

Access to antiretroviral treatment and sexual behaviours of HIV-infected patients aware of their serostatus in Côte d'Ivoire

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Objective: To compare sexual behaviours of HIV-infected patients in Côte d'Ivoire whether or not they had access to antiretroviral treatment (ARV).

Design and methods: Cross-sectional survey using face-to-face interviews among all patients, informed of their HIV serostatus, attending the eight health centers in charge of HIV care in Abidjan and Bouaké. Univariate comparisons of declared sexual behaviours during the prior 6 months between the 164 ARV-treated and the 547 non-ARV-treated respondents. Multiple logistic regressions to identify factors related to sexual abstinence in the total sample and to unprotected sexual intercourse in the subsample of sexually active respondents during the same period were performed.

Results: More than half of the 711 respondents (53.0%) declared an absence of sexual activity during the previous 6 months, with this proportion being significantly higher among women (60.6%), and among both men (85.7%) and women (92.4%) who were not living in a stable relationship. Among the 334 sexually active patients, 49.7% declared a low frequency of sexual intercourse ('once a month or less'), and 43.7% declared at least one episode of unprotected sexual intercourse. In multivariate analysis, recent diagnosis of HIV infection (< 9 months), having only one sexual partner and not knowing her/his serostatus, high alcohol consumption, absence of episodes of acute morbidity, not participating in household's expenditures and not being ARV-treated were significantly related to a higher likelihood of HIV-related risky sexual behaviours.

Conclusion: Sexual abstinence is the preventive strategy of choice for a majority of HIV-infected patients aware of their serostatus and consulting for care in Côte d'Ivoire. In these patients, access to ARV is not associated with an increase in HIV-related risky sexual behaviours.

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Introduction

Concerns have been raised world-wide that improvements in health status and quality of life of HIV-infected patients due to access to effective treatment such as highly active antiretroviral therapies (HAART) may indeed increase the opportunities for continued or relapse to risk behaviours among HAART-treated individuals [1]. Furthermore, they may create a new threat for public health through transmission of HIV viral strains that have already acquired genetic resistance characteristics against actual therapies [2]. Such concerns about the potential negative impact of access to HAART on the transmission of the HIV virus may be even more pronounced in the context of developing countries. In Africa, reported condom use remains low at 20 to 25% among men with non-spousal partners and 11 to 24% among women [3,4]. Data about West African women who learned of their HIV serostatus during pregnancy show that only a minority disclose this status to their main partner. Moreover they find it difficult to avoid unprotected sexual relations, as suggested by self-reports as well as by the high rate of new pregnancies in this population [5,6].

As the access to antiretroviral treatment (ARV) has been very limited in developing countries up to now, little is known about the evolution of HIV-related sexual behaviours among HIV-positive patients in the developing world once they have started antiretroviral treatment. The cross-sectional survey among HIV-infected patients, informed of their serostatus, which was carried out to contribute to the socio-economic and behavioural evaluation of the Drug Access Initiative (DAI) in Côte d'Ivoire gave us the opportunity to collect data about sexual behaviours in this population and to compare them between ARV-treated patients and patients who have access to HIV care but not to ARVs.

Material and methods

The methodology of the cross-sectional survey, carried out from December 1999 to February 2000, among patients, informed of their HIV serostatus, who attended one of the eight health centers in charge of HIV care in Abidjan and Bouaké (the Infectious Diseases department in Treichville University Hospital, USAC, Abidjan Military Hospital, Antituberculous Center in Adjamé, Abidjan, CIRBA, Hôpital de jour de Bouaké, CAT de Bouaké, CAT de Treichville) has been described elsewhere in this special issue [7]. The questionnaire administered to patients in the face-to-face interview included three multi-item questions about sexual behaviours and condom use, with regular as well as occasional partners, during the 6-month period prior to the survey. An additional question dealt with the circumstances of the last sexual intercourse. The wording of these questions was similar to that validated in the large-scale French survey

on sexual behaviours in the general population [8] as adapted to the Ivoirian context. Two additional questions asked ARV-treated patients if they have changed their behaviours since initiation of treatment.

