

## Background

Incidence and prognosis of a number of chronic diseases are known to vary by socio-economic status<sup>1</sup>. However, little is known about the effect of social deprivation on HIV treatment outcomes in the UK, a setting with universal free access to healthcare, including HIV diagnosis and treatment.

Any impact of socio-economic status on virological outcome may be mediated in part through differential patterns of adherence to antiretroviral treatment (ART)<sup>2,3</sup>.

Using data from the Antiretrovirals, Sexual Transmission Risk and Attitudes (ASTRA) study<sup>4</sup>, we investigated the association between socio-economic status and virological rebound, among individuals with initial virological suppression on ART in the UK.

## Methods

ASTRA is a questionnaire study of 3258 individuals from 8 UK HIV outpatient clinics in 2011/2012 with longitudinal linkage to clinical records for consenting participants (92%) at 4 clinics.

This analysis includes 1490 participants who had viral load (VL) ≤50 c/mL at the time of the questionnaire (baseline), had received ART for >6 months at the time of baseline VL, and had ≥1 subsequent VL measure.

We considered the following questionnaire-assessed socio-economic factors: financial hardship, employment, housing, education, time in UK, English reading ability, and social support (using the modified Duke-UNC functional social support questionnaire).

Self-reported ART non-adherence was assessed by questionnaire and defined as missing ART for ≥2 consecutive days in the 3 months prior to baseline (0; 1; ≥2).

Individuals were followed from baseline until virological rebound (1<sup>st</sup> VL>200 c/mL) or last available VL (latest April 2014). Follow-up was not censored if ART was interrupted.

We calculated the percentage who had experienced virological rebound, by socio-economic factor, using Kaplan-Meier plots.

The association between each socio-economic factor and virological rebound was assessed in separate Cox regression models. Then each model was adjusted for (i) demographic factors (gender/sexual orientation, ethnicity, age, centre of care) only and (ii) demographic factors and baseline non-adherence.

Sensitivity analyses considered (i) rebound as 2 consecutive VL>200 c/mL, (ii) rebound as a single VL>50 c/mL (iii) additionally counting ART interruption as rebound.

