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Annabel Desgrees-Du-Lou, Julie Pannetier, Andrainolo Ravalihasy, Mireille Le Guen, Anne Gosselin, et al.. Is hardship during migration a determinant of HIV infection? Results from the ANRS PARCOURS study of sub-Saharan African migrants in France. *AIDS. Official journal of the international AIDS Society*, 2016, 30 (4), pp.645-656. 10.1097/QAD.0000000000000957 . hal-04039778

HAL Id: hal-04039778

<https://hal.science/hal-04039778>

Submitted on 6 Jun 2023

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Is hardship during migration a determinant of HIV infection? Results from the ANRS PARCOURS study of sub-Saharan African migrants in France

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Objectives: In Europe, sub-Saharan African migrants are a key population for HIV infection. We analyse how social hardships during settlement in France shape sexual partnerships and HIV risk.

Design: PARCOURS is a life-event survey conducted in 2012–2013 in 74 health-care facilities in the Paris region, among three groups of sub-Saharan migrants: 926 receiving HIV care (296 acquired HIV in France), 779 with chronic hepatitis B, and 763 with neither HIV nor hepatitis B (reference group).

Methods: Hardships (lack of residence permit, economic resources and housing) and sexual partnerships were documented for each year since arrival in France. For each sex, reported sexual partnerships were compared by group and their associations with hardships each year analysed with mixed-effects logistic regression models.

Results: Hardships were frequent: more than 40% had lived a year or longer without a residence permit, and more than 20% without stable housing. Most of the migrants had nonstable and concurrent partnerships, more frequent among those who acquired HIV in France compared with reference group, as were casual partnerships among men (76.7 vs. 54.2%; $P=0.004$) and women (52.4 vs. 30.5%; $P=0.02$), concurrent partnerships among men (69.9 vs. 45.8%; $P=0.02$), and transactional partnerships among women (8.6 vs. 2.3%; $P=0.006$). Hardship increased risky behaviours: in women, lacking a residence permit increased casual and transactional partnerships [resp. odds ratio (OR) = 2.01(1.48–2.72) and OR = 6.27(2.25–17.44)]. Same trends were observed for lacking stable housing [OR = 3.71(2.75–5.00) and OR = 10.58 (4.68–23.93)].

Conclusion: Hardships faced by migrants increase HIV risks. Women, especially during the period without stable housing, appear especially vulnerable.

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AIDS 2016, **30**:645–656

Keywords: African migrants, France, hardship, hepatitis B, HIV acquisition, sexual risk

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Received: 30 June 2015; revised: 12 October 2015; accepted: 21 October 2015.

DOI:10.1097/QAD.0000000000000957

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Introduction

In the European Union, people from sub-Saharan Africa remain a key population for HIV infection, despite the recent decreasing trend in the number of new diagnoses among them [1]. In France, HIV incidence is an estimated 29 times higher among men and 69 times higher among women of sub-Saharan origin compared with men and women in the general heterosexual population, respectively [2]. This group ranks second, behind MSM [3–5], among those most affected by HIV and has a high prevalence of chronic hepatitis B [6,7].

These rates are due not only to a high prevalence of these infectious diseases in their countries of origin but also, for HIV, to infection after arrival in Europe. In the United Kingdom, for example, the proportion of Africans living with HIV who acquired it after arriving is estimated at 31% [8]. At least 35% of sub-Saharan Africans living with HIV in France acquired it in France [9].

These postmigration infections may be attributable to sexual risk behaviours within intra-African sexual networks where HIV prevalence is high [10]. African men in the United Kingdom report more partners and a higher frequency of concurrent partnerships than non-African men. Although African women do not differ from other women in their sexual behaviour, their higher frequency of sexually transmitted infections (STIs) suggests they are subject to sexual risks by their sexual networks [11].

International migration causes occupational and social disruptions, including residential and conjugal instability, that may generate such risky behaviours [12]. Increasing barriers to immigration in the European Union may reinforce these difficulties upon arrival [13]. Qualitative studies among migrants have shown that adverse living conditions lead to sexual harassment or transactional sexuality in exchange for basic goods, accommodations, and help in coping with an illegal stay [14,15]. However, to the best of our knowledge, no quantitative studies have addressed the extent to which social hardships throughout the migration process shape sexual partnerships.

National sexual behaviour surveys show that sexual and preventive behaviours largely depend on social status [16,17]. They have not, however, investigated migratory pathways or hardships in detail in France, as the sample sizes by country of birth have prevented a focus on migrant-specific issues [16].

Using data from a large life-event survey of people from sub-Saharan Africa living in France, we aim to investigate the extent to which social hardships during the migration trajectory may act as distal factors of HIV infection by exposing sub-Saharan African migrants to sexual partnerships that may be risky for STIs and HIV. In this article, we describe sexual partnerships after migration in relation

to HIV status and how these postmigration sexual partnerships are associated with economic, housing and administrative hardships.

Methods

Study design and participants

The PARCOURS study was conducted to analyse how health trajectories and social and migratory paths are interlaced for migrants from sub-Saharan Africa living in France. This retrospective quantitative life-event survey was conducted from February 2012 to May 2013 in health-care facilities in the greater Paris metropolitan area (Ile-de-France) among three groups of migrants born in sub-Saharan Africa: one group receiving HIV care, one group with chronic hepatitis B (and not HIV infected), and a third group of people visiting primary-care centres. Recruitment took place at facilities randomly selected from an exhaustive list of HIV outpatient hospital clinics (24), hepatitis treatment clinics (20) and general practice medical centres (30).