In addition to biomedical data obtained from medical files and socio-economic and behavioural data collected during the face-to-face interview, the questionnaire also included the French version of the Centre for Epidemiological Studies depression (CES-D) scale [9] that had been adapted and validated to the Ivoirian situation [10]. The CES-D score ranges from 0 to 60, with higher values corresponding to the highest likelihood of depression. The questionnaire also included the seven-items of the 'Physical Ability' sub-scale of the Medical Outcome Study Short Form Health Survey (MOS-SF), that has previously been validated in French [11]: the higher the score on this scale (graduated from 0 to 100), the better is the individual capability in physical functioning.

Chi-square test, Fisher's exact test, or Mann-Whitney test were used to perform univariate comparisons of socio-demographic, clinical and behavioural characteristics in the whole sample of respondents whether or not they had declared sexual activity in the previous 6 months. According to recommendations in the literature on sexual behaviours, these analyses were carried out separately by gender [8].

Similar comparisons were also performed in the sub-sample of sexually active patients whether or not they declared at least one episode of unprotected sexual intercourse during the same 6-month period. In this sub-sample, we also compared the characteristics of the last sexual intercourse whether or not respondents were ARV-treated at time of the survey.

Logistic regressions were performed to analyze factors associated with abstinence of sexual activity during the previous 6 months in both sub-samples of male and female respondents, as well as unprotected sexual intercourse in the sub-sample of sexually active respondents. They were also used to analyze whether being ARV treated had an impact on these behaviours after adjustment for potential confounding variables. In the three cases, all explanatory variables associated with the outcome variable (abstinence of sexual activity, unprotected sex) with a P -value ≤ 0.1 in univariate analyses were included in the initial logistic model. Age, antiretroviral treatment, and sex in the case of the sub-sample of sexually active respondents, were also introduced in the initial models even if they did not fulfil this condition of significance (P -value ≤ 0.1) in univariate analysis. Final multivariate models were obtained by using a backward stepwise procedure based on log-likelihood ratio to eliminate non-significant ($P > 0.05$) variables from initial models, and by forcing the "ARV treatment" variable

in the model, even when it did not fulfil this condition. As data about CD4 cell counts at time of the survey were missing for some respondents, all three multivariate models were also computed with an initial introduction of this variable on the samples of respondents who had available data about their immunological status.

Results

A total of 711 (65.4%) of the 1087 HIV-infected adult patients, informed of their HIV serostatus, who attended, at least once, at one of the participating health centers during the study period, were included in the survey. Among these 711 respondents, 51.1% were men, 53.9% were younger than 35 years and 50.2% lived in collective housing, which is an indicator of low socioeconomic status in Ivoirian society. A total of 456 respondents (64.1%) declared that they had a stable relationship with a regular partner, this proportion being significantly higher among male than among female respondents (73.0 versus 54.9%, $P < 0.001$). Overall, more than half of HIV-infected patients ($n = 377$; 53.0%) declared an absence of sexual activity during the previous 6 months, this proportion being significantly higher among women (60.6%) than among men (45.7%) ($P < 0.001$).

Factors associated with sexual abstinence

The great majority of both men and women who were not living in a stable relationship with a regular partner (respectively 85.7 and 92.4%) declared having been sexually abstinent in the previous 6 months. Among the 454 respondents who had a stable relationship with a regular partner, less than one-third ($n = 130$, 28.6%) knew the HIV serostatus of this partner. The majority (63.2%) of these 130 respondents belonged to seroconcordant HIV-positive couples but both acknowledged seroconcordant and serodiscordant couples maintained sexual activity in similar proportions (70.3 and 65.3%, respectively). Multivariate analysis confirmed the relationship between sexual abstinence and absence of a regular partner (Table 1).

Overall, about a quarter of respondents (24.5%) reached the maximum value (100) for the score of physical functioning. This proportion of patients without any impairment of their physical capability tended to be higher among ARV-treated than non-ARV-treated patients (29.9 versus 22.9%; $P = 0.06$). For both men and women, a lower score of physical functioning was related to a greater likelihood of having been sexually abstinent in univariate as well as multivariate analyses (Table 1).

