Aquarius Population Health

Modelling Report: EU27 Status Towards HIV Transmission Elimination

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Contents

Executive Summary

Despite ongoing efforts to achieve Sustainable Development Goal (SDG) 3.3 for HIV, approximately 25,000 new HIV diagnoses occur each year in the EU/EEA (1,2). More than 50% of these diagnoses are considered late stage (CD4 count < 350) (2,3). We used an HIV transmission model to estimate the number of new HIV infections 2025-2030 if current intervention levels stay the same. We also estimate the short- and long-term economic consequences of these new infections. Model results indicate that 544,000 new infections (both undiagnosed and diagnosed) are expected to occur by 2030 within the EU27. HIV care costs across the EU27 are predicted to be € 54,8 billion - € 88,4 billion, with lifetime costs of new infections estimated at € 109,6 billion - € 336,5 billion. Our findings suggest that the EU is not on track to achieve the SDG 3.3 for HIV by 2030 without further investment in proactive interventions.

Highlights

EU27 status towards HIV transmission elimination & future costs

New infections acquired by 2030

Currently, there are

~25,000

new diagnoses of HIV in Europe each year (2).

More than

50%

of individuals with HIV in Europe are **diagnosed late** (CD4 count < 350), years after infection (3).

Our modelling predicts between **2025-2030**, there will be

544,000

new infections across the EU27, in the absence of increased intervention.

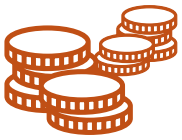
By **2030**,

192,000

of these new infections will be diagnosed with the majority of the remaining cases to be diagnosed post 2030.

Our findings suggest that, without additional interventions, the EU27 will **not** meet the SDG 3.3 target of a 95% reduction in HIV infections from 2010 levels by 2030, as incidence is projected to rise from 2025-2030, rather than fall.

Costs in the absence of further intervention



The **immediate** (2025-2030) healthcare costs for all people with HIV across the EU27 is

€54,8- €88,4 billion*,

including existing and new diagnoses.

The estimated **lifetime healthcare costs** of these new HIV transmissions are

€109,6- €336,5 billion,

including the treatment and management costs over the long term.

Future actions: Looking towards prevention

The estimated rise in new infections and subsequent healthcare costs requires **proactive interventions**, placing **prevention** at the centre of HIV response strategies.

A regional, EU-approach, combined with country-specific strategies are essential for reducing the burden of new infections and will avert significant HIV-related healthcare costs.

*billion = 1,000,000,000 Abbreviations: EU= European Union; HIV= Human Immunodeficiency Viruses; SDG= Sustainable Development Goals

1. Background

The European Centre for Disease Prevention and Control (ECDC) reports that there are an estimated 778,000 individuals living with HIV in the EU/EEA (4). The countries of the European Union (EU) have committed to achieving the global UNAIDS targets and the United Nations' Sustainable Development Goal (SDG) 3.3 (1,5–7). These goals aim to significantly reduce new infections, expand access to prevention tools such as pre-exposure prophylaxis (PrEP) and ensure equitable access to testing and care, particularly in key populations. Many countries aim to achieve zero new HIV transmissions by 2030, often defined by a 95% reduction in transmissions since 2010 (8).

Despite these efforts, there has only been a 35% reduction in new HIV diagnoses since 2010 (1) and each year, approximately 25,000 new HIV diagnoses continue to be reported across the EU/EEA (2). Additionally, the uptake of HIV prevention interventions remains low across the 27 European Union (EU27) countries. Over 50% of individuals are still diagnosed late (CD4 count < 350), often years after acquiring HIV (2,3). Without new interventions and increased investment, most countries are unlikely to achieve SDG 3.3 (1,5–7). Furthermore, recent reductions in global funding could challenge the existing progress toward HIV transmission elimination across Europe (9).

2. Introduction

This research assesses the progress toward the HIV transmission elimination goals based on the current status of the UNAIDS targets across the EU. In this study, we estimated the total number of new HIV infections, both diagnosed and undiagnosed, that would happen between 2025 and 2030 if interventions continue at current levels. We also quantify the potential short and long–term economic consequences in the absence of further intervention.

Highlights on page 4 provide an overview of the results on the current progress toward reaching HIV transmission elimination across the EU27.