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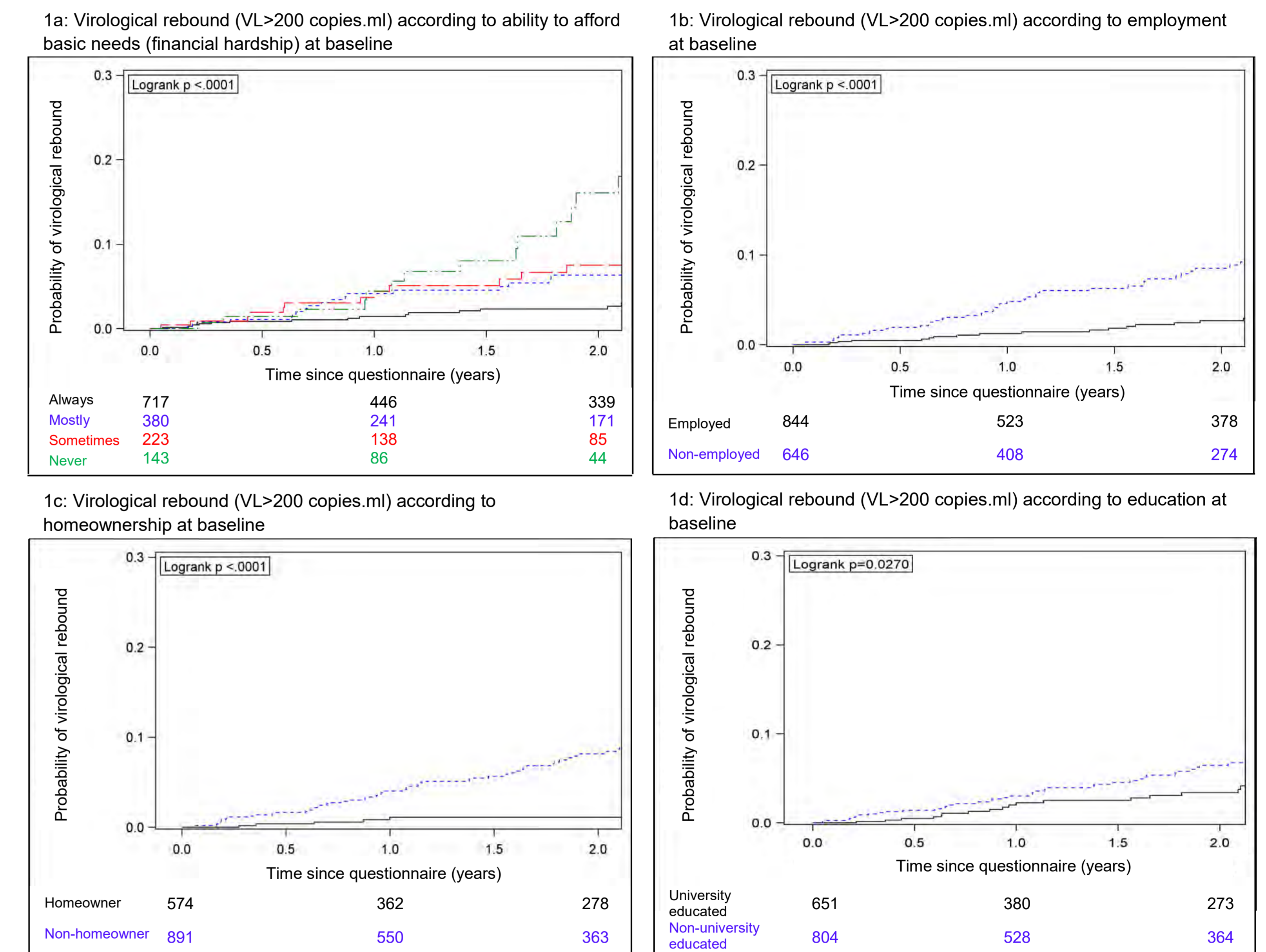
## Results

**Table 1. Socio-economic characteristics of participants (N=1490)**

Factor		N	%	Factor		N	%
Gender/sexual orientation	MSM	1123	75	Housing	Homeowner	574	39
	Non-MSM Men	141	9		Renting from council	451	30
Ethnicity	Women	226	15		Renting privately	327	22
	White	1107	74		Temporary/homeless	30	2
	Black	254	17		Staying with family	79	5
Age	Other/missing	129	9	Other/missing	29	2	
	<30 years	36	2	Education (highest level)	University degree or higher	651	44
	30-49 years	940	64		Secondary school	591	40
≥50 years	484	33	None		152	10	
Other/missing	129	9	Other/missing		96	6	
Money for basic needs? (Financial hardship)	Always	717	48	Time in UK	Born in UK	869	58
	Mostly	380	26		In UK > 5 years	821	55
	Sometimes	223	15		In UK ≤5 years	52	3
Employment	No	143	10	English reading ability	Native English	869	58
	Employed	844	57		Fluent	489	33
	Unemployed	245	16		Not fluent	89	6
	Sick/disabled	201	13	Social support	High	884	59
	Retired	109	7		Medium	448	30
Other/missing	91	6	Low		142	10	

- 65/1490 experienced virological rebound (rate 2.8/100 person-years; 95% CI 2.1-3.5) over a follow-up period of 2361 person-years (median 3 (range 1-17) VL measures per person).
- The percentage who had experienced virological rebound by 2 years (5.4%; 95% CI 4.0-6.8) was significantly higher among those reporting they were unable to afford basic needs, non-employed, non-homeowners, non-university educated and those with lowest social support score (Figure 1 and Table 2).
- After adjustment for demographic factors, the following were associated with higher risk of virological rebound: increasing financial hardship, non-employment, non-homeownership, non-university education, and low social support score (Table 2).
- Although further adjustment for baseline non-adherence did not fully explain the associations, they were attenuated (Table 2).
- All sensitivity analyses, (i) rebound as 2 consecutive VL>200 c/mL, (ii) rebound as a single VL>50 c/mL (iii) additionally counting ART interruption as rebound, were consistent.