Table 1 details all additional factors which were found to be associated ($P < 0.1$) with sexual abstinence in univariate analysis. Older age and being illiterate were clearly associated with the absence of sexual activity in the case of women whereas these factors did not seem

to play a role, after multivariate adjustment, for men. On the contrary, although various indicators of lower socioeconomic status were found to be related to sexual abstinence for both sexes, such a relationship was only confirmed by multivariate analysis in the case of men. Male respondents who lived in poor housing conditions (with no access to tap water) in a highly populated household (with more than eight members), who were unemployed and who did not have income to contribute to expenditures of their household were more likely to have refrained from any sexual activity. We also found that not having disclosed HIV serostatus to others was related to sexual abstinence for both men and women, although this was again confirmed by multivariate analysis only in the case of male respondents.

Data on CD4 cell counts were only available for 321 male and 328 female respondents (91.3% of total sample). When analysis was restricted to these patients, advanced immunodepression (having CD4 cell count $\leq 200 \times 10^6$ cells/l) was associated with sexual abstinence for men but not for women.

Finally, Table 1 shows that being ARV treated did not have any influence on the fact of being or not sexually abstinent, even after adjustment for potential confounders through multivariate analysis.

Sexual activity of HIV-infected patients

Among the 334 respondents who declared that they had been sexually active in the previous 6 months, 14.7, 35.6, and 49.7%, respectively, declared that they had sexual intercourse 'more than once a week', 'two or three times per month' and 'once a month or less' during this period. Frequency of sexual intercourse was higher among men than among women (17.8, 38.0, and 44.2% versus 10.2, 32.1, and 57.7%, respectively; $P = 0.05$), but was similar among ARV-treated and non-ARV-treated patients. Among the 164 ARV-treated patients, 44.5% had renounced sexual intercourse, 39.0% had 'reduced frequency of sexual intercourse' after treatment had been initiated, whereas the remaining 16.5% maintained the same frequency of sexual activity. For the majority of ARV-treated patients, initiation of treatment had occurred quite recently (71.3% for one year or less) and no relationship was found between time since initiation of ARVs and sexual activity. Among these sexually active HIV-infected patients, 22.8% declared more than one sexual partner during the previous 6 months. The proportion of those declaring multiple sexual partners was higher among men than among women (29.4 versus 13.1%, $P < 0.001$).

HIV-related risky sexual behaviours

A total of 146 out of the 334 sexually active patients (43.7%) declared at least one episode of unprotected sexual intercourse in the previous 6 months. The proportion of sexually active patients who declared such

Table 1. Factors associated with sexual abstinence among male (n = 363) and female (n = 348) HIV-infected patients consulting for HIV care in Côte d'Ivoire (December 1999–February 2000).

