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## Country of birth is associated with discrepancies in the prescription of two-drug regimens in successfully treated people living with HIV in France

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9 **Two-drug regimen prescription and country of birth**

10

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50 **ABSTRACT**

51 **Objectives.** We aimed to examine the association of the country of birth and the other  
52 patients' characteristics with the prescription of two-drug regimens (2DRs) in virally  
53 suppressed PLWH in France.

54 **Design.** Observational study conducted from the national Dat'AIDS prospectively collected  
55 database.

56 **Methods.** We included all adults who were actively in care on 31<sup>st</sup> December 2020 in 26 French  
57 centers, with an HIV plasma viral load (pVL) <50 copies/mL for at least 6 months while on ART.  
58 Patients with chronic hepatitis B were excluded because they are not eligible to 2DRs.  
59 Univariate and multivariate logistic regressions were built to analyze relationships between  
60 patients' characteristics and receiving a 2DR.

61 **Results.** We analyzed data from 28 395 PLWH: 41.7% men who have sex with men, 31.7%  
62 women and 26.5% heterosexual men; 35% born abroad. Median age was 53 years (IQR 44-  
63 60); ART duration 14 years (8-23); duration of virological suppression 87 months (42-142).  
64 2DRs (mainly dolutegravir/rilpivirine, 53.8%, or dolutegravir/lamivudine, 41.7%) were  
65 prescribed in 16.3% of the patients and were less common in the "born abroad" group (18.9%  
66 versus 11.5%). The multivariate model showed that individuals born in France were more  
67 likely to receive a 2DR (aOR: 1.62 [1.50-1.74]), independently of other characteristics. Older  
68 PLWH and those with higher CD4 T-cell counts were also more likely to receive a 2DR.

69 **Conclusion.** Despite unrestricted access to ART in France, independently from HIV disease  
70 parameters, PLWH born abroad were less likely to receive 2DRs as a maintenance regimen  
71 than those born in France. Qualitative data are needed to better understand physicians'  
72 prescribing practices.

73 **INTRODUCTION**

74 Recent studies have reported disparities in antiretroviral therapy (ART) prescribing in the  
75 United States [1] and France [2,3] as a first line based on race, ethnicity and/or country of  
76 birth. Non-White and foreign-born people living with HIV (PLWH) were less likely to receive  
77 integrase stand transfer inhibitor (INSTI)-containing regimens, or to receive them in the  
78 earliest calendar periods, than White and native people living with HIV. Social inequalities,  
79 differential access to private insurance, or presumed poor adherence to ART may partly  
80 explain these disparities.

81 Following these studies, we wanted to investigate possible differences in ART prescriptions  
82 among successfully treated PLWH, according to country of birth. We considered two-drug  
83 regimens (2DRs) as a beneficial maintenance therapy innovation for PLWH with no hepatitis  
84 B virus (HBV) coinfection, since 2DRs have been included in all international guidelines for  
85 several years [4,5]. We aimed to determine whether country of birth was associated with the  
86 prescription of 2DRs among PLWH undergoing viral suppression in France, where health  
87 coverage is universal, independent of social and economic conditions. Indeed, in France, the  
88 cost of all antiretroviral treatments is covered at 100% by the national health insurance  
89 system, with no advance payment by the patient.

90

91 **METHODS**

92 Information was extracted from the Dat'AIDS cohort (Clinicaltrials.gov reference:  
93 NCT02898987), approved by the French National Committee on Informatics and Human  
94 Rights (CNIL number: 1357652) [6].

95 In this observational study, we selected adult patients actively in care on 31<sup>st</sup> December 2020  
96 in 26 centers, with an HIV plasma viral load (pVL) <50 copies/mL for at least 6 months while

97 on ART. We collected sex, place of birth (“France” or “abroad”), age (on 31<sup>st</sup> December 2020),  
98 duration from HIV diagnosis and ART initiation, duration of virological suppression (pVL <50  
99 copies/mL), ongoing ART, CD4+T cell count nadir, and last CD4+T cell count. Patients with  
100 chronic hepatitis B (based on positive AgHBs) were excluded because they are not eligible to  
101 2DRs, which do not include tenofovir. All data were censored on 1<sup>st</sup> January 2021.

102 Univariate and multivariate logistic regressions with backward elimination following p-values  
103 were built to analyze relationships between patients’ characteristics and receiving a 2DR. The  
104 multivariable models at first included all the characteristics related with a 2DR in univariate  
105 analysis with a p-value <0.10, and then was step by step reduced, successively excluding  
106 characteristics with p-values ≥0.05. Only variables with p-values <0.05 were kept in the final  
107 model. All statistics were done using R (R Foundation for Statistical Computing, 2020).

