HIV testing history and access to treatment among migrants living with HIV in Europe

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Abstract
Introduction: Migrants are overrepresented in the European HIV epidemic. We aimed to understand the barriers and facilitators to HIV testing and current treatment and healthcare needs of migrants living with HIV in Europe.

Methods: A cross-sectional study was conducted in 57 HIV clinics in nine countries (Belgium, Germany, Greece, Italy, The Netherlands, Portugal, Spain, Switzerland and United Kingdom), July 2013 to July 2015. HIV-positive patients were eligible for inclusion if they were as follows: 18 years or older; foreign-born residents and diagnosed within five years of recruitment. Questionnaires were completed electronically in one of 15 languages and linked to clinical records. Primary outcomes were access to primary care and previous negative HIV test. Data were analysed using random effects logistic regression. Outcomes of interest are presented for women, heterosexual men and gay/bisexual men.

Results: A total of 2093 respondents (658 women, 446 heterosexual men and 989 gay/bisexual men) were included. The prevalence of a previous negative HIV test was 46.7%, 43.4% and 82.0% for women, heterosexual and gay/bisexual men respectively. In multivariable analysis previous testing was positively associated with: receipt of post-migration antenatal care among women, permanent residency among heterosexual men and identifying as gay rather than bisexual among gay/bisexual men. Access to primary care was found to be high (>83%) in all groups and was strongly associated with country of residence. Late diagnosis was common for women and heterosexual men (60.8% and 67.1%, respectively) despite utilization of health services prior to diagnosis. Across all groups almost three-quarters of people on antiretrovirals had an HIV viral load <50 copies/mL.

Conclusions: Migrants access healthcare in Europe and while many migrants had previously tested for HIV, that they went on to test positive at a later date suggests that opportunities for HIV prevention are being missed. Expansion of testing beyond sexual health and antenatal settings is still required and testing opportunities should be linked with combination prevention measures such as access to PrEP and treatment as prevention.

Keywords: HIV; migrants; HIV serodiagnosis; primary healthcare; health services accessibility

Additional Supporting Information may be found online in the Supporting information tab for this article.
acquisition are as high as 62% in some populations [5]. In addition, social inequalities associated with migration (e.g. low income, unemployment, poor housing) [6], HIV-related stigma and discrimination, and changes in sexual behaviour may increase the risk of late diagnosis or HIV infection [7-10].

Controlling the HIV epidemic within Europe is dependent on ensuring that migrants have prompt access to HIV testing, antiretroviral therapy (ART) and ongoing healthcare [5,11,12]. Migrant populations are, of course, heterogeneous making it difficult for policymakers and HIV prevention specialists to provide interventions and services targeted at specific migrant sub-groups. Often research in this area focuses on one migrant population (e.g. Central and Eastern Europeans [13]) or migrants in one country [14]. Most of the available research has been conducted with heterosexual migrants from Sub-Saharan Africa [15]. While this reflects the global HIV epidemic, the heterogeneity of migrants living with HIV in Europe [3] rationalizes researching other population groups, particularly migrant gay and bisexual men. In this study we present the results of the first collaborative European survey examining the key socio-demographic, behavioural and structural factors associated with HIV testing and primary care utilization among migrants living with HIV in Europe. We examine how these factors differ across gender-related group and present recommendations for targeted health promotion and intervention development.

2 | METHODS

2.1 | Study design

Full details of the methods used in the aMASE (advancing Migrant Access to health Services in Europe) Study have been described elsewhere [16]. A convenience sample was recruited within 57 clinics across the EuroCoord European Network of Excellence on HIV Research (www.eurocoord.net). Data collection took place in nine countries (Belgium, Germany, Greece, Italy, The Netherlands, Portugal, Spain, Switzerland and the United Kingdom) between July 2013 and July 2015. Patients were eligible for inclusion if they were (1) HIV positive, (2) aged 18 years and over, (3) foreign-born and resident in the country of recruitment for six months or more, (4) diagnosed within five years of the study date and (5) able to complete, either alone or supported, a computer-assisted self or personal interview in any one of the 15 languages available (Amharic, Arabic, Dutch, English, French, German, Greek, Italian, Polish, Portuguese, Russian, Turkish, Tigrinya, Spanish and Somali). In Switzerland, migrants from neighbouring Austria, France, Germany and Italy were excluded.

Eligible participants were identified through clinic records and asked to participate by clinicians or recruitment researchers. Most participants completed within-questionnaire “tick box” informed consent; participants in Belgium, Switzerland, Greece and Germany completed additional separate consent forms required by local research ethics committees.

The survey instrument was developed by an expert panel made up of experienced epidemiologists and community representatives and covered: socio-demographic characteristics (including migration history); sexual and HIV risk behaviour; health service use and experiences of living with HIV. Questionnaires were matched to clinical records (CD4 cell counts, viral loads, viral clades, HIV testing history, co-infections, AIDS-defining illnesses, treatment initiation) using a unique study number.

The target sample size was 2000 participants (1000 men and 1000 women) from all clinics. Participants were recruited from a minimum of two clinics in each of the nine countries, with each clinic forming a discrete cluster. We assumed the intra-cluster correlation would be relatively weak (e.g. 0.005), at least after adjustment for country of residence and other variables selected into our statistical regression models. Assuming an average cluster size of 50 participants, the design effect for the study is 1.25 and hence an overall effective sample size of approximately 1600. With this effective sample size outcomes within each gender are estimated to be within 3.5% across Europe based on a 95% confidence interval, and to be within 10% for each country (even if the assumed underlying prevalence is 50%, which would minimize precision).

2.2 | Ethics

Ethical approval was obtained separately in each participating country. See Additional file 1 for full details.

2.3 | Outcomes and variables of interest

The primary outcome measures were access to primary care and a previous negative HIV test. Primary care represents integration into healthcare services, beyond attendance at HIV clinics. Access to primary care was defined as possession of a health card (Italy/Spain), regular follow up with the Infectious Diseases Unit (Greece) or registration with a general practitioner (GP) or family doctor (all other countries) at the time of survey completion. Participants were asked if they had ever had a negative HIV test (year and country) and where possible missing self-reported data were replaced by data from clinical records. Previous HIV testing was used as a marker of access to HIV prevention opportunities (e.g. how well messages promoting frequent HIV testing are reaching migrants before diagnosis) and analysis of this variable was restricted to those diagnosed post-migration.

Data are presented by three gender-related groups (women, heterosexual men and gay/bisexual men) as it was assumed that the three groups were all likely to be different with regard to HIV testing history and sexual behaviour. Individuals who identified as transgender were assumed to form a distinct group and were subsequently excluded from analysis due to low numbers.

Participants were grouped according to region of birth based on United Nations Statistics Division geographic regions and sub-regions classifications [17]. Individuals were classified as diagnosed “late” if they were diagnosed with a CD4 cell count <350 cells/mm³ (<200 cells/mm³ for “very late”) and without serological evidence (e.g. avidity testing) of recent seroconversion.

2.4 | Statistical analysis

We undertook statistical analysis using Stata (version 14.1). We accounted for the clustering of participants at clinic and the country level by declaring countries to be strata and
clinics to be primary sampling units using the complex survey functions. In descriptive analysis proportions were compared using a design-based chi-square equivalent test and linear regression used to compare means.

Associations between the primary outcomes and socio-demographic/behavioural factors were analysed using logistic regression, with a random effect for clinics. Initial analysis showed that access to primary care was unexpectedly very high in some countries for some gender-related groups (e.g. 100% of women in Italy and The Netherlands). Consequently, for each group, associations are only explored in countries where less than 95% of respondents reported access to primary care.