Patients were eligible if they were born in sub-Saharan Africa, aged 18 to 59, diagnosed at least 3 months earlier with HIV infection or chronic hepatitis B (for those groups), and not diagnosed with either HIV or hepatitis B for the primary-care group. Doctors asked all eligible patients, except those with major cognitive or health impairments, to participate and collected their written consent.

A trained interviewer administered a face-to-face standardized life-event history questionnaire to each participant. Information collected included socio-demographic characteristics, conditions of migration and life in France, relational, sexual, and reproductive history, and health-care pathways, including HIV and hepatitis B virus (HBV) testing. Each dimension of interest was documented year by year from birth until the time of data collection. Same sex experience was documented by number of male and female partners over the lifetime (sex of the partner at each relationship was not available). Condom use with each partner was documented only for the last 12-month period.

Clinical and laboratory information was documented from medical records. All information was anonymously collected.

Participants received 15€ vouchers. The Advisory Committee on Data Collection in Health Research (CCTIRS) and the French Data Protection Authority (CNIL) both approved this project.

The complete survey protocol is registered on ClinicalTrials.gov (NCT02566148).

Groups of interest

Based on earlier work [9], we divided the HIV group into two subgroups according to whether they were estimated at more than 95% probability to have been infected before or after arrival in France. The analysis considers four groups: two groups with HIV infection, one group who acquired HIV before arrival (HIV-BFR) and one who acquired HIV after arrival in France (HIV-FR); one group with chronic hepatitis B (CHB group), namely with a chronic sexually communicable disease that is different from HIV, and the reference group with neither HIV nor hepatitis B (REF GROUP).

Outcomes and variables of interest

For each year between arrival in France and year of data collection, four sexual partnership types were investigated: stable, casual, transactional partnerships, and paid sex. A stable partnership was defined as a partnership that lasted at least a year, a casual partnership as one lasting less than a year or reported as short or casual, and a transactional partnership as one that was accepted, but unwanted, to obtain housing, clothes, food, papers, or money. Paid sex was defined as reporting paying someone to have sex. As we could not detail all the sexual partnerships within a year, we constructed a proxy for concurrency: partnerships were considered concurrent if at least two relationships of any type occurred within the same year.

For each of the five partnerships (stable, casual, transactional, paid and concurrent), we used two measures: reported at least once while living in France (yes/no), and a time-dependent variable; that is, reported each year from arrival in France to year of data collection (yes/no for a given year).

The migrants' living conditions in France were documented for each year between arrival and year of data collection through three variables: residence permit (permanent or 10 years, temporary or 1–3 years, or none), economic resources (from their work, from a spouse or other family member, state allowance, none) and housing situation (had their own housing, housed by family, associations or workers' hostels, no stable housing), again treated as time-dependent variables. We also measured three indicators of experience of legal, economic and housing hardships: whether the individual had lived for at least 1 year in France without a residence permit, without economic resources, and without stable housing.

Statistical analyses

First, socio-demographic characteristics, main reasons for coming to France, hardships in France and condom use in the last year were compared between groups with a design-based χ^2 test to compare proportions and a quantile regression with a robust variance estimator to compare medians.

Second, the proportions of having each type of partnership at least once since arriving in France in the HIV-FR, HIV-BFR and CHB groups were compared to the reference group using multivariate design-based Poisson regression models adjusted for age, education level and arrival period in France or, for rare events, a design-based χ^2 test.

Third, the associations by year since arrival in France between each sexual partnership type and residence permit, economic resources and housing situation were analysed with mixed-effects logistic regression models. Multivariate models were adjusted for education level, age at arrival in France, period of arrival, and main reason for migration. All models were adjusted for study group and time.

Data were weighted according to each individual's probability of inclusion in the survey, and the weights applied to all percentages. All analyses were stratified by sex.

All analyses were performed in Stata SE 13.1 (Stata Corporation, College Station, Texas, USA).

Results

Study population and hardship experiences

In the participating services, a total of 1184 (reference group), 1829 (HIV) and 1169 (CHB) individuals met the eligibility criteria. Among them, 124, 141 and 25, respectively, were not offered participation by their physicians due to health problems. Eventually, we interviewed 763 migrants in the reference group (participation rate: 71.9%), 926 migrants with HIV (participation rate: 54.9%), and 779 migrants with CHB (participation rate: 68.5%). We excluded 28 people whose HIV infection could not be dated and five people with missing data from the analyses, leaving a total of 762 in the reference group, 296 in the HIV-FR group, 599 in the HIV-BFR group and 776 in the CHB group.

Women accounted for 57% of the reference group, 53% of the HIV-FR group, 67% of HIV-BFR and 28% of the CHB group.

The median age was 41 years in the reference group for both sexes. Men in the HIV-FR group were older (50 years, $P < 0.01$), and women in the CHB group were younger (37 years, $P < 0.01$) (Table 1). With regard to education level, 80% of the women and 75% of the men in the reference group had attended at least some secondary school; the other groups did not differ. Most of the migrants (>95%) came from Western and Central Africa (Table 1). Côte d'Ivoire, Cameroon, Mali, the

Table 1. Socio-demographic characteristics and legal, economic and housing hardships in France by sex and by study group – ANRS PARCOURS study.