3. Methods

3.1 Transmission model adaptation

We adapted a previously published HIV transmission model by Massey et al., 2023 (10). The epidemiological model took 2024 as the baseline year and was run through 2030, producing estimates for the 2025 to 2030 time period. The model incorporates country-level data on HIV incidence, diagnosis rates, treatment coverage, viral suppression, and prevention interventions. The

most recently available data were sourced to represent the best estimates for these inputs, and align with the April 2025 publication from the European Centre for Disease Prevention and Control (ECDC) (1). Changes to the population due to migration were excluded, given the large geographic region the EU27 represents, the lack of data to make appropriate adjustments and uncertainties regarding future trends.

3.2 Modelling the number of new infections

We quantified the predicted number of new infections in the EU27 countries in three steps: defining the risk profiles, adapting the model for each risk profile, and running the model and aggregating results.

Step 1: Defining risk profiles

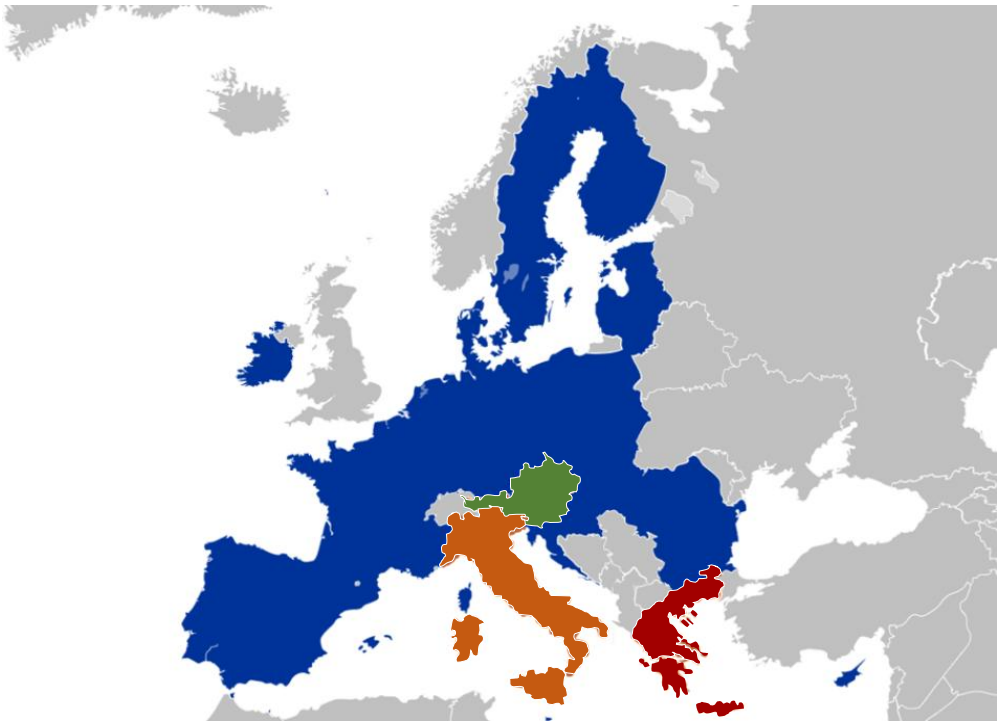
To provide a comprehensive overview of progress toward HIV transmission elimination goals across the EU27, while accounting for geographical and epidemiological variations among countries, we adopted a pragmatic, data-driven approach. We designated three archetypes based on risk profiles for HIV transmission: low, medium and high risk. Each of the EU27 countries was categorised into one of these archetype risk profiles (Appendix Table 1).

Multiple factors contribute to the risk of transmission of HIV. In grouping countries by risk profile, some countries had conflicting risk factors, such as both high estimated incidence and high rates of diagnosis. Therefore, we based the categorisation on performance against the first UNAIDS target – the percentage of people living with HIV who were diagnosed within each country (Annex 1e, ECDC report 2023 (4)). This statistic is robustly reported and serves as a likely proxy for other levels of engagement in the continuum of care and preventative services.

In cases where this indicator was not available (Estonia, Hungary and Latvia), we used recent trends in HIV incidence to inform categorisation into the archetypes.

Based on this framework, we selected countries to represent each archetype (Austria: low risk, Italy: medium risk, Greece: high risk; Figure 1). The selection was informed by data completeness, population size, and expert opinion regarding the representativeness of each risk profile.