	Male respondents				Female respondents			
	Sexual activity in prior 6 months		P ^b	OR (95% CI) Multivariate ^a	Sexual activity in prior 6 months		P ^b	OR (95% CI) Multivariate ^a
No n = 166 (45.7)	Yes n = 197 (54.3)	No n = 211 (60.6)			Yes n = 137 (39.4)			
Being ARV-treated	33 (19.9)	55 (27.9)	0.08	0.60 [0.30–1.19] ^c	40 (19.0)	36 (26.3)	0.15	1.53 [0.72–3.22]
Age > 35 years	99 (59.6)	108 (54.8)	0.36	–	82 (38.9)	39 (28.5)	0.05	2.65 [1.32–5.34]
Illiterate	42 (25.3)	34 (17.3)	0.06	–	75 (35.5)	28 (20.4)	0.003	2.79 [1.47–5.34]
Education level lower than secondary school	74 (44.6)	108 (54.8)	0.05	–	82 (38.9)	66 (48.2)	0.09	–
No access to tap water in household	66 (39.8)	53 (26.9)	0.009	2.18 [1.17–4.09]	67 (31.8)	26 (19.0)	0.009	–
Being unemployed	71 (42.8)	31 (15.7)	0.000	2.21 [1.16–4.22]	121 (57.3)	70 (51.1)	0.25	–
Does not contribute to household's expenditures	44 (26.5)	13 (6.6%)	0.000	2.58 [1.02–6.53]	126 (59.7)	96 (70.1)	0.05	–
Has lost job since HIV diagnosis	44 (26.5)	23 (11.7)	0.000	–	92 (43.6)	42 (30.7)	0.015	–
No stable relationship with a regular partner	84 (50.6)	14 (7.1)	0.000	14.36 [7.01–29.41]	145 (68.7)	12 (8.8)	0.000	21.4 [10.6–43.4]
No. of persons in household > 8	50 (30.1)	38 (19.3)	0.02	1.81 [1.01–3.37]	72 (34.1)	34 (24.8)	0.06	–
CD4 cell count ≤ 200 × 10 ⁶ /l ^d	91 (61.5)	87 (50.0)	0.02	1.92 [1.05–3.52] ^f	94 (46.1)	55 (44.4)	0.76	–
Personally feels in bad state of health	109 (65.7)	106 (53.8)	0.02	–	125 (59.2)	73 (53.3)	0.27	–
Already had information about ARV treatments	97 (58.4)	87 (44.2)	0.007	–	131 (62.1)	66 (48.2)	0.01	–
Has not disclosed HIV+ serostatus to others	68 (41.0)	59 (29.9)	0.03	1.20 [1.02–1.56]	72 (34.1)	23 (16.8)	0.000	–
Score of physical abilities (median and IQR)	71.4 [57.1–92.9]	85.7 [71.4–100.0]	0.000	0.98 [0.97–0.99] ^e	78.6 [57.1–92.9]	85.7 [64.3–100.0]	0.004	0.98 [0.97–0.99] ^e

^aMultiple logistic regression model. ^bChi-square test or Mann–Whitney test. ^cVariable forced in the logistic regression model. ^dFor the 321 male respondents and the 328 female respondents who had available data on CD4 cell counts. ^eOdds ratio (OR) per unit increase of the score used. ^fWhen logistic regression model is applied to the sample of 321 male respondents with available data on CD4 cell count. ARV, antiretroviral treatment; CI, confidence interval; IQR, inter-quartile range.

HIV-related sexual behaviour was similar among men (42.6%) and women (45.2%) ($P = 0.64$), and also among the 308 respondents who declared living in a stable relationship with a regular partner (43.2%) and among the 26 who had no regular partner (50.0%) ($P = 0.50$). Episodes of unprotected sex also occurred in similar proportions with regular partners (46.5%) and with occasional partners (47.0%). However, respondents who declared multiple sexual partners were more likely always to have used condoms (65.8%) than those who only had one single partner during the previous 6 months (53.5%), although this difference was only close to statistical significance in univariate analysis ($P = 0.06$) (Table 2).

No relationship was found between age of respondents, stage of HIV disease as measured by CDC classification for clinical stage or CD4 cell counts and HIV-related sexual risk behaviour. However, patients who did not have any episode of acute morbidity in the same period were more likely to declare HIV-related risky sexual behaviour. A relationship was also found between HIV-related risky sexual behaviour and a higher score on the CES–D scale, but this was not confirmed by multivariate analysis (Table 2)

As shown in Table 2, ARV-treated patients were significantly less likely to declare episodes of unprotected sex (29.7%) than patients who did not have access to ARVs

Table 2. Factors associated with HIV-related risky sexual behaviour among sexually active HIV-infected patients consulting for HIV care in Côte d'Ivoire (n = 334) (December 1999–February 2000).

