

Are European HIV cohort data within EuroCoord representative of the diagnosed HIV population?

Georgia Vourli^a, Anastasia Pharris^b, Francoise Cazein^c,
 Dominique Costagliola^d, Francois Dabis^e, Julia Del Amo^f,
 Valerie Delpech^g, Asuncion Díaz^f, Enrico Girardi^h,
 Annabelle Gourlay^{i,j}, Barbara Günsenheimer-Bartmeyer^k,
 Victoria Hernando^f, Georgios Nikolopoulos^l, Kholoud Porterⁱ,
 Magdalena Rosińska^m, Caroline Sabinⁱ, Barbara Suligojⁿ,
 Virginie Supervie^d, Ferdinand Wit^o and Giota Touloumi^a

Objective: HIV cohorts are an important source of clinical data for informing public health policies and programmes. However, the generalizability of cohort findings to the wider population of people diagnosed with HIV in each country remains unclear. In this work, we assessed the representativeness of six large national HIV cohorts within Europe.

Design and methods: Individual-level cohort data were provided from national cohorts in France, Germany, Greece, Italy, Spain and the United Kingdom. Analysis focused on new HIV diagnoses reported to The European Surveillance System (TESSy) during three time periods (2000–2004, 2005–2009 and 2010–2013), to allow for temporal changes. Cohort and TESSy records were matched and compared by age, sex, transmission mode, region of origin and CD4⁺ cell count at diagnosis. The probability of being included in each cohort given demographic characteristics was estimated and used to generate weights inversely proportional to the probability of being included.

Results: Participating cohorts were generally representative of the national HIV-diagnosed population submitted to TESSy. However, people who inject drugs, those born in

^aDepartment of Hygiene, Epidemiology and Medical Statistics, Medical School, NKUA, Athens, Greece, ^bEuropean Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden, ^cSanté Publique France, The French National Public Health Agency, ^dSorbonne Université, INSERM, Institut Pierre Louis d'Epidémiologie et de Santé Publique (IPLESP), Paris, ^eUniversité Bordeaux, ISPED, Centre INSERM U1219 – Bordeaux Population Health, Bordeaux, France, ^fNational Center of Epidemiology, Instituto de Salud Carlos III, Madrid, Spain, ^gPublic Health England, London, UK, ^hClinical Epidemiology Unit, National Institute for Infectious Diseases L. Spallanzani, Rome, Italy, ⁱInstitute for Global Health, University College London, ^jDepartment of Population Health, Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK, ^kSTI Unit, Department of Infectious Disease Epidemiology HIV/AIDS, Robert Koch-Institute, Berlin, Germany, ^lMedical School, University of Cyprus, Nicosia, Cyprus, ^mDepartment of Epidemiology of Infectious Diseases and Surveillance, National Institute of Public Health-National Institute of Hygiene, Warsaw, Poland, ⁿCentro Operativo AIDS, Istituto Superiore di Sanità, Rome, Italy, and ^oStichting HIV Monitoring, Amsterdam, The Netherlands.

Correspondence to Dr Georgia Vourli, PhD, Department of Hygiene, Epidemiology and Medical Statistics, Medical School, NKUA, Mikras Asias 75 Street, Athens, Greece.

Tel: +30 210746223; e-mail: gvourli@med.uoa.gr

Received: 4 April 2018; accepted: 3 September 2018.

DOI:10.1097/QAD.0000000000002034

ISSN 0269-9370 Copyright © 2018 The Author(s). Published by Wolters Kluwer Health, Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

a country other than that reporting the data, those with low CD4⁺ cell counts at diagnosis, and those more than 55 years were generally underrepresented in the cohorts examined.

Conclusion: These European cohorts capture a representative sample of the HIV-diagnosed populations in each country; however some groups may be underrepresented.

Copyright © 2018 The Author(s). Published by Wolters Kluwer Health, Inc.

AIDS 2019, **33**:133–143

Keywords: cohorts, HIV, representativeness, surveillance

Introduction

HIV infection continues to be of major public health importance worldwide, notably because significant numbers of new infections and premature deaths continue to occur [1]. In the era of test and treat approaches and of biomedical prevention [2], the development and assessment of effective public health responses requires the monitoring of not only new diagnoses and routes of transmission, but also other key markers including linkage to care, treatment uptake and viral suppression.

HIV surveillance in Europe is carried out by the European Centre for Disease Prevention and Control (ECDC) and the WHO Regional Office for Europe. HIV cases reported annually by European Union Member States to The European Surveillance System (TESSy), hosted at ECDC, remain the best estimate of the number of people diagnosed with HIV, although underreporting does occur in some Member States. Although the demographic data collected by TESSy provides important information for monitoring, data on clinical indicators are often lacking. EuroCoord was a Network of Excellence established by several of the largest HIV cohorts and collaborations within Europe – as part of this collaborative effort, EuroCoord supported the development of a combined dataset including individual demographic data and clinical indicators for almost 300 000 HIV-positive adults and children [3].

HIV cohorts are an important source of data for informing policy. However, cohorts may systematically exclude specific groups of individuals, those less likely to access care, such as people who inject drugs (PWID) [4–6]. The representativeness of each cohort is usually assessed by comparing the characteristics of cohort participants to those of corresponding reference populations [7–10]. Several methods to account for selection bias have been proposed [11–13].

The aim of the present work was to assess the representativeness of several large cohorts of HIV-positive adult individuals followed within EuroCoord by comparing their characteristics with those diagnosed from the

same countries as submitted to TESSy. These findings can inform our understanding of whether, and in which settings and population groups, results based on cohort data can be generalized to the wider population, allowing ECDC, European Union Member States, and the European Commission to confidently use cohort data to provide guidance on issues of public health importance with regard to HIV infection.

Methods

Seven cohorts within EuroCoord that do not form the basis of their respective national surveillance systems were included in analyses: the French Hospitals Database on HIV ANRS CO4 and Aquitaine ANRS CO3 from France [14,15], Clinical Surveillance of HIV Disease (ClinSurv) from Germany [16], Athens Multicentre AIDS Cohort Study (AMACS) from Greece, Italian Cohort Naïve Antiretrovirals (ICONA) from Italy [17], Cohort of the Spanish HIV Research Network (CoRIS) from Spain, and the UK Collaborative HIV Cohort (UK CHIC) from the United Kingdom [18].

TESSy data of individuals diagnosed up to 2013 and reported up to 2015 in these six countries were provided by ECDC under agreement for data confidentiality. Anonymized data with variables on age, sex, transmission mode, country/region of origin, year of diagnosis and CD4⁺ cell counts at diagnosis were included. Individual cohort data on the same variables were provided from each participating country. All participating cohorts had approval from relevant country authorities.

Statistical analysis

TESSy data were considered as the gold standard against which the characteristics of cohort participants were compared. Analyses focused on HIV cases diagnosed during the time periods 2000–2004, 2005–2009 and 2010–2013 to account for changes in individual characteristics over time. Each country and time period was analysed separately.

To avoid confusion due to different percentages of missing data in TESSy and the cohorts, multivariate imputation by chained equations was applied before analysis (see Appendix, <http://links.lww.com/QAD/B370>) [19]. Transmission mode was categorized as: MSM, PWID and 'other', which mainly included those reportedly infected through heterosexual contact. Region of origin was categorized as: reporting country, other European (nonreporting) country/Australia/North America and Africa/Asia/Latin America. Age was categorized as 15–24.9, 25–34.9, 35–44.9, 45–54.9 and at least 55 years; and CD4⁺ cell counts as less than 200, 200–349, 350–499 and at least 500 cells/ μ l. Region of origin was not adequately recorded in ClinSurv, whereas ethnicity instead of origin was recorded in the UK CHIC Study and thus it was not analysed in these countries. In ICONA, participants from Italy were recorded as Europeans, and thus the region of origin could only be categorized in two groups. CD4⁺ cell counts were not reported to TESSy from Germany and for France were only reported from 2008 onwards.

TESSy and cohort datasets from each country were merged by a pseudo-id created by combining each individual covariate pattern with a unique within-covariate pattern serial number. The distributions of individual characteristics in the two datasets were compared. An indicator of whether a diagnosed individual reported to TESSy was included in the cohort was generated. Multivariable logistic regression models were fitted to estimate the probability of diagnosed individuals being included in the cohort given their characteristics and stabilized weights inversely proportional to this probability were generated [11–13].

Inference was based on the median stabilized weights for the levels of the studied covariates, pooled over all periods and other covariates, along with the corresponding interquartile range (IQR); underrepresentation required that the entire IQR was greater than 1.