108

## 109 **RESULTS**

110 We included 28 395 PLWH, including 18 525 (65%) who were born in France, and 9 870 (35%)  
111 who were born abroad. In the whole population, 67.2% were men, the median age was 53  
112 years (IQR 44-60), ART duration 14 years (8-23); duration of virological suppression 87 months  
113 (42-142). Patients who were born abroad were younger, more often women, had shorter HIV  
114 and ART histories, and shorter duration of virological suppression (Table 1). 2DRs (mainly  
115 dolutegravir/rilpivirine, 53.8%, or dolutegravir/lamivudine, 41.7%) were prescribed in 16.3%  
116 of the patients and were less common in the “born abroad” group (18.9% versus 11.5%).  
117 Conversely, boosted protease inhibitor (bPI)-based regimens were more common in patients  
118 born abroad (7.7% versus 2.7%).

119 The multivariate model showed that individuals born in France were more likely to receive a  
120 2DR (aOR: 1.62 [1.50-1.74]), independently of other characteristics (Table 2). Older PLWH and

121 those with higher CD4 T-cell counts were also more likely to receive a 2DR. Regarding the  
122 association of country of birth with the prescription of a 2DR, similar results were found when  
123 the study population was restricted to men (aOR: 1.29 [1.17-1.43]) (Supplementary File).  
124 Similar results were also found when the study population was restricted to individuals born  
125 in Sub-Saharan Africa, who counted for 59.6% of the “born abroad” group (aOR: 1.87 [1.70-  
126 2.07]) (Supplementary File).

127

## 128 **DISCUSSION**

129 Our results demonstrated clear disparities in the choice of ART in successfully treated PLWH  
130 in France. Patients who were not born in France were less likely to receive 2DRs, despite good  
131 adherence to ART, as evidenced by sustained viral suppression, and despite similar  
132 reimbursement of all antiretroviral regimens. We chose to focus our analysis on 2DRs,  
133 assuming that this therapeutic strategy is a benefit innovative option for PLWH [7], but we  
134 could also have conducted this analysis on antiretroviral classes (e.g., prescription of boosted-  
135 PI- or INSTI-containing ART). Indeed, the distribution of these classes suggested important  
136 differences in maintenance ART prescriptions by place of birth, as highlighted in previous  
137 studies among treatment-naïve PLHIV [1–3].

138 The most widely used and currently recommended 2DRs are based on dolutegravir [4,5], as  
139 illustrated in our study population, where more than 90% of patients were on  
140 dolutegravir/rilpivirine or dolutegravir/lamivudine. Women could have been less likely to  
141 receive dolutegravir-based 2DRs in recent periods, due to concerns about fetal side effects in  
142 pregnancy and/or weight gain. The 2018 international alert on the increased risk of neural  
143 tube closure in women exposed to dolutegravir in early pregnancy in Botswana [8] may have  
144 had a lasting effect on prescribing practices among women, although this increased risk has



145 now been downgraded [9]. Weight gain associated with INSTI use [10] has been reported to  
146 be more frequent in women of African heritage, especially if they were already overweight  
147 [11,12]. Consequence of these weight gains are still unclear, and physicians may act with  
148 cautiousness in women, especially in the more recent calendar periods of prescription.  
149 However, the analysis restricted to men showed persistent disparities in ART choice.

150 In addition, as our study spanned the time period of the COVID-19 crisis, it is possible that care  
151 provision at the end of the study period differed following place of birth. Indeed, it has  
152 previously been reported that PLWH born abroad experienced more disruptions in care during  
153 the Covid-19 epidemic than PLWH born in France [13]. This could also (partly) explain  
154 differences in prescriptions.

155 2DRs have been shown to be non-inferior to 3DRs in maintaining control of HIV replication  
156 while avoiding toxicities and ART drug interactions when tenofovir disoproxil fumarate and  
157 bPIs were discontinued [14–16]. Age was related with higher probability of switching to 2DRs,  
158 which may be driven by co-morbidities and the wish to avoid drug-drug interactions with co-  
159 medications [17].

160 The strength of the study is the large prospectively followed population, allowing us to  
161 perform sensitivity analyses. Nevertheless, there are limitations. We were not able to take in  
162 account the individuals' social situation, which is not collected in the cohort. However, the  
163 social situation should not be related to ART availability nor to the choice of the drugs in a  
164 country with unrestricted access to treatment. Finally, being “born abroad” included various  
165 situations. In our population, 59% of PLWH not born in France were of African origin, the  
166 others coming from various places around the world. Thus, our results may not apply to PLWH  
167 originate from North hemisphere countries, but they were too few to be analyzed in a  
168 separate way.

