HIV-related outcomes among migrants living in Europe compared with the general population: a systematic review and meta-analysis

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Summary

Background Compared with the general population, international migrants arriving in Europe face severe socioeconomic challenges that result in higher HIV prevalence and limited access to health care, potentially leading to negative outcomes. In this systematic review and meta-analysis, we aimed to investigate the incidence of HIV-related outcomes among international migrants arriving in Europe compared with the incidence among the general population.

Methods We did a systematic review and meta-analysis to identify studies investigating HIV-related outcomes in migrants and the general population living with HIV in Europe. Six authors (EDV, VP, VS, SDG, MC, and RN) independently searched PubMed, Scopus, and Web of Science from database inception until July 22, 2023 (with an update on March 3, 2024), then screened titles and abstracts of all potentially eligible articles. Studies were included if they were observational studies; investigated clinical, virological, or immunological outcomes in migrants living with HIV; were conducted in Europe; had at least one control group of non-migrants living in a European country; and were in English. Titles and abstracts were screened for eligibility followed by a full-text assessment by two authors (EDV, VP, VS, SDG, MC, or RN). Data were extracted from articles using a structured Redcap form. Primary outcomes of our systematic review were (1) mortality, (2) AIDS-defining condition, (3) combined outcome of AIDS or death, (4) treatment discontinuation, (5) rate of loss to follow-up, (6) virological failure, and (7) immunological failure. Data were reported as relative risks (RRs) or odds ratios with their 95% CIs. The study is registered with PROSPERO, CRD42024501191.

Findings Of the 1316 articles identified (1297 in the initial search and 19 in the updated search), 18 were included in our systematic review, consisting of 104 597 participants who were followed up for a mean of 86·6 months. The meta-analysis, adjusted for potential confounders, showed that migrants present similar mortality risk (RR 0·88, 95% CI 0·75–1·04), but higher risk for AIDS-defining conditions (1·21, 1·11–1·31), treatment discontinuation (2·39, 1·49–3·29), loss to follow-up (2·53, 1·41–4·53), and virological failure (1·93, 1·34–2·52) compared with the general population. Subanalyses for WHO regions showed that risk was driven mainly by migrants from the African region.

Interpretation Compared with the non-migrant population, migrants living in Europe with HIV face higher risks for progression to AIDS, loss to follow-up, treatment discontinuation, and virological failure. Interventions aimed to improve HIV care among migrants living in Europe are urgently needed.

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Introduction

In Europe, migrants face multiple system and individual-level barriers that affect access and retention into HIV care. These barriers include economic constraints, legal and administrative obstacles, and health-care workers' limited ability to address language barriers and to customise their practice according to migrants' displacement journeys, cultural background, and individual health needs.[1] Additionally, factors such as HIV-related stigma, fear of violence and deportation, and social marginalisation deter migrants and refugees from seeking medical attention, thereby exacerbating their vulnerability to adverse HIV outcomes.[2] The issue of health-care access for migrant populations, especially migrants in irregular or undocumented status, continues to be a highly sensitive and controversial political subject.[3] Migrant health is rarely included in health priority setting of European countries, and health policies are not incorporated into the migration governance framework.[4] In Italy, for example, the country with the highest number of migrant arrivals in 2023,[5] there is no initiative explicitly addressing migrant-specific health needs, and current policies go as far as allowing administrative detention and criminalising search and rescue by non-governmental

Research in context

Evidence before this study

According to the International Organization for Migration, migration in Europe is anticipated to increase due to ongoing drivers like economic disparities, political instability, and climate change. We searched PubMed, Scopus, and Embase for studies written in English, published up to March 3, 2024, and reporting migration as a potential risk factor for mortality, AIDS-defining conditions, treatment discontinuation, loss to follow-up, and virological failure among people living with HIV in Europe. Before this study, most meta-analyses focused on HIV prevalence among migrants, consistently indicating higher prevalence compared with general populations. A large meta-analysis suggested a potential mortality benefit for migrants; although, findings were mixed when considering deaths from infectious causes. However, there is limited comprehensive data on other critical HIV-related outcomes such as AIDS-defining conditions, treatment discontinuation, loss to follow-up, and virological failure. This gap in the literature underscores the necessity for a more detailed investigation into the range of HIV-related health outcomes among migrant populations in Europe.

Added value of this study

Our systematic review and meta-analysis contribute to the existing knowledge by providing in-depth comparisons of a wider spectrum of HIV-related health outcomes between migrant and non-migrant populations in Europe. Through quantifying the risks associated with different outcomes and stratifying by country of origin based on WHO regions, this study offers a comprehensive analysis that goes beyond prevalence and mortality, encompassing treatment, virological, and immunological outcomes.