Factors were first analysed individually (see tables in the results section for variables included in univariate analysis) and those factors found to have significant associations with the primary outcomes ($\alpha=0.05$) were incorporated into a regression model using backwards selection from a hierarchy of groups. That is, covariates were arranged into logical groupings (e.g. socioeconomic, sexual behaviour etcetera) with factors considered least important tested for possible removal first. Covariate groupings not significant at the 5% level were discarded (see Table 1). In all models, \textit{a priori} factors (country of residence, age, region of birth, years since migration, immigration status) were included. Sensitivity analyses were conducted (1) including years since HIV diagnosis as a predefined factor in the models and (2) excluding respondents who had migrated from another country in Europe (if that was not the country of birth). Associations are reported as odds ratios (OR) and adjusted OR (aOR) with 95% confidence intervals. Tests for interaction were performed.

### Table 1. Covariate groupings of factors significant in univariate analysis for each primary outcome, tested in multivariate analysis in decreasing order of importance (1 = most important)

| Previous negative testing for HIV | Access to primary care |
|---------------------------------|------------------------|
| **Women**                      |                        |
| 1. Country of residence, Age, Region of birth, Years in current country of residence, Immigration status$^a$ | 1. Country of residence, Age, Region of birth, Years in current country of residence, Immigration status$^a$ |
| 2. Antenatal service attendance in the 2 years prior to diagnosis$^a$children | 2. Employment |
| 3. Number of lifetime sexual partners & Diagnosed with STI before HIV diagnosis | 3. Any health service attendance in two years before diagnosis |
| 4. Education level               |                        |
| **Heterosexual men**            |                        |
| 1. Country of residence, Age, Region of birth, Years in current country of residence, Immigration status$^a$ | 1. Country of residence, Age, Region of birth, Years in current country of residence, Immigration status$^a$ |
| 2. Number of children cared for in the home | 2. Employment |
| **Gay/Bisexual men**            |                        |
| 1. Country of residence, Age, Region of birth, Years in current country of residence, Immigration status$^a$ | 1. Country of residence, Age, Region of birth, Years in current country of residence, Immigration status$^a$ |
| 2. Number of sexual partners in current country of residence | 2. Currently on ART |
| 3. Diagnosed with an STI before HIV diagnosis  | 3. Any health service attendance in 2 years before diagnosis |
| 4. Sexual orientation            |                        |
| 5. Employment & Income           |                        |

$^a$Preselected covariates included in all models. Groupings and order of importance based on \textit{a priori} assumptions informed by expert insight.

### RESULTS

Of 3794 patients registered on enrolment logs, 3251 eligible HIV-positive migrants were invited to participate and 2209 (68%) accepted and completed the survey. Participation was higher in men (75%) than in women (64%, $p < 0.001$), and decreased with age (83% in people aged 18 to 24 years and 62% in those aged over 64 years, $p = 0.04$). Those born in Oceania and North America (Rest of World) were most likely to participate compared with those born in Africa or Europe (91.3% vs. 62.4% vs. 64.4%, respectively, $p < 0.001$).

In total, 2117 respondents (658 women, 1435 men and 24 transgender) with matching clinical records were available for analysis. The 24 transgender participants were excluded from analysis leaving a final sample of 2093 subjects. Respondents were from 152 different countries: 35.1% Africa; 31.6% Latin America & Caribbean and 23.0% Europe (Table 2). See Figures S1 and S2 in Additional file 2 for full data). A large proportion of the sample were men (1435/2093; 68.6%) of which 68.9% (989/1435) were men who described their sexual orientation as gay or bisexual; there were differences between the three gender-related groups in nearly all demographic characteristics (Table 2). The majority of women and heterosexual men were born in Africa compared with gay/bisexual men (63.1% vs. 57.0% vs. 7.4%, $p < 0.001$) who were more likely to have been born in Latin America/Caribbean (18.2% vs. 16.1% vs. 46.1%, $p < 0.001$). Median times in Current Country of Residence (CCOR) were 7, 10 and 9 years for women, heterosexual men and gay men respectively. Other notable socio-demographic differences were in education level, employment status, income and immigration status with
Table 2. Socio-demographic characteristics of survey respondents, by gender (men separated by sexual orientation)

|                                | Women       | Heterosexual men | Gay/bisexual men | p value |
|--------------------------------|-------------|------------------|------------------|---------|
| Total number of respondents n (row %) | 658 (31.4)  | 446 (21.3)       | 989 (47.3)       |         |
| Median age in years (IQR)a      | 37 (30.9 to 44.6) | 41 (34.3 to 48.4) | 35 (29.4 to 41.6) |         |
| Region of birtha                |             |                  |                  | <0.001  |
| Africa                          | 415 (63.1)  | 254 (57.0)       | 73 (7.4)         |         |
| Latin America/Caribbean         | 120 (18.2)  | 72 (16.1)        | 456 (46.1)       |         |
| Rest of World                   | 32 (4.9)    | 39 (8.7)         | 146 (14.8)       |         |
| Europe                          | 91 (13.8)   | 81 (18.2)        | 314 (31.7)       |         |
| Mean age in years at migration (SD) | 29.3 (9.9)  | 30.1 (10.0)      | 26.3 (8.7)       | <0.001  |
| Median years in CCOR (IQR)a     | 7 (4.1 to 12.7) | 10 (6.1 to 15.0) | 9 (4.8 to 13.9)  |         |
| Ethnicity (n = 1881)b           |             |                  |                  | <0.001  |
| Black African/Caribbean         | 334 (59.5)  | 205 (51.8)       | 51 (5.5)         |         |
| White European                  | 92 (16.4)   | 69 (17.4)        | 296 (32.0)       |         |
| Latin American/Hispanic         | 39 (7.0)    | 26 (6.6)         | 177 (19.2)       |         |
| Mixed Ethnicity                 | 44 (7.8)    | 30 (7.6)         | 204 (22.1)       |         |
| Other                           | 52 (9.3)    | 66 (16.7)        | 196 (21.2)       |         |
| Education: upper secondary or morea | 322 (48.9)  | 228 (51.1)       | 802 (81.1)       | <0.001  |
| Employment status: working full/part timea | 276 (41.9)  | 217 (48.7)       | 666 (67.3)       | <0.001  |
| Relationship statusa            |             |                  |                  | 0.005   |
| Married/Cohabitating            | 273 (41.5)  | 195 (43.7)       | 352 (35.6)       |         |
| Single                          | 302 (45.9)  | 170 (38.1)       | 513 (51.9)       |         |
| Living apart relationship/marriage | 83 (12.6)   | 81 (18.2)        | 124 (12.5)       |         |
| Has childrena                   | 474 (72.6)  | 301 (69.2)       | 97 (9.9)         | <0.001  |
| Religion of those who attend services (n = 1165)a | 428 (85.8)  | 235 (76.1)       | 306 (85.7)       | <0.001  |
| Christian (All denominations)   |             |                  |                  |         |
| Muslim                          | 48 (9.6)    | 67 (21.7)        | 13 (3.6)         |         |
| Other                           | 23 (4.6)    | 7 (2.3)          | 38 (10.6)        |         |
| Sexual orientation (n = 2076)a   |             |                  |                  | <0.001  |
| Gay/Lesbian                     | 12 (18)     | 0 (0.0)          | 843 (85.2)       |         |
| Heterosexual                     | 616 (94.5)  | 417 (95.9)       | 0 (0.0)          |         |
| Bisexual                        | 14 (2.1)    | 0 (0.0)          | 146 (14.8)       |         |
| Other                           | 10 (1.5)    | 18 (4.1)         | 0 (0.0)          |         |
| Monthly income compared to national minimum wage (n = 1975)a |             |                  |                  | <0.001  |
| More or a lot more              | 65 (10.6)   | 60 (14.3)        | 430 (45.6)       |         |
| About the same                  | 82 (13.4)   | 70 (16.7)        | 167 (17.7)       |         |
| Less than minimum wage          | 215 (35.0)  | 126 (30.1)       | 189 (20.1)       |         |
| Own wage not earned             | 236 (38.4)  | 148 (35.3)       | 140 (14.7)       |         |
| Not known                       | 16 (2.6)    | 15 (3.6)         | 16 (1.7)         |         |
| Moderate/severe household hunger in past 4 weeks (n = 2006)a | 136 (21.8)  | 112 (26.8)       | 124 (12.8)       | <0.001  |
| Immigration status (n = 2078)a   |             |                  |                  | <0.001  |
| Permanent residency permit      | 335 (51.5)  | 258 (58.4)       | 777 (78.8)       |         |
| Temporary residency permit      | 238 (36.6)  | 147 (33.3)       | 152 (15.4)       |         |
| Asylum seeker/Refugee status    | 77 (11.8)   | 37 (8.4)         | 57 (5.8)         |         |
| Unknown                         | 58 (8.9)    | 23 (2.2)         | 48 (4.9)         |         |
| Travelled back to country of birth in past year | 191 (29.0)  | 133 (29.8)       | 497 (50.3)       | <0.001  |