Results

In total, 235 437 individuals reported to TESSy and 96 768 cohort participants of known sex, diagnosed after 2000 and during the periods covered by both surveillance and cohorts, were included in the analyses.

In general, the cohorts captured the main characteristics of the HIV-diagnosed individuals in the corresponding countries (Table 1). Main trends over time observed in TESSy were also seen in the cohorts. However, specific subgroups were underrepresented (Fig. 1). PWID, those born in another country, those with low CD4⁺ cell counts at diagnosis, older individuals and women were, in general, underrepresented in the cohorts, but in different

degrees across different countries (Fig. 1). PWID were underrepresented in France, Greece, Spain and the United Kingdom. In Germany, this finding held only for the 2005–2009 period. In Italy, Spain and the United Kingdom, individuals reporting other transmission mode were underrepresented; in France and Greece individuals originated from other than the reporting country and in Spain those originated from another (nonreporting) European country were also underrepresented; individuals who were older than 55 years were underrepresented in Italy, Spain, the United Kingdom and, to some extent, in Greece. Women were also slightly underrepresented in most countries including Italy, Spain and the United Kingdom, whereas in Greece, women were underrepresented only in the 2005–2009 period.

Although the degree of underrepresentation or overrepresentation was quite low when we considered each variable separately, it varied substantially when we considered the degree of representation by covariate patterns (i.e. combining all variables). In France, PWID originated from outside the country were highly underrepresented (stabilized weights: 1.8–13.1), as were MSM originated from Africa, Asia or Latin America (stabilized weights: 1.2–4.6). Similarly, in Greece, PWID originated from other European countries were substantially underrepresented (stabilized weights: 1.6–4.9). In Spain, PWID originated from other countries were also underrepresented (stabilized weights: 1.5–3.4).

Application of inclusion weights efficiently compensated for observed imbalances and reproduced the structure of the corresponding diagnosed population (Appendix, Fig. A1, <http://links.lww.com/QAD/B370>).

Discussion

This is the first effort to assess the representativeness of European HIV cohorts within EuroCoord compared with the wider population of HIV-diagnosed individuals reported to TESSy. Our findings suggest that, whilst cohort participants are a fairly representative sample of HIV-diagnosed individuals, some groups remain underrepresented or overrepresented within these cohorts.

All participating cohorts, other than CoRIS in which participants are also recruited from an STI clinic, are HIV clinic-based. Thus, differences between cohorts and TESSy data may reflect differences between individuals who are and are not linked to care. PWID tended to be underrepresented in all cohorts and time periods, except in ICONA. Impaired access to care and retention in care for PWID is a global challenge [6,20,21]. Older individuals also tended to be underrepresented in some cohorts. Results from previous studies are conflicting, reporting either higher or lower probability of inclusion

Table 1. Demographic characteristics in cohort and The European Surveillance System data for individuals diagnosed between 2000 and 2013, Germany, Greece and the United Kingdom; for France, only individuals diagnosed between 2003 and 2013 were included and for Italy only data for 2010–2013, whereas in Spain only individuals diagnosed between 2005 and 2013 are included.

	France		Germany		Greece		Italy		Spain		United Kingdom	
	Cohort, N (%)	Surveillance, N (%)	Cohort, N (%)	Surveillance, N (%)	Cohort, N (%)	Surveillance, N (%)	Cohort, N (%)	Surveillance, N (%)	Cohort, N (%)	Surveillance, N (%)	Cohort, N (%)	Surveillance, N (%)
Transmission mode												
MSM	11 067 (38.5)	20 238 (34.0)	8 206 (58.0)	21 730 (64.2)	3 776 (60.7)	4 535 (53.5)	1 637 (49.6)	6 252 (40.5)	5 239 (62.6)	14 980 (53.3)	17 560 (48.8)	36 019 (40.0)
PWID	577 (2.0)	2 305 (3.9)	948 (6.7)	2 019 (6.0)	759 (12.2)	1 482 (17.5)	201 (6.1)	947 (6.1)	497 (5.9)	2521 (9.0)	724 (2.0)	2 168 (2.4)
Other	17 114 (59.5)	36 937 (62.1)	4 992 (35.3)	10 096 (29.8)	1 682 (27.1)	2 458 (29.0)	1 465 (44.4)	8 250 (53.4)	2 638 (31.5)	10 612 (37.7)	17 686 (49.2)	51 888 (57.6)
Sex												
Male	19 091 (66.4)	38 144 (64.1)	11 191 (79.1)	27 691 (81.8)	5 287 (85.0)	6 988 (82.5)	2 658 (80.5)	11 898 (77.0)	7 054 (84.2)	22 904 (81.5)	24 761 (68.8)	57 562 (63.9)
Female	9 667 (33.6)	21 336 (35.9)	2 955 (20.9)	6 154 (18.2)	930 (15.0)	1 487 (17.5)	645 (19.5)	3 551 (23.0)	1 320 (15.8)	5 209 (18.5)	11 209 (31.2)	32 513 (36.1)
Age group												
15–24.9	3 316 (11.5)	5 543 (9.3)	1 671 (11.8)	3 953 (11.7)	731 (11.8)	788 (9.3)	367 (11.1)	1 278 (8.3)	1 088 (13.0)	3 083 (11.0)	4 525 (12.6)	10 156 (11.3)
25–34.9	10 109 (35.2)	18 632 (31.3)	4 476 (31.6)	11 614 (34.3)	2 571 (41.4)	3 297 (38.9)	1 076 (32.6)	4 748 (30.7)	3 343 (39.9)	10 322 (36.7)	14 630 (40.7)	34 521 (38.3)
35–44.9	8 639 (30.0)	18 762 (31.5)	4 777 (33.8)	10 681 (31.6)	1 720 (27.7)	2 457 (29.0)	1 030 (31.2)	4 909 (31.8)	2 486 (29.7)	8 864 (31.5)	11 066 (30.8)	28 334 (31.5)
45–54.9	4 346 (15.1)	10 613 (17.8)	2 098 (14.8)	5 074 (15.0)	761 (12.2)	1 148 (13.5)	570 (17.3)	2 935 (19.0)	1 026 (12.3)	4 039 (14.4)	4 187 (11.6)	11 916 (13.2)
55+	2 348 (8.2)	5 930 (10.0)	1 124 (7.9)	2 523 (7.5)	434 (7.0)	785 (9.3)	260 (7.9)	1 579 (10.2)	431 (5.1)	1 805 (6.4)	1 562 (4.3)	5 148 (5.7)
Origin												
Reporting country	18 889 (65.7)	29 138 (49.0)	9 575 (67.7)	18 039 (53.3)	5 228 (84.1)	6 572 (77.5)	2 751 (83.3)	12 389 (80.2)	5 538 (66.1)	17 489 (62.2)		
Europe, USA	731 (2.5)	2 576 (4.3)	1 595 (11.3)	2 619 (7.7)	413 (6.6)	926 (10.9)	552 (16.7)	3 060 (19.8)	481 (5.7)	2 115 (7.5)		
Africa, Asia, etc	9 138 (31.8)	27 766 (46.7)	2 976 (21.0)	13 187 (39.0)	576 (9.3)	977 (11.5)			2 355 (28.1)	8 509 (30.3)		
CD4 ⁺ cells/ μ l ^a												
<200	1 309 (23.5)	6 186 (30.3)			1 702 (27.4)	2 948 (34.8)	881 (26.7)	5 651 (36.6)	1 932 (23.1)	8 266 (29.4)	9525 (26.5)	28 956 (32.1)
200–349	1 291 (23.1)	4 433 (21.7)			1 353 (21.8)	1 901 (22.4)	636 (19.3)	3 093 (20.0)	1 661 (19.8)	5 430 (19.3)	8 346 (23.2)	20 646 (22.9)
350–499	1 198 (21.5)	3 804 (18.7)			1 191 (19.2)	1 399 (16.5)	666 (20.2)	2 661 (17.2)	1 743 (20.8)	5 173 (18.4)	7 519 (20.9)	17 113 (19.0)
500+	1 785 (32.0)	5 968 (29.3)			1 971 (31.7)	2 227 (26.3)	1 120 (33.9)	4 044 (26.2)	3 038 (36.3)	9 244 (32.9)	10 580 (29.4)	23 360 (25.9)

PWID, people who inject drug.

^aFor France CD4⁺ cell counts concern only on the last study period (2008–2013).