Implications of all the available evidence

The findings emphasise the critical need for health-care systems in Europe to adapt to the growing migrant population by developing targeted and effective HIV care strategies. These findings call for public health responses that address the multifaceted challenges faced by this group. Ensuring equitable access to health care and improving the overall management of HIV in migrants are imperative for mitigating the increased risk for HIV-related adverse outcomes and for achieving broader public health goals. Additional data are needed to identify effective strategies for overcoming the barriers that migrants face in accessing and remaining in care.

organisations.[6] As a result, basic health determinants such as access to education, dignified labour, and proper housing are being withdrawn from this population mainly because of lack of political will. These conditions might lead to delayed HIV diagnosis, inadequate treatment adherence, and suboptimal viral suppression.[7] Importantly, this situation exists despite mounting evidence that HIV prevalence among international migrants is higher than in the general population.[8–10]

HIV continues to pose a global health challenge, with over 39 million individuals worldwide living with HIV. In 2021 alone, approximately 1·4 million individuals acquired the virus, with the sharpest rise in new infections and AIDS-related deaths occurring in eastern Europe and central Asia.[11] In Europe the same year, migrants represented 42% of all new HIV diagnosis.[12] In 2023, almost 300 000 people migrated to Europe, mainly from the Middle East, and northern and western Africa.[5] In accordance with the latest UNAIDS strategy to combat AIDS, efforts should focus on addressing inequalities that contribute to the spread of HIV.[13] The strategy emphasises the entitlement of international migrants to the highest possible health standards. The UNAIDS strategy sets a goal for 2025 to ensure that at least 90% of migrants have access to comprehensive HIV services. These services should aim not only to prioritise adherence to antiretroviral therapy (ART) but also to address intimate partner violence, sexual and gender-based violence, and to provide emergency contraception and post-exposure prophylaxis.

Although scientific evidence has predominantly focused on the prevalence of HIV among international migrants,[8,9,10] fewer studies have directly compared the experiences of migrants living with HIV with those of their non-migrant counterparts. In this systematic review and meta-analysis, we aimed to investigate the incidence of HIV-related outcomes among international migrants arriving in Europe compared to the incidence among the general population. Specifically, we sought to analyse whether being a migrant is correlated with a different incidence risk in terms of mortality, AIDS-defining events, treatment discontinuation, loss to follow-up, virological failure, and immunological failure.

Methods

Search strategy and selection criteria

In this systematic review and meta-analysis, we independently searched PubMed, Scopus, and Embase on July 22, 2023, for studies about migration as a potential risk factor for unfavourable outcomes in people living with HIV. We updated the search on March 3, 2024, to find any additional studies. The detailed search strategy for each database is in appendix 3 (p 3).

See Online for appendix 3

Studies were included if they met the following criteria: (1) data collected from observational studies, (2) investigated clinical, virological, or immunological outcomes in migrants living with HIV, (3) the study was conducted in Europe, (4) had at least one control group of non-migrants living in a European country, and (5) studies written in English. Articles were excluded

if: (1) they did not include a control group with non-migrant people, (2) studies had no clearly identifiable migrant population, or in which the definition of a migrant conflicted with our own (eg, defining migrant status on the basis of ancestry or ethnicity), (3) research included non-human samples and animal models, and (4) articles were reviews, letters, in-vivo or in-vitro experiments, commentaries, posters, or case-reports. We defined migrants as any individual born outside of the country where the study was conducted. No studies were excluded on the basis of migrant country of origin.

Each article was screened for eligibility first by title and abstract, followed by full-text assessment. Both screening phases were conducted in pairs, with two junior researchers (EDV, VP, VS, SDG, MC, and RN) independently evaluating the articles for inclusion. Conflicts were resolved by senior researchers (FVS, FDG, and NV). The titles and abstracts were screened using Rayyan web-app for systematic reviews.[14] Any inconsistencies were resolved by consensus with a senior author (NV).

The study is registered with PROSPERO, CRD42024501191. The revised 2020 PRISMA guidelines were followed for this study (appendix 3 pp 12–14).[15]

Data analysis

From the studies we extracted the first author's name, publication date, country in which the study was conducted, participant age, percentage of females, study design, sample size, follow-up period (in months), region of origin, and data about the outcomes of interest. Data were extracted with a structured Redcap form.[16] Disagreements between a pair of junior researchers during data extraction were resolved by a senior author. Migrants' countries of origin were categorised into the regions identified by WHO: African region, region of the Americas, Eastern Mediterranean region, European region, South-East Asia region, and the Western Pacific region.[17]

To address data redundancy in overlapping cohorts across different studies, we conducted a structured evaluation for each outcome assessed in our meta-analysis. We systematically reviewed cohort characteristics, study periods, and inclusion criteria to identify potential participant overlap. When multiple studies drew from the same cohort (eg, the Swiss HIV Cohort Study and the French Hospital Database on HIV), we examined the extent of temporal overlap and differences in eligibility criteria to assess whether the same participants could have been counted more than once for the same outcome. The proportion of potentially duplicated participants was then estimated relative to the outcome-specific total sample size.