	Men				Women				P value
	Ref. group N = 355 %	HIV-FR N = 139 %	HIV-BFR N = 207 %	CHB N = 559 %	Ref. group N = 407 %	HIV-FR N = 157 %	HIV-BFR N = 392 %	CHB N = 217 %	
Age (years)									
18–34	32.4	9.4	14.1	32.2	33.9	21.1	23.0	38.3	<0.001
35–44	27.5	22.3	38.5	37.9	25.4	43.5	47.6	42.3	
45–60	40.1	68.3	47.4	29.9	40.7	35.4	29.5	19.5	
Educational level									
None/primary	25.3	19.0	21.2	32.2	19.9	18.6	18.1	21.3	0.69
Secondary	46.5	43.9	49.9	38.6	54.4	62.0	59.6	57.5	
Superior	28.3	37.2	28.9	29.2	25.7	19.4	22.3	21.1	
Region of birth									
West Africa	64.6	56.9	57.3	79.4	53.3	57.2	45.5	73.2	<0.001
Central Africa	31.2	40.3	41.4	18.9	42.0	39.6	51.3	25.0	
East/Southern Africa	4.2	2.9	1.3	1.7	4.8	3.2	3.1	1.8	
Age at arrival in France									
Median (IQR)	26 (22–32)	25 (22–29)	35 (28–39)	27 (23–33)	26 (20–31)	23 (17–27)	30 (26–36)	26 (21–33)	<0.001
Duration of stay in France									
Median (IQR)	12 (4–24)	24 (14–31)	10 (5–13)	12 (6–17)	13 (6–25)	20 (1–25)	10 (5–14)	10 (4–16)	<0.001
Partnership status at arrival in France									
Single	61.3	64.8	50.3	65.5	46.4	61.5	53.1	54.7	0.07
Stable partner in France	23.6	26.3	31.0	16.1	47.9	30.7	39.9	41.5	
Stable partner in country of origin	15.1	8.9	18.7	18.5	5.8	7.8	7.1	3.8	
Systematic condom use in the last 12 month with									
The last stable partner ^a	6.2	32.0	46.1	9.8	3.2	37.8	46.3	9.1	<0.001
The last casual partner ^b	54.8	88.8	79.6	66.1	28.4	59.5	59.1	44.7	0.02
Ever had same-sex relationship	0.8	4.8	6.4	0.3	0.5	3.2	1.0	1.1	0.12
Main reason for coming to France									
Join a family member	15.4	15.5	14.4	12.0	46.1	54.2	32.5	47.4	<0.001
Find work	38.7	43.5	42.2	48.1	19.8	22.6	39.8	25.1	
Threatened in your country	23.7	12.6	21.1	17.6	17.4	5.2	11.8	13.7	
Study	20.3	28.5	5.6	16.4	13.0	14.1	5.5	6.8	
Medical reasons	1.9	0.0	16.7	5.9	3.7	3.9	10.4	7.0	
Legal, economic, and housing hardships in France									
Ever had one year with no resident permit	50.3	61.1	61.1	69.0	42.9	48.7	52.0	54.5	0.08
Ever had one year with no financial resource	10.5	12.1	18.1	8.7	7.3	7.0	14.1	10.8	0.07
Ever had one year with no stable housing	33.5	31.2	44.6	29.0	21.7	25.0	35.1	27.6	0.01

Weighted percentages. P value: design-based χ^2 test comparison of proportion and quantile regression with robust variance estimator for median comparison across groups. CHB, chronic hepatitis B;

HIV-BFR, HIV acquired before migration; HIV-FR, HIV acquired in France; IQR, interquartile range; REF GROUP, reference group.

^aRespondents with at least one stable partner in the last 12 month.

^bRespondents with at least one casual partner in the last 12 month.

Table 2. Types of sexual partnerships in France by sex and by study group – ANRS PARCOURS study.

	Men				Women			
	Ref. group N = 355 %	HIV-FR N = 139 %	HIV-BFR N = 207 %	CHB N = 559 %	Ref. group N = 407 %	HIV-FR N = 157 %	HIV-BFR N = 392 %	CHB N = 217 %
No partnership in France	[95% CI] 13.5 [8.6–20.5] Ref.	[95% CI] 1.0 [0.1–6.6] P* < 0.001	[95% CI] 10.1 [6.4–15.7] P = 0.35	[95% CI] 8.1 [6.3–10.4] P = 0.05	[95% CI] 9.0 [4.5–17.1] Ref.	[95% CI] 3.5 [1.3–9.1] P = 0.09	[95% CI] 10.4 [7.0–15.1] P = 0.70	[95% CI] 9.9 [5.7–16.7] P = 0.82
Ever in France								
Had stable partnership	74.9 [65.7–82.3] Ref.	90.2 [80.6–95.3] P = 0.85	77.8 [73.0–82.0] P = 0.73	78.4 [73.9–82.2] P = 0.17	83.8 [74.9–90.0] Ref.	91.8 [86.8–95.0] P = 0.67	75.1 [68.9–80.5] P = 0.30	81.5 [76.4–85.7] P = 0.71
Had casual partnership	54.2 [46.6–61.5] Ref.	76.7 [68.0–83.5] P = 0.004	53.2 [43.5–62.6] P = 0.40	57.3 [52.1–62.2] P = 0.32	30.5 [21.4–41.3] Ref.	52.4 [42.7–61.9] P = 0.02	40.8 [35.0–46.8] P = 0.03	32.1 [26.8–37.8] P = 0.74
Had transactional partnership	1.0 [0.4–2.1] Ref.	6.4 [2.2–17.5] P = 0.003	3.8 [1.5–9.6] P = 0.02	1.3 [0.6–2.9] P = 0.52	2.3 [1.4–3.9] Ref.	8.6 [3.6–18.8] P = 0.006	5.5 [3.6–8.2] P = 0.04	2.6 [0.9–7.2] P = 0.91
Paid for sex	11.9 [8.4–16.5] Ref.	21.2 [15.5–28.3] P = 0.06	11.9 [7.2–19.1] P = 0.80	12.7 [9.7–16.5] P = 0.84	0.0 [–] Ref.	0.0 [–] Ref.	0.2 [0.0–1.3] P = 0.26	1.2 [0.2–5.8] P = 0.08
Had concurrent partnerships	45.8 [38.3–53.5] Ref.	69.9 [61.9–76.9] P = 0.02	44.3 [32.6–56.7] P = 0.95	42.2 [34.5–50.2] P = 0.59	19.1 [13.9–25.5] Ref.	28.8 [19.7–40.1] P = 0.23	21.0 [16.8–25.9] P = 0.17	16.2 [12.1–21.4] P = 0.54