	Unprotected sexual intercourse in the previous 6 months		Level of sign P ^b	OR (95% CI) univariate	OR (95% CI) multivariate ^a
	Yes n = 146 (%)	No n = 188 (%)			
Age			0.9		
≤ 35 years	81 (55.5)	106 (56.4)		1	
> 35 years	65 (44.5)	82 (43.6)		1.04 [0.67–1.60]	–
Sex			0.6		
Male	84 (57.5)	113 (60.1)		1	
Female	62 (42.5)	75 (39.9)		1.11 [0.72–1.73]	–
ARV-treated			0.002		
No	119 (81.5)	124 (66.0)		1	1
Yes	27 (18.5)	64 (34.0)		0.44 [0.26–0.74]	0.52 [0.29–0.93]
Has known his/her HIV serostatus since			0.000		
> 9 months	60 (41.1)	116 (71.7)		1	1
≤ 9 months	86 (58.9)	72 (38.3)		1.60 [1.24–2.05]	1.90 [1.1–3.12]
Knowledge of HIV serostatus of main partner			0.000		
Knows	22 (15.1)	68 (36.2)		1	1
Doesn't know (or no regular partner)	124 (84.9)	120 (63.8)		3.19 [1.86–5.49]	3.15 [1.71–5.80]
Already had information about ARV treatments			0.000		
Yes	60 (41.1)	121 (64.4)		1	
No	86 (58.9)	67 (35.6)		2.59 [1.66–4.04]	–
High alcohol consumption			0.06		
No	116 (79.5)	164 (87.2)		1	1
Yes	30 (20.5)	24 (12.8)		1.77 [0.98–3.18]	2.32 [1.18–4.53]
Number of sex partners in previous 6 months			0.06		
1	120 (82.2)	138 (73.4)		1	1
2 or more	26 (17.6)	50 (26.6)		0.74 [0.52–1.03]	0.42 [0.23–0.78]
Education level			0.03		
≥ Secondary school	66 (45.2)	108 (57.4)		1	
< Secondary school	80 (54.8)	80 (42.6)		1.32 [1.03–1.69]	–
Access to tap water in household			0.000		
Yes	98 (67.1)	157 (83.5)		1	
No	48 (32.9)	31 (16.5)		2.48 [1.48–4.16]	–
Actively contributes to household's expenditures			0.05		
Yes	90 (61.6)	135 (71.8)		1	1
No	56 (38.4)	53 (28.2)		1.59 [1.00–2.51]	2.11 [1.04–4.30]
Had an episode of acute morbidity in the previous 6 months			0.01		
Yes	82 (56.2)	131 (69.7)		1	1
No	64 (43.8)	57 (30.3)		1.79 [1.15–2.82]	1.79 [1.09–2.93]
Participates in activities of NGOs			0.000		
Yes	22 (15.1)	60 (31.9)		1	
No	124 (84.9)	128 (68.1)		1.83 [1.26–2.68]	
CES–D score (median and interquartiles)	19.0 [12.0–27.0]	16.5 [10.0–25.0]	0.02	1.02 [1.00–1.05] ^c	

^aOdds ratios (ORs) were calculated using multiple logistic regression. ^bChi-square test or Mann–Whitney test. ^cOR per unit increase of score used. ARV, antiretroviral treatment; CI, confidence interval; NGO, non-governmental organization; CES–D, Centre for Epidemiological Studies depression scale.

Table 3. Behaviour during last sexual intercourse among sexually active HIV-infected patients consulting for HIV care in Côte d'Ivoire (n = 334) (December 1999–February 2000).

	ARV-treated patients		Non-ARV-treated patients		P (1+2) vs (3+4) ^a	P (1+3) vs (2+4) ^a
	Male (1) n = 55	Female (2) n = 36	Male (3) n = 142	Female (4) n = 101		
When?						
Less than one month	37 (67.3%)	16 (44.4%)	84(59.2%)	51(50.5%)	0.66	0.03
One month or more	18 (32.7%)	20 (55.6%)	58 (40.8%)	50(49.5%)		
With who?						
Main partner	53 (96.4%)	34 (94.4%)	117 (82.4%)	94 (93.1%)	0.02	0.04
Occasional partner	2 (3.6%)	2 (5.6%)	25 (17.6%)	7 (6.9%)		
Use of condoms						
Yes	43 (78.2%)	30 (83.3%)	91 (64.1%)	52 (53.0%)	< 0.001	0.15
No	12 (21.8%)	6 (16.7%)	51 (35.9%)	49 (47.0%)		

^aChi-square or Fisher test. ARV, antiretroviral treatment.