Data are n (%), median (Inter-quartile range) or mean (Standard Deviation). N = 2093 unless otherwise stated.

*a* Tested as an independent predictor in univariate analysis for both outcomes.

*b* Excludes Portugal due to restrictions on data collection. CCOR=Current Country of Residence.

Gay/bisexual men more likely to report paid work, higher earnings, higher levels of education and more than three-quarters (78.8%) reporting permanent residency compared with 51.5% of women and 58.4% of heterosexual men (Table 2).

### 3.1 Access to testing and care pre-diagnosis

Table 3 shows HIV testing history and clinical characteristics of respondents at the time of diagnosis. Late (or very late)
HIV diagnosis was a feature in all groups (50.0% of women, 56.9% of heterosexual men and 29.8% of gay/bisexual men were diagnosed late); most respondents were diagnosed post-migration, with median times to diagnosis five, eight and seven years for women, heterosexual men and gay men respectively (Table 3). Health service attendance in the two years prior to diagnosis was high (>70%) in all groups but less than a quarter of women, 26% of heterosexual men and 38.9% of gay/bisexual men recalled HIV testing being mentioned/discussed at that time. Of those who had visited a GP before being diagnosed, only 11.4% of women, 21.0% of men and 28.6% of gay/bisexual men recalled being offered an HIV test. Recollections of provider-initiated HIV test discussions in sexual health clinics were higher: 66% of women, 69.6% of heterosexual men and 73.2% of gay/bisexual men. Less than half of women recalled being offered a test in antenatal care (Table 3).

There were high rates (82.8%) of previous negative testing among migrant gay/bisexual men, but less than half of women and heterosexual men (46.9% and 43.9%, respectively) reported ever having had a negative test (Table 3).

Among women, those who received antenatal care in CCOR (post-migration) were three times as likely to have had a previous negative test (aOR 3.21 95% CI 1.55 to 6.66) than those who had not received antenatal care post-migration (Table 4). Multivariable analysis among heterosexual men found previous negative testing was significantly

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**Table 3. Characteristics of survey respondents by gender (men separated by sexual orientation) at time of diagnosis**

|                                | Women               | Heterosexual men | Gay/bisexual men |
|--------------------------------|---------------------|------------------|------------------|
| Median age in years at diagnosis (IQR) | 34 (28.4 to 41.8) | 38 (31.7 to 45.7) | 34 (28.4 to 41.8) |
| Median CD4 cell count at diagnosis (IQR) (n = 15)a | 277 (124 to 438) | 240 (85 to 409) | 450 (276 to 639) |
| Late diagnosis (n = 1815)b,c | Diagnosed <350 cells mm³ | 293 (50.0) | 227 (56.9) | 248 (29.8) |
| Diagnosed <200 cells mm³ | 173 (29.5) | 148 (37.1) | 110 (13.3) |
| Median years between migration to CCOR and diagnosis (n = 1859)c | Diagnosed in CCOR (n = 2081)c | 5 (1 to 10) | 8 (3 to 13) | 7 (3 to 12) |
| AIDS defining illness within 3 months of diagnosis (n = 1997) | 101 (16.0) | 86 (20.5) | 63 (6.7) |
| <1 year between negative test and diagnosis (n = 1315) | 21 (6.8) | 18 (9.5) | 181 (22.2) |
| Attended health services in the 2 years prior to diagnosis (n = 1878)c | 423 (70.7) | 310 (74.5) | 717 (83.0) |
| Can recall mention of HIV testing at health service before diagnosis (n = 1448)c | 105 (24.8) | 81 (26.3) | 279 (38.9) |
| Place where offered HIV test before diagnosisa | Antenatal (n = 55) | 26 (49) | – | – |
| Inpatient (n = 255) | 24 (29.6) | 13 (22.4) | 24 (27.9) |
| Emergency (n = 322) | 5 (5.7) | 5 (6.9) | 13 (8.0) |
| Sexual health clinic or HIV testing clinic (n = 257) | 14 (66.7) | 16 (69.6) | 156 (73.2) |
| Outpatient (n = 317) | 15 (15.2) | 15 (23.8) | 35 (22.6) |
| GP/family doctor (n = 690) | 23 (11.4) | 32 (21.3) | 97 (28.6) |
| Other services (n = 143) | 14 (22.6) | 9 (33.3) | 13 (24.1) |
| Place of diagnosis (n = 1878)c | Antenatal service | 74 (12.4) | 3 (0.7) | 3 (0.3) |
| Hospital service, e.g. Emergency/Inpatient/Outpatient | 240 (40.1) | 196 (47.2) | 171 (19.8) |
| Sexual health clinic or HIV testing clinic | 75 (12.5) | 66 (15.9) | 376 (43.5) |
| GP/Family Doctor | 105 (17.5) | 95 (22.9) | 201 (23.3) |
| Private clinic | 17 (2.8) | 7 (1.7) | 43 (5.0) |
| Other | 88 (14.7) | 48 (11.6) | 70 (8.1) |
| Tested because unwell/health problemsc | 261 (39.7) | 230 (51.6) | 256 (25.9) |
| Tested because of perceived riskc | 128 (19.5) | 77 (17.3) | 384 (38.8) |
| Previous self-reported negative HIV test (n = 2028)d | 294 (46.7) | 183 (43.4) | 801 (82.0) |
| Country of previous negative test (n = 1258) | Current country of residence | 128 (44.3) | 95 (54.0) | 524 (66.1) |
| Country of birth | 145 (50.2) | 67 (38.1) | 218 (27.5) |
| Other country | 16 (5.5) | 14 (8.0) | 51 (6.4) |

Data are n (%), median (Inter-quartile range) or mean (Standard Deviation). CCOR=Current Country of Residence. N=2093 unless otherwise stated.