We used the Newcastle–Ottawa Scale (NOS) to assess quality of studies.[18] This scale assigns a maximum of nine points based on three quality parameters: selection, comparability, and outcome. Consistent with previous works using NOS grading, we graded studies as having a high (<5 stars), moderate (5–7 stars), or low risk of bias (≥8 stars). A senior author (FVS) resolved any discordant star attributions.

The primary outcomes of our systematic review were: (1) mortality, (2) AIDS-defining condition, (3) combined outcome of AIDS or death, (4) treatment discontinuation, (5) rate of loss to follow-up, (6) virological failure, and (7) immunological failure. Virological failure was defined as not attaining viral load suppression of fewer than 50 copies per mL 6 months after starting therapy in a person not previously on ART.[19] We defined immunological failure as not restoring CD4 cell count (ie, any increase from baseline level).

For outcomes of interest we used the cumulative incidence for dichotomous variables, adjusted for the largest number of factors available for each study, extracting the data from original multivariate analyses. We meta-analysed extracted data to derive pooled relative risks (RRs) with their 95% CIs. In most studies, analysis was adjusted for a wide range of potential confounders, including ART regimen, educational level, and sexual orientation. Immunological failure was

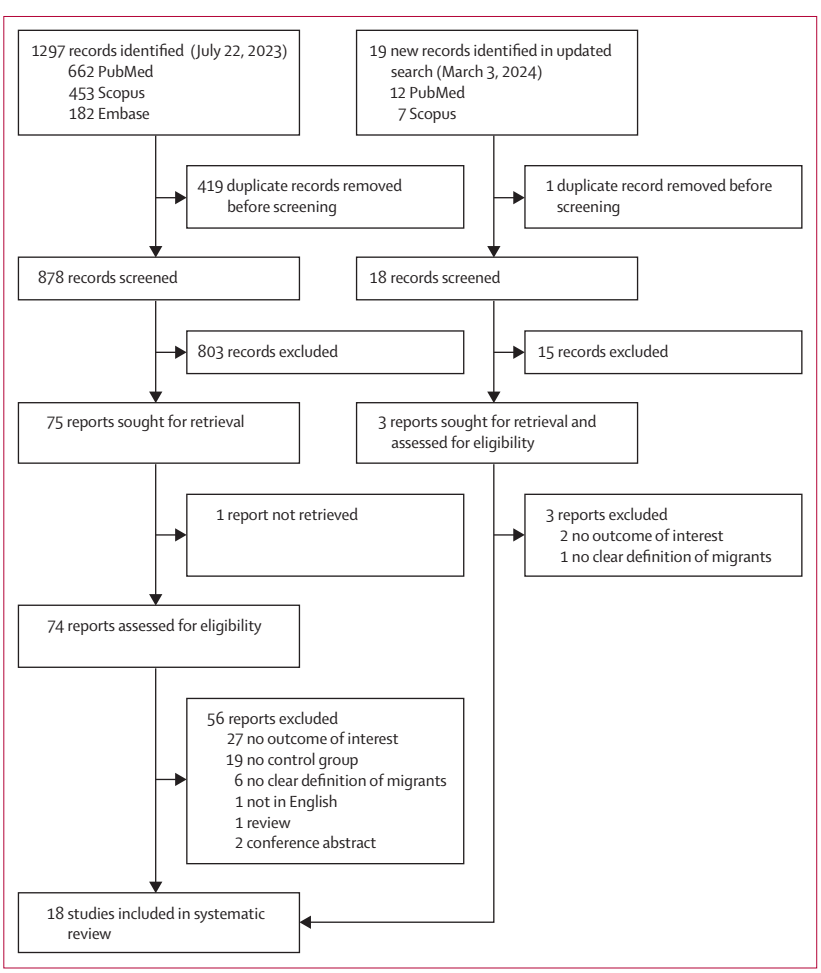

Figure 1: **PRISMA flowchart of the systematic review search strategy**

reported using CD4 cell counts at follow-up versus baseline in the two groups (ie, migrants and general population). Therefore, first we calculated the standardised mean differences (SMDs) between the differences between the two groups, then we transformed the SMDs in to odds ratio (ORs). In all the analyses, random-effect models were applied because of anticipated clinical heterogeneity.[20]

We assessed statistical heterogeneity with the I^2 statistic, which was categorised as low (30–49%), moderate (50–74%), or high (≥75%).[21] In cases of high heterogeneity, we planned to run sensitivity and meta-regression analyses, with at least ten studies for an outcome,[22] but no outcome reached this number.

For all the outcomes, we assessed publication bias by visually inspecting funnel plots and Egger bias test: we planned a fill and trim analysis in the presence of publication bias.[23,24] All analyses were performed using STATA/MP (version 14.0) and MedCalc (version 22.016; MedCalc Software, Ostend, Belgium), and a p value of less than 0·05 was considered statistically significant.

Role of the funding source

There was no funding source for this study.