169 Overall, our study shows important differences in ART prescriptions according to place of  
170 birth, which cannot be explained by clinical or biological conditions. The study was not  
171 designed to explore the mechanisms explaining these discrepancies, which suggest health  
172 inequalities. Differences in education, information on therapeutic advances, and access to  
173 clinical trials between PLWH born in France and abroad may contribute to this observation  
174 [18,19]. Additionally, we cannot exclude that false beliefs – implicit or not – about racial  
175 differences, can lead to different therapeutic attitudes according to race, ethnicity or country  
176 of birth [20]. Qualitative work is needed to investigate those mechanisms.

177 **REFERENCES**

- 178 1 Zalla LC, Cole SR, Eron JJ, Adimora AA, Vines AI, Althoff KN, *et al.* **Association of Race and**  
179 **Ethnicity With Initial Prescription of Antiretroviral Therapy Among People With HIV in the**  
180 **US.** *JAMA* 2023; **329**:52.
- 181 2 Palich R, Agher R, Wetshikoy DJ, Cuzin L, Seang S, Soulie C, *et al.* **Birth country influences**  
182 **the choice of antiretroviral therapy in HIV-infected individuals: experience from a French**  
183 **HIV centre.** *J Acquir Immune Defic Syndr* Published Online First: 17 October 2022.  
184 doi:10.1097/QAI.0000000000003114
- 185 3 Palich R, Hentzien M, Hocqueloux L, Duvivier C, Allavena C, Huleux T, *et al.* **Country of birth**  
186 **is associated with antiretroviral therapy choice in treatment-naive persons living with HIV**  
187 **in France.** *AIDS* Published Online First: 21 April 2023. doi:10.1097/QAD.0000000000003588
- 188 4 European AIDS Clinical Society. Guidelines for the management of people living with HIV in  
189 Europe - v11.1. 2022.[https://www.eacsociety.org/media/guidelines-11.1\\_final\\_09-10.pdf](https://www.eacsociety.org/media/guidelines-11.1_final_09-10.pdf)  
190 (accessed 29 April 2023).
- 191 5 Thompson MA, Horberg MA, Agwu AL, Colasanti JA, Jain MK, Short WR, *et al.* **Primary Care**  
192 **Guidance for Persons With Human Immunodeficiency Virus: 2020 Update by the HIV**  
193 **Medicine Association of the Infectious Diseases Society of America.** *Clin Infect Dis* 2021;  
194 **73**:e3572–e3605.
- 195 6 Pugliese P, Cuzin L, Cabié A, Poizot-Martin I, Allavena C, Duvivier C, *et al.* **A large French**  
196 **prospective cohort of HIV-infected patients: the Nadis Cohort.** *HIV Med* 2009; **10**:504–  
197 511.
- 198 7 Gibas KM, Kelly SG, Arribas JR, Cahn P, Orkin C, Daar ES, *et al.* **Two-drug regimens for HIV**  
199 **treatment.** *Lancet HIV* 2022; **9**:e868–e883.

- 200 8 Zash R, Makhema J, Shapiro RL. **Neural-Tube Defects with Dolutegravir Treatment from**  
201 **the Time of Conception.** *N Engl J Med* 2018; **379**:979–981.
- 202 9 Zash R, Holmes L, Diseko M, Jacobson DL, Brummel S, Mayondi G, *et al.* **Neural-Tube**  
203 **Defects and Antiretroviral Treatment Regimens in Botswana.** *N Engl J Med* 2019; **381**:827–  
204 840.
- 205 10 Bai R, Lv S, Wu H, Dai L. **Effects of different integrase strand transfer inhibitors on**  
206 **body weight in patients with HIV/AIDS: a network meta-analysis.** *BMC Infect Dis* 2022;  
207 **22**:118.
- 208 11 Kerchberger AM, Sheth AN, Angert CD, Mehta CC, Summers NA, Ofotokun I, *et al.*  
209 **Weight Gain Associated With Integrase Stand Transfer Inhibitor Use in Women.** *Clin Infect*  
210 *Dis* 2020; **71**:593–600.
- 211 12 Lake JE, Wu K, Bares SH, Debroy P, Godfrey C, Koethe JR, *et al.* **Risk Factors for Weight**  
212 **Gain Following Switch to Integrase Inhibitor-Based Antiretroviral Therapy.** *Clin Infect Dis*  
213 Published Online First: 26 February 2020. doi:10.1093/cid/ciaa177
- 214 13 Zucman D, Rasnaama A, Majerholc C, Vallée A. **The COVID-19 Pandemic and the**  
215 **Migrant Population for HIV Diagnosis and Care Follow-Up: They Are Left Behind.**  
216 *Healthcare (Basel)* 2022; **10**:1607.
- 217 14 van Wyk J, Ajana F, Bisshop F, De Wit S, Osiyemi O, Portilla J, *et al.* **Efficacy and Safety**  
218 **of Switching to Dolutegravir/Lamivudine Fixed-Dose Two-Drug Regimen Versus**  
219 **Continuing a Tenofovir Alafenamide-Based Three- or Four-Drug Regimen for**  
220 **Maintenance of Virologic Suppression in Adults With HIV-1: Phase 3, Randomized, Non-**  
221 **inferiority TANGO Study.** *Clin Infect Dis* Published Online First: 6 January 2020.  
222 doi:10.1093/cid/ciz1243