aIndividuals diagnosed in current country of residence only.
bIndividuals diagnosed with serological evidence of seroconversion (e.g. avidity testing) excluded.
cTested as an independent predictor in univariate analysis.
dData missing from self-report supplemented from clinic records.
Table 4. Factors associated with self-reported previous HIV-negative test\(^a\), among women, heterosexual men and gay or bisexual men living with diagnosed HIV post-migration and attending HIV clinics in Europe

|                      |       | OR  | AOR  | 95% CI     | \(p\) value |
|----------------------|-------|-----|------|------------|-------------|
| **Women (N = 565)**  |       |     |      |            |             |
| **Current country of residence (CCOR)** |       |     |      |            |             |
| Belgium              | 53.8  | 1.59| 1.49 | 0.72 to 3.10| 0.233       |
| Greece               | 29.5  | 0.57| 0.68 | 0.30 to 1.53|             |
| Germany              | 66.7  | 3.19| 3.21 | 0.68 to 15.18|             |
| Italy                | 26.1  | 0.48| 0.59 | 0.19 to 1.86|             |
| Netherlands          | 50.0  | 1.37| 1.79 | 0.61 to 5.27|             |
| Portugal             | 50.0  | 1.40| 1.49 | 0.74 to 3.02|             |
| Spain                | 42.3  | 1.00| 1.00 | –            |             |
| Switzerland          | 44.9  | 1.04| 1.41 | 0.63 to 3.20|             |
| United Kingdom       | 58.7  | 1.96| 1.76 | 0.90 to 3.45|             |
| **Age**              |       |     |      |            | 0.154       |
| 18 to 24             | 35.1  | 0.57| 0.71 | 0.32 to 1.57|             |
| 25 to 34             | 49.5  | 1.00| 1.00 | –            |             |
| 35 to 44             | 48.4  | 0.96| 0.85 | 0.54 to 1.33|             |
| 45 to 54             | 48.5  | 0.93| 0.81 | 0.47 to 1.41|             |
| 55+                  | 31.7  | 0.47| 0.36 | 0.16 to 0.80|             |
| **Region of birth**  |       |     |      |            | 0.305       |
| Africa               | 50.6  | 1.00| 1.00 | –            |             |
| Latin America/Caribbean | 44.5 | 0.78| 0.79 | 0.46 to 1.36|             |
| Rest of World        | 28.0  | 0.38| 0.42 | 0.15 to 1.17|             |
| Europe               | 39.0  | 0.62| 0.73 | 0.41 to 1.30|             |
| **Years resident in country** |       |     |      |            | 0.050       |
| \(\leq 2\)           | 41.9  | 0.70| 0.57 | 0.26 to 1.25|             |
| 3 to 5               | 38.0  | 0.56| 0.48 | 0.28 to 0.82|             |
| 6 to 10              | 49.1  | 0.92| 0.82 | 0.52 to 1.31|             |
| >10                  | 52.2  | 1.00| 1.00 | –            |             |
| **Immigration status** |      |     |      |            | 0.327       |
| Permanent residency  | 50.7  | 1.00| 1.00 | –            |             |
| Temporary residency  | 41.7  | 0.69| 0.72 | 0.46 to 1.13|             |
| Refugee/Asylum seeker/Unknown | 43.4 | 0.76| 0.77 | 0.44 to 1.32|             |
| **Has children**     |       |     |      |            | 0.006       |
| No children          | 44.7  | 1.04| 1.00 | 0.64 to 1.54|             |
| Has children, no antenatal care in CCOR | 43.9 | 1.00| 1.00 | –            |             |
| Has children, received antenatal care in CCOR | 75.0 | 3.88| 3.21 | 1.55 to 6.66|             |
| **Heterosexual men (N = 379)** |       |     |      |            |             |
| **Current country of residence (CCOR)** |       |     |      |            | 0.106       |
| Belgium              | 57.1  | 1.78| 2.51 | 1.14 to 5.52|             |
| Greece               | 32.0  | 0.63| 0.68 | 0.30 to 1.55|             |
| Germany              | 25.0  | 0.44| 0.43 | 0.08 to 2.42|             |
| Italy\(^b\)          | 0.0   | –   | –    | –            |             |
| Netherlands          | 52.6  | 1.48| 2.24 | 0.79 to 6.33|             |
| Portugal             | 40.0  | 0.89| 0.92 | 0.42 to 2.04|             |
| Spain                | 42.9  | 1.00| 1.00 | –            |             |
| Switzerland          | 53.5  | 1.53| 1.41 | 0.65 to 3.06|             |
| United Kingdom       | 51.7  | 1.42| 1.55 | 0.76 to 3.14|             |
| **Age (years)**      |       |     |      |            | 0.092       |
| 18 to 24             | 30.0  | 0.39| 0.36 | 0.08 to 1.56|             |
| 25 to 34             | 50.5  | 0.92| 0.88 | 0.50 to 1.56|             |
| 35 to 44             | 50.7  | 1.00| 1.00 | –            |             |
| 45 to 54             | 39.4  | 0.65| 0.58 | 0.33 to 1.00|             |
| 55+                  | 34.2  | 0.54| 0.42 | 0.19 to 0.94|             |

\(^a\) Data for Italy, Spain and UK are not currently available.

\(^b\) Data for Italy is not available.
| Region of birth               | % (n/N)   | OR  | AOR  | 95% CI   | p value |
|-------------------------------|----------|-----|------|----------|---------|
| Africa                        | 44.2 (91/206) | 1.00 | 1.00 | –        | 0.578   |
| Latin America/Caribbean       | 48.4 (31/64) | 1.26 | 1.32 | 0.69 to 2.52 |       |
| Rest of World                 | 38.2 (13/34) | 0.82 | 1.10 | 0.48 to 2.54 |       |
| Europe                        | 50.7 (38/75) | 1.35 | 1.55 | 0.81 to 2.97 |       |
| Years resident in country     |          |     |      |          | 0.428   |
| ≤2                            | 50.0 (5/10)  | 0.98 | 1.96 | 0.47 to 8.22 |       |
| 3 to 5                        | 45.5 (25/55) | 0.90 | 1.25 | 0.60 to 2.60 |       |
| 6 to 10                       | 51.4 (56/109) | 1.34 | 1.54 | 0.90 to 2.64 |       |
| >10                           | 42.4 (87/205) | 1.00 | 1.00 | –        |         |
| Immigration status            |          |     |      |          | 0.013   |
| Permanent residency           | 50.0 (117/234) | 1.00 | 1.00 | –        |         |
| Temporary residency           | 33.7 (29/86) | 0.42 | 0.41 | 0.23 to 0.75 |       |
| Refugee/Asylum seeker/Unknown | 45.8 (27/59) | 0.80 | 0.55 | 0.27 to 1.15 |       |