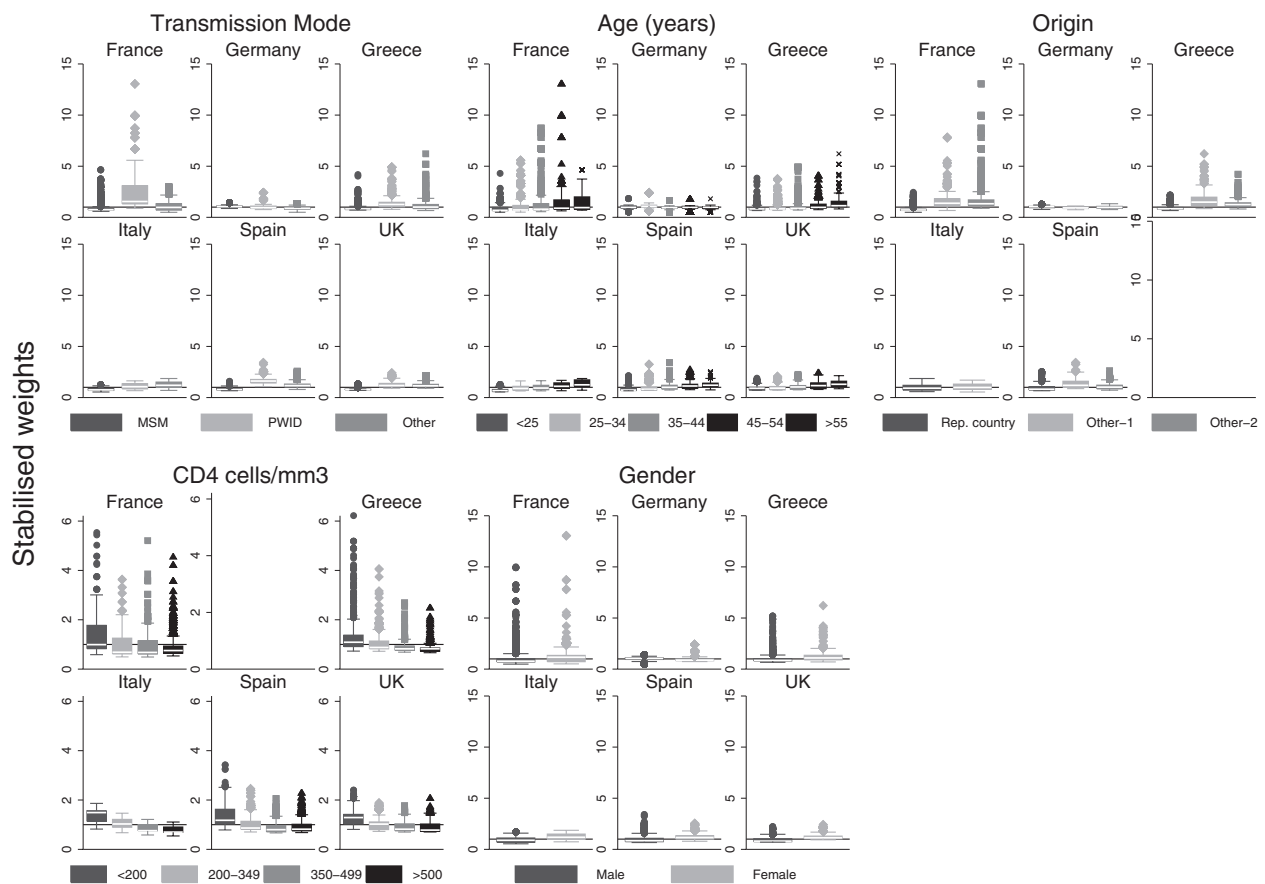


Fig. 1. Distribution of the stabilized weights assigned to cohorts' participants, pooled over all time periods by transmission mode (MSM; people who inject drugs; other: mainly those reporting heterosexual contact as the source of infection), age group, region of origin, CD4⁺ cell count category and sex. Region of origin Other-1 corresponds to migrants originating from other European countries, North America and Australia and other-2 to migrants originating from Africa, Asia and Latin America. Weights regarding the CD4⁺ cell counts in France concern only the 2008–2013 period.

for older individuals [5,22]. However, it has been reported previously that older age is significantly associated with late diagnosis [23]. As previously described [5], women were also slightly underrepresented in most cohorts. In accordance with previous studies that report suboptimal access to care among migrants, there were indications that migrants were underrepresented [24,25]. Individuals with low CD4⁺ cell counts were less likely to be included in most cohorts, possibly because they may die shortly after their diagnosis, or because they often start combined antiretroviral treatment (cART) immediately and are perhaps excluded from cohorts recruiting cART-naïve individuals (e.g. ICONA, CoRIS). Underrepresentation of individuals with a low CD4⁺ cell count in cohorts has also been reported [5].

In this work, TESSy data were considered the gold standard with which cohort data were compared. However, surveillance data also have limitations. Changes over time were taken into account by analysing each study period separately. To account for reporting delays, we analysed data up to 2013, whereas the average delays in

the analysed countries are less than 6 months [26]. Surveillance data included in TESSy may underestimate the number of people diagnosed with HIV in some countries, because of underreporting (as in France, underreporting was estimated at 29.6% for 2010–2013 in France). Additional limitations include a lack of data on migrant status as well as misclassified and/or missing data that are more likely to occur in surveillance settings than in cohorts. Thus, differences between cohort and surveillance data may be due to the different conditions under which data collection is performed by cohorts and surveillance systems.

The observed differences may also reflect delayed enrolment into the cohorts. In cases of recent epidemics in specific groups, enhanced linkage to care is essential so that these newly infected individuals are promptly provided access to ART and clinical follow-up and, where relevant, included in HIV cohorts.

In summary, our findings indicate that the main European cohorts capture a representative sample of the HIV-

diagnosed population. Nevertheless, the sample of individuals participating in HIV cohorts within Euro-Coord may differ systematically from the population of HIV-diagnosed individuals reported to ECDC through TESSy. Given that vulnerable patients tend to be underrepresented, estimation of public health indices based on cohort data could lead to overoptimistic conclusions. Provided that cohorts are able to capture data on all characteristics associated with inclusion into the cohort, weighted analyses are likely to provide more unbiased estimates of public health-indices [12,13]. Supplementing surveillance data with annual updates of public health relevance such as treatment uptake and viral suppression should be the gold standard of HIV surveillance. This information can be provided from existing clinical cohorts and should ideally be expanded to all patients accessing HIV care in a given country. Therefore, the results of this project could be used to more effectively triangulate HIV surveillance and cohort data for public health action.

Acknowledgements

FHDH-ANRS CO4 cohort, France.

The FHDH ANRS CO4 cohort is funded by the ANRS, INSERM and the French Ministry of Health.

Scientific Committee: S. Abgrall, L. Bernard, E. Billaud, F. Boué, L. Boyer, A. Cabié, F. Caby, A. Canestri, D. Costagliola, L. Cotte, P. De Truchis, X. Duval, C. Duvivier, P. Enel, H. Fischer, J. Gasnault, C. Gaud, S. Grabar, M.A. Khuong, O. Launay, L. Marchand, M. Mary-Krause, S. Matheron, G. Melica-Grégoire, H. Melliez, J.L. Meynard, M. Nacher, J. Pavie, L. Piroth, I. Poizot-Martin, C. Pradier, J. Reynes, E. Rouveix, A. Simon, L. Slama, P. Tattevin, H. Tissot-Dupont.

COREVIH coordinating center: French Ministry of Health (G. Astier, J. Biga, T. Kurth, I. Prade), Technical Hospitalization Information Agency, ATIH (N. Jacquemet).

Statistical analysis center: UMRS 1136 INSERM et UPMC (D. Costagliola, *Principal investigator*, S. Abgrall, S. Grabar, M. Guiguet, S. Lang, L. Lièvre, M. Mary-Krause, H. Roul, H. Selinger-Leneman), INSERM-Transfert (V. Potard).

COREVIH: *Paris area*: Corevih Ile de France Centre (Paris-GH Pitié-Salpêtrière: O. Benveniste, A. Simon, G. Breton, C. Lupin, E. Bourzam; Paris-Hôpital Saint-Antoine: P.M. Girard, L. Fonquernie, N. Valin, B. Lefebvre, M. Sebire; Paris-Hôpital Tenon: G. Pialoux, M.G. Lebrette, P. Thibaut, A. Adda, M. Hamidi, J. Cadranet, A. Lavolé, A. Parrot), *Corevih Ile de France Est* (Bobigny-Hôpital Avicenne: O. Bouchaud, N. Vignier, F.