- 223 15 Aboud M, Orkin C, Podzamczar D, Bogner JR, Baker D, Khuong-Josses M-A, *et al.*  
224 **Efficacy and safety of dolutegravir–rilpivirine for maintenance of virological suppression**  
225 **in adults with HIV-1: 100-week data from the randomised, open-label, phase 3 SWORD-1**  
226 **and SWORD-2 studies.** *Lancet HIV* 2019; **6**:e576–e587.
- 227 16 Katlama C, Assoumou L, Valantin M-A, Soulié C, Martinez E, Béniguel L, *et al.* **Dual**  
228 **therapy combining raltegravir with etravirine maintains a high level of viral suppression**  
229 **over 96 weeks in long-term experienced HIV-infected individuals over 45 years on a PI-**  
230 **based regimen: results from the Phase II ANRS 163 ETRAL study.** *J Antimicrob Chemother*  
231 2019; **74**:2742–2751.
- 232 17 Allavena C, Hanf M, Rey D, Duvivier C, BaniSadr F, Poizot-Martin I, *et al.* **Antiretroviral**  
233 **exposure and comorbidities in an aging HIV-infected population: The challenge of**  
234 **geriatric patients.** *PloS One* 2018; **13**:e0203895.
- 235 18 Glied S, Lleras-Muney A. **Technological innovation and inequality in health.**  
236 *Demography* 2008; **45**:741–761.
- 237 19 Bass SB, D’Avanzo P, Alhajji M, Ventriglia N, Trainor A, Maurer L, *et al.* **Exploring the**  
238 **Engagement of Racial and Ethnic Minorities in HIV Treatment and Vaccine Clinical Trials:**  
239 **A Scoping Review of Literature and Implications for Future Research.** *AIDS Patient Care*  
240 *STDs* 2020; **34**:399–416.
- 241 20 Williams DR, Wyatt R. **Racial Bias in Health Care and Health: Challenges and**  
242 **Opportunities.** *JAMA* 2015; **314**:555–556.

243

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245 Dat’AIDS study Group: Besançon: C. Chirouze, K. Bouiller, F. Bozon, AS. Brunel, L. Hustache-  
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247 Brest: S. Jaffuel, S. Ansart, Y. Quintric, S. Rezig, L. Quaesaet, P. Gazeau. Clermont-Ferrand: C.  
248 Jacomet, N. Mrozek, C. Theis, M. Vidal, C. Richaud, F. Anglade, L. Sauvat, V. Corbin, C.  
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256 Ader, C. Brochier, F. Brunel-Dalmas, O. Cannesson, A. Conrad, S. Degroodt, T. Ferry, M.  
257 Godinot, V. Icard, J.M. Livrozet, D. Makhloufi, T. Perpoint, S. Roux, MA. Trabaud, C. Triffault-  
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259 Ravaux, A. Ménard, Y. Belkhir, P. Colson, C. Dhiver, M. Martin-Degioanni, L. Meddeb, M.  
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261 Zaegel-Faucher, H. Laroche, M. Dos Santos, MJ. Ducassou, S. Galie, A. Ivanova, I. Jaquet, V.  
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263 B. Bigeard, C. Bidelogne, O. Cabras, L Carnino, L. Cuzin, L. Fagour, A. Gros-Dubois, K. Guitteaud,  
264 C. Lahuna, E. Louis-Michel, A. Métais, F Quenard, S. Pierre-François. Metz: C. Robert, Z. Cavalli,  
265 L. Bucy, R. Genet, C. Schneifer, P. Perez. Montpellier: J. Reynes, M. Bistoquet, E Delaporte, V.  
266 Le Moing, J. Lejeune, N. Meftah, C. Merle de Boever, B. Montes, A. Montoya Ferrer, N. Pansu,  
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268 Bouillon, A. Charmillon, M. Delestan, C. Emilie, E. Frentiu, F. Goehringer, S. Hénard, E.  
269 Jeanmaire, C. Rabaud, A. Radjabaly-Mandjee. Nantes: F. Raffi, C. Allavena, E. André-Garnier,  
270 A. Asquier-Khati, E. Billaud, C. Biron, B. Bonnet, S. Bouchez, D. Boutoille, C. Brunet-Cartier, M.