Gay or bisexual men (n = 780)

| Current country of residence |          |     |      |          | <0.001  |
|------------------------------|----------|-----|------|----------|---------|
| Belgium                      | 83.1 (49/59) | 1.13 | 0.65 | 0.27 to 1.60 |       |
| Greece                       | 44.4 (20/45) | 0.15 | 0.12 | 0.05 to 0.29 |       |
| Germany                      | 50.0 (3/6)   | 0.26 | 0.17 | 0.02 to 1.28 |       |
| Italy b                      | 0.0 (0/4)    | 1.00 | 1.00 | –        |         |
| Netherlands                  | 90.3 (56/62) | 1.75 | 1.33 | 0.48 to 3.69 |       |
| Portugal                     | 91.1 (41/45) | 1.72 | 3.41 | 1.11 to 10.50 |       |
| Spain                        | 88.3 (299/357) | 1.00 | 1.00 | –        |         |
| Switzerland                  | 78.4 (29/37) | 0.66 | 0.63 | 0.24 to 1.67 |       |
| United Kingdom               | 89.3 (151/169) | 1.71 | 1.06 | 0.53 to 2.13 |       |
| Age (years)                  |          |     |      |          | 0.045   |
| 18 to 24                     | 70.6 (48/68) | 0.54 | 0.43 | 0.22 to 0.85 |       |
| 25 to 34                     | 83.8 (269/321) | 1.00 | 1.00 | –        |         |
| 35 to 44                     | 83.6 (219/262) | 0.99 | 0.90 | 0.54 to 1.51 |       |
| 45 to 54                     | 90.3 (93/103) | 1.61 | 1.87 | 0.82 to 4.25 |       |
| 55+                          | 73.1 (19/26)  | 0.57 | 1.10 | 0.33 to 3.62 |       |
| Region of birth              |          |     |      |          | 0.292   |
| Africa                       | 76.9 (40/52) | 0.67 | 1.36 | 0.54 to 3.40 |       |
| Latin America/Caribbean      | 83.3 (319/383) | 1.00 | 1.00 | –        |         |
| Rest of World                | 81.3 (87/107) | 0.84 | 1.17 | 0.55 to 2.51 |       |
| Europe                       | 84.9 (202/238) | 1.02 | 1.84 | 0.97 to 3.50 |       |
| Years resident in country    |          |     |      |          | 0.128   |
| ≤2                           | 90.7 (39/43) | 1.65 | 3.71 | 1.09 to 12.66 |       |
| 3 to 5                       | 80.3 (118/147) | 0.87 | 1.79 | 0.90 to 3.53 |       |
| 6 to 10                      | 82.8 (212/256) | 0.98 | 1.13 | 0.67 to 1.91 |       |
| >10                          | 83.5 (279/334) | 1.00 | 1.00 | –        |         |
| Immigration status           |          |     |      |          | 0.125   |
| Permanent residency          | 85.4 (527/617) | 1.00 | 1.00 | –        |         |
| Temporary residency          | 78.1 (89/114) | 0.63 | 0.72 | 0.38 to 1.37 |       |
| Refugee/Asylum seeker/Unknown| 65.3 (32/49)  | 0.35 | 0.44 | 0.20 to 0.99 |       |
| Number of sexual partners in current country of residence |          |     |      |          | 0.008   |
| 0 to 5                       | 81.3 (109/134) | 0.33 | 0.41 | 0.18 to 0.93 |       |
| 6 to 10                      | 72.6 (61/84)  | 0.18 | 0.32 | 0.14 to 0.74 |       |
| 11 to 20                     | 81.4 (79/97)  | 0.33 | 0.41 | 0.18 to 0.93 |       |
| 21 to 50                     | 73.4 (94/128) | 0.21 | 0.24 | 0.12 to 0.49 |       |
| 51 to 100                    | 86.0 (104/121) | 0.46 | 0.46 | 0.21 to 1.02 |       |
| More than 100                | 93.1 (201/216) | 1.00 | 1.00 | –        |         |
associated with immigration status, with those with temporary residency significantly less likely to have had a previous test than those with permanent residency (aOR 0.41 95% CI 0.23 to 0.75; Table 4) after adjusting for CCOR, age, region of birth and years since migration. Among gay/bisexual men, negative testing was significantly associated with: CCOR, age, total number of sexual partners in CCOR, previous diagnosis with a sexually transmitted infection and sexual orientation—with bisexual men being less likely (aOR 0.43 95% CI 0.25 to 0.74) to have had a previous negative test than gay men (Table 4). Sensitivity analyses did not indicate that including the number of years since HIV diagnosis would improve the multivariable models and did not affect the associations of the other factors. Sensitivity analysis excluding respondents who had migrated from another country in Europe (n = 188) did not appreciably alter the findings.

### Access to treatment and ongoing care

Most participants in all groups were on antiretroviral treatment and 77.2% of women, 75.9% of heterosexual men and 77.9% of gay/bisexual men on treatment had an undetectable viral load (<50 copies/mL; Table 5). Most of those not on treatment reported this was because of their doctor’s advice or because they were newly diagnosed. Around a third of women (32.2%) had experienced difficulties with health services since migration, a third of whom cited long waiting times in clinics, 22% did not trust GP confidentiality while 19.9% said they were unclear of their legal rights to access care (Table 5). Slightly fewer men of either sexual orientation group reported difficulties overall. Among gay/bisexual men, long waiting times were a problem for 40.1% who reported difficulties, whereas 25.3% were unclear of their rights to access care. For heterosexual men who reported problems, language barriers presented difficulties for 27.7% and a quarter (25.3%) were unclear of their rights to access care.

Travel expenses and prescription costs presented additional barriers for those who funded this element of their care. The cost of prescriptions (for all medication, not just antiretrovirals) resulted in delaying or forgoing medications for 8.3% of women, 8.8% of heterosexual men and 4.9% of gay/bisexual men. Around one in ten women (11.9%), 15.1% of heterosexual men and 6.9% of gay/bisexual men reported missing appointments due to travel costs (Table 5).

Access to primary care was varied across countries. In Greece, Germany, Italy, the Netherlands and United Kingdom >95% of respondents in one or more gender-related group reported having a primary care physician or access to an infectious disease unit (Table 6). In multivariable analysis, access to primary care was associated with CCOR and immigration status in all three groups. In addition, years since migration and being on antiretroviral therapy remained significantly associated with access to primary care among gay/bisexual men.

There were no significant interactions between CCOR or country of birth and any of the factors in the models selected for any group (data not shown).

### DISCUSSION

This study provides valuable data about the barriers and facilitators to secondary HIV prevention and accessing primary care for different migrant groups living with HIV in Europe. In addition, we have shown that for migrant women and heterosexual men, structural factors related to child-bearing or immigration status have a strong association with access to HIV testing. For migrant gay/bisexual men barriers to testing are mainly related to sexual behavioural factors with bisexual men and those with fewer partners less likely to have a previous negative test. Access to primary care, an indicator of integration into health services, was found to be strongly associated with current country of residence in all groups and immigration status among women and gay/bisexual men.

### Policy Implications

Our findings suggest that for migrant women and heterosexual men, interventions that target sexual behaviour or other individual-level lifestyle factors might not be particularly successful in increasing the uptake of HIV testing. Rather, interventions that aim to address structural barriers could achieve more in the effort to increase access to earlier and regular testing. Large numbers in each group had attended primary care in the two years prior to diagnosis, however, attendance was not associated with the probability of having a negative test before diagnosis, or was it associated with late diagnosis (data not shown). The low proportion of individuals offered an HIV test before diagnosis suggests that there are continued missed opportunities for HIV testing, particularly in primary care. Policies advocating opportunistic provider-initiated testing, as provided in antenatal services in much of Europe, have

### Table 4. (Continued)

| % (n/N) | OR | AOR | 95% CI | p value |
|--------|----|-----|--------|---------|
| Diagnosed with STI before HIV diagnosis | | | | |
| No | 75.2 (354/471) | 1.00 | 1.00 | – |
| Yes | 95.1 (294/309) | 6.42 | 4.41 | 2.42 to 8.03 |
| Sexual orientation | | | | |
| Gay | 85.4 (568/665) | 1.00 | 1.00 | – |
| Bisexual | 69.6 (80/115) | 0.37 | 0.43 | 0.25 to 0.74 |

OR, odds ratio; AOR, adjusted odds ratio; 95% CI, 95% confidence interval; ART, antiretroviral therapy; STI, sexually transmitted infection.

*After final model selection. All models adjusted for factors listed in the model.