Méchaï, S. Makhloufi, P. Honoré; Bondy-Hôpital Jean Verdier; Paris-GH Lariboisière-Fernand Widal: J.F. Bergmann, V. Delcey, A. Lopes, P. Sellier, M. Parrinello; Paris-Hôpital Saint-Louis: E. Oksenhendler, L. Gerard, J.M. Molina, W. Rozenbaum, B. Denis, N. De Castro, C. Lascoux), *Corevih Ile de France Nord* (Paris-Hôpital Bichat-Claude Bernard: Y. Yazdanpanah, S. Matheron, S. Lariven, V. Joly, C. Rioux; St Denis-Hôpital Delafontaine: M.A. Khuong-Josses, M. Poupard, B. Taverne), *Corevih Ile de France Ouest* (Argenteuil-CH Victor Dupouy: L. Sutton, V. Masse, P. Genet, B. Wifaq, J. Gerbe; Boulogne Billancourt-Hôpital Ambroise Paré: E. Rouveix, S. Greffe, C. Dupont, A. Freire Maresca, E. Reimann; Colombes-Hôpital Louis Mourier: M. Bloch, F. Meier, E. Mortier, F. Zeng, B. Montoya; Garches-Hôpital Raymond Poincaré: C. Perronne P. de Truchis, D. Mathez, D. Marigot-Outtandy, H. Berthé; Le Chesnay-Hôpital André Mignot: A. Greder Belan, A. Therby, C. Godin Collet, S. Marque Juillet, M. Ruquet, S. Roussin-Bretagne, P. Colardelle; Mantes La Jolie-CH François Quesnay: F. Granier, J.J. Laurichesse, V. Perronne; Meulan-CHI de Meulan les Mureaux: T. Akpan, M. Marcou; Nanterre-Hôpital Max Fourestier: V. Daneluzzi, J. Gerbe; Poissy-CHI de Poissy: C. Veyssier-Belot, H. Masson; St Germain en Laye-CHI de St Germain-en-Laye: Y. Welker, P. Brazille; Suresnes-Hôpital Foch: J.E. Kahn, D. Zucman, C. Majerholc, E. Fourn, D. Bornarel), *Corevih Ile de France Sud* (Clamart-Hôpital Antoine Béclère: F. Boué, S. Abgrall, V. Chambrin, I. Kansau, M. Raho-Moussa; Créteil-Hôpital Henri Mondor: J.D. Lelievre, G. Melica, M. Saidani, C. Chesnel, C. Dumont; Kremlin Bicêtre-Hôpital de Bicêtre: D. Vittecoq, O. Derradji, C. Bolliot, C. Goujard, E. Teicher, J. Gasnault, M. Mole, K. Bourdic; Paris-GH Tarnier-Cochin: D. Salmon, C. Le Jeunne, O. Launay, P. Guet, M.P. Pietri, E. Pannier Metzger, V. Marcou, P. Loulergue, N. Dupin, J.P. Morini, J. Deleuze, P. Gerhardt, J. Chanal; Paris-Hôpital Européen Georges Pompidou: L. Weiss, J. Pavie, M.L. Lucas, C. Jung, M. Ptak; Paris-Hôpital Hôtel Dieu: J.P. Viard, J. Ghosn, P. Gazalet, A. Cros, A. Maignan; Paris-Hôpital Necker adultes: C. Duvivier, O. Lortholary, C. Rouzaud, F. Touam, K. Benhadj; Paris-CMIP Pasteur: P.H. Consigny, P. Bossi, A. Gergely, G. Cessot, F. Durand).

Outside Paris area: *Corevih Alsace* (CH de Mulhouse: G. Beck-Wirth, C. Michel, M. Benomar; CHRU de Strasbourg: D. Rey, M. Partisani, C. Cheneau, M.L. Batard, P. Fischer), *Corevih de l'Arc Alpin* (CHU de Grenoble: P. Leclercq, M. Blanc, P. Morand, O. Epaulard, A. Signori-Schmuck), *Corevih Auvergne-Loire* (CHU de Clermont-Ferrand: H. Laurichesse, C. Jacomet, M. Vidal, D. Coban, S. Casanova; CHRU de Saint-Etienne: A. Fresard, C. Guglielminotti, E. Botelho-Nevers, A. Brunon-Gagneux, V. Ronat); *Corevih Basse-Normandie* (CHRU de Caen: R. Verdon, S. Dargère, E. Haustraete, P. Féret, P. Goubin), *Corevih Bourgogne* (CHRU de Dijon: P. Chavanet, A. Fillion, L. Piroth, D. Croisier, S. Gohier),

Corevih Bretagne (CHU de Rennes: C. Arvieux, F. Souala, J.M. Chaplain, M. Ratajczak, J. Rohan), *Corevih Centre Poitou-Charentes* (CHRU de Tours), *Corevih Franche-Comté* (CH de Belfort: J.P. Faller, O. Ruyer, V. Gendrin, L. Toko; CHRU de Besançon: C. Chirouze, L. Hustache-Mathieu, J.F. Faucher, A. Proust, N. Magy-Bertrand, H. Gil, N. Méaux-Ruault); *Corevih Haute-Normandie* (CHRU de Rouen), *Corevih Languedoc-Roussillon* (CHU de Montpellier; CHU de Nîmes: A. Sotto, I. Rouanet, J.M. Mauboussin, R. Doncesco, G. Jacques), *Corevih Lorraine Champagne Ardennes* (Nancy-Hôpital de Brabois: T. May, C. Rabaud, M. Andre, M. Delestan, M.P. Bouillon; CHRU de Reims: F. Bani-Sadr, C. Rouger, J.L. Berger, Y. Nguyen), *Corevih de Midi-Pyrénées Limousin* (Toulouse CHU Purpan: B. Marchou, P. Delobel, G. Martin Blondel, L. Cuzin, N. Biezunski, L. Alric, D. Bonnet, M. Guivarch, A. Palacin, V. Payssan), *Corevih Nord-Pas de Calais* (CH de Tourcoing: H. Melliez, F. Ajana, A. Meybeck, N. Viget), *Corevih PACA Est* (Nice Hôpital Archet 1: C. Pradier, P. Pugliese, P.M. Roger, E. Rosenthal, J. Durant, E. Cua, A. Naqvi, I. Perbost, K. Risso; C.H. Antibes-Juan les Pins: D. Quinsat; CHI de Fréjus/St Raphaël: P. Del Giudice; C.H. de Grasse: P.Y. Dides), *Corevih PACA Ouest* (Marseille-Hôpital de la Conception: P. Enel, R. Sambuc, M.S. Antolini-Bouvenot, P. Druart, L. Meddeb, I. Ravaux, A. Menard, C. Tomei, C. Dhiver, H. Tissot-Dupont; Marseille-Hôpital Nord: J. Moreau, S. Mokhtari, M.J. Soavi, V. Thomas; Marseille-Hôpital Sainte-Marguerite: I. Poizot-Martin, S. Bregigeon, O. Faucher, V. Obry-Roguet, A.S. Ritleng, N. Petit; Marseille-Centre pénitentiaire des Baumettes: C. Bartoli, J.M. Ruiz, D. Blanc; C.H. d'Aix-En-Provence: T. Allegre, M. Sordage, J.M. Riou, C. Faudon; C.H. d'Avignon: B. Slama, H. Zerazhi, O. Boulat, S. Chebrek, M. Beyrne; C.H. de Digne Les Bains: P. Granet Brunello; C.H. de Gap: L. Pellissier, D. Bonnabel; C.H. de Martigues: R. Cohen Valensi, B. Mouchet, G. Mboungou; CHI de Toulon: A. Lafeuillade, E. Hope-Rapp, G. Hittinger, G. Philip, V. Lambry), *Corevih Pays de la Loire* (CHU de Nantes: F. Raffi, C. Allavena, E. Billaud, N. Hall, V. Reliquet), *Corevih de la Vallée du Rhône* (Lyon-Hôpital de la Croix-Rousse: C. Chidiac, L. Cotte, T. Ferry, T. Perpoint, P. Miaillhes; Lyon-Hôpital Edouard Herriot: A. Boibieux, J.M. Livrozet, D. Makhloufi, F. Brunel, P. Chiarello).