271 Cavellec, C. Deschanvres, Th. Drumel, BJ. Gaborit, M. Grégoire, T. Jovelin, M. Lefebvre, R.  
272 Lecomte, R. Mahot, P. Morineau, E. Paredes, V. Reliquet, A. Soria. Nice: P. Pugliese, S. Bréaud,  
273 M. Buscot, M. Carles, D. Chirio, E. Cua, P. Dellamonica, E. Demonchy, A. De Monte, J. Durant,  
274 S. Ferrando, A. Naqvi, I. Perbost, C. Pradier, B. Prouvost-Keller, K. Risso, I. Touitou, A. Viot, S.  
275 Wehrle-Pugliese. Niort: S. Sunder, K. Schepers, V. Goudet, A. Dos Santos, V. Rzepecki. Orléans  
276 :L. Hocqueloux, G. Béraud, C. Gubavu, V. Legros, C. Mille, F. Peira, T. Prazuck, A. Sève. Paris  
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278 E. Teicher, S. Jaureguiberry. Paris APHP Bichat: V. Joly, C. Charpentier, D. Descamps, M.  
279 Digumber, A. Gervais, J. Ghosn, Z. Julia, R. Landman, S. Lariven, S. Le Gac, F. Louni, N. Peiffer-  
280 Smadja, G. Peytavin, C. Rioux, Y. Yazdanpanah. Paris APHP Necker, Institut Pasteur: C. Duvivier,  
281 K. Amazzough, G. Benabdelmoumen, P. Bossi, G. Cessot, C. Charlier, PH. Consigny, C. De La  
282 Porte Des Vaux, M. Garzaro, E. Gomes-Pires, P. Hochedez, K. Jidar, E. Lafont, F. Lanternier, O.  
283 Lortholary, C. Louisin, J. Lourenco, C. Melenotte, O. Pacoud, P. Parize, F. Ruyno, C. Rouzard,  
284 F. Taieb. Paris APHP Pitié Salpêtrière: R. Palich, MA. Valantin, C. Katlama, A. Faycal, R. Agher,  
285 Y. Dudoit, N. Hamani, N. Qatib, I. Qzaibri, L. Lenclume, L. Schneider, S. Seang, R. Tubiana.  
286 Quimper: N. Hall, P. Perfezou, JC. Duthe, FB. Drevillon, JP. Talarmin, L. Khatchatourian. Reims:  
287 F. Bani-Sadr, JL. Berger, V. Brodard, M. Hentzien, I. Kmiec, D. Lambert, H. Marty, Y. N'Guyen.  
288 Rennes: C. Arvieux, M. Baldeyrou, F. Benezit, JM. Chapplain, M. Dupont, JC. Duthé, S. Ismaël,  
289 T. Jovelin, A. Lebot, F. Lemaitre, D. Luque-Paz, A. Maillard, C. Morlat, S. Patrat-Delon, L. Picard,  
290 M. Poisson-Vannier, C. Pronier M. Revest, P. Tattevin, J. Vivent. St Etienne: A. Gagneux-  
291 Brunon, E. Botelho-Nevers, A. Frésard, A. Pouvaret, V. Ronat. Strasbourg: D. Rey, C. Cheneau,  
292 C. Bernard-Henry, E. De Mautort, S. Fafi-Kremer, P. Fischer, P. Gantner, C. Mélounou, A.  
293 Ursenbach, P. Klee, Y. Hansmann, N. Lefebvre, Y. Ruch, F. Danion, B. Hoellinger, T. Lemmet, V.  
294 Gerber, M. Bourne-Watrin. Toulouse: P. Delobel, M. Alvarez, N. Biezunski, X. Boumaza, A.

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299

#### 300 **CONFLICTS OF INTEREST**

301 RP, LH, TH, AM have received travel grants and honoraria from Gilead, ViiV Healthcare and  
302 Merck. MH has received travel grants and honoraria from Gilead and ViiV Healthcare. LC has  
303 received travel grants from ViiV Healthcare. PD has no conflict of interest to declare.

304

#### 305 **ETHICS STATEMENT**

306 Information was extracted from the Dat'AIDS cohort (Clinicaltrials.gov reference:  
307 NCT02898987), approved by the French National Committee on Informatics and Human  
308 Rights (CNIL number: 1357652).

309

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311 This study was done as routine work and was not funded.

