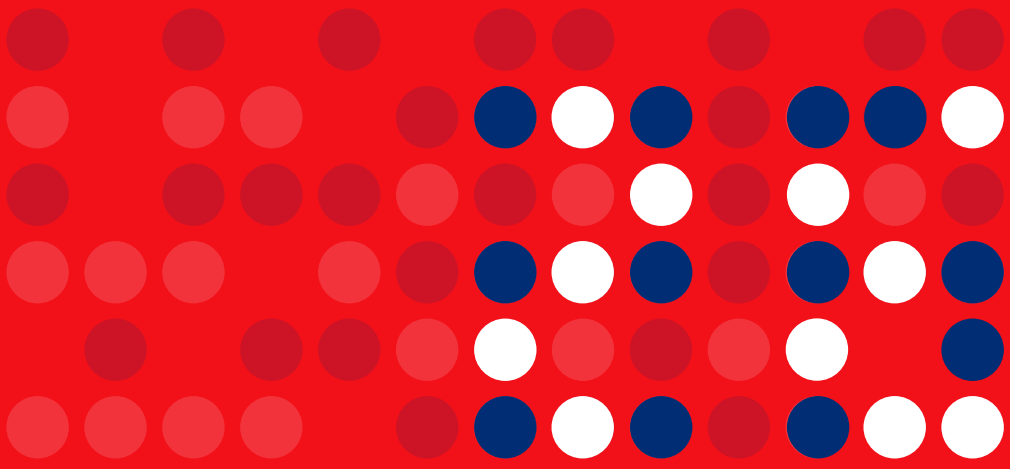
Human Immunodeficiency Virus (HIV)
Infection in the Netherlands

hiv Monitoring

HIV Monitoring Report 2026



About Stichting hiv monitoring

Stichting hiv monitoring (SHM) is tasked by the Dutch Ministry of Health, Welfare and Sport to continually monitor and report on all aspects of HIV infection and treatment across the population of people with HIV in the Netherlands.

In collaboration with all HIV treatment centres across the Netherlands, SHM has developed a framework for systematically collecting long-term HIV data of all registered individuals. The Netherlands is the only country in the world to have such a framework, which enables healthcare professionals to aspire to the highest standard of HIV care.

SHM contributes to the knowledge of HIV by studying the course of the HIV infection and the effect of treatment. Patient data are collected and entered into the database in a pseudonymised form for analyses and reporting purposes. In this way SHM is able to comprehensively map the population of people with HIV and treatment outcomes in the Netherlands.

Our mission

To further the knowledge and understanding of all relevant aspects of HIV infection, including comorbidities and co-infections, in people with HIV in care in the Netherlands.

www.hiv-monitoring.nl

hiv Monitoring

HIV Monitoring Report 2026

Human Immunodeficiency Virus (HIV) Infection in the Netherlands

Interactive PDF user guide

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Words and numbers that are underlined are links — clicking on them will take you to further information within the document or to a web page (in a new window) if they are a url (e.g., http://www.cdc.gov/hiv/guidelines/).

Reference numbers

Click on the reference numbers in the text to see the reference details on a web page (in a new window).

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Monitoring the HIV population in the Netherlands is a collaborative effort between stichting hiv monitoring (SHM) and 23 health institutes acknowledged by the Dutch Minister of Health, Welfare and Sport as HIV treatment centres or subcentres. In addition, children and adolescents with HIV are monitored in four institutes recognised as paediatric HIV treatment centres.

The following health institutions are recognized as centres for adult HIV care (in alphabetical order of city):

1 Noordwest Ziekenhuisgroep	Alkmaar
2 Flevoziekenhuis	Almere
3 Amsterdam UMC	Amsterdam
4 DC Klinieken Lairesse - HIV Focus Centrum	Amsterdam
5 OLVG	Amsterdam
6 Medisch Centrum Jan van Goyen (MC Jan van Goyen)	Amsterdam
7 Rijnstate	Arnhem
8 HagaZiekenhuis (Leyweg site)	Den Haag
9 HMC (Haaglanden Medisch Centrum)	Den Haag
10 Catharina Ziekenhuis	Eindhoven
11 Medisch Spectrum Twente (MST)	Enschede
12 Adrz (Admiraal De Ruyter Ziekenhuis)	Goes
13 Universitair Medisch Centrum Groningen (UMCG)	Groningen
14 Spaarne Gasthuis	Haarlem
15 Frisius MC	Leeuwarden
16 Leids Universitair Medisch Centrum (LUMC)	Leiden
17 Maastricht UMC+ (MUMC+)	Maastricht
18 Radboudumc	Nijmegen
19 Erasmus MC	Rotterdam
20 Maasstad Ziekenhuis	Rotterdam
21 ETZ (Elisabeth-TweeSteden Ziekenhuis)	Tilburg
22 Universitair Medisch Centrum Utrecht (UMC Utrecht)	Utrecht
23 Isala	Zwolle