Weighted percentages. CHB, chronic hepatitis B; CI, confidence interval; HIV-BFR, HIV acquired before migration; HIV-FR, HIV acquired in France; REF GROUP, reference group. *P compared to the reference group by a design-based multivariate Poisson regression models adjusted for age, education level, and period of arrival in France or by design-based χ^2 test in case of rare events (no partnership, transactional partnership for men and paid sex for women).

Democratic Republic of the Congo, and Senegal were the most frequent home countries.

The median duration of residence in France was 13 years [inter quartile range (IQR): 6–25] for women and 12 years [IQR: 4–24] for men in the reference group; the median age at arrival in France was 26 years for both sexes. Those in the HIV-FR group had been in France longer and had arrived younger. The reported reasons for migration substantially differed by sex: men most often reported coming to seek work (40–50% of the men, depending on the group), and women left for family unification (30–50%, depending on the group). Approximately 40% of women and 20% of men came to France with or to join a stable partner (Table 1). Hardships after migration in France were frequent. In the reference group, 43% of women and 50% of men reported that for at least 1 year, they had had no residence permit, 22% of women and 34% of men had no stable housing, and 7% of women and 11% of men had no economic resources. These hardships were still more common in the groups living with HIV or hepatitis B (Table 1).

Sexual partnerships after migration: differences between HIV, chronic hepatitis B and reference groups

Most African migrants were sexually active while in France. Among both sexes, 75–92% reported stable partnerships after migration, with no significant differences between groups (Table 2).

Nonstable partnerships followed different patterns in men and women. Among men in the reference group, 54.2% reported casual partnerships in France, 45.8% had concurrent partnerships, 11.9% had paid for sex, compared with 76.7% ($P=0.004$), 69.9% ($P=0.02$) and 21.2% ($P=0.06$) of men in the HIV-FR group, respectively. In the CHB and HIV-BFR groups, however, none of these partnerships significantly differed from the reference group. Men reported transactional partnerships in France rarely, mostly in HIV groups: 1% of the reference group compared with 6.4% of the HIV-FR group ($P=0.003$) and 3.8% of the HIV-BFR group ($P=0.02$) (Table 2).

Among women in the reference group, 30.5% reported casual partnerships, 19.1% concurrent partnerships and 2.3% transactional partnerships. None reported paying for sex. Casual and transactional partnerships were more frequent in the groups living with HIV: 52.4% ($P=0.02$) and 8.6% ($P=0.006$), respectively, in the HIV-FR group and 40.8% ($P=0.03$) and 5.5% ($P=0.04$) in the HIV-BFR group (Table 2). Concurrent partnership rates in the HIV groups did not differ significantly from those in the reference group. None of the women's partnership indicators differed between the CHB and reference groups (Table 2).

Consistent condom use in the last 12 months with casual partners was reported by 28% of women and 55% of men in the reference group and was higher in the CHB and HIV groups. Among men, 5% of the HIV group and less than 1% of the other groups declared having ever had one male partner.

Association between sexual partnerships and housing, residence permit and resources over time

Among men, compared to men with a 10-year residence permit, the probabilities of casual relationships and of paid sex were higher during the years they had no residence permit [odds ratio; OR = 1.62 (1.29–2.03) and OR = 1.79 (1.05–3.04), respectively] or only had a temporary status [OR = 1.38 (1.15–1.65) and OR = 1.89 (1.19–2.99), respectively]. Conversely, the probabilities of casual relationships and paid sex were lower when they had no resources [OR = 0.52 (0.31–0.86) and OR = 0.15 (0.03–0.64)]. Housing conditions were also associated with sexual partnerships: lack of stable housing was positively associated with casual partnerships [OR = 1.70 (1.31–2.21)] and collective housing (workers' hostels) with paid sex [OR = 4.30 (2.58–7.16), ref. stable housing] (Table 3).

Among men, the probabilities of both stable and concurrent partnerships were lower when they had a temporary residence permit [OR = 0.50 (0.42–0.60) and OR = 0.74 (0.61–0.90), respectively] or none at all [OR = 0.23 (0.19–0.30) and OR = 0.46 (0.36–0.60)] and no resources [OR = 0.36 (0.22–0.58) and OR = 0.37 (0.20–0.69)]. The probability of stable partnerships decreased for those without their own housing [OR = 0.23 (0.19–0.27) when housed by family members, OR = 0.27 (0.21–0.35) in collective or associative housing, OR = 0.31 (0.24–0.40) with no stable housing]. After adjustment, all associations remained significant (Table 3).

Among women, casual and transactional partnerships were more probable during the years they had no residence permit [OR = 2.01 (1.48–2.72) and OR = 6.27 (2.25–17.44), respectively], were housed by family members [OR = 1.69 (1.35–2.13) and OR = 2.63 (1.19–5.82)] or had no stable housing [OR = 3.71 (2.75–5.00) and OR = 10.58 (4.68–23.93)] (Table 4). The probability of concurrent partnerships increased during the years without residence permit [OR = 2.68 (1.76–4.07)], stable housing [OR = 2.15 (1.45–3.19)] or when resources came from state allowances [OR = 1.77 (1.12–2.79)].