Overseas: Corevih Guadeloupe (CHU de Pointe-à-Pitre: B. Hoen, I. Lamaury, I. Fabre, K. Samar, E. Duvallon; C.H. Saint-Martin: C. Clavel, S. Stegmann, V. Walter), *Corevih Guyane* (CH de Cayenne: M. Nacher, L. Adriouch, F. Huber, V. Vantickke, P. Couppié), *Corevih Martinique* (CHU de Fort-de-France: A. Cabié, S. Abel, S. Pierre-François), *Corevih de La Réunion* (St Denis-CHU Félix Guyon: C. Gaud, C. Ricaud, R. Rodet, G. Wartel, C. Sautron; St Pierre-GH Sud Réunion: P. Poubeau, G. Borgherini, G. Camuset).

ANRS CO3 Aquitaine Cohort, France.

ANRS CO3 Aquitaine cohort is an open and prospective cohort of HIV-1 infected patients started in 1987, supported by the ANRS and the CHU de Bordeaux.

Scientific Committee: Blanco P, Bonnet F (Chair), Bouchet S., Breilh D., Cazanave C., Dupon M., Desjardins S., Gaborieau V., Gérard Y., Gimbert A., Fleury H., Lacaze-Buzy L., Lacoste D., Lawson-Ayayi S., Lazaro E., Leleux O., Malvy D., Mercié P., Morlat P., Neau D., Pellegrin I., Pellegrin J.L., Petrov-Sanchez V., Tchamgoué S., Vandenhende M., Vareil M.O., Thiébaud R., Wittkop L. (Co-Chair). Steering Committee: Bonnet F (Chair), Lacaze-Buzy L., Leleux O., Pellegrin I., Wittkop L. Coordinating Center: Multimorbidity and Public Health in Patients with HIV or Hepatitis (MORPH3Eus) CMG-EC de l'INSERM U1219/ANRS, Bordeaux Population Health, France (Bonnet F, Leleux O., Le Marec F, Perrier A., Wittkop L.).

Participating Centers: Internal Medecine and Infectious Diseases, Saint Andre Bordeaux University Hospital, (Bonnet F, Bernard N., Biscay P., Dondia D., Duffau P., Faure I., Hessamfar M., Lacoste D., Mercie M., Morlat P., Paccalin F., Pertusa M.C., Vandenhende M.A., Riebero E., Rivoisy C.); Infectious Diseases and Tropical Medecine, Pellegrin Bordeaux University Hospital, (Cazanave C., Dauchy F.A., Dupon M., Dutronc H., Neau D., Malvy D., Pistone T., Receveur M.C., Wirth G.); Internal Medecine and Infectious Diseases, Haut Leveque Bordeaux University Hospital, (Greib C., Lazaro E., Pellegrin J.L., Viillard J.F.); Internal Medecine, Agen Hospital, (Imbert Y., Rispal P.); Internal Medecine, Libourne Hospital, (Caubet O., Ferrand H., Tchamgoue S.); Infectious Diseases, Bayonne Hospital, (Farbos S., Vareil M.O., Wille H.); Internal Medecine and Infectious Diseases, Dax Hospital, (Andre K., Caunegre L., Gerard Y.); Infectious Diseases, Saint-Cyr Hospital, (Chossat I.); Internal Medecine, Mont de Marsan Hospital (Gerard Y.); Internal Medecine, Arcachon Hospital, (Courtault C.); Internal Medecine and Infectious Diseases, Périgueux Hospital, (Berthol N., Cougoul B., Lataste P., Marie J., Rouanes N.); Internal Medecine and Infectious Diseases, Pau Hospital, (Dumondin G., Gaborieau V.); Internal Medecine, Orthez Hospital, (Gerard Y.).

ClinSurv HIV, Germany.

The clinical surveillance of HIV, ClinSurv HIV, is funded by the Robert Koch Institute, which is the German Public Health Institute.

Berlin: P.D. Dr K. Arastéh, S. Kowohl Vivantes (Auguste-Viktoria-Clinic); Dr D. Schürmann, M. Warncke Charité, University Medicine Berlin; Bonn: Prof Dr J. Rockstroh, Dr J. Wasmuth, S. Hass University Medical Centre Bonn; Duesseldorf: P.D. Dr B.O. Jensen, C. Feind University Medical Centre Düsseldorf; Essen: Dr S. Esser, P. Schenk-Westkamp University Clinic Essen; Frankfurt:

A. Haberl, C. Stephan HIV Center J.W.Goethe-University Frankfurt; Hamburg: Prof Dr A. Plettenberg, F. Kuhlendahl ifi (Institute for Interdisciplinary Medicine); Drs A. Adam/L. Weitner/K. Schewe, H. Goey, Drs S. Fenske/T. Buhk/Prof H.J. Stellbrink/P.D.C. Hoffmann/S. Hansen at ICH (Infectious Diseases Centre) Study Centre Hamburg Hamburg; P.D. Dr O. Degen, M. Heuer at University Medical Centre Hamburg-Eppendorf; Hannover: Prof Dr M. Stoll, S. Gerschmann at Medical University Hannover; Kiel: Prof Dr H. Horst, S. Trautmann at University Clinic Schleswig-Holstein; Cologne: Prof Dr G. Fätkenheuer, D. Gillor at University Medical Centre Cologne; Munich: Prof Dr J. Bogner, B. Sonntag at University Hospital Munich; Regensburg: Prof Dr B. Salzberger at University Medical Centre Regensburg; Rostock: Dr C. Fritzsche at University Clinic Rostock.

AMACS, Greece.

Steering Committee: Antoniadou A., Chrysos G., Daikos G., Gargalianos-Kakolyris P., Gogos H.A., Katsarou O., Lazanas M., Metallidis S., Panagopoulos P., Papanizos V., Paraskevis D., Sambatakou H. (Co-Chair), Sipsas N., Skoutelis A., Touloumi G. (Chair).

Coordinating Center: Department of Hygiene, Epidemiology and Medical Statistics, Medical School, National and Kapodistrian University of Athens, Greece (Touloumi G., Pantazis N., Vourli G.).

Participating Centers: 4th Dept of Internal Medicine, Medical School, National and Kapodistrian University of Athens, Attikon University Hospital (Antoniadou A., Papadopoulos A.); Infectious Disease Unit, 'Tzaneio' General Hospital of Piraeus (Chrysos G., Nitsotolis T.); 1st Dept of Propedeutic Medicine, Athens University, Medical School 'Laikon' General Hospital (Daikos G., Psychogiou M.); 1st Dept of Medicine, Infectious Diseases Unit, 'G. Gennimatas' Athens General Hospital (Gargalianos-Kakolyris P., Xylomenos G.); 1st Dept of Internal Medicine, Infectious Diseases Section, Patras University Hospital (Gogos H.A., Marangos M.N.); Blood Transfusion Unit, and National Reference Centre for Congenital Bleeding Disorders, Laikon General Hospital (Katsarou O., Kouramba A.); Infectious Diseases Unit, Department of Pathophysiology, General Hospital of Athens 'Laikon' and Medical School, National and Kapodistrian University of Athens, Athens, Greece (Sipsas N.V., Kontos A.); Infectious Diseases Unit, Red Cross General Hospital of Athens (Lazanas M., Chini M.); First Internal Medicine Department, Infectious Diseases Division, Medical School, Aristotle University of Thessaloniki (Metallidis S., Tsachouridou O.); AIDS Unit, Clinic of Venereologic & Dermatologic Diseases, Athens University, Medical School, Syngros Hospital (Papanizos V., Kourkounti S.); HIV Unit, 2nd Dept. of Internal Medicine, Athens University, Medical School,

Hippokraton General Hospital (Sambatakou H., Mariolis I.); Infectious Diseases & HIV Division, Dept of Internal Medicine, Evaggelismos Athens General Hospital (Skoutelis A., Papastamopoulos V.); Infectious Diseases Unit, University General Hospital of Alexandroupolis, Democritus University of Thrace (Panagopoulos P., Ganitis A.).

ICoNA, Italy.

Board of directors: A. d'Arminio Monforte (President), M. Andreoni, A. Antinori, A. Castagna, F. Castelli, R. Cauda, G. Di Perri, M. Galli, R. Iardino, G. Ippolito, A. Lazzarin, G. Marchetti, C.F. Perno, F. von Schloesser, P. Viale.

Scientific secretary: A. d'Arminio Monforte, A. Antinori, A. Castagna, F. Ceccherini-Silberstein, A. Cozzi-Lepri, E. Girardi, S. Lo Caputo, C. Mussini, M. Puoti.