312

#### 313 **CONTRIBUTORSHIP STATEMENT**

314 RP designed the study and wrote the first draft; MH and LC designed and performed the  
315 analysis; LH, CD, CA, TH, PD, DR and AM were responsible for data quality in the centers and  
316 provided useful advice in the discussion. AM was responsible for English editing.



**Table 1. Patients' characteristics, depending on the place of birth.**

		Born in France N = 18 467	Born abroad N = 9 870	<i>P</i>
Age (years)		55 [47-61]	49 [41,58]	<0.0001
Age (%)	<45 years	3 709 (51.6)	3 473 (48.4)	<0.0001
	45-53 years	4 760 (63.4)	2 752 (36.6)	
	54-60 years	5 158 (73.8)	1 834 (26.2)	
	>60 years	4 898 (73.1)	1 811 (26.9)	
Gender and sexual orientation (%)	Women	3 900 (43.5)	5 065 (56.5)	<0.0001
	MSM <sup>1</sup>	10 042 (84.5)	1 847 (15.5)	
	MSW <sup>2</sup>	4 575 (60.9)	2 937 (39.1)	
Duration from HIV diagnosis (years)		20 [11-28]	15 [9-21]	<0.0001
CD4+T cells nadir (cell/mm <sup>3</sup> )		229 [103-348]	212 [102-323]	<0.0001
CD4+T cells nadir (%)	<200	8 022 (63.7)	4 571 (36.3)	<0.0001
	201-350	5 954 (64.3)	3 311 (35.7)	
	351-500	2 855 (67.8)	1 356 (32.2)	
	>500	1 688 (72.9)	629 (27.1)	
Duration from first line of ART (years)		16 [9-24]	13 [7-19]	<0.0001
Duration of viral suppression (months)		122 [69-177]	90 [46-150]	<0.0001
Ongoing ART (%)	2 NRTIs <sup>3</sup> + 1 bPI <sup>4</sup>	517 (39.9)	780 (60.1)	<0.0001
	2 NRTIs <sup>3</sup> + 1 NNRTI <sup>5</sup>	4 925 (63.4)	2 842 (36.6)	
	2 NRTIs <sup>3</sup> + 1 INSTI <sup>6</sup>	7 786 (63.8)	4 410 (38.2)	
	Two-drug regimen	3 499 (75.7)	1 125 (24.3)	
	Other	1 798 (71.6)	713 (28.4)	
Last CD4+T cells (cell/mm <sup>3</sup> )		706 [525-927]	638 [472-841]	<0.0001
Last CD4+T cells (%)	<200	348 (61.3)	220 (38.7)	<0.0001
	200-350	1 188 (58.4)	846 (41.6)	
	350-500	2 475 (58.4)	1 764 (41.6)	
	>500	14 311 (67.2)	6 985 (32.8)	
Number of ART lines		5 [3-9]	5 [3-7]	<0.0001

NOTES. All variables were fully assessed except for gender: 7 missing values for patients born in France and 23 for patients born abroad and last CD4+T cells: 206 missing values for patients born in France and 55 for patients born abroad. 1. Men having sex with men. 2. Men having sex with women. 3. Nucleosidic reverse transcriptase inhibitor. 4. Boosted protease inhibitor. 5. Non-nucleosidic reverse transcriptase inhibitor. 6. Integrase strand transfer inhibitor.

**Table 2. Patients' characteristics related with being treated by a 2-drug regimen.**

		OR, 95%CI	aOR, 95%CI
		Univariate	Multivariate
Age (years)	<44	Ref.	Ref.
	45-53	1.46 [1.33-1.61]	1.40 [1.27-1.55]
	53-60	1.80 [1.64-1.98]	1.66 [1.50-1.83]
	>61	2.39 [2.18-2.63]	2.25 [2.04-2.48]
Born in France		1.81 (1.68-1.94)	1.62 [1.50-1.74]
Gender and sexual orientation	Women	Ref.	-
	MSM <sup>1</sup>	1.29 [1.20-1.40]	-
	MWW <sup>2</sup>	1.07 [0.98-1.17]	-
Duration from HIV diagnosis (per year)		1.03 (1.02-1.03)	-
CD4+T cells nadir (cell/mm <sup>3</sup> )	<200	Ref.	-
	200-350	1.00 [0.93-1.07]	-
	350-500	0.93 [0.85-1.03]	-
	>500	0.85 [0.75-0.96]	-
Duration from first line of ART (per year)		1.04 [1.03-1.04]	-
Duration of viral suppression (months)		1.00	-
Last CD4+T cells (cell/mm <sup>3</sup> )	<200	Ref.	Ref.
	200-350	1.34 [1.00-1.80]	1.33 [0.99-1.79]
	350-500	1.40 [1.07-1.86]	1.44 [1.10-1.92]
	>500	1.62 [1.25-1.13]	1.68 [1.30-2.22]
Number of ART lines (for 1)		1.07 [1.07-1.08]	-