Results

We identified 1316 articles (1297 in the initial search and 19 in the updated search), of which 420 were removed as duplicates (figure 1). After screening, 77 full texts were retrieved, and we included 18 studies in our analysis (table 1). The main reason of exclusion was the absence of information about the outcomes of interest of our

	Study design	Country where the study was conducted	Main WHO region of origin	Total sample size	Non-migrant group sample size	Migrant population sample size	Women, n/N (%)	Men, n/N (%)	Age, years	Mean duration of follow-up, months
Been et al (2016)[25]	Cross-sectional	Netherlands	African region	352	19	333	148/352 (42·0%)	204/352 (58·0%)	41 (11)*	NR
Chappell et al (2022)[26]	Retrospective cohort	Mixed†	African region	2620	1146	1474	1385/2620 (52·9%)	1235/2620 (47·1%)	NR	74
Conway et al (2019)[27]	Retrospective cohort	Spain	Region of the Americas	6889	4106	2783	1405/6889 (20·4%)	5484/6889 (79·6%)	34 (29–40)‡	216
de Monteynard et al (2016)[28]	Retrospective cohort	France	African region	9746	7297	2449	2896/9746 (29·7%)	6850/9746 (70·3%)	39 (33–47)‡	60
Keiser et al (2012)[29]	Prospective cohort	Switzerland	African region	4483	3628	855	1421/4483 (31·7%)	3062/4483 (68·3%)	37 (31–43)‡	33
Kesselring et al (2010)[30]	Retrospective cohort	Netherlands	Region of the Americas	6057	4136	1921	2302/6057 (38·0%)	3755/6057 (62·0%)	33 (28–39)‡	84
Lagi et al (2021)[31]	Retrospective cohort	Italy	African region	2515	1633	882	606/2515 (24·1%)	1909/2515 (75·9%)	NR	120
Nellen et al (2009)[32]	Prospective cohort	Netherlands	African region	142	81	61	66/142 (46·5%)	76/142 (53·5%)	NR	24
Pérez-Molina et al (2010)[33]	Retrospective cohort	Spain	Region of the Americas	1090	703	387	318/1090 (29·2%)	772/1090 (70·8%)	NR	6
Ridolfo et al (2017)[34]	Prospective cohort	Italy	Region of the Americas	885	640	245	218/885 (24·6%)	667/885 (75·4%)	38 (32–45)‡	144
Saracino et al (2016)[35]	Prospective cohort	Italy	African region	5773	4598	1175	1189/5773 (20·6%)	4584/5773 (79·4%)	NR	132
The Antiretroviral Therapy Cohort Collaboration (2013)[36]	Prospective cohort	Mixed	African region	48 854	36 367	12 487	14 459/48 854 (29·6%)	34 395/48 854 (70·4%)	NR	12
Soumah et al (2020)[37]	Retrospective cohort	France	African region	163	62	101	74/163 (45·4%)	89/163 (54·6%)	14 (7–17)‡	9
Staehelin et al (2003)[38]	Retrospective cohort	Switzerland	African region	2684	2294	390	913/2684 (34·0%)	1771/2684 (66·0%)	NR	48
Staehelin et al (2012)[39]	Prospective cohort	Switzerland	African region	4654	3846	808	1360/4654 (29·2%)	3294/4654 (70·8%)	NR	348
Sumari-de Boer et al (2012)[40]	Case–control	Netherlands	African region	201	89	112	90/201 (44·8%)	111/201 (55·2%)	43 (11)*	18
Tariq et al (2016)[41]	Prospective cohort	UK	African region	7211	726	6485	7211/7211 (100·0%)	0/7211 (0·0%)	NR	108
Yebra et al (2009)[42]	Retrospective cohort	Spain	African region	278	188	90	74/278 (26·6%)	204/278 (73·4%)	NR	36

NR=not reported. *Mean (SD). †Belgium, France, Greece, Italy, the Netherlands, Poland, Portugal, Spain, Sweden, Switzerland, the UK, and Ireland. ‡Median (Q1–Q3).

Table 1: **Descriptive characteristics of the included studies**

systematic review and the absence of a control group. The list of excluded references is in appendix 3 (pp 4–8).

18 studies included 104 597 participants, consisting of 71 559 non-migrant individuals and 33 038 migrant individuals living with HIV (table 1). Median follow-up time was 60 months. 16 studies had a cohort design (nine retrospective and seven prospective), one study was cross-sectional, and one was case–control. Most studies were done in Italy (n=3), the Netherlands (n=4), and Spain (n=4). 65 933 (63·0%) participants were male and 38 664 (37·0%) were female, and participants had an mean age of 37 years (SD 10·3). The mean duration of follow-up ranged from 6 to 348 months, with a mean of 86·6 months (88·9). The main WHO region of origin was the African region in 14 studies,[25,26,28,29,31,32,35–42] the region of the Americas in four studies,[27,30,33,34] the South-East Asia region in two studies,[30,37] and the Eastern Mediterranean region in four studies.[27,33,35,36] Only two studies provided data on migrants moving within the European region.[26,27] No studies reported data stratified for migrants coming from the Western Pacific region.