Figure 1: Geographic region modelled (blue), with countries representing each archetype in green (low), orange (medium), and red (high)



Step 2: Adapting the model for each archetype

We adapted the model for each archetype by using national surveillance data and other publicly available sources (Appendix, Table 2) to populate the *current intervention status* for the country chosen for that archetype. This included data on HIV prevalence and diagnosis, screening and treatment parameters. To account for heterogeneity and geographic diversity across all countries and enable meaningful generalisations, we used parameters related to *population-level* characteristics, such as life expectancy in the HIV-negative population (Appendix Table 3) from Italy across the three archetypes. We also generalised Italian sources where other data were not available. Additionally, parameters associated with the impact of antiretroviral therapy (ART) (e.g., ART effectiveness) and the natural history of HIV were kept as is in Massey et al. 2023 (10).

Step 3: Running the model and aggregating results

After creating model adaptations for each archetype, we ran the three models to generate the number of new infections (both diagnosed and undiagnosed) projected to occur between 2025 and

2030. The results were adjusted based on the total adult population (ages 15-64) in the EU27 countries corresponding to each archetype (Appendix Table 3).

To validate the model, modelled results for the number of people with diagnosed HIV in Italy were compared against recent trends in surveillance data on the number of new diagnoses.

3.3 Calculating costs

A range of costs was estimated for both *lifetime costs* for *new infections* acquired in 2025 to 2030 and the *immediate* costs associated with HIV care for *all people living with HIV* in the EU27 from 2025 to 2030. These are two different indicators, with some people represented in both, and hence are not mutually exclusive. Low and high values were estimated to account for the heterogeneity in the standard of care and associated costs across the EU27 countries and reflect uncertainty in cost estimates.

3.3.1 Lifetime costs of new infections acquired between 2025 and 2030

We calculated the lower bound of lifetime ART costs for new infections acquired between 2025 and 2030 by multiplying each additional infection by the estimated lifetime ART cost (Appendix Table 4). The lifetime ART cost was calculated using the median annual cost of ART per person across the EU27 countries (11), adjusted to 2024 values using standard inflation rates (12). Although the ECDC reported annual ART costs reflect the inclusion of generics at the time of publication, we assume the use of generics will continue to rise, resulting in lower medication costs for countries over time. Therefore, for the lower bound estimates, we applied a 2% annual reduction in ART costs over the lifetime horizon to reflect the increasing use of generics. The 2% annual cost reduction was determined based on evidence from studies that assessed the impact of generics on costs over time in European countries where generics have been widely adopted (13,14).

We assumed an average lifetime ART duration of 32.5 years (15). This was based on data from Italy, taking the difference between the mean age at diagnosis and life expectancy among people living with HIV who are on ART (16,17). Costs associated with additional aspects of HIV care, such as background disease management costs and those related to opportunistic infections or other sequelae, were excluded in the lower bound estimate.

To calculate the upper bound of lifetime HIV costs, we added an estimate for all direct medical costs to the ART costs over the lifetime. This estimate was based on a comparison between the maximum bound of healthcare costs published in a report by Radu et al, 2025 (18), and ECDC-reported ART costs (11) across six EU countries: France, Germany, Italy, Spain, Ireland and Poland. The healthcare costs include hospitalisation, diagnostic tests, primary care and outpatient consultations, in addition to the ART costs (19).

The analysis indicated that within the EU, ART medication costs may represent only ~62% of all direct healthcare costs for people living with HIV. We used this proportion to adjust the annual cost to include all direct healthcare costs. This adjusted figure was then used to calculate the lifetime total direct medical costs for new infections.

3.3.2 Immediate (2025 – 2030) cost of treating all people living with HIV

The immediate short-term (2025-2030) costs for all people living with HIV was also estimated.

First, we estimated the lower bound of costs (ART only) for *new diagnoses* across the EU27 by calculating the total number of person-years on ART for individuals who will acquire HIV in 2025-2030. This was done by running the model to estimate the number of *new diagnoses* for each year from 2025 to 2030. We then adjusted for the proportion of patients who are engaged in care and receiving ART (4), excluding those diagnosed but not receiving care. We then multiplied this estimate of the person-years of individuals on ART by the annual ART cost (as previously defined).

Second, we added to this the ART costs for people living with HIV *who were already diagnosed before 2025* and would receive care from 2025 to 2030. This was based on published data for the total number of diagnosed people living with HIV, adjusted for both diagnosis rates and treatment engagement, using available ECDC data (4). The resulting estimate of individuals on ART was multiplied by the annual ART cost.

For the upper-bound estimate of short-term costs for all people living with HIV, we added the direct medical costs associated with all HIV treatment and management for those engaged in care, as previously determined. All short-term costs exclude medical expenses for those undiagnosed or unengaged in care.