**Figure 1a-d. Probability of virological rebound over time by socio-economic factor (N=1490)**



**Table 2. Association between socio-economic factors and risk of virological rebound (N=1490)**

Socio-economic factor*	Rate <sup>†</sup>	Unadjusted				Adjusted for demographics*			Adjusted for demographics* and non-adherence <sup>‡</sup>		
		HR	95% CI	p	aHR	95% CI	p	aHR	95% CI	p	
Money for basic needs? (Financial hardship)	Always	1.48	1		<.0001*	1		0.0075*	1		0.0993*
	Mostly	3.28	2.22	(1.16, 4.24)		1.84	(0.94, 3.61)		1.72	(0.88, 3.38)	
	Sometimes	3.80	2.57	(1.25, 5.30)		1.86	(0.85, 4.04)		1.22	(0.54, 2.76)	
	No	7.14	4.87	(2.43, 9.77)		2.97	(1.36, 6.47)		2.21	(1.00, 4.91)	
Employed	Yes	1.42	1		<.0001	1		<.0001	1		0.0003
	No	4.51	3.18	(1.86, 5.43)		3.72	(2.06, 6.71)		3.05	(1.67, 5.58)	
Homeowner	Yes	0.64	1		<.0001	1		0.0004	1		0.0010
	No	4.28	6.71	(2.90, 15.53)		4.81	(2.02, 11.44)		4.31	(1.80, 10.31)	
University education	Yes	1.81	1		0.0295	1		0.0548	1		0.1124
	No	3.35	1.84	(1.06, 3.18)		1.78	(0.99, 3.21)		1.62	(0.89, 2.93)	
Time in UK	Born in UK	2.38	1		0.2033	1		0.6526	1		0.2889
	In UK >5 years	3.36	1.43	(0.86, 2.39)		0.77	(0.38, 1.57)		0.65	(0.30, 1.37)	
	In UK ≤5 years	5.03	2.11	(0.75, 5.94)		1.18	(0.39, 3.56)		1.25	(0.42, 3.73)	
English reading ability	Native English	2.38	1		0.2316	1		0.8497	1		0.5969
	Fluent	3.30	1.41	(0.83, 2.38)		0.82	(0.41, 1.64)		0.76	(0.37, 1.55)	
	Not fluent	4.42	1.88	(0.79, 4.47)		0.84	(0.28, 2.53)		0.59	(0.19, 1.77)	
Social support	High	1.86	1		0.0011*	1		0.0017*	1		0.0434*
	Medium	3.59	1.94	(1.12, 3.35)		2.00	(1.13, 3.56)		1.57	(0.87, 2.84)	
	Low	5.39	2.89	(1.49, 5.62)		2.77	(1.35, 5.68)		2.03	(0.96, 4.27)	

\* each socio-economic factor considered in a separate model for all results; \* gender/sexual orientation, ethnicity, age and centre of care; \* self-reported number of times ≥2 consecutive days of ART missed in 3 months prior to baseline (0; 1; ≥2); <sup>†</sup> per 100 person-years; <sup>‡</sup> test for trend; aHR=adjusted Hazard Ratio

## Conclusions

Even in this setting with free access to healthcare, and low rates of virological rebound, we observed a strong association between social deprivation and increased risk of rebound among people with initial virological suppression, suggesting that personal and social circumstances impact substantially on the success of HIV treatment.

Our results suggest that these associations are, at least in part, mediated through difficulties in taking ART.

Targeted adherence interventions and increased social support for those most at risk should be considered.

We need a better understanding of the drivers of low adherence in these groups to inform effective support strategies.

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References: 1) Marmot et al. Public Health. 2012;126:S4-S10. 2) Robbins et al. JAIDS (1999). 2007;44(1):30. 3) Howard et al. AIDS. 2002;16(16):2175-82. 4) Speakman et al. PLoS One. 2013;8(10):e77230.