Mortality was evaluated in four studies. Overall, migrants living with HIV have a slightly lower risk of mortality (RR 0·88, 95% CI 0·75–1·04; p=0·13) compared with non-migrants, although this difference is not statistically significant (table 2; figure 2). However, migrants were significantly more likely to have AIDS-defining conditions, with a relative risk of 1·21 (1·11–1·31; table 2; figure 2). The combined outcome of AIDS or death was evaluated in only one study, showing an increased risk for migrants (1·51, 0·96–2·38), but this finding was not statistically significant (p=0·072). The studies indicate no publication bias and consistently low heterogeneity (I^2=0·0%).

In three studies including 5036 participants, migration was associated with a more than a doubled risk of treatment discontinuation (RR 2·39, 95% CI 1·49–3·29) than in non-migrants (table 2; figure 3). Similarly, the risk of being lost to follow-up is significantly higher (RR 2·53, 1·41–4·53; p=0·0023) in migrants than in non-migrants based on three studies with 12 579 individuals (table 2; figure 3). However, there was considerable heterogeneity in the lost to follow-up outcome (I^2=62·2%), indicating variability in the study results, and the heterogeneity for treatment discontinuation was moderate (I^2=25·8%).

Seven studies, comprising 18 858 participants, evaluated virological failure, and the results from our meta-analysis indicate that migrants are 93% more likely to have this outcome compared with the general population (RR 1·93, 95% CI 1·34–2·52; table 2; figure 4). No publication bias was detected. We identified only one study on immunological failure that met our inclusion criteria.[37] As a result, the SMD analysis was not feasible. This study reported a statistically significant higher CD4 cell counts in the non-migrant population compared with the migrant population at the end of the 48 month follow-up.

	Number of studies	Sample size	RR (95% CI)	p value	I^2*	Publication bias
Mortality	4	60 675	0·88 (0·75–1·04)	0·13	0·0%	No
AIDS-defining conditions	4	65 938	1·21 (1·11–1·31)	<0·0001	0·0%	No
AIDS or death	1	2620	1·51 (0·96–2·38)	0·072	..	..
Treatment discontinuation	3	5036	2·39 (1·49–3·29)	<0·0001	25·8%	No
Loss to follow-up	3	12 579	2·53 (1·41–4·53)	0·0023	62·2%	No
Virological failure	7	18 858	1·93 (1·34–2·52)	<0·0001	57·3%	No

RR=relative risk. *I^2 quantifies the degree of heterogeneity: low (30–49%), moderate (50–74%), or high (≥75%). Some participants might contribute to multiple outcomes, see appendix 3 (pp 15–16) for further details.

Table 2: **Association between migration and outcomes of interest in people living with HIV in Europe**

Association between WHO region of origin and outcomes in people living with HIV in Europe revealed consistently different HIV-related health outcomes (appendix 3 p 9). Individuals originating from the WHO African region had significantly increased risk across several outcomes. Four studies reported geographically stratified risk for developing AIDS-defining conditions, showing a 24% increased risk for people originally from the WHO African region (RR 1·24, 95% CI 1·13–1·36). Also, virological failure was more than twice as likely to occur among this subpopulation across three studies than in migrants originating from regions other than the region of Africa (2·07, 1·57–2·74). People coming from sub-Saharan Africa presented a significant increased risk for the composite outcome AIDS or death (3·10, 1·30–7·40) and treatment discontinuation (2·20, 1·18–4·12), but only one study per outcome reported stratified analysis. Additionally, migrant people coming to Europe from the WHO region of the Americas were at increased risk for virological failure (3·33, 1·64–6·78).

Overall, four studies were rated as being at high-risk of bias (<5 stars). The moderate-risk group (5–7 stars) included six studies, suggesting a fair level of study design but potential for improvement. Nine studies were categorised with a low risk of bias (≥8 stars). Detailed risk of bias assessment is in appendix 3 (pp 10–11).

The risk of data redundancy was outcome-specific and generally low. The estimated proportion of overlapping participants ≤7·6% or less for mortality and 6·7% or less for AIDS-defining conditions for each outcome. This redundancy was due to partial overlap in study periods and variations in inclusion criteria. For virological failure, a higher redundancy risk (up to 21·6%) was identified, primarily due to greater cohort overlap and broader inclusion periods. No redundancy risk was detected for treatment discontinuation, loss to follow-up, or immunological failure outcomes. These findings are detailed in appendix 3 (pp 15–16).