1. Men having sex with men. 2. Men having sex with women.

**Supplementary Table 1. Patients' characteristics, depending on the place of birth (analysis restricted to men).**

		Born in France N = 14 554	Born abroad N = 4 572	<i>P</i>
Age (years)		54 [47-61]	53 [43-61]	<0.0001
Age (%)	<45 years	3 592 (70.3)	1 521 (29.7)	<0.0001
	45-53 years	3 718 (78.2)	1 035 (21.8)	
	54-60 years	3 790 (79.2)	994 (20.8)	
	>60 years	3 454 (77.2)	1 022 (22.8)	
Gender and sexual orientation (%)	MSM <sup>1</sup>	9 979 (85.9)	1 635 (14.1)	<0.0001
	MSW <sup>2</sup>	4 575 (60.9)	2 937 (39.1)	
Duration from HIV diagnosis (years)		18 [10-27]	15 [8-23]	<0.0001
CD4+T cells nadir (cell/mm <sup>3</sup> )		235 [106-357]	203 [85-323]	<0.0001
CD4+T cells nadir (%)	<200	6 130 (73.2)	2 244 (26.8)	<0.0001
	201-350	4 630 (76.6)	1 411 (23.4)	
	351-500	2 389 (79.2)	591 (19.8)	
	>500	1 405 (81.2)	326 (18.8)	
Duration from first line of ART (years)		15 [8-23]	12 [7-19]	<0.0001
Duration of viral suppression (months)		120 [69-175]	92 [48-153]	<0.0001
Ongoing ART (%)	2 NRTIs <sup>3</sup> + 1 bPI <sup>4</sup>	354 (62.9)	209 (37.1)	<0.0001
	2 NRTIs <sup>3</sup> + 1 NNRTI <sup>5</sup>	3 891 (76.7)	1 186 (23.3)	
	2 NRTIs <sup>3</sup> + 1 INSTI <sup>6</sup>	6 302 (74)	2 218 (26)	
	Two-drug regimen	2 695 (81.8)	598 (18.2)	
	Other	1 312 (78.4)	361 (21.6)	
Last CD4+T cells (cell/mm <sup>3</sup> )		693 [515-906]	614 [447-822]	<0.0001
Last CD4+T cells (%)	<200	273 (62.2)	133 (32.8)	<0.0001
	200-350	1 020 (67.9)	482 (32.1)	
	350-500	2 021 (69.6)	884 (30.4)	
	>500	11 100 (78.4)	3 050 (21.6)	
Number of ART lines		5 [3-9]	4 [3-7]	<0.0001

NOTES. 1. Men having sex with men. 2. Men having sex with women. 3. Nucleosidic reverse transcriptase inhibitor. 4. Boosted protease inhibitor. 5. Non-nucleosidic reverse transcriptase inhibitor. 6. Integrase strand transfer inhibitor.

**Supplementary Table 2. Patients' characteristics related with being treated by a 2-drug regimen (analysis restricted to men).**

		OR, 95%CI	aOR, 95%CI
		Univariate	Multivariate
Age (years)	<44	Ref.	Ref.
	45-53	1.23 [1.09-1.37]	-
	53-60	1.38 [1.24-1.54]	-
	>61	1.94 [1.75-2.16]	-
Born in France		1.51 [1.37-1.66]	1.29 [1.17-1.43]
Gender and sexual orientation	MSM <sup>1</sup>	Ref.	Ref.
	MWW <sup>2</sup>	0.81 [0.75-0.88]	0.86 [0.79-0.94]
Duration from HIV diagnosis (per year)		1.02 [1.01-1.02]	-
CD4+T cells nadir (cell/mm <sup>3</sup> )	<200	Ref.	-
	200-350	1.03 [0.94-1.12]	-
	350-500	0.99 [0.88-1.10]	-
	>500	0.82 [0.71-0.95]	-
Duration from first line of ART (per year)		1.03 [1.02-1.03]	-
Duration of viral suppression (months)		1.00 [1.00-1.00]	-
Last CD4+T cells (cell/mm <sup>3</sup> )	<200	Ref.	Ref.
	200-350	1.53 [1.08-2.19]	1.60 [1.13-2.31]
	350-500	1.71 [1.24-2.41]	1.85 [1.33-2.64]
	>500	1.86 [1.37-2.61]	2.19 [1.59-3.08]
Number of ART lines (for 1)		1.07 [1.06-1.08]	1.06 [1.05-1.07]

NOTES. 1. Men having sex with men. 2. Men having sex with women.