Casual and concurrent partnerships decreased during years women depended on their spouse's resources [OR = 0.50 (0.37–0.69) and OR = 0.65 (0.43–0.97), respectively]. All of these associations remained significant after adjustment.

Table 3. Factors associated with sexual partnerships year by year since arrival in France among men (16 804 person-years at risk) (mixed-effects logistic regression models).

	Stable partnership			Casual partnership			Paid sex			Concurrent partnerships		
	Univariate		Multivariate	Univariate		Multivariate	Univariate		Multivariate	Univariate		Multivariate
	% PYR ^a	OR [95% CI] ^b	OR [95% CI] ^c	% PYR	OR [CI95%]	OR [95% CI]	% PYR	OR [95% CI]	OR [95% CI]	% PYR	OR [95% CI]	OR [CI95%]
Residence permit ^d												
Residence permit (10 years or more)	77.9	1.00	1.00	24.6	1.00	1.00	1.4	1.00	1.00	22.5	1.00	1.00
Temporary residence permit	64.8	0.50**[0.42-0.60]	0.47**[0.39-0.58]	30.5	1.38**[1.15-1.65]	1.41**[1.15-1.72]	4.6	1.89**[1.19-2.99]	1.86*[1.12-3.08]	20.6	0.74**[0.61-0.90]	0.69**[0.56-0.85]
No residence permit	50.4	0.23**[0.19-0.30]	0.23**[0.18-0.30]	30.3	1.62**[1.29-2.03]	1.77**[1.37-2.28]	6.0	1.79**[1.05-3.04]	1.82*[1.03-3.24]	14.6	0.46**[0.36-0.60]	0.47**[0.35-0.62]
Resources ^d												
Your own work	71.8	1.00	1.00	27.9	1.00	1.00	3.8	1.00	1.00	21.5	1.00	1.00
Work of spouse or other family members	51.1	0.38**[0.28-0.51]	0.56**[0.41-0.78]	22.0	0.65*[0.46-0.93]	0.53**[0.36-0.76]	3.8	0.95 [0.48-1.88]	0.58 [0.28-1.21]	11.6	0.62*[0.41-0.93]	0.65 [0.42-1.01]
State allowances	46.3	0.22**[0.16-0.31]	0.27**[0.19-0.37]	36.7	1.09 [0.80-1.48]	0.89 [0.65-1.22]	3.8	0.74 [0.36-1.52]	0.56 [0.27-1.16]	16.7	0.61**[0.43-0.87]	0.61**[0.43-0.87]
No resource	41.8	0.36**[0.22-0.58]	0.60 [0.37-0.99]	20.7	0.52*[0.31-0.86]	0.43**[0.25-0.72]	1.6	0.15*[0.03-0.64]	0.11**[0.02-0.51]	8.2	0.37*[0.20-0.69]	0.40**[0.21-0.75]
Housing situation ^d												
Your own housing	77.4	1.00	1.00	24.9	1.00	1.00	2.0	1.00	1.00	19.0	1.00	1.00
Housed by your family	48.1	0.23**[0.19-0.27]	0.32**[0.26-0.39]	31.3	1.41**[1.18-1.69]	1.50**[1.23-1.83]	4.4	1.47 [0.93-2.31]	1.68*[1.05-2.67]	16.9	0.84 [0.68-1.04]	1.18 [0.94-1.47]
Associations, workers' hostels	62.3	0.27**[0.21-0.35]	0.30**[0.23-0.39]	27.7	2.02**[1.57-2.60]	2.00**[1.53-2.61]	7.6	4.30**[2.58-7.16]	4.16**[2.46-7.04]	26.4	1.24 [0.94-1.63]	1.35*[1.02-1.80]
No stable housing	51.6	0.31**[0.24-0.40]	0.36**[0.27-0.47]	36.2	1.70**[1.31-2.21]	1.67**[1.26-2.22]	5.9	1.57 [0.89-2.78]	1.80 [1.00-3.25]	21.5	0.94 [0.70-1.26]	1.12 [0.82-1.53]
Main reason for coming to FR												
Join a family member	63.0	1.00	1.00	29.3	1.00	1.00	1.6	1.00	1.00	15.9	1.00	1.00
Find work	68.1	1.04 [0.57-1.90]	0.87 [0.46-1.63]	24.6	0.64 [0.36-1.14]	0.73 [0.39-1.37]	4.9	2.61 [0.95-7.19]	1.48 [0.56-3.91]	21.7	1.72 [0.96-3.10]	2.37**[1.23-4.40]
Threatened in your country	66.8	1.16 [0.57-2.35]	0.92 [0.45-1.89]	35.0	1.37 [0.69-2.68]	1.47 [0.72-3.02]	4.0	2.48 [0.79-7.82]	1.60 [0.53-4.86]	22.5	2.08*[1.04-4.15]	2.71**[1.30-5.65]
Study	67.8	0.69 [0.34-1.41]	0.60 [0.29-1.27]	30.4	1.56 [0.80-3.07]	1.02 [0.49-2.14]	1.7	0.70 [0.19-2.55]	0.56 [0.16-1.99]	17.9	1.09 [0.55-2.19]	1.09 [0.51-2.32]
Medical reasons	66.5	1.25 [0.46-3.42]	0.83 [0.30-2.32]	26.8	0.58 [0.22-1.54]	0.96 [0.34-2.67]	4.3	1.47 [0.27-8.03]	1.44 [0.29-7.12]	19.5	1.03 [0.37-2.88]	1.43 [0.48-4.23]
Level of education												
None/primary	69.9	1.00	1.00	19.4	1.00	1.00	4.2	1.00	1.00	22.1	1.00	1.00
Secondary	63.5	0.51**[0.32-0.82]	0.47**[0.29-0.77]	30.9	4.12**[2.60-6.53]	4.60**[2.81-7.53]	4.0	0.97 [0.50-1.87]	1.51 [0.76-2.99]	18.3	1.17 [0.73-1.86]	1.40 [0.86-2.31]
Postsecondary	68.8	0.95 [0.57-1.58]	0.75 [0.42-1.35]	31.5	3.55**[2.17-5.79]	3.98*[2.20-7.20]	2.6	0.48 [0.22-1.05]	1.06 [0.44-2.55]	20.4	1.16 [0.70-1.91]	1.53 [0.85-2.79]
Group												
REF GROUP	67.6		1.00	28.7		1.00	3.4		1.00	20.4		1.00
HIV-FR	70.4		0.82 [0.42-1.63]	33.7		3.18**[1.61-6.28]	3.6		1.65 [0.63-4.29]	26.3		2.11*[1.08-4.11]
HIV-BFR	61.7		0.41**[0.22-0.76]	31.7		1.93*[1.02-3.65]	5.5		1.72 [0.69-4.28]	19.5		1.10 [0.58-2.09]
CHB	66.7		1.09 [0.68-1.75]	23.7		0.85 [0.53-1.37]	3.2		0.78 [0.38-1.60]	17.0		0.75 [0.46-1.21]
Time in France (in years)			1.07**[1.05-1.08]			0.95**[0.94-0.96]			0.94**[0.91-0.96]			1.01 [1.00-1.02]