Discussion

In this systematic review and meta-analysis, we investigated the risk of unfavourable outcomes among migrants and non-migrant individuals living with HIV in

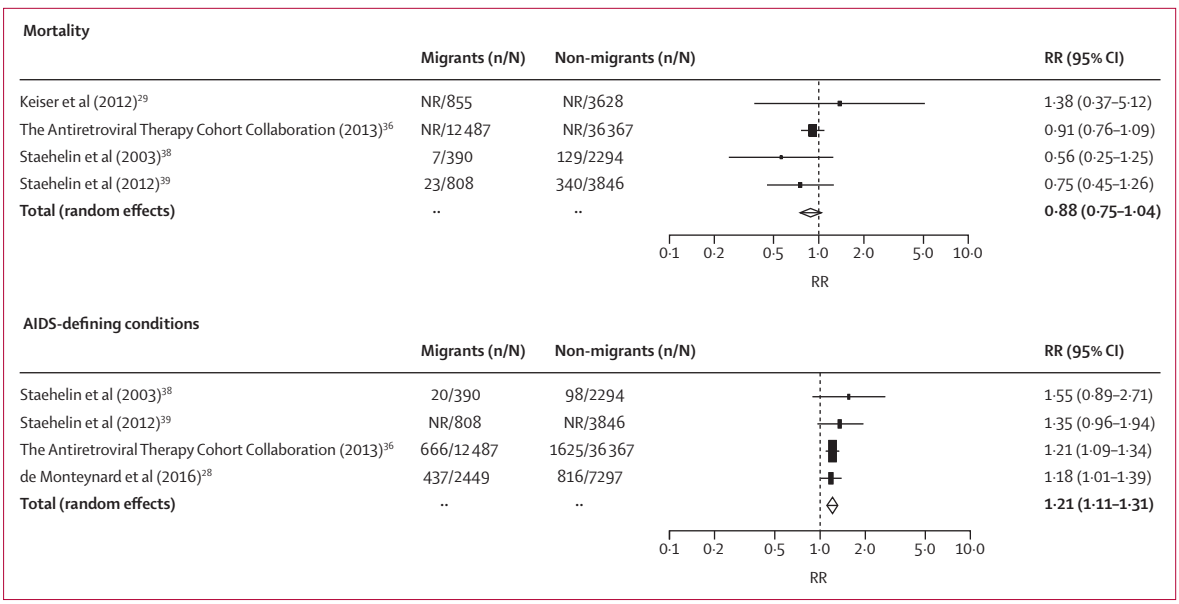

Figure 2: **Forest plot of mortality and AIDS-associated conditions**
NR=not reported. RR=relative risk.

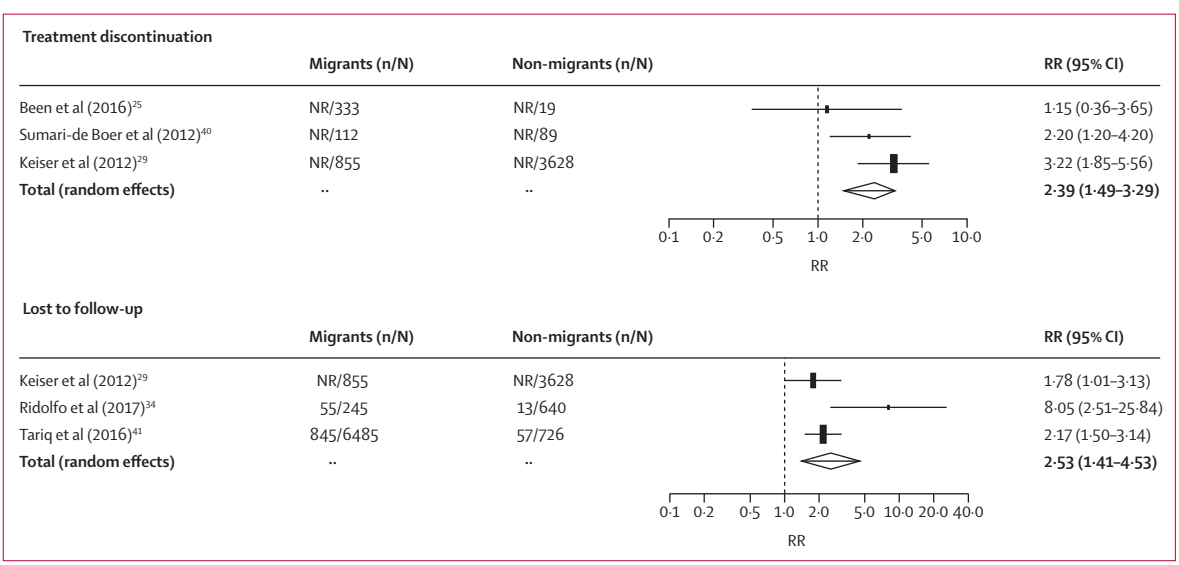

Figure 3: **Forest plot of treatment discontinuation and loss to follow-up**
NR=not reported. RR=relative risk.