(49.0%). Results of multivariate analysis, also presented in Table 2, show that the following factors remain significantly related to a higher likelihood of risky sexual behaviour: having learnt his/her HIV serostatus only recently (less than 9 months); not knowing HIV serostatus of regular partner; high alcohol consumption; having only one partner; not having experienced a recent episode of acute morbidity; not participating in household's expenditures; and not being ARV-treated.

Table 3 describes the circumstances of the most recent sexual intercourse for both male and female respondents, whether or not they were ARV treated. It shows that male non-ARV-treated patients were more likely to have their most recent intercourse with an occasional partner. Overall, 35.3% of patients did not use condoms during their most recent intercourse but this proportion was significantly lower among ARV-treated than non-ARV-treated individuals.

Discussion

Since the advent of the AIDS epidemic, extensive research has been carried out, in both developed [12–14] and developing countries [15–17], about sexual behaviours and their relationships with the dynamic of spread of the HIV viruses in various populations. By contrast, the sexual behaviours of HIV-infected persons had not received similar attention until quite recently [18]. As HAART has become widely available in developed countries, there have been disturbing reports of a decreased awareness of HIV risks in the general population [19], and of an increased incidence of sexually transmitted diseases [20–22] and of high-risk sexual behaviours among homosexual and bisexual men [23–27]. Such reports have legitimately raised concerns that access to HAART may favour an increase and resumption of risky sexual behaviours among the treated HIV-infected population [1,28]. However, data from

cohort studies in developed countries remain unclear about whether or not HIV-positive individuals receiving HAART effectively tend to adopt risky sexual behaviours more frequently than those who are not on treatment [29–31].

Data about sexual behaviours among HIV-positive persons living in developing countries are scarce. In a cross-sectional study from Brazil, 60% of female partners of HIV-infected men reported safe sexual behaviour after they had been informed of their partner's serostatus [32]. In Tanzania, access to care has been associated with increased adoption of preventive behaviours among recently diagnosed HIV-infected patients [33]. To our knowledge, the survey carried out for the evaluation of the DAI in medical centers of Côte d'Ivoire was the first to compare sexual behaviours of HIV-infected patients in a developing country, whether or not they had access to ARV.

In the developed world, studies among HIV-infected patients in the pre-HAART era have shown how the expression of their sexuality has been affected by their HIV status and how sex life tapered off sharply or simply stopped for a large minority of them [18]. More than half of Ivoirian HIV-infected patients who participated in our survey declared sexual abstinence in the previous 6 months, and one-half of those who remained sexually active had a low frequency of sexual intercourse (once a month or less) during this period.

As in developed countries [34–36], absence of sexual activity in Ivoirian patients was also found to be related to physical impairment associated with HIV disease and, in the case of male patients, with more advanced immunodepression. However, results of the multivariate analysis about factors related to sexual abstinence in these patients clearly show that this behaviour is not only related to physiological and psychological factors

that may directly impede sexual activity. Sexual abstinence also seems to be the *de facto* preventive strategy of choice for a large portion of HIV-infected patients aware of their serostatus in Côte d'Ivoire. This is particularly true for women, for both men and women who do not live in stable relationships, and for men with the lowest socio-economic status and/or who live in social environments where disclosure of HIV serostatus to family and friends is highly difficult. Previous studies in Côte d'Ivoire have already mentioned that women who are aware of their HIV serostatus tend to prolong the traditional postnatal sexual abstinence period [37]. A high prevalence of sexual abstinence is also consistent with the fact that in Côte d'Ivoire, such behaviour is systematically recommended in counseling to HIV-infected patients by most health professionals and social workers and has been publicly supported by religious and spiritual leaders [38,39]. In addition, the survey shows that at the current limited stage of diffusion of the DAI, access to ARV did not change the proportion of patients who remained sexually abstinent.