Notably, all cost estimates excluded the broader costs to society, such as lost productivity or carer costs.

4. Results

4.1 Overall estimates

The model results indicate that if current HIV intervention levels remain unchanged, over half a million new infections (544,000, both diagnosed and undiagnosed) are projected to occur across Europe between 2025 and 2030. This trajectory suggests that the SDG of "zero HIV transmission" will not be met by 2030, given current levels of intervention.

Based on current screening rates, our model predicts that by 2030, only 192,000 of these new infections will be diagnosed. The remaining new infections are likely to be diagnosed beyond this time horizon, in accordance with countries' current rates of diagnosis among people living with HIV and percent diagnosed late (i.e., CD4 count <350). The model validation showed that while the model estimates a higher overall number of *new infections* compared to figures reported in the ECDC report, the projected number of *diagnoses* from the model aligns with ECDC-reported data trends (approximately 30,000 annually (modelled results), compared to 25,000 (ECDC) (2)).

The lifetime costs to the EU27 healthcare systems of treating 544,000 people who will acquire a *new HIV infection* by 2030 are estimated to be €109,6 to €336,5 billion. Focusing on the short-term period from 2025 to 2030, we estimated that the costs for HIV treatment and management for those who are linked to care and receiving treatment, including existing and newly diagnosed patients, will be between €54,8 billion and €88,4 billion. This estimate excludes the medical costs for individuals who are not diagnosed or not engaged in care.

4.2 Results by country profile

Based on country-level risk profiles, the model estimates that there will be 352,000 new infections by 2030 in countries with the highest transmission risk. Although these high-risk countries make up 33% of the total EU population, they account for 65% of all new HIV diagnoses.

In countries with a medium risk profile, which represent approximately 60% of the EU population, an estimated 137,000 new infections are projected (25% of the total new infections).

In contrast, countries classified as having the lowest risk of HIV transmission (6% of the EU population) are expected to see 55,000 new HIV infections (10% of all EU infections) over the same period.

5. Discussion

This work represents a pragmatic and timely analysis aimed at generating broad, EU-level estimates of HIV transmission and evaluating whether SDG 3.3 will be achieved within the next five years. The findings suggest that, if current levels of investment and intervention continue, approximately 544,000 new infections are expected to occur by 2030. HIV treatment and care costs for 2025 to 2030 are projected to be €54,8 billion to €88,4 billion, with lifetime costs for these additional infections estimated between €109,6 billion to €336,5 billion across the EU. It is important to note that these estimates likely underestimate the overall economic burden of HIV, as they only reflect direct medical costs (inclusive of treatment and management costs) and do not account for the broader societal costs.

The estimated number of new HIV infections from this analysis provides insight into the projected epidemiology of HIV in the EU. While surveillance data report 25,000 new HIV diagnoses in the EU/EEA in 2023, these figures only represent the proportion of people with an HIV infection who have been diagnosed, excluding many people living with HIV who remain undiagnosed (2). This reflects the fact that only a minority of individuals will be diagnosed in the same year they acquire HIV, as evidenced by surveillance data on the percentage of late diagnoses (2,3).

Modelling allows us to account for the delay between infection and diagnosis by estimating the total number of new infections, including those not yet diagnosed and identified through surveillance. The proportion of late diagnoses (over 50%) reported in surveillance data serves as a validation point for the model and helps align projected transmissions with observed cases of delayed detection.

Many assumptions had to be made to generate results, as is often necessary with models. A significant generalising assumption is that the HIV transmission rates and levels of prevention interventions will be similar across countries within the same risk profile. Many parameters were also generalised from our ‘medium’ risk profile. Additionally, our estimates represent the general population, as that is the level at which high-quality data are available. We recognise, however, that

there are wide disparities across population groups, and that interventions are most effective when focused within key populations.

Despite the assumptions made in our model, the research offers several methodological strengths that highlight its robustness and relevance. First, we used a well-established HIV transmission model (10), which was informed by and updated with the most recent epidemiological and surveillance data. This approach enhances transparency and replicability. Second, we calculated EU-level outcomes by subdividing the region into risk profiles based on progress towards UNAIDS goals and aggregating the results according to the adult population size within each risk profile. This provides a more accurate approximation of HIV transmission compared to generalising across the entire region. Finally, the projections for the number of new diagnoses aligned with national surveillance data, supporting the external validity of our estimates.