Steering Committee: M. Andreoni, A. Ammassari, A. Antinori, C. Balotta, A. Bandera, P. Bonfanti, S. Bonora, M. Borderi, A. Calcagno, L. Calza, M.R. Capobianchi, A. Castagna, F. Ceccherini-Silberstein, A. Cingolani, P. Cinque, A. Cozzi-Lepri, A. d'Arminio Monforte, A. De Luca, A. Di Biagio, E. Girardi, N. Gianotti, A. Gori, G. Guaraldi, G. Lapadula, M. Lichtner, S. Lo Caputo, G. Madeddu, F. Maggiolo, G. Marchetti, S. Marcotullio, L. Monno, C. Mussini, S. Nozza, M. Puoti, E. Quiros Roldan, R. Rossotti, S. Rusconi, M.M. Santoro, A. Saracino, M. Zaccarelli.

Statistical and monitoring team: A. Cozzi-Lepri, I. Fanti, L. Galli, P. Lorenzini, A. Rodano, M. Shanyinde, A. Tavelli.

Biological bank inmil: F. Carletti, S. Carrara, A. Di Caro, S. Graziano, F. Petrone, G. Prota, S. Quartu, S. Truffa.

Participating physicians and centers: Italy A. Giacometti, A. Costantini, C. Valeriani (Ancona); G. Angarano, L. Monno, C. Santoro (Bari); F. Maggiolo, C. Suardi (Bergamo); P. Viale, V. Donati, G. Verucchi (Bologna); F. Castelli, E. Quiros Roldan, C. Minardi (Brescia); T. Quirino, C. Abeli (Busto Arsizio); P.E. Manconi, P. Piano (Cagliari); B. Cacopardo, B. Celesia (Catania); J. Vecchiet, K. Falasca (Chieti); L. Sighinolfi, D. Segala (Ferrara); F. Mazzotta, F. Vichi (Firenze); G. Cassola, C. Viscoli, A. Alessandrini, N. Bobbio, G. Mazzarello (Genova); C. Mastroianni, V. Belvisi (Latina); P. Bonfanti, I. Caramma (Lecco); A. Chiodera, A.P. Castelli (Macerata); M. Galli, A. Lazzarin, G. Rizzardini, M. Puoti, A. d'Arminio Monforte, A.L. Ridolfo, R. Piolini, A. Castagna, S. Salpietro, L. Carezzi, M.C. Moioli, C. Tincati, G. Marchetti (Milano); C. Mussini, C. Puzzone (Modena); A. Gori, G. Lapadula (Monza); N. Abrescia, A. Chirianni, G. Borgia, F. Di Martino, L. Maddaloni, I. Gentile, R. Orlando (Napoli); F. Baldelli,

D. Francisci (Perugia); G. Parruti, T. Ursini (Pescara); G. Magnani, M.A. Ursitti (Reggio Emilia); R. Cauda, M. Andreoni, A. Antinori, V. Vullo, A. Cristaudo, A. Cingolani, G. Baldin, S. Cicalini, L. Gallo, E. Nicastrì, R. Acinapura, M. Capozzi, R. Libertone, S. Savinelli, A. Latini, G. Iaiani, L. Fontanelli Sulekova (Roma); M. Cecchetto, F. Viviani (Rovigo); M.S. Mura, G. Madeddu (Sassari); A. De Luca, B. Rossetti (Siena); P. Caramello, G. Di Perri, G.C. Orofino, S. Bonora, M. Sciandra (Torino); M. Bassetti, A. Londero (Udine); G. Pellizzer, V. Manfrin (Vicenza).

CoRIS, Spain.

The current work was supported by the Spanish Network of HIV/AIDS (RD12/0017/0018 and RD16CIII/0002/0006) and CIBER Epidemiología y Salud Pública (CIBERESP), Spain. J. del Amo, V. Hernando, A. Diaz: 'This article presents independent results and research. The views expressed are those of the authors and not necessarily those of the Instituto de Salud Carlos III'.

Centers and investigators involved in CoRIS: Executive Committee: Santiago Moreno, J.D.A., David Dalmau, María Luisa Navarro, María Isabel González, Jose Luis Blanco, Federico Garcia, Rafael Rubio, Jose Antonio Iribarren, Félix Gutiérrez, Francesc Vidal, Juan Berenguer, Juan González. Fieldwork, data management and analysis: Paz Sobrino, V.H., Belén Alejos, Débora Álvarez, Inma Jarrín, Cristina Moreno. BioBank HIV: M Ángeles Muñoz-Fernández, Isabel García-Merino, Coral Gómez Rico, Jorge Gallego de la Fuente y Almudena García Torre. Participating centres: Hospital General Universitario de Alicante (Alicante): Joaquín Portilla, Esperanza Merino, Sergio Reus, Vicente Boix, Livia Giner, Carmen Gadea, Irene Portilla, María Pampliega, Marcos Díez, Juan Carlos Rodríguez, Jose Sánchez-Payá. Hospital Universitari de Bellvitge (Hospital de Llobregat): Daniel Podzamczar, Elena Ferrerm Arkaitz Imaz, Evan Van Den Eynckle, Silvana Di Yacovo, Maria Sumoy. Hospital Universitario de Canarias (Santa Cruz de Tenerife): Juan Luis Gómez, Jehovana Hernández, María Remedios Alemán, María del Mar Alonso, María Inmaculada Hernández, Felicitas Díaz-Flores, Dácil García, Ricardo Pelazas. Hospital Universitario Central de Asturias (Oviedo): Victor Asensi, Eulalia Valle, José Antonio Cartón. Hospital Clínico San Carlos (Madrid): Vicente Estrada Pérez, Maria Jesus Téllez Molina, Jorge Vergas García, Elisa Pérez-Cecila Carrera. Hospital Doce de Octubre (Madrid): Rafael Rubio, Federico Pulido, Otilia Bisbal, Mariano Matarranz, Maria Lagarde, Rafael Rubio-Martín, Asunción Hernando, Laura Bermejo y Lourdes Dominguez. Hospital Universitario Donostia (San Sebastián): José Antonio Iribarren, Julio Arrizabalaga, María José Aramburu, Xabier Camino, Francisco Rodríguez-Arrondo, Miguel Ángel von Wichmann, Lidia Pascual Tomé, Miguel Ángel Goenaga, M^a Jesús Bustinduy, Harkaitz Azkune Galparsoro, Maialen Ibarburen, Mirian Aguado, Maitane Umerez. Hospital

General Universitario de Elche (Elche): Félix Gutiérrez, Mar Masiá, Cristina López, Sergio Padilla, Andrés Navarro, Fernando Montolio, Catalina Robledano, Joan Gregori Colomé, Araceli Adsuar, Rafael Pascual, Federico Carlos, Maravillas Martínez, Jara Llenas García, Marta Fernández, Elena García. Hospital Germans Triás i Pujol (Badalona): Roberto Muga, Jordi Tor, Arantza Sanvisens. Hospital General Universitario Gregorio Marañón (Madrid): Juan Berenguer, Juan Carlos López Bernaldo de Quirós, Pilar Miralles, Isabel Gutiérrez, Margarita Ramírez, Belén Padilla, Paloma Gijón, Ana Carrero, Teresa Aldamiz-Echevarría, Francisco Tejerina, Francisco Jose Parras, Pascual Balsalobre, Cristina Diez. Hospital Universitari de Tarragona Joan XXIII, IISPV, Universitat Rovira i Virgili (Tarragona): Francesc Vidal, Joaquín Peraire, Consuelo Viladés, Sergio Veloso, Montserrat Vargas, Miguel López-Dupla, Montserrat Olona, Alba Aguilar, Joan Josep Sirvent, Verónica Alba, Olga Calavia. Hospital Universitario La Fe (Valencia): Marta Montero, José Lacruz, Marino Blanes, Eva Calabuig, Sandra Cuellar, José López, Miguel Salavert. Hospital Universitario La Paz/IdiPaz (Madrid): Juan González, Ignacio Bernardino de la Serna, José Ramón Arribas, María Luisa Montes, Jose M^a Peña, Blanca Arribas, Juan Miguel Castro, Fco Javier Zamora, Ignacio Pérez, Miriam Estébanez, Silvia García, Marta Díaz, Natalia Stella Alcáriz, Jesús Mingorance, Dolores Montero, Alicia González, Maria Isabel de José. Hospital de la Princesa (Madrid): Ignacio de los Santos, Jesús Sanz, Ana Salas, Cristina Sarriá, Ana Gómez Berrocal, Lucio Garcia-Fraile. Hospital San Pedro-CIBIR (Logroño): José Antonio Oteo, José Ramón Blanco, Valvanera Ibarra, Luis Metola, Mercedes Sanz, Laura Pérez-Martínez. Hospital Universitario Miguel Servet (Zaragoza): Ascensión Pascual, Carlos Ramos, Piedad Arazo, Desiré Gil. Hospital Universitari Mutua de Terrassa (Terrassa): David Dalmau, Angels Jaén, Mireia Cairó, Daniel Irigoyen, Queralt Jordano, Mariona Xercavins, Javier Martínez-Lacasa, Pablo Velli, Roser Font, Montse Sanmartí, Laura Ibáñez. Complejo Hospitalario de Navarra (Pamplona): María Rivero, Marina Itziar Casado, Jorge Alberto Díaz, Javier Uriz, Jesús Repáraz, Carmen Irigoyen, María Jesús Arraiza. Hospital Parc Taulí (Sabadell): Ferrán Segura, María José Amengual, Gemma Navarro, Montserrat Sala, Manuel Cervantes, Valentín Pineda, Victor Segura, Marta Navarro, Esperanza Antón, M^a Merce Nogueras. Hospital Ramón y Cajal (Madrid): Santiago Moreno, José Luis Casado, Fernando Dronda, Ana Moreno, María Jesús Pérez Elías, Dolores López, Carolina Gutiérrez, Nadia Madrid, Angel Lamas, Paloma Martí, Alberto de Diaz, Sergio Serrano, Lucas Donat. Hospital Reina Sofia (Murcia): Alfredo Cano, Enrique Bernal, Ángeles Muñoz. Hospital San Cecilio (Granada): Federico García, José Hernández, Alejandro Peña, Leopoldo Muñoz, Jorge Parra, Marta Alvarez, Natalia Chueca, Vicente Guillot, David Vinuesa, Jose Angel Fernández. Centro Sanitario Sandoval (Madrid): Jorge Del Romero, Carmen Rodríguez, Teresa Puerta, Juan Carlos Carrió, Mar Vera, Juan Ballesteros. Hospital de la Santa Creu i Sant Pau (Barcelona): Pere Domingo, M^a Antonia Sambeat, Karuna Lamarca, Gracia