Note: Model was not performed on transactional sex for men since this was very rare. CHB, chronic hepatitis B; CI, confidence interval; HIV-BFR, HIV acquired before migration; HIV-FR, HIV acquired in France; REF GROUP, reference group.
^aPercentage of person-years at risk.
^bOdds ratio adjusted for study group and time.
^cOdds ratio adjusted for study group, time, age, period at arrival, level of education, main reason for coming in France, housing situation, resources, residence permit.
^dTime-varying variables.
 P* < 0.05. *P* < 0.01.

Table 4. Factors associated with sexual partnerships year by year since arrival in France among women (15 148 person-years at risk) (mixed-effects logistic regression models).

	Stable partnership			Casual partnership			Transactional partnership			Concurrent partnerships		
	Univariate		Multivariate	Univariate		Multivariate	Univariate		Multivariate	Univariate		Multivariate
	% PYR ^a	OR [95% CI] ^b	OR [95% CI] ^c	% PYR	OR [95% CI]	OR [95% CI]	% PYR	OR [95% CI]	OR [95% CI]	% PYR	OR [95% CI]	OR [95% CI]
Residence permit ^d												
Residence permit (10 years or more)	72.7	1.00	1.00	6.4	1.00	1.00	0.2	1.00	1.00	2.2	1.00	1.00
Temporary residence permit	68.3	0.99 [0.84-1.17]	1.11 [0.91-1.35]	10.1	1.23 [0.96-1.58]	1.02 [0.77-1.34]	0.9	2.04 [0.83-5.02]	1.40 [0.53-3.72]	4.6	1.31 [0.91-1.86]	1.28 [0.87-1.88]
No residence permit	58.9	0.56** [0.45-0.69]	0.89 [0.69-1.14]	12.4	2.01** [1.48-2.72]	1.46* [1.03-2.08]	2.0	6.27** [2.25-17.44]	3.56* [1.19-10.63]	6.6	2.68** [1.76-4.07]	2.77** [1.73-4.45]
Resources ^d												
Your own work	73.3	1.00	1.00	8.9	1.00	1.00	0.6	1.00	1.00	3.7	1.00	1.00
Work of spouse or other family members	77.5	0.94 [0.76-1.16]	1.08 [0.87-1.35]	5.1	0.50** [0.37-0.69]	0.48** [0.35-0.66]	0.6	0.94 [0.41-2.15]	0.84 [0.36-1.95]	2.7	0.65* [0.43-0.97]	0.58* [0.39-0.88]
State allowances	56.8	0.46** [0.36-0.59]	0.57** [0.45-0.73]	11.0	1.37 [0.98-1.91]	1.18 [0.85-1.65]	0.9	2.36 [0.81-6.90]	1.37 [0.46-4.07]	5.3	1.77* [1.12-2.79]	1.65* [1.03-2.64]
No resource	32.3	0.12** [0.07-0.21]	0.25** [0.15-0.43]	22.2	1.61 [0.94-2.74]	0.96 [0.55-1.65]	4.4	0.77 [0.21-2.83]	0.36 [0.09-1.44]	9.8	0.85 [0.41-1.75]	0.59 [0.28-1.25]
Housing situation ^d												
Your own housing	79.3	1.00	1.00	6.3	1.00	1.00	0.2	1.00	1.00	2.9	1.00	1.00
Housed by your family	48.1	0.12** [0.10-0.14]	0.16** [0.13-0.19]	10.9	1.69** [1.35-2.13]	1.79** [1.39-2.30]	0.8	2.63* [1.19-5.82]	2.23 [0.96-5.18]	3.9	1.01 [0.73-1.39]	1.02 [0.72-1.44]
Associations, workers' hostels	54.3	0.25** [0.18-0.34]	0.28** [0.20-0.39]	9.8	1.30 [0.84-2.03]	0.94 [0.58-1.52]	1.1	2.53 [0.70-9.11]	2.02 [0.51-7.93]	2.5	0.52 [0.25-1.07]	0.45* [0.21-0.97]
No stable housing	50.0	0.22** [0.17-0.28]	0.26** [0.20-0.34]	21.4	3.71** [2.75-5.00]	2.99** [2.17-4.13]	4.6	10.58** [4.68-23.93]	8.17** [3.41-19.60]	9.6	2.15** [1.45-3.19]	1.72* [1.13-2.62]
Main reason for coming to FR												
Join a family member	73.0	1.00	1.00	5.8	1.00	1.00	0.3	1.00	1.00	2.6	1.00	1.00
Find work	66.9	0.32** [0.21-0.50]	0.32** [0.20-0.51]	11.9	3.20** [2.08-4.90]	2.80** [1.75-4.47]	1.2	5.76** [1.87-17.72]	3.06 [0.93-10.13]	4.7	1.87* [1.13-3.10]	1.71 [0.97-3.01]
Threatened in your country	58.5	0.11** [0.06-0.20]	0.14** [0.08-0.26]	11.1	4.94** [2.86-8.53]	3.34** [1.85-6.05]	1.5	14.08** [3.65-54.27]	5.80* [1.41-23.91]	3.8	1.98* [1.02-3.86]	1.54 [0.74-3.21]
Study	67.4	0.38** [0.20-0.74]	0.24** [0.12-0.48]	11.3	3.62** [1.95-6.70]	2.72** [1.40-5.30]	0.6	3.53 [0.68-18.29]	3.25 [0.59-17.80]	3.7	1.78 [0.85-3.73]	1.29 [0.57-2.92]
Medical reasons	58.8	0.22** [0.10-0.47]	0.35** [0.16-0.77]	11.6	3.53** [1.74-7.16]	2.78** [1.30-5.96]	0.9	4.64 [0.75-28.59]	2.70 [0.42-17.23]	9.0	4.01** [1.82-8.81]	4.37** [1.84-10.40]
Level of education												
None/primary	73.1	1.00	1.00	6.9	1.00	1.00	0.4	1.00	1.00	3.2	1.00	1.00
Secondary	68.7	0.65 [0.41-1.04]	1.11 [0.91-1.35]	8.5	1.90** [1.18-3.06]	1.50 [0.93-2.42]	0.8	1.79 [0.54-5.91]	1.78 [0.55-5.74]	3.7	1.80* [1.01-3.19]	1.71 [0.95-3.07]
Postsecondary	65.7	0.84 [0.48-1.47]	0.89 [0.69-1.14]	10.3	2.18** [1.25-3.80]	1.80* [1.01-3.21]	0.7	1.16 [0.27-4.92]	1.43 [0.33-6.19]	3.8	1.64 [0.84-3.20]	1.78 [0.87-3.63]
Group												
REF GROUP	74.5		1.00	6.6		1.00	0.5		1.00	3.2		1.00
HIV-FR	64.1		0.28** [0.16-0.49]	9.2		2.19** [1.25-3.82]	0.8		3.47 [0.89-13.50]	3.8		1.64 [0.85-3.17]
HIV-BFR	64.6		0.35** [0.22-0.56]	11.6		2.13** [1.35-3.36]	1.2		2.13 [0.72-6.29]	4.9		1.40 [0.81-2.41]
CHB	70.3		0.81 [0.48-1.37]	7.3		1.14 [0.67-1.94]	0.2		0.36 [0.08-1.76]	2.5		0.73 [0.38-1.41]
Time in France (in years)			0.93** [0.92-0.94]			0.99 [0.98-1.01]			0.94 [0.87-1.01]			0.94** [0.92-0.96]