6. Conclusions

Our findings suggest that the EU27 will not achieve the SDG 3.3 targets by 2030, as incidence is projected to *increase* without further levels of intervention, rather than *reducing* to 95% of the 2010 levels. The estimated rise in the number of new HIV infections and subsequent healthcare costs underscores the urgent need for proactive measures, such as prevention, to end the HIV epidemic. While treatment remains crucial in reducing the impact of HIV on both individuals and the healthcare system, many individuals in Europe are experiencing HIV-related health complications and associated costs over a lifetime (2,20).

Therefore, to reverse the trend of increasing transmissions and achieve SDG 3.3 as well as the UNAIDS prevention targets across Europe (1,6), significant investment will be required across the EU27 countries. Given the heterogeneity of these nations, a tailored country-specific shift in investment, from a treatment-focused approach to prevention, is essential. Investing in prevention now will provide long-term benefits, through a significant reduction of future transmissions, improved early diagnosis, and decreased health and economic burden of HIV on individuals, the healthcare system and society as a whole (21).

Future work should focus on a more granular analysis of specific sub-populations and targeted interventions that could most effectively reduce HIV transmission and help achieve national and international public health goals.

7. Statements

7.1 Ethics Approvals

Ethics approval was not required for this study since it did not include primary data collection. All data used were already published or available on request.

7.2 Funding Statement & Acknowledgements

This work was commissioned and funded by Gilead Sciences. The work was carried out independently by Aquarius Population Health. We thank Ellie Moran for her contributions to the editing and preparation of the report.

8. Appendices

Appendix Table 1: Categorisation of EU27 countries based on the risk of HIV transmission

***High** risk* [1]	***Medium** risk* [2]	***Low** risk* [3]
Bulgaria	Belgium	Austria*
Croatia	Cyprus	Romania
Czechia	Denmark	
Estonia	Finland	
France	Germany	
Greece*	Hungary	
Latvia	Ireland	
Lithuania	Italy*	
Luxembourg	Netherlands	
Malta	Portugal	
Poland	Slovenia	
Slovakia	Spain	
	Sweden	

*Countries serving as a representative of the profile.

[1] Represents 33% of the EU population, with the highest incidence and/or <90% of people living with HIV diagnosed

[2] Represents 61% of the EU population, with medium incidence and/or ≥90% to <95% people living with HIV diagnosed

[3] Represents 6% of the EU population, with lower incidence and/or ≥95% of people living with HIV diagnosed

Appendix Table 2: Model epidemiology inputs (HIV prevalence, prevention, screening, diagnosis and treatment): Austria, Italy and Greece

Parameter	Mean	Archetype Country	Source
HIV prevalence			
Total HIV infected population	0.10%	Austria	ECDC, HIV/AIDS surveillance in Europe, 2024 (2)
	0.20%	Italy	ISS, HIV and AIDS case diagnosis report, 2024 (17)
	0.20%	Greece	UNAIDS, Greece, 2023 (22)
Total HIV uninfected population	99.9%	Austria	ECDC, HIV/AIDS surveillance in Europe, 2024 (2)
	99.8%	Italy	ISS, HIV and AIDS case diagnosis report, 2024 (17)
	99.8%	Greece	UNAIDS, Greece, 2023 (22)
Number of existing people living with HIV (pre-2025)	7, 732	Austria	ECDC, Continuum of Care report, 2023 (4)
	140,730	Italy	
	17,175	Greece	
HIV prevention			
Uninfected patients using PrEP	0.03%[1]	All	Nozza et al., 2024 (23)
Uninfected patients not using PrEP	99.97%	All	Calculated
Uninfected patients newly adopting PrEP annually	0.002%	All	Author's calculations based on data on PrEP utilisation among UK heterosexuals (10)
Uninfected patients discontinuing PrEP	1.48%[2]	All	Coyer et al., 2020 (24)
Relative reduction in incidence for individuals on PrEP	80%	All	Nichols et al., 2016 (25)
HIV screening			
Annual testing probability (CD4 count > 200)	0.25%	Austria	Die AIDS-Hilfen, HIV and STI tests, 2023 (26)
	4.34%	Italy	Background screening rate in Monforte et al, 2025 (27), derived from (28), with the assumption of increased indicator-based testing for people living with HIV
	5.09%	Greece	ECDC, HIV/AIDS surveillance in Europe, 2024 (2)
Annual testing probability (CD4 count < 200)	100%	Austria	Assumption based on Massey et al.,2023 (10)
	84%	Italy	ECDC, Continuum of HIV Care report, 2023 (4)
	84%	Greece	ECDC, Continuum of HIV Care report, 2023 (4)
HIV diagnoses			
	3%	Austria	ECDC, Continuum of HIV Care report, 2023 (4)