*Excluded from multivariable analysis because of perfect prediction (separation).
be successful in increasing HIV testing and diagnosing women at earlier stages of infection [18] and a similar approach could work in primary care. Previous studies have shown that the introduction of routine, rapid or point-of-care testing in primary care is feasible and acceptable, especially among migrant or black and minority ethnic communities [19-22]. In addition, there may still be missed opportunities among migrant or black and minority ethnic communities testing in primary care is feasible and acceptable, especially shown that the introduction of routine, rapid or point-of-care approach could work in primary care. Previous studies have shown that the introduction of routine, rapid or point-of-care testing in primary care is feasible and acceptable, especially similar to those expressed by patients living with other chronic conditions, for example, long waiting times and difficulties with appointments [30,31]. This is perhaps to be expected as the mechanisms of accessing care are well documented as barriers, particularly among migrants who have competing interests which deprioritize health concerns [10]. Immigration legislation differs across Europe and changes to health policy affecting migrants frequently occur [32,33].

Migration status with transmission risk in national surveillance data will enhance the ability to monitor and address HIV prevention needs for migrant MSM. In this study, we have shown that the main barriers to accessing ongoing healthcare are similar to those expressed by patients living with other chronic conditions, for example, long waiting times and difficulties with appointments [30,31]. This is perhaps to be expected as the mechanisms of accessing care are well documented as barriers, particularly among migrants who have competing interests which deprioritize health concerns [10].

Within this survey a substantial proportion of respondents were not taking ART, possibly because the data from this study were collected before updated European HIV Treatment Guidelines recommended immediate ART initiation irrespective of CD4 count [34]. The impact of the new guidelines on the uptake of ART in this population cannot be known from this study and further research is needed to establish if there remains a substantial (16 to 31%) deficit in uptake of ART, particularly among migrant gay and bisexual men, and whether high treatment costs are a barrier to ART initiation or

**Table 5. HIV treatment characteristics of aMASE clinic survey respondents, by gender (men separated by sexual orientation)**

| Most recent CD4 cell count ≥350 cells mm\(^{-3}\) (n = 2011) | Women       | Heterosexual men | Gay/bisexual men |
|------------------------------------------------------------|-------------|------------------|------------------|
|                                                            | 494 (76.8) | 282 (65.4)       | 814 (86.9)       |
| Undetectable viral load (<50 copies/mL) (n = 1540)\(^a\)   | 409 (77.2) | 290 (75.9)       | 489 (77.9)       |
| Currently not on HIV treatment (n = 2090)\(^b\)            | 105 (16.0) | 40 (9.0)         | 312 (31.6)       |
| Reason not on HIV treatment (n = 457)                      |             |                  |                  |
| Doctor’s advice or newly diagnosed                         | 90 (85.7)  | 33 (82.5)        | 276 (88.5)       |
| High cost or otherwise inaccessible                       | 3 (2.9)    | 0 (0.0)          | 15 (4.8)         |
| Fear of side effects or other difficulties taking medication| 9 (8.6)    | 5 (12.5)         | 25 (8.0)         |
| Other reason                                              | 7 (6.7)    | 3 (7.5)          | 16 (5.1)         |
| Access to primary care (n = 2076)                         | 552 (85.1) | 369 (83.5)       | 833 (84.6)       |
| Government-funded HIV treatment and care (n = 972)\(^bc\)  | 244 (78.2) | 142 (76.6)       | 319 (70.3)       |
| Experienced difficulties with health service in CCOR (n = 2093)| 211 (32.3) | 132 (29.9)       | 272 (27.7)       |
| No GP/Health card/insurance (n = 628)                      | 33 (15.3)  | 18 (13.1)        | 58 (20.9)        |
| Unclear of rights to access medical care (n = 629)         | 43 (19.9)  | 35 (25.5)        | 70 (25.3)        |
| Long waiting times for an appointment/in the clinic (n = 628)| 72 (33.3)  | 29 (21.2)        | 111 (40.1)       |
| Does not trust the GP confidentiality (n = 628)            | 48 (22.2)  | 31 (22.6)        | 37 (13.4)        |
| Difficulty communicating with staff because of language differences (n = 628)| 55 (25.5)  | 38 (27.7)        | 38 (13.7)        |
| Difficulty negotiating healthcare system (e.g. finding GP, payment, travel) (n = 629)| 22 (10.2)  | 13 (9.5)         | 31 (11.2)        |
| Missed clinical appointments because of travel expenses (n = 2071)| 77 (11.9)  | 66 (15.1)        | 68 (6.9)         |
| Delayed/forwent medication because of prescription costs (n = 2078)\(^d\)| 54 (8.3)  | 39 (8.8)         | 48 (4.9)         |

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**Notes:**
- Data are n (%), CCOR, Current Country of Residence.
- \(^a\)Only those on antiretroviral therapy (ART).
- \(^b\)Tested as an independent predictor in univariate analysis.
- \(^c\)Includes co-pays.
- \(^d\)Includes medicines other than antiretroviral therapy.
Table 6. Factors associated with access to primary care among women, heterosexual men and gay/bisexual men living with diagnosed HIV and attending HIV clinics in Europe