Note: Model was not performed on paid sex for women since this was very rare. CHB, chronic hepatitis B; CI, confidence interval; HIV-BFR, HIV acquired before migration; HIV-FR, HIV acquired in France; REF GROUP, reference group.
^aPercentage of person-years at risk.
^bOdds ratio adjusted for study group and time.
^cOdds ratio adjusted for study group, time, age, period at arrival, level of education, main reason for coming in France, housing situation, resources, residence permit.
^dTime-varying variables.
 * $P < 0.05$. ** $P < 0.01$.

Among women, being in a stable partnership was associated with having a residence permit, her own home, and resources (Table 4).

Discussion

This study shows that hardship affects a large proportion of sub-Saharan migrants in France during their settlement process and is associated with an increased risk of casual and concurrent partnerships, which appear to be related to HIV acquisition in France. Such findings support our hypothesis of hardship being a distal factor of HIV infection for sub-Saharan migrants living in France.

Associations between hardship and sexual partnerships differed with sex: among men, stable relationships, and possibly concurrent ones, occur with being settled, with regard to papers, housing and resources. Casual partnerships and paid sex were more frequent in years without residence permits or stable housing but less frequent in years without economic resources.

Among women, hardship increased the probability of casual, transactional and concurrent partnerships. Women who arrived for family unification, mostly to join a spouse, and who depended financially on him, were less likely to engage in nonstable partnerships.

These results underline the gendered organization of sexuality: men need resources for each type of partnership, whether stable, casual or paid. For women, security is associated with stable partnerships, and material hardship with casual and transactional sex. The higher probability of transactional partnerships for women who lack stable housing or a residence permit underlies their particular vulnerability during these insecure situations, which can last several years: as observed in ethnographic studies, they may be bound to accept unwanted sex in exchange for accommodation, to avoid homelessness and to facilitate the issue of their residence permits [14]. These results are consistent with those of a previous survey among sub-Saharan Africans in the Paris region that found concurrent partnerships were twice as likely among women without their own resources, thereby suggesting an association between women's sexual risks and economic insecurity [18].

The associations observed between casual, transactional and concurrent partnerships and the acquisition of HIV while in France may reveal behavioural determinants of HIV acquisition after migration in both sexes and insufficient protection of sexual intercourse in these types of partnerships. It was not possible to collect information on condom use for each year since arrival in France due to possible recall bias, but the level of condom use in the last year confirmed a level of condom use too

low to prevent STIs, even in cases of nonstable relationships, and particularly among women. The low condom use often described in Africa [19] thus appears to continue after migration [5].