The following health institutions are recognized as centers for paediatric HIV care:

A Emma Kinderziekenhuis (EKZ), Amsterdam UMC	Amsterdam
B Beatrix Kinderziekenhuis (BKZ), UMCG	Groningen
C Erasmus MC Sophia Kinderziekenhuis	Rotterdam
D Wilhelmina Kinderziekenhuis (WKZ), UMC	Utrecht

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1. HIV in the Netherlands

Ard van Sighem, Daniela Bezemer, Casper Rokx, Eline Op de Coul, Marc van der Valk

Results shown in this chapter are based on data recorded in the SHM database as of 1 May 2026. On a few occasions, as indicated in the text or figures, data are used as of 1 September 2026.

Key findings

In 2025, 500 people were newly diagnosed with HIV: 255 (51%) men who have sex with men (MSM), 130 (26%) other men, 95 (19%) women, and 20 (4%) trans individuals (registered in the SHM database as of 1 September 2026).

In the past five years, the annual number of new HIV diagnoses increased: 425 in 2021, 446 in 2022, 484 in 2023, 489 in 2024, and 500 in 2025.

The estimated number of newly acquired HIV infections rose from 315 in 2020 to

The increase in the number of diagnoses was most prominent in people born in 1990 or later, including 47% of all diagnoses in MSM and approximately 30% in all other men and in women.

An increasing proportion of MSM and trans individuals with a new HIV diagnosis reported prior use of PrEP. In 2025, the proportion was 21%, while 51% had not used PrEP. Information on prior use of PrEP was not available for the remaining 28%.

In 2023-2025, 306 (38%) of all diagnosed MSM and 177 (48%) of MSM born in 1990 or later had evidence of having acquired their infection at most one year before. Of these, 281 (35%) had a negative HIV test in the year prior to their diagnosis. This indicates that they were likely aware of being at risk of acquiring HIV and would have benefited from PrEP.

The proportion diagnosed with late-stage HIV remained high among other men (56%) and among women (60%) and was much lower among MSM (29%).

By the end of 2025, there were an estimated 26,225 people with HIV in the Netherlands, including 1,650 (6%) with an undiagnosed HIV infection. Altogether, 86% of people with HIV had a suppressed viral load.

Introduction

By May 2026, stichting hiv monitoring (SHM) had registered 37,435 individuals with HIV. The vast majority of these (36,330, or 97.0%) agreed to the collection of further clinical data once registered, whereas 1,105 (3.0%) declined to take part. Among those whose clinical data had been collected, most (34,752) were registered with one of the HIV treatment centres in the Netherlands (*Figure 1.1*).

Of the 34,752 individuals registered in the Netherlands, the vast majority were diagnosed with HIV-1 (33,523, or 96%). Only 102 people were diagnosed with HIV-2, while 62 individuals were found to carry antibodies against both HIV-1 and HIV-2. Data is limited for individuals registered before the start of the AIDS Therapy Evaluation in the Netherlands (ATHENA) study in 1998, which accounts for the absence of serological information for most of the remaining 1,065.

The first part of this chapter focuses on the characteristics of people with HIV-1 at the time of diagnosis, and individuals with HIV-1 still in care at the end of 2025. This is followed by a brief overview of trans people with HIV-1. The chapter concludes with an outline of the population with an HIV-2 infection.