|                          | % (n/N)      | OR  | AOR  | 95% CI       | p value |
|--------------------------|--------------|-----|------|--------------|---------|
| **Women (N = 409)**      |              |     |      |              |         |
| Current country of residence |            |     |      |              | <0.001  |
| Belgium                  | 81.5 (88/108)| 0.38| 0.42 | 0.17 to 1.04 |         |
| Greece\(^b\)             | 98.5 (65/66) | –   | –    | –            |         |
| Germany\(^b\)            | 80.0 (8/10)  | –   | –    | –            |         |
| Italy\(^b\)              | 100.0 (35/35)| –   | –    | –            |         |
| Netherlands\(^b\)        | 100.0 (20/20)| –   | –    | –            |         |
| Portugal                 | 54.8 (46/84) | 0.10| 0.09 | 0.04 to 0.21 |         |
| Spain                    | 92.1 (140/152)| 1.00| 1.00 | –            |         |
| Switzerland              | 66.2 (43/65) | 0.17| 0.22 | 0.09 to 0.56 |         |
| United Kingdom\(^b\)     | 98.2 (107/109)| –   | –    | –            |         |
| Age (years)              |              |     |      |              | 0.129   |
| 18 to 24                 | 71.4 (20/28) | 0.69| 0.47 | 0.17 to 1.28 |         |
| 25 to 34                 | 78.4 (120/153)| 1.00| 1.00 | –            |         |
| 35 to 44                 | 80.0 (108/135)| 1.10| 1.04 | 0.54 to 1.98 |         |
| 45 to 54                 | 81.5 (53/65) | 1.21| 1.24 | 0.52 to 2.95 |         |
| 55+                      | 57.1 (16/28) | 0.37| 0.39 | 0.14 to 1.08 |         |
| Region of birth          |              |     |      |              | 0.420   |
| Africa                   | 74.5 (190/255)| 1.00| 1.00 | –            |         |
| Latin America/Caribbean  | 86.9 (86/99)| 2.26| 0.90 | 0.39 to 2.06 |         |
| Rest of World            | 61.5 (8/13)  | 0.55| 0.35 | 0.09 to 1.34 |         |
| Europe                   | 78.6 (33/42) | 1.25| 0.66 | 0.25 to 1.70 |         |
| Years resident in country|              |     |      |              | 0.252   |
| ≤2                       | 62.8 (27/43)| 0.26| 0.40 | 0.14 to 1.12 |         |
| 3 to 5                   | 71.7 (91/127)| 0.39| 0.45 | 0.20 to 1.03 |         |
| 6 to 10                  | 79.3 (88/111)| 0.59| 0.60 | 0.27 to 1.35 |         |
| >10                      | 86.7 (111/128)| 1.00| 1.00 | –            |         |
| Immigration status       |              |     |      |              | 0.028   |
| Permanent residency      | 84.0 (178/212)| 1.00| 1.00 | –            |         |
| Temporary residency      | 68.1 (81/119)| 0.41| 0.41 | 0.22 to 0.79 |         |
| Refugee/Asylum seeker/Unknown | 74.4 (58/78) | 0.55| 0.56 | 0.26 to 1.21 |         |
| **Heterosexual men (N = 271)** |          |     |      |              | 0.004   |
| Current country of residence |          |     |      |              |         |
| Belgium                  | 63.3 (38/60)| 0.25| 0.34 | 0.14 to 0.85 |         |
| Greece\(^b\)             | 96.3 (52/54)| –   | –    | –            |         |
| Germany\(^b\)            | 100.0 (9/9) | –   | –    | –            |         |
| Italy\(^b\)              | 100.0 (23/23)| –   | –    | –            |         |
| Netherlands\(^b\)        | 90.5 (19/21) | –   | –    | –            |         |
| Portugal                 | 72.1 (31/43)| 0.37| 0.24 | 0.09 to 0.61 |         |
| Spain                    | 87.4 (104/119)| 1.00| 1.00 | –            |         |
| Switzerland              | 65.3 (32/49)| 0.27| 0.22 | 0.09 to 0.56 |         |
| United Kingdom\(^b\)     | 95.3 (61/64)| –   | –    | –            |         |
| Age (years)              |              |     |      |              | 0.211   |
| 18 to 24                 | 62.5 (5/8)   | 0.56| 0.44 | 0.08 to 2.40 |         |
| 25 to 34                 | 80.0 (56/70)| 1.33| 1.40 | 0.61 to 3.21 |         |
| 35 to 44                 | 75.0 (75/100)| 1.00| 1.00 | –            |         |
| 45 to 54                 | 69.7 (46/66)| 0.77| 0.56 | 0.26 to 1.22 |         |
| 55+                      | 85.2 (23/27)| 1.92| 1.72 | 0.49 to 6.04 |         |
|                                | % (n/N) | OR    | AOR   | 95% CI          | p value |
|--------------------------------|---------|-------|-------|-----------------|---------|
| **Region of birth**            |         |       |       |                 |         |
| Africa                         | 68.9 (104/151) | 1.00  | 1.00  |                 | 0.572   |
| Latin America/Caribbean        | 83.3 (50/60)   | 2.26  | 1.27  | 0.52 to 3.09    |         |
| Rest of World                  | 71.4 (10/14)   | 1.13  | 1.07  | 0.28 to 4.00    |         |
| Europe                         | 89.1 (41/46)   | 3.71  | 2.18  | 0.72 to 6.57    |         |
| **Years resident in country**  |         |       |       |                 |         |
| ≤2                             | 64.3 (9/14)    | 0.38  | 1.11  | 0.28 to 4.45    | 0.879   |
| 3 to 5                         | 57.4 (27/47)   | 0.29  | 0.72  | 0.28 to 1.88    |         |
| 6 to 10                        | 77.4 (65/84)   | 0.72  | 0.87  | 0.39 to 1.95    |         |
| >10                            | 82.5 (104/126) | 1.00  | 1.00  |                 |         |
| **Immigration status**         |         |       |       |                 |         |
| Permanent residency            | 84.9 (135/159)| 1.00  | 1.00  |                 | 0.040   |
| Temporary residency            | 67.7 (44/65)   | 0.26  | 0.40  | 0.18 to 0.88    |         |
| Refugee/Asylum seeker/Unknown  | 55.3 (26/47)   | 0.22  | 0.34  | 0.13 to 0.92    |         |
| **Gay/bisexual men (N = 913)** |         |       |       |                 | <0.001  |
| Current country of residence   |         |       |       |                 |         |
| Belgium                        | 75.6 (65/86)   | 0.40  | 0.31  | 0.11 to 0.86    |         |
| Greece b                       | 96.4 (53/55)   | –     | –     |                 |         |
| Germany b                      | 100.0 (12/12) | –     | –     |                 |         |
| Italy b                        | 100.0 (5/5)    | –     | –     |                 |         |
| Netherlands                    | 94.9 (74/78)   | 2.38  | 1.62  | 0.43 to 6.12    |         |
| Portugal                       | 52.9 (27/51)   | 0.14  | 0.06  | 0.02 to 0.16    |         |
| Spain                          | 88.6 (365/412) | 1.00  | 1.00  |                 |         |
| Switzerland                    | 59.0 (36/61)   | 0.19  | 0.08  | 0.03 to 0.21    |         |
| United Kingdom                 | 87.1 (196/225) | 0.87  | 0.55  | 0.24 to 1.26    |         |
| **Age**                        |         |       |       |                 | 0.334   |
| 18 to 24                       | 72.6 (61/84)   | 0.66  | 0.69  | 0.36 to 1.30    |         |
| 25 to 34                       | 80.0 (308/385) | 1.00  | 1.00  |                 |         |
| 35 to 44                       | 86.0 (257/299) | 1.53  | 1.03  | 0.62 to 1.70    |         |
| 45 to 54                       | 94.3 (115/122)| 4.11  | 2.11  | 0.85 to 5.26    |         |
| 55+                            | 95.7 (22/23)   | 5.50  | 1.34  | 0.16 to 11.34   |         |
| **Region of birth**            |         |       |       |                 | 0.255   |
| Africa                         | 83.3 (55/66)   | 1.06  | 2.36  | 0.95 to 5.88    |         |
| Latin America/Caribbean        | 82.4 (371/450)| 1.00  | 1.00  |                 |         |
| Rest of World                  | 85.7 (114/133)| 1.28  | 1.49  | 0.74 to 3.00    |         |
| Europe                         | 84.5 (223/264)| 1.16  | 1.13  | 0.63 to 2.01    |         |
| **Years resident in country**  |         |       |       |                 | <0.001  |
| ≤2                             | 59.8 (58/97)   | 0.15  | 0.17  | 0.09 to 0.35    |         |
| 3 to 5                         | 72.6 (127/175)| 0.27  | 0.44  | 0.24 to 0.82    |         |
| 6 to 10                        | 89.6 (250/279)| 0.89  | 1.21  | 0.66 to 2.22    |         |
| >10                            | 90.6 (328/362)| 1.00  | 1.00  |                 |         |
| **Immigration status**         |         |       |       |                 | <0.001  |
| Permanent residency            | 88.0 (639/726)| 1.00  | 1.00  |                 |         |
| Temporary residency            | 70.2 (92/131)| 0.33  | 0.48  | 0.28 to 0.85    |         |
| Refugee/Asylum seeker/Unknown  | 57.1 (32/56)   | 0.15  | 0.21  | 0.10 to 0.45    |         |
| **Currently on ART**           |         |       |       |                 | 0.001   |
| No                             | 79.9 (231/289) | 0.69  | 0.42  | 0.26 to 0.70    |         |
| Yes                            | 85.3 (532/624)| 1.00  | 1.00  |                 |         |

OR, odds ratio; AOR, adjusted odds ratio; 95% CI, 95% confidence interval; ART, antiretroviral therapy.