Europe. Our findings indicate that international migrants face an increased risk of treatment discontinuation, loss to follow-up, and virological failure, and being diagnosed with an AIDS-defining condition. When stratified data were available, we found that outcomes were generally worse for migrants originally from the WHO African region. Even though not statistically significant, the only outcome that showed a tendency to favour migrants over the general population was mortality. This finding aligns with current literature and is supported by a large meta-analysis exploring the global pattern of mortality in international migrants and including more than 15·2 million migrants,[43] which showed that migrants living in high-income countries present consistently lower mortality rates across a wide ranges of diseases. Interestingly, when stratified for mortality related to HIV infection, this survival advantage seemed to reverse. This finding was likely due to an initially increased prevalence in the country of origin and impaired access to care in the country of destination. Our study provides consistent evidence in support of the latter hypothesis. However, it's worth noting that, in contrast with our analysis, the work conducted by Aldridge and colleagues used crude data with high heterogeneity.

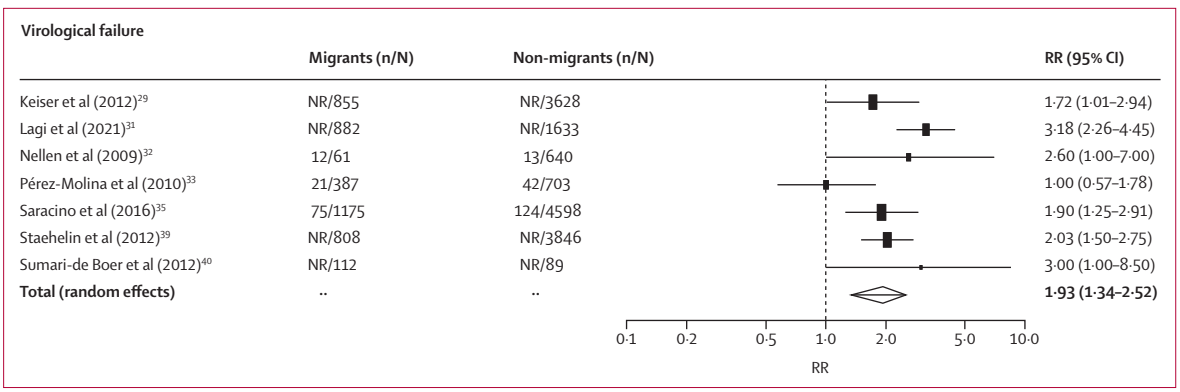

Figure 4: **Forest plot of virological failure**
NR=not reported. RR=relative risk.

In our study, migrants living with HIV presented a more than doubled risk for both treatment discontinuation and loss to follow-up, which suggests a widespread presence of barriers to retaining these individuals in care. Despite mounting evidence indicating that HIV prevalence is 70% higher among international migrants—and up to four-fold higher in specific subgroups at high risk such as undocumented migrants[44,45]—European countries are still struggling to ensure adequate health-service delivery to this population.[46] The challenges in retaining migrants within the health-care system, coupled with their difficulties in accessing health services, effectively put migrants in the condition of being entirely marginalised within the European health-care delivery system.

Barriers to accessing health care can arise at various stages, including testing, treatment, follow-up, and prevention. Migrants might refrain from seeking care due to previous negative experiences with the health-care system, stigma associated with HIV, specific social norms and cultural factors, fear of deportation, language barriers, lack of time for transportation, or unaffordable health services.[47] Conversely, in destination countries, budget constraints, local policies, reactions of resident communities, and, most importantly, the attitudes of health-care professionals can affect retention in care, impacting outcomes for migrants living with HIV. Examples on how these barriers might be addressed come from the UK[48] and Poland,[49] and, in 2023 WHO released a health-care curriculum guide to support the operationalisation of migrant health.[1]

Among people moving to Europe, vulnerability to HIV results not only from increased prevalence rates in the country of origin, but also from conditions during their travel and in the country of destination, including physical and sexual violence,[50] forced sex,[51] and sexual exploitation.[52] In addition, migrants are disproportionately affected by race-based discrimination, social marginalisation, economic hardship and poor mental health,[53] which are all risk factors for both HIV acquisition and progression towards adverse outcomes. Along with an increased risk of treatment discontinuation and loss to follow-up, in our analysis we found that migrants living with HIV present a risk of virological failure that is 93% higher than the general population and progression towards AIDS that is 21% higher. This finding is consistent with a systematic review comparing Hispanic and non-Hispanic White individuals living with HIV in the USA,[54] which shows that the former group is at increased risk for presenting with AIDS at the time of HIV diagnosis. Our study also identifies migrants from sub-Saharan African countries as particularly vulnerable to adverse outcomes, such as virological failure and progression to AIDS. Structural racism and fear of discrimination might play a substantial role in this subgroup, but evidence is lacking. Most studies included in this meta-analysis did not control for socioeconomic factors, making it difficult to discern the structural drivers of these health inequalities. Additionally, for migrants from non-African regions, the lack of association might reflect limited statistical power rather than true equivalence. Future research should focus on investigating the specific factors contributing to these disparities among migrant populations, with particular emphasis on socioeconomic factors and health system navigability.