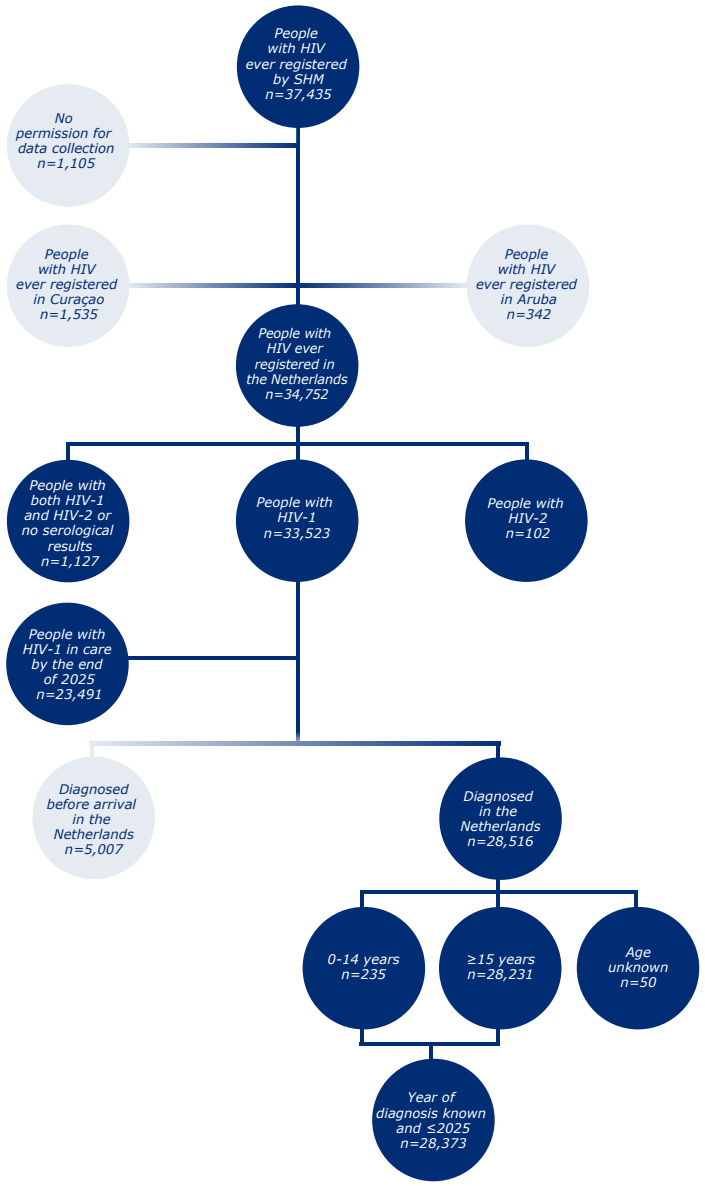
Infection, diagnosis, entry into care, and registration	
HIV infection	The moment an individual acquires HIV. The time of infection is often unknown.
HIV diagnosis	The moment an HIV infection in an individual is confirmed by blood tests. The time of diagnosis can be weeks, months, or years after infection.
Entry into care	The moment an individual with HIV first receives care at an HIV treatment centre. This usually takes place within a few weeks of HIV diagnosis.
Registration	The moment an HIV physician or nurse notifies SHM of an individual with HIV (in care) and the individual's details are recorded in the SHM database. Registration usually takes place within a few months of entering care, but can take longer. Demographic and clinical data from the time of HIV diagnosis can only be collected after registration.

HIV-1

Individuals with HIV-1

Of the 33,523 individuals in the Netherlands who were ever diagnosed with HIV-1, 5,007 (15%) were born abroad and had a documented HIV diagnosis prior to arrival in the Netherlands (*Figure 1.1*). These 5,007 individuals have been excluded from the analyses on newly diagnosed individuals later in this section. The remaining 28,516 individuals were newly diagnosed while living in the Netherlands, or their date of arrival in the country has not yet been recorded in the SHM database.

***Figure 1.1:** Overview of the population with HIV registered by stichting hiv monitoring (SHM).*



Individuals diagnosed before arriving in the Netherlands

Of the 5,007 individuals who were born abroad and had a documented HIV-1 diagnosis before arriving in the Netherlands, 1,072 (21%) arrived in the Netherlands in 2023-2025, including 260 in 2025 (*Figure 1.2A*). Information on diagnosis abroad and date of arrival in the Netherlands has been recorded for all newly registered individuals since early 2018, but is not yet available for everyone included in the SHM database.

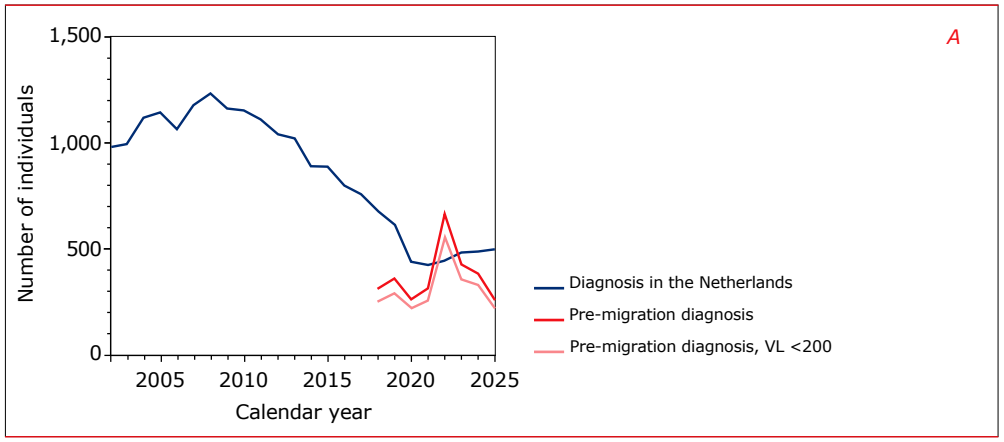
Of the 1,072 people who arrived in 2023-2025 with a documented pre-arrival HIV diagnosis, 576 (54%) were men who have sex with men (MSM), 228 (21%) were other men, 218 (20%) were women, and 50 (5%) were trans people. The median age at the time of arrival was 36 years (interquartile range [IQR] 30-44); 107 (10%) were below 25 years of age, including 4 children under the age of 15, while 112 (10%) were 50 years of age or older. In terms of geographic origins, migrants arrived from:

