, -0.01)*	0.33 (0.22, 0.44)*	-0.06 (-0.11, -0.01)*	0.30 (0.12, 0.49)*
Ever been hospitalized?	-0.04 (-0.09, 0.01)	0.29 (0.17, 0.41)*	-0.04 (-0.08, -0.01)*	0.11 (-0.02, 0.24)

*estimated for service use cluster membership, adjusted for race/gender, insurance, age at entry

Table: Comparison of included vs. excluded patients

Variable		Excluded (n=1,592)	Included (n=1,798)	p-value
Race/Gender group	white male	285 (22%)	432 (24%)	
	white female	124 (10%)	100 (6%)	0.000
	non-white male	562 (44%)	815 (45%)	
	non-white female	306 (24%)	451 (25%)	
Insurance status	self-pay	314 (43%)	552 (31%)	
	private	172 (24%)	539 (30%)	0.000
	public	236 (33%)	707 (39%)	
County of residence	primary	300 (23%)	513 (29%)	
	secondary	633 (50%)	868 (48%)	0.000
	outer	287 (22%)	374 (21%)	
	out of state	57 (4%)	43 (2%)	
Age at entry (years)	mean (SD)	40.3 (0.35)	41.0 (0.26)	0.087
Annualized visits, 1st year	mean (SD)	2.44 (0.06)	4.18 (0.05)	0.000
First HIV detectable	No (≥400c/mL)	656 (65%)	949 (54%)	0.000
	Yes (<400c/mL)	350 (35%)	799 (46%)	
First CD4 ≥350c/mL	No	462 (44%)	773 (43%)	0.626
	Yes	581 (56%)	1010 (57%)	
Ever hospitalized	%	846 (66.3%)	1070 (59.5%)	0.000
Ever visited ER	%	1031 (80.7%)	1222 (68.0%)	0.000

**Some totals for excluded patients do not add up to n=1,592 due to missing data*