**Supplementary Table 3. Patients' characteristics, depending on the place of birth (analysis restricted to PLWH originated from Sub-Saharan Africa).**

		Born in France N = 18 456	Born abroad N = 5 887	<i>P</i>
Age (years)		55 [47-61]	47 [40-55]	<0.001
Age (%)	<45 years	3 951 (60.4)	2 594 (39.6)	<0.0001
	45-53 years	4 403 (73.4)	1 593 (26.6)	
	54-60 years	5 178 (84.8)	926 (15.2)	
	>60 years	4 924 (87.1)	731 (12.9)	
Gender and sexual orientation (%)	Women	9 985 (97.5)	260 (2.5)	<0.0001
	MSM <sup>1</sup>	4 576 (73.5)	1 646 (26.5)	
	MSW <sup>2</sup>	3 888 (49.7)	3 937 (50.3)	
Duration from HIV diagnosis (years)		20 [11-28]	15 [8-19]	<0.001
CD4+T cells nadir (cell/mm <sup>3</sup> )		231 [105-351]	218 [114-324]	<0.001
CD4+T cells nadir (%)	<200	7 908 (75.2)	2 613 (24.8)	<0.0001
	201-350	5 917 (74.4)	2 039 (25.6)	
	351-500	2 868 (77)	853 (23)	
	>500	1 763 (83.9)	339 (16.1)	
Duration from first line of ART (years)		16 [9-24]	12 [7-17]	<0.001
Duration of viral suppression (months)		97 [50-151]	64 [31-114]	<0.001
Ongoing ART (%)	2 NRTIs <sup>3</sup> + 1 bPI <sup>4</sup>	493 (45.8)	583 (54.2)	<0.0001
	2 NRTIs <sup>3</sup> + 1 NNRTI <sup>5</sup>	4 940 (73)	1 824 (27)	
	2 NRTIs <sup>3</sup> + 1 INSTI <sup>6</sup>	7 767 (75.6)	2 5608 (24.4)	
	Two-drug regimen	3 492 (86.4)	548 (13.6)	
	Other	1 764 (82.2)	381 (17.8)	
Last CD4+T cells (cell/mm <sup>3</sup> )		707 [527-928]	617 [461-803]	<0.001
Last CD4+T cells (%)	<200	332 (73.9)	117 (26.1)	<0.001
	200-350	1 163 (69)	523 (31)	
	350-500	2 470 (68.1)	1 161 (31.9)	
	>500	14 286 (78.1)	4 013 (21.9)	
Number of ART lines		5 [3-9]	4 [3-7]	<0.001

NOTES. 1. Men having sex with men. 2. Men having sex with women. 3. Nucleosidic reverse transcriptase inhibitor. 4. Boosted protease inhibitor. 5. Non-nucleosidic reverse transcriptase inhibitor. 6. Integrase strand transfer inhibitor.

**Supplementary Table 4. Patients' characteristics related with being treated by a 2-drug regimen (analysis restricted to PLWH originated from Sub-Saharan Africa).**

		OR, 95%CI	aOR, 95%CI
		Univariate	Multivariate
Age (years)	<44	Ref.	Ref.
	45-53	1.48 [1.33-1.64]	1.22 [1.09-1.35]
	53-60	1.78 [1.61-1.96]	1.24 [1.11-1.38]
	>61	2.34 [2.12-2.58]	1.60 [1.44-1.78]
Born in France		2.25 [2.05-2.48]	1.87 [1.70-2.07]
Gender and sexual orientation	Women	Ref.	Ref.
	MSM <sup>1</sup>	1.36 [1.26-1.48]	-
	MWW <sup>2</sup>	1.09 [0.99-1.19]	-
Duration from HIV diagnosis (per year)		1.03 [1.02-1.03]	-
CD4+T cells nadir (cell/mm <sup>3</sup> )	<200	Ref.	-
	200-350	0.99 [0.91-1.07]	-
	350-500	0.90 [0.81-0.99]	-
	>500	0.86 [0.75-0.98]	-
Duration from first line of ART (per year)		1.04 [1.03-1.04]	-
Duration of viral suppression (months)		1.00 [1.00-1.00]	-
Last CD4+T cells (cell/mm <sup>3</sup> )	<200	Ref.	-
	200-350	1.10 [0.82-1.51]	-
	350-500	1.16 [0.88-1.56]	-
	>500	1.33 [1.02-1.77]	-
Number of ART lines (for 1)		1.07 [1.06-1.08]	1.06 [1.05-1.07]

NOTES. 1. Men having sex with men. 2. Men having sex with women.