*After final model selection.

bExcluded from multivariable analysis because of perfect prediction (separation) or small numbers. All models adjusted for factors listed in the table.
adherence for migrants who are not entitled to free ART. To highlight the benefits of HIV treatment, clinicians and policymakers should consider the enhanced promotion of campaigns such as “Undetectable = Untransmittable” to migrants who have not received accurate and up-to-date information about the risks of sexual transmission of HIV for those successfully on ART [35,36].

Migration-specific barriers, such as language barriers and difficulties understanding the legal rights to accessing healthcare, presented a problem for 20 to 25% of participants who experienced difficulties, although this finding is likely to have been underestimated (see below). These barriers may present challenges to physicians providing complex ongoing HIV healthcare. For example, language barriers could lead to poor health literacy among patients and consequently impact on the initiation of—and adherence to—ART as well as potentially facilitating onward transmission [37]. While it is beyond the scope of this survey to ascertain whether uncertainty surrounding the legal rights to access care leads to poor clinic attendance or adherence, other studies have shown that fear of deportation has prevented individuals from seeking care [10]. In addition, as some healthcare providers seek to normalize HIV by shifting care aware from specialist services to general practice, this study presents a timely understanding of some of the potential barriers to such policies.

Finally, this study found that poverty may influence access to ongoing care, with a substantial proportion of all groups reporting missing clinic appointments due to travel expenses and delaying or foregoing medication due to prescription costs. Poverty was especially prevalent among heterosexual men with over 20% reporting moderate or severe household hunger in the past four weeks. Poverty is well recognized as being associated with lower engagement in care [38-41]. While tackling the overall problem of economic inequality is beyond the capacity of service providers, these impediments to care need to be recognized and where possible support offered to help mitigate this barrier.

4.2 | Limitations

This study is not without its limitations [16]. The clinics and the countries were not selected at random and as such this is a convenience sample and therefore some of the prevalence estimates may have been over- or underestimated. In particular, it is likely that access to primary care was overestimated in some countries, as by including “health cards” and “infectious disease units” in our definition of primary care we may not have been able to sufficiently distinguish between family doctors/GPs and specialist care for HIV; therefore, caution is urged when using these estimates in healthcare planning. The proportions of respondents experiencing difficulties accessing health services are likely to have been underestimated, as those who experienced the greatest difficulties would not have been available in clinic to be recruited to the survey. It was assumed that those without a previous negative HIV test had experienced barriers to HIV testing up until the point of diagnosis. It is possible that some individuals had tested for the first time immediately after being exposed to HIV risk. However, given that a large proportion of participants were diagnosed late, it is likely that this previous negative testing is a suitable proxy for access to HIV testing.

5 | CONCLUSION

Migrants are accessing healthcare in Europe prior to HIV diagnosis. While many migrants had previously tested negative for HIV, missed opportunities for earlier diagnosis persist among all migrant groups. In gay and bisexual migrant men many of who initially tested HIV negative in the receiving country went on to acquire HIV at a later date. Interventions to further expand testing outside of sexual health and antenatal settings are still required and these opportunities should be linked with combination prevention measures such as access to PrEP and treatment as prevention.

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COMPETING INTERESTS

The authors of this manuscript have no competing interests to declare.

AUTHORS’ CONTRIBUTIONS

JDA and FB initiated this project. All authors and contributors in acknowledgement sections were involved in data collection and exchange. IF carried out the data analyses and drafted the initial manuscript. FB, JDA and AC were also involved in analysis interpretation and contributed to the discussion and conclusions. AC also provided statistical support. All authors contributed to the design of the study, commented on the manuscript and approved the final draft.

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APPENDIX

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Additional File 1. Ethical approval for the aMASE (advancing Migrant Access to Health Services in Europe) studies in each participating country.

Additional File 2.

Figure S1. Current country of residence of male and female respondents to the aMASE Clinic Survey. N = 2093 from 57 clinic sites (min, max patients 1, 148): Belgium 255, 4 clinics (27, 148); Germany 31, 2 clinics (14, 17; Greece 175, 8 clinics (1, 60) Italy 63, 2 clinics (20, 43); Netherlands 119, 3 clinics (28, 51); Portugal 179, 7 clinics (5, 54); Spain 693, 18 clinics (9, 141); Switzerland 177, 6 clinics (5, 42); United Kingdom 401, 7 clinics (21, 106).

Figure S2. Country of birth of male and female respondents to the aMASE clinic survey. N = 2093 from 152 countries. Brazil 146; Colombia 107; Nigeria 96; Ecuador 74; Cameroon 59; Ghana 58; Venezuela 57; Romania 56; Italy 52; Guinea-Bissau 49; Albania 43; Peru 39; Cuba 37; Argentina 36; Dominican Republic 36; Congo (Kinshasa) 35; Portugal 35; Poland 34; Russia 33; Spain 32; France 31; Guinea 30; Angola 28; Equatorial Guinea 27; Morocco 27; Ukraine 26; Cote d’Ivoire 25; Zimbabwe 25; Cape Verde 24; United States of America 23; Bulgaria 22; Eritrea 22; Ethiopia 20; United Kingdom 20; Georgia 19; Rwanda 19; Togo 19; Bolivia 17; Mozambique 17; South Africa 17; Kenya 16; China 15; Paraguay 15; Thailand 15; Germany 14; Mexico 14; Suriname 13; Burundi 12; Philippines 12; Sierra Leone 12; Turkey 12; India 11; Chile 9; Malaysia 9; Serbia 9; Uruguay 9; Australia 8; Canada 8; Honduras 8; Hungary 8; Malawi 8; Netherland 8; Senegal 8; Tanzania 8; Uganda 8; Benin 7; Burkina Faso 7; Czech Republic 7; Iran 7; Jamaica 7; Lebanon 7; Pakistan 7; Armenia 5; Belgium 5; Cyprus 5; Indonesia 5; Kazakhstan 5; Liberia 5; Nicaragua 5; Sweden 5; Switzerland 5; Uzbekistan 5; Finland 4; Greece 4; Hong Kong 4; Mali 4; Mauritius 4; Moldova 4; Nepal 4; Sao Tome and Principe 4; Trinidad and Tobago 4; Zambia 4; Austria 3; Congo (Brazzaville) 3; Egypt 3; Estonia 3; Gambia, The 3; Ireland 3; Israel 3; Japan 3; Latvia 3; Netherlands Antilles 3; Sri Lanka 3; Sudan 3; Vietnam 3; Afghanistan 2; Antigua and Barbuda 2; Bangladesh 2; Bosnia and Herzegovina 2; Botswana 2; Denmark 2; Gabon 2; Guatemala 2; Iraq 2; Kosovo 2; Macedonia 2; Madagascar 2; New Zealand 2; Norway 2; Panama 2; Seychelles 2; Slovakia 2; Slovenia 2; Somalia 2; Taiwan 2; Algeria 1; Azerbaijan 1; Bahamas, The 1; Barbados 1; Belarus 1; Burma 1; Central African Republic 1; Comoros 1; Croatia 1; Djibouti 1; Dominica 1; El Salvador 1; Guyana 1; Haiti 1; Laos 1; Libya 1; Lithuania 1; Mauritania 1; Niger 1; Oman 1; Swaziland 1; Syria 1; Tajikistan 1; Timor-Leste 1; Turkmenistan 1; United Arab Emirates 1.

Additional File 3

Table S2. Sociodemographic characteristics of survey respondents, by gender (men separated by sexual orientation)

Table S3. Characteristics of survey respondents by gender (men separated by sexual orientation) at time of diagnosis

Table S4. HIV treatment characteristics of aMASE clinic survey respondents, by gender (men separated by sexual orientation)