Proportion infected and undiagnosed	6%	Italy	
	15%	Greece	
Probability of diagnosis within 3 months of infection	26%	All	Massey et al., 2023 (29)
HIV treatment			
ART infectiousness reduction	100%		Assumption
Probability of starting ART within 3 months	98.6%	All	ISS, HIV and AIDS case diagnosis report, 2024 (17)
Proportion diagnosed and on treatment	95%	Austria	ECDC, Continuum of HIV Care report, 2023 (4)
	93%	Italy	
	82%	Greece	
Proportion diagnosed and not on treatment	5%	Austria	Calculated from above
	7%	Italy	
	18%	Greece	
Probability of starting ART within 6 months (>200 CD4 count)	95.2%	All	Massey et al., 2023 (29)
Probability of starting ART within 6 months (<200 CD4 count)	98%	All	Assumption based on Massey et al., 2023 (10), Croxford et al., 2018 (30)
CD4 count at diagnosis:			ISS, HIV and AIDS case diagnosis report, 2024 (17)
CD4>500	22.1%	All	
500≥CD4≥350	17.9%		
350>CD4>200	18.6%		
CD4<200	41.4%		
Proportion virologically suppressed	89%	Austria	ECDC, Continuum of HIV care report, 2023 (4)
	92%	Italy	
	32%	Greece	

[1]Calculated from the number of individuals in active follow-up
[2]Calculated from 3-year cumulative probability; utilising UK data as no country-specific data available
Abbreviations AIDS: Acquired Immunodeficiency Syndrome; ART: antiretroviral treatment; ECDC: European Centre for Disease Prevention and Control; HIV: human immunodeficiency virus; ISS: Istituto Superiore Di Sanita (Higher Institute of Health); PrEP: Pre-exposure Prophylaxis; STI: sexually transmitted infection; UK: United Kingdom; VLS: viral load suppression

Appendix Table 3: Model population inputs: Austria, Italy, and Greece

Parameter	Mean	Archetype Country	Source
Total adult (15 – 64) population	6,026,458	Austria	Eurostat, Population age structure by major groups, 2024 (31)
	37,446,731	Italy	
	6,614,858	Greece	
% of males of total population	49	All	Istat, Resident population, 2025 (32)
Life expectancy	83	All	Istat, Demographic indicator, 2024 (33)
Uninfected starting median age	43[1]	All	ISS, HIV and AIDS case diagnosis report, 2022 (34)
Infected starting median age	41	All	ISS, HIV and AIDS case diagnosis report, 2024 (17)
Average growth per year	-0.11	All	Istat, Population and household projections, 2024 (35)
Average increase in median age per year	0.11	All	
Average increase in median age per year, infected population	0.58	All	Smit et at., 2015 & Smit et al., 2017 (36,37)

[1]Derived by weighting the mid-point of reported age categories by associated n values

Abbreviations AIDS: Acquired Immunodeficiency Syndrome; HIV: human immunodeficiency virus; Istat: Istituto Nazionale di Statistica (National Institute of Statistics); ISS: Istituto Superiore Di Sanita (Higher Institute of Health

Appendix Table 4: Model cost inputs

Parameter	Mean	Source
Annual cost of ART per person (€), base	11,800	ECDC, HIV treatment and care, 2017 (11), inflated to 2024 using the European Union Consumer Price Index, 2024 (12).
Annual total direct medical costs (€), upper bound	19,032	Author's calculation based on the median annual cost of ART (11,12) and the proportion of ART cost relative to the total healthcare costs (18). Author's calculation based on the median annual cost of ART (11,12) and the proportion of ART cost relative to the total healthcare costs (18).
Annual national reduction in ART costs per person, lower bound	2%	Author's calculation based on longitudinal data for France and the Netherlands (13,14).
Expected lifetime treatment duration (in years)	32.5	Author's calculation based on the difference between age at diagnosis ISS, HIV and AIDS case diagnosis report, 2024 (17) and age of death for individuals on treatment from Trickey et al., 2023 (16).

Abbreviations AIDS: Acquired Immunodeficiency Syndrome; ART: antiretroviral treatment; ECDC: European Centre for Disease Prevention and Control; HIV: human immunodeficiency virus; ISS: Istituto Superiore Di Sanita (Higher Institute of Health)

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