Mateo, Mar Gutiérrez, Irene Fernández. Hospital Universitario Santiago de Compostela (Santiago de Compostela): Antonio Antela, Elena Losada. Hospital Son Espases (Palma de Mallorca): Melchor Riera, Maria Peñaranda, Maria Leyes, M^a Angels Ribas, Antoni A Campins, Carmen Vidal, Leire Gil, Francisco Fanjul, Carmen Marinescu. Hospital Universitari Vall d'Hebron (Barcelona): Esteban Ribera. Hospital Virgen de la Victoria (Málaga): Jesús Santos, Manuel Márquez, Isabel Viciano, Rosario Palacios, Isabel Pérez, Carmen Maria González. Hospital Universitario Virgen del Rocío (Sevilla): Pompeyo Viciano, Manuel Leal, Luis Fernando López-Cortés, Nuria Espinosa. Hospital Universitario de Basurto (Bilbao): Josefa Muñoz, Miren Zuriñe Zubero, Josu Mirena Baraia-Etxaburu, Sofia Ibarra, Oscar Ferrero, Josefina López de Munain, M^a Mar Cámara. Iñigo López, Mireia de la Peña. Hospital Universitario Infanta Sofía (San Sebastián de los Reyes): Inés Suárez-García, Eduardo Malmierca. Hospital Universitario Costa del Sol (Marbella): Julián Olalla, Alfonso del Arco, Javier de la torre, José Luis Prada, Zaira Caracuel. Hospital del Poniente (El Ejido): Ana Maria Lopez-Lirola, Ana Belén Lozano, Elisa Fernández, Inés Pérez, Juan Manuel Fernández. Hospital Universitario Santa Lucía (Cartagena): Onofre Juan Martínez, Francisco Jesús Vera, Lorena Martínez, Josefina García, Begoña Alcaraz, Amaya Jimeno. INIBIC-Complejo Hospitalario Universitario de A Coruña (A Coruña): Eva Poveda, Berta Pernas, Álvaro Mena, Marta Grandal, Ángeles Castro, José D. Pedreira. Hospital Clínico Universitario Virgen de la Arrixaca (Murcia): Carlos Galera, Helena Albendin, Asunción Iborra, Antonio Moreno, Maria Angeles Campillo, Asunción Vidal. Hospital Marina Baixa (Villajoyosa): Concha Amador, Francisco Pasquau, Javier Ena, Concha Benito, Vicenta Fenoll. Complejo Hospitalario de Jaén (Jaén): Mohamed Omar Mohamed-Balghata, Maria Amparo Gómez. Hospital San Agustín de Avilés (Avilés): Miguel Alberto de Zarraga, Maria Eugenia Rivas. Fundación Jiménez Díaz (Madrid): Miguel Górgolas.

UK CHIC, United Kingdom.

UK CHIC is funded by the UK Medical Research Council (Grant numbers G0000199, G0600337, G0900274 and M004236). The views expressed in this article are those of the researchers and not necessarily those of the Medical Research Council.

UK CHIC Steering Committee: Jonathan Ainsworth, Sris Allan, Jane Anderson, Abdel Babiker, David Chadwick, V.D., David Dunn, Martin Fisher, Brian Gazzard, Richard Gilson, Mark Gompels, Phillip Hay, Teresa Hill, Margaret Johnson, Sophie Jose, Stephen Kegg, Clifford Leen, Fabiola Martin, Mark Nelson, Chloe Orkin, Adrian Palfreeman, Andrew Phillips, Deenan Pillay, Frank Post, Jillian Pritchard, C.S., Memory Sachikonye, Achim Schwenk, Anjum Tariq, Roy Trelvelion, John Walsh.

UK CHIC Central Co-ordination: University College London (Teresa Hill, Sophie Jose, Andrew Phillips, C.S.); Medical Research Council Clinical Trials Unit at UCL (MRC CTU at UCL), London (David Dunn, Adam Glabay).

UK CHIC Participating Centres: Brighton and Sussex University Hospitals NHS Trust (M. Fisher, N. Perry, S. Tilbury, E. Youssef, D. Churchill); Chelsea and Westminster Hospital NHS Foundation Trust, London (B. Gazzard, M. Nelson, R. Everett, D. Asboe, S. Mandalia); King's College Hospital NHS Foundation Trust, London (F. Post, H. Korat, C. Taylor, Z. Gleisner, F. Ibrahim, L. Campbell); Mortimer Market Centre, University College London (R. Gilson, N. Brima, I. Williams); Royal Free NHS Foundation Trust/University College London (M. Johnson, M. Youle, F. Lampe, C. Smith, R. Tsintas, C. Chaloner, S. Hutchinson, C. Sabin, A. Phillips, T. Hill, S. Jose, A. Thornton, S. Huntington); Imperial College Healthcare NHS Trust, London (J. Walsh, N. Mackie, A. Winston, J. Weber, F. Ramzan, M. Carder); Barts and The London NHS Trust, London (C. Orkin, J. Lynch, J. Hand, C. de Souza); Homerton University Hospital NHS Trust, London (J. Anderson, S. Munshi); North Middlesex University Hospital NHS Trust, London (J. Ainsworth, A. Schwenk, S. Miller, C. Wood); The Lothian University Hospitals NHS Trust, Edinburgh (C. Leen, A. Wilson, S. Morris); North Bristol NHS Trust (M. Gompels, S. Allan); Leicester, University Hospitals of Leicester NHS Trust (A. Palfreeman, K. Memon, A. Lewszuk); Middlesbrough, South Tees Hospitals NHS Foundation Trust (D. Chadwick, E. Cope, J. Gibson); Woolwich, Lewisham and Greenwich NHS Trust (S. Kegg, P. Main, Dr Mitchell, Dr Hunter), St George's Healthcare NHS Trust (P. Hay, M. Dhillon); York Teaching Hospital NHS Foundation Trust (F. Martin, S. Russell-Sharpe); Coventry, University Hospitals Coventry and Warwickshire NHS Trust (S. Allan, A. Harte, S. Clay); Wolverhampton, The Royal Wolverhampton Hospitals NHS Trust (A. Tariq, H. Spencer, R. Jones); Chertsey, Ashford and St Peter's Hospitals NHS Foundation Trust (J. Pritchard, S. Cumming, C. Atkinson); Public Health England, London (V. Delpech); UK Community Advisory Board (R. Trelvelion).