As a consequence, by increasing casual, transactional and concurrent partnerships, poor social conditions facilitate HIV acquisition. The association between poverty and HIV risk through transactional relationships have already been shown among young women in South Africa [20]. Women engaged in transactional – thus unequal – partnerships are not in a position to ask for protected sexual relations and are more often HIV infected. Here, we show the same association in France for the first time. Social hardships appear to favour risky sexual behaviour, especially among women, and might be thus viewed as an indirect risk factor for female HIV acquisition. Casual and transactional partnerships were also more frequent among the women who acquired HIV before migration, perhaps because stable partnerships are more difficult when living with HIV [21].

Among men, HIV acquisition in France was associated with casual and concurrent relationships, as well as paid sex. Paid sex among men was strongly associated with collective housing (e.g. workers' hostels), which reveals the difficulty and often the prohibition of having sex in this setting. Male casual sex appeared to be related to housing and residence permit insecurity. Conversely, male concurrent partnerships appeared to be related to social stability (remunerated activity, long-term residence permit) and were frequent, as observed previously in the United Kingdom [11] and France [10]. Among men, HIV contamination in France may therefore concern men settled as well as men facing hardship.

The sexual situation of African migrants in the CHB group did not differ from that of the reference group. This finding is consistent with what is known about the epidemiology of chronic hepatitis B: chronicity is much more frequent when HBV transmission occurs in early childhood [7] and therefore is not necessarily associated with sexual risk behaviours.

This survey has some limitations: PARCOURS was conducted only in the greater Paris metropolitan region, but this region contains 60% of the sub-Saharan migrants living in France [22]. Only migrants attending healthcare facilities were recruited. Nonetheless, in France, migrants can access social security coverage and receive healthcare free-of-charge after 3 months of residence, regardless of legal status. The similarity of the distribution by sex and age of our reference group to that of the sub-Saharan migrant population in the region might limit any such bias [22]. The HIV and hepatitis B groups are representative of the migrants followed up for these infections because their follow-up takes place mainly in hospitals in France [23]. Self-reported data may be subject

to reporting biases, especially when reporting sexual activity [24]. The life-event method of data collection, which facilitates recall of events and their order in time, substantially reduces this bias [25,26]. Yearly information allows a detailed analysis of the concurrence between sexual partnerships and living arrangements. We distinguished transactional and casual partnerships, as the latter do not necessarily involve asymmetric power relationships. Nonetheless, the transactional nature of casual partnerships might have been underreported or not perceived as such [27], and these two types of situations overlap somewhat. Moreover, our definition of concurrent partnerships does not capture the difference between concurrency and rapid serial monogamy.

Some of the stable partnerships reported by migrants might be transnational, either contracted before migration or during return to the country of origin. It is therefore possible that we are slightly overestimating the proportion of concurrent partnerships that involve sexual relations in France. Nonetheless, only 6% of the women and 15% of the men reported leaving a stable partner behind in Africa when they came to France, thus transnational partnerships may result in sexual risk behaviour on return visits.

Lastly, our sample was not large enough to investigate hardship and sexual risks among sub-Saharan MSM while they might be at high risk due to higher stigma [28].

In conclusion, hardships faced by African migrants after arrival in Europe shape their sexual behaviours and partnerships and indirectly increase their sexual and HIV risk, though in different ways among men and women. We previously estimated that at least 35% of sub-Saharan migrants living with HIV in France might have acquired HIV after migration [9]. It is therefore crucial to question structural barriers due to immigration policy and to improve HIV prevention. Moreover, prevention strategy must address men and women differently because gender shapes the living conditions and correlates to sexual life over the immigration trajectory. An effective policy of sexual risk prevention for men must specifically target concurrent partnerships. Protecting migrant women from a lack of personal accommodation might prevent them from being bound to accept risky partnerships. This concept is especially important given the recent political context in Europe, which has tightened immigration requirements and likely increased the risks of insecurity at a time when women account for an increasingly high proportion of African migration to Europe [29].

Acknowledgements

A.D.L., R.D.S., F.L., N.B. and N.L. designed the research and organized the data collection. J.P., A.R., A.G.,

M.L.G. and H.P. prepared and analysed the data. All authors participated to data interpretation. A.D.L. and J.P. performed the literature search and drafted the manuscript. A.D.L., R.D.S., F.L., N.B. and N.L. critically revised the manuscript for important intellectual content.

The PARCOURS Study Group included A.D.L., F.L., R.D.-S., N.B., N.L. (scientific coordinators), J.P., A.R., A.G., E Rodary, D Pourette, J Situ, P Revault, P Sogni, J Gelly, Y Le Strat, N Razafindratsima.

This study was supported by the French National Agency for research on AIDS and Viral hepatitis (ANRS) and the Directorate-General of Health (DGS, French Ministry of Health). The funders of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the article. A.D.L. had full access to all the data and final responsibility for the decision to submit for publication.

The authors would like to thank all the people who participated in the study, the RAAC-Sida, COMEDE, FORIM and SOS hepatitis associations for their support in preparing and conducting the survey, G Vivier, E Lelièvre (INED) and A Gervais (AP-HP) for their support in preparing the questionnaire, A Guillaume for the communication tools, ClinSearch and Ipsos for data collection, Jo Ann Cahn for the English translation, and staff at all participating centres.

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Funding: French National Agency for research on AIDS and viral hepatitis (ANRS).

Conflicts of interest

There are no conflicts of interest.

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