This emerging health need, although still vastly understudied,[55] urgently necessitates the adaptation of health-care systems across Europe. The International Organization of Migration identifies five main drivers for resettlement—economics, demographics, social, political, and environmental[56]—and all are expected to increase under the escalating impact of the climate crisis, which serves as a threat multiplier.[57] Based on these premises, our meta-analysis suggests that the anticipated rise in the number of migrants residing in Europe could lead to an increase in the number of people living with HIV who discontinue antiretroviral therapy, do not achieve virological suppression, and progress towards AIDS.

As outlined in the European Charter of Fundamental Rights,[58] everyone is entitled to equitable access to health care, but policies are failing to ensure this fundamental right to people on the move. In the present

study, we used a comprehensive definition of migration, precluding the identification of specific risk profiles within this diverse population, as seen in previous meta-analyses.[10,43] Nonetheless, even with a broad definition, our findings revealed a substantial disparity in HIV care delivery and in the occurrence of HIV-related adverse clinical outcomes between non-migrants and migrants living in Europe. To achieve equitable health for all, European institutions should actively develop culturally inclusive, migrant-friendly health systems. New strategies to optimise screening of infectious diseases[59] and to obtain migrant trust are needed. Trauma and psychosocial distress experienced after leaving their home countries needs to be considered. Our systematic review highlights that, despite the magnitude of the problem, very few studies are explicitly designed to investigate health determinants in migrants living with HIV. In some cases, such as Türkiye, which hosts one of the highest numbers of refugees in the world, we did not find any studies investigating long-term HIV outcomes among people on the move. More comprehensive data on individual health needs and on effective strategies to overcome existing barriers are urgently needed. Finally, political action must be taken to minimise violence experienced during travels, thereby ending migrants being forcibly turned away at borders, collective expulsions, and border externalisation policies.

Our study has several limitations. First, we adopted a broad definition of migration that did not account for the distinct experiences of different groups of migrants, such as undocumented individuals, refugees, and asylum seekers. Also, the definition we adopted, of foreign-born individuals, does not include internally displaced people, who are expected to increase in Europe due to extreme weather events and ongoing conflicts. Second, our search was restricted to studies within Europe, limiting the generalisability of our findings to other geographical settings. Likewise, we found no study conducted in Eastern Europe. This is a substantial limitation, given that most of the world's refugees are situated in low-income and middle-income countries near conflict-affected nations. Third, the dynamics of migration are highly fluid, influenced by changing routes, state-level political agreements, and crises in countries of origin. Consequently, our findings might not accurately capture the future complexities and evolving dynamics of migration. Fourth, our analysis focused on aggregate data, which might mask individual variability and does not account for within-group differences that could be crucial in understanding and addressing the needs of migrants living with HIV. Fifth, the study did not adequately account for differences in health-care infrastructure, HIV service delivery, and sociocultural factors between European countries. Sixth, although our risk-of-bias assessment indicates that a significant proportion of the included studies were of high quality, the presence of moderate-risk studies within our sample suggests that some of our findings might be influenced by underlying methodological limitations. Seventh, most cohorts began before 2010, when ART standards differed from current practice, which might have introduced calendar-period effects into the analysis. Eighth, from a methodological point of view, we explored the possible presence of publication bias using the Egger's test, but it is well known that this test has some inherent limitations when the number of studies is fewer than ten.[23] Finally, a potential limitation of our meta-analysis is the risk of data redundancy arising from overlapping cohorts across different studies. Although we conducted a detailed assessment to quantify this risk and found it to be minimal for most outcomes, a higher proportion of overlap was observed for virological failure. Nonetheless, the included studies often employed distinct inclusion criteria and partially overlapping periods, which probably mitigated the extent of duplication.

In this systematic review and meta-analysis, we found that migrants living with HIV in Europe are at increased risk of treatment discontinuation, loss to follow-up, virological failure, and incidence of AIDS-defining conditions. The study calls for European health-care systems to adopt inclusive and culturally sensitive care strategies to improve diagnosis, treatment retention, and equitable access to antiretroviral therapy for migrants. Future research should focus on providing prospective, long-term data on migrant HIV outcomes, and on identifying effective strategies to improve retention into care. Such efforts are crucial to inform policies and practices that can reduce health risks and improve care for migrants living with HIV.

Contributors

FVS, FDG, and NV designed the study. LF wrote the study protocol. NV oversaw statistical analyses. LF, EDV, VP, VS, SDG, MC, and RN screened the articles and extracted data from the articles included in the meta-analysis. FVS, FDG, and NV supervised screening and data extraction. FVS, FDG, and NV accessed and verified the data. FVS drafted the first version of the manuscript. AS, MB, FDG, NV, and GR critically reviewed the manuscript. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication. All authors approved the final manuscript.

Declaration of interests

We declare no competing interests.

Data sharing

The data from this study will be made available to researchers upon request to the corresponding author.

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