More than 40% of sexually active patients in our sample declared HIV-related risky sexual behaviours in the previous 6 months and more than one-third did not use condoms during their last intercourse. Heterosexual intercourse is the main mode of transmission of HIV in developing countries such as Ivory Coast and sexual behaviours may be quite different than those observed among men having sex with men or injecting drug users in developed countries. However, some determinants of unsafe sexual behaviours in HIV-infected persons that had been identified in studies carried out in the developed world [18], such as recent knowledge of HIV diagnosis, high alcohol consumption, and absence of episodes of acute morbidity, were also found to be present in Ivoirian patients. The well-established relationship between depressive moods and higher frequency of risky sexual practices among HIV-infected persons [40] was also found in this sample, although this was not confirmed by multivariate analysis.

In this survey, more than two-thirds of HIV-infected patients who lived in a stable relationship had no information about the serostatus of their partner and this absence of information was related to a greater likelihood of unsafe sex. This, and the additional fact that patients with a single partner were more likely than those with multiple partners to practise unprotected sex suggests the specific difficulties in negotiating condom use in the context of monogamous relationships that have already been documented in Africa [17,41].

Another finding of this study is that among sexually active HIV-infected patients, who were aware of their serostatus and in contact with the health care system in Côte d'Ivoire, access to antiretroviral treatment was associated with a lower likelihood of risky sexual behaviours

in comparison with those who did not have access to ARVs. Of course, this finding must be interpreted with caution.

First, the observed lower frequency of risky behaviours among ARV-treated patients, in comparison with patients who did not get access to ARVs, may not be directly linked to ARV *per se*, but rather to the global improvement of care, support and counselling associated with prescription of ARVs in the context of the Ivoirian DAI. It has been recently argued that approaches to the prevention and control of the HIV epidemic in Africa have been too heavily based on early experiences and policies from industrialized countries, in which the disease only affects specific risk groups, and that it was urgent to redefine HIV/AIDS as 'a public health and infectious disease emergency' and to put a greater emphasis on HIV testing and counselling [42]. In comparison with other patients, ARV-treated individuals have certainly benefited from increased efforts for secondary prevention and promotion of safe sexual behaviours from various health care professionals. These include their prescribing physicians who may have given special attention to the potential risk of dissemination of resistant viral strains before initiating the use of anti-retroviral drugs in these patients and during follow-up.

Second, in multivariate analysis, ARV was only one predictor of lower likelihood of risky sexual behaviour that appears to be more heavily influenced by other social and personal characteristics of respondents, including their interaction with their regular partner.

Third, some general limitations of this survey have to be acknowledged. Its design was cross-sectional whereas a longitudinal assessment, prior and after initiation of ARV, would have been more appropriate, especially to evaluate the potential impact of access to ARV on subsequent sexual behaviours. In addition, assessment of sexual behaviours was based on self-reports which may be biased by socially desirable responding [43], and we cannot exclude that these biases may have been more pronounced among patients who went through the complex process of getting access to ARV than in the rest of the sample. Moreover, this survey was carried out less than 18 months after the effective launching of the DAI and its design was cross-sectional. Therefore, treated patients in the sample had limited follow-up. We cannot exclude that the long-term impact of ARV on sexual and social life of patients may create new opportunities for risk behaviours. In comparison with current standards of care in developed countries, initiation of ARV in the Ivoirian DAI tended to happen at lower CD4 cell count levels and thus at lower levels of sexual activity. The relative improvement in quality of life, and consequently in willingness to have an active sexual life, associated with effective treatment, may therefore be more pronounced in this population. In such a context of later

initiation, the impact of ARV on the risk behaviours in the HIV-infected population may be quite different to that in the Western world and remains difficult to predict.

Making ARV more widely available in Africa certainly calls attention to the necessity of increasing parallel efforts for both primary and secondary prevention among patients who are already HIV infected. To date, the experience of the Ivoirian DAI does not support the a priori fears that access to ARVs may facilitate risk behaviours among African HIV-infected patients, although longer follow-up and further research are clearly needed to assess the impact of ARV on subsequent behaviours in these patients. In any case, it rather confirms the argument that prevention and access to care, including ARV, should mutually reinforce each other in resource-poor settings [44].

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Appendix

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