The current work was supported by the European Centre for Disease Prevention and Control (contract number ECD. 5665).

Authors' contribution: G.V. performed the statistical analysis and drafted the article. A.P., A.G., K.P., M.R. and F.W. acted as advisors for the study design and the statistical analysis. D.C., F.D., J.D.A., V.D., E.G., B.G.B., V.H., C.S., V.S., G.V. and G.T. described in detail eligibility criteria, geographical coverage and all characteristics of the cohorts they represented for this work. J.D.A., V.D., C.S., D.C. were also member of the study advisory committee. F.C., A.D., B.G.B., V.H. and B.S.

discussed the corresponding characteristics of their countries' National surveillance systems. G.T. supervised the study design and analysis and coauthored the draft article. All authors contributed substantially in finalizing the article.

Conflicts of interest

A.P. is employed by the ECDC. D.C. reports grants from Janssen-Cilag (2017–2018), Merck-Sharp & Dohme-Chibret (2015–2017), ViiV (2015), personal fees from Janssen-Cilag (2016, 2018) and Merck-Sharp & Dohme-Chibret (2015, 2017) for lectures, personal fees from ViiV (2015), for travel/accommodations/meeting expenses, personal fees from Gilead France from 2011 until December 2015 for French HIV board, personal fees from Innavirvax (2015 and 2016) and Merck Switzerland (2017) for consultancy, outside the submitted work. J.D.A. has received teaching fees from MSD, Gilead and ViiV Healthcare. E.G. has received personal fees from Gilead Sciences, Janssen, Otsuka Novel Products and Angelini for consultancy or lectures outside the submitted work. A.G. has participated in an advisory board for ViiV Healthcare (2016). K.P. has served on advisory boards for ViiV Healthcare. M.G. reports grants from the European Centre for Disease Prevention and Control paid to her institution. C.S. has received funding for the membership of Data Safety and Monitoring Boards, Advisory Boards, Speaker Panels and for the preparation of educational materials from Gilead Sciences, ViiV Healthcare and Janssen-Cilag. V.S. has served on advisory boards for ViiV Healthcare (2016) and Gilead (2018) and reports lecture fees from MSD (2014), Gilead (2014, 2015, 2017), Abbvie (2018) and Janssen (2018), outside the submitted work. G.T. has received grants unrelated to this study from Gilead Sciences Europe, UCL, ECDC and EU and National fund. All other authors have no conflicts of interest to declare.

References

1. UNAIDS. *Global AIDS update*. Geneva: UNAIDS; 2016.
2. Lundgren JD, Babiker AG, Gordin F, Emery S, Grund B, Sharma S, et al., Insight Start Study Group. **Initiation of antiretroviral therapy in early asymptomatic HIV infection.** *N Engl J Med* 2015; **373**:795–807.
3. EuroCoord. Enhancing clinical and epidemiological HIV research in Europe through cohort collaboration. <http://www.eurocoordinated.net/>. [Accessed 12 February 2018]
4. Thadhani R, Tonelli M. **Cohort studies: marching forward.** *Clin J Am Soc Nephrol* 2006; **1**:1117–1123.
5. Raboud J, Su D, Burchell AN, Gardner S, Walmsley S, Bayoumi AM, et al. **Representativeness of an HIV cohort of the sites from which it is recruiting: results from the Ontario HIV Treatment Network (OHTN) cohort study.** *BMC Med Res Methodol* 2013; **13**:31.
6. Supervie V, Marty L, Lacombe JM, Dray-Spira R, Costagliola D, Group F-ACs. **Looking beyond the cascade of HIV care to end the AIDS epidemic: estimation of the time interval from HIV infection to viral suppression.** *J Acquir Immune Defic Syndr* 2016; **73**:348–355.
7. Brilleman SL, Pachana NA, Dobson AJ. **The impact of attrition on the representativeness of cohort studies of older people.** *BMC Med Res Methodol* 2010; **10**:71.
8. Klijs B, Scholtens S, Mandemakers JJ, Snieder H, Stolk RP, Smidt N. **Representativeness of the Lifelines Cohort Study.** *PLoS One* 2015; **10**:e0137203.
9. Loubet P, Guerrisi C, Turbelin C, Blondel B, Launay O, Bardou M, et al. **First nationwide web-based surveillance system for influenza-like illness in pregnant women: participation and representativeness of the French G-GrippeNet cohort.** *BMC Public Health* 2016; **16**:253.
10. Woolfenden S, Eapen V, Axelsson E, Hendry A, Jalaludin B, Dissanayake C, et al. **Who is our cohort: recruitment, representativeness, baseline risk and retention in the 'Watch Me Grow' study?** *BMC Pediatr* 2016; **16**:46.
11. Alonso A, Segui-Gomez M, de Irala J, Sanchez-Villegas A, Beunza JJ, Martinez-Gonzalez MA. **Predictors of follow-up and assessment of selection bias from dropouts using inverse probability weighting in a cohort of university graduates.** *Eur J Epidemiol* 2006; **21**:351–358.
12. Hernan MA, Hernandez-Diaz S, Robins JM. **A structural approach to selection bias.** *Epidemiology* 2004; **15**:615–625.
13. Taylor AW, Dal Grande E, Grant J, Appleton S, Gill TK, Shi Z, et al. **Weighting of the data and analytical approaches may account for differences in overcoming the inadequate representativeness of the respondents to the third wave of a cohort study.** *J Clin Epidemiol* 2013; **66**:461–464.
14. Mary-Krause M, Grabar S, Lievre L, Abgrall S, Billaud E, Boue F, et al. **Cohort Profile: French Hospital Database on HIV (FHDH-ANRS CO4).** *Int J Epidemiol* 2014; **43**:1425–1436.
15. ANRS CO3 Aquitaine Cohort Profile. http://www.hivforum.org/storage/documents/Cohorts/2012/anrs_co3_aquitaine_cohort_profile.pdf. [Accessed 13 February 2018]
16. Batzing-Feigenbaum J, Kollan C, Kuhne A, Matysiak-Klose D, Gunsenheimer-Bartmeyer B, Hamouda O. **Cohort profile: the German ClinSurv HIV project – a multicentre open clinical cohort study supplementing national HIV surveillance.** *HIV Med* 2011; **12**:269–278.
17. ICONA cohort profile. http://www.fondazioneicona.org/_new/pages/presentationFolder/. [Accessed 13 February 2018]
18. The UK Collaborative HIV Cohort (UK CHIC) Study. <http://www.ukchic.org.uk/>. [Accessed 13 February 2018]
19. van Buuren S, Boshuizen HC, Knook DL. **Multiple imputation of missing blood pressure covariates in survival analysis.** *Stat Med* 1999; **18**:681–694.
20. Grau LE, Griffiths-Kundishora A, Heimer R, Hutcheson M, Nunn A, Towey C, et al. **Barriers and facilitators of the HIV care continuum in Southern New England for people with drug or alcohol use and living with HIV/AIDS: perspectives of HIV surveillance experts and service providers.** *Addict Sci Clin Pract* 2017; **12**:24.
21. Risher K, Mayer KH, Beyrer C. **HIV treatment cascade in MSM, people who inject drugs, and sex workers.** *Curr Opin HIV AIDS* 2015; **10**:420–429.
22. Monge S, Diez M, Alvarez M, Guillot V, Iribarren JA, Palacios R, et al. **Use of cohort data to estimate national prevalence of transmitted drug resistance to antiretroviral drugs in Spain (2007–2012).** *Clin Microbiol Infect* 2015; **21**:105e1–105e5.
23. Ellman TM, Sexton ME, Warshafsky D, Sobieszczyk ME, Morrison EA. **A forgotten population: older adults with newly diagnosed HIV.** *AIDS Patient Care STDS* 2014; **28**:530–536.
24. Reyes-Uruena J, Campbell C, Hernandez C, Vives N, Folch C, Ferrer L, et al. **Differences between migrants and Spanish-born population through the HIV care cascade, Catalonia: an analysis using multiple data sources.** *Epidemiol Infect* 2017; **145**:1670–1681.
25. Whyte J, Whyte MD, Hires K. **A study of HIV positive undocumented African migrants' access to health services in the UK.** *AIDS Care* 2015; **27**:703–705.
26. Rosinska M, Pantazis N, Janiec J, Pharris A, Amato-Gauci AJ, Quinten C, et al. **Potential adjustment methodology for missing data and reporting delay in the HIV Surveillance System, European Union/European Economic Area, 2015.** *Euro Surveill* 2018; **23**:1700359.