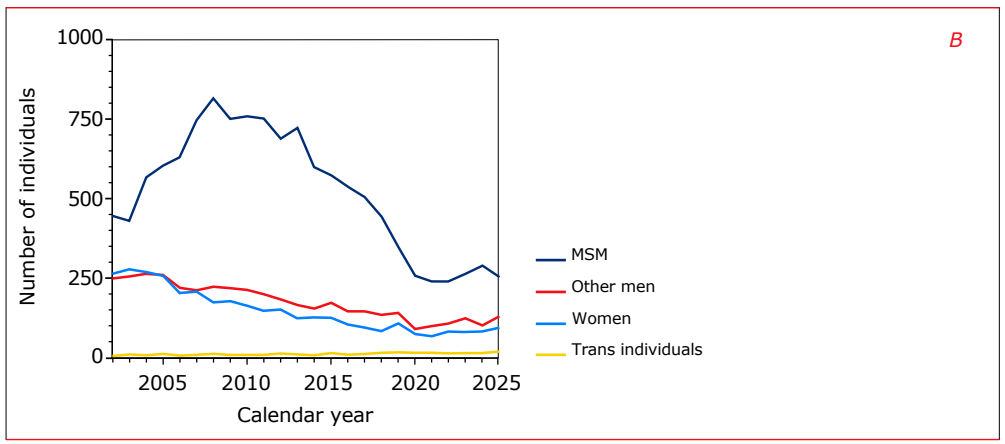
- South America (253, 24%);
- sub-Saharan Africa (183, 17%);
- eastern Europe (179, 17%);
- central Europe (104, 10%);
- western Europe (101, 9%);
- Caribbean (71, 7%);
- Middle East and north Africa (64, 6%);
- south and southeast Asia (64, 6%); and
- other regions (53, 5%).

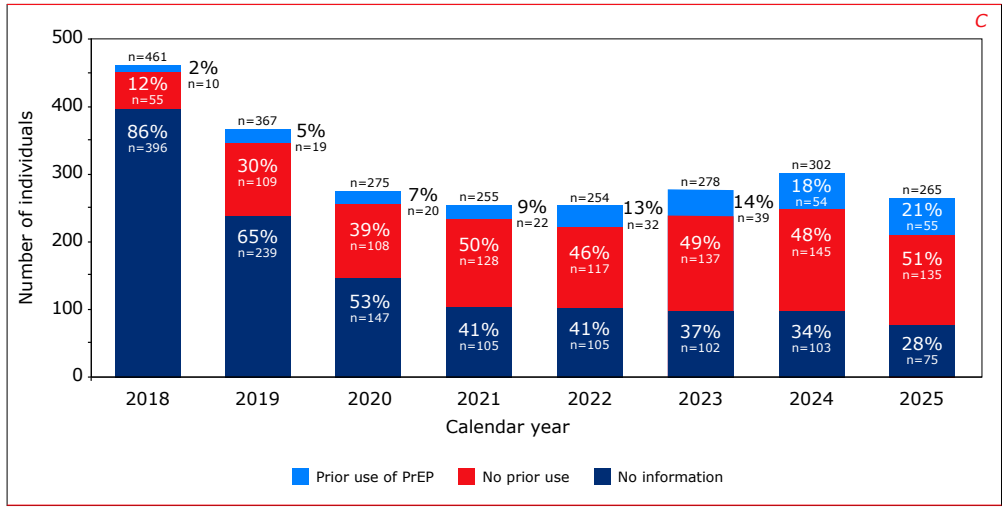
The most commonly reported countries of origin (from where at least 30 individuals with a known HIV diagnosis arrived in the Netherlands) were Ukraine (122, 11%), Brazil (72, 7%), Colombia (66, 6%), Turkey (41, 4%), Curaçao (38, 4%), Poland (38, 4%), Suriname (36, 3%), Venezuela (32, 3%), and Nigeria (30, 3%).

The majority (954, or 89%) of the 1,072 people had already started antiretroviral therapy (ART) before arriving in the Netherlands, while 38 (4%) started ART in the Netherlands; for 80 (7%) migrants there was no unequivocal evidence whether they started ART before or after arrival due to uncertainty in date of arrival and/or date of start ART. By the time the 1,072 individuals entered HIV care in the Netherlands, their median CD4 counts were 663 (IQR 460-902) cells/mm^3. HIV RNA levels were below 1,000 copies/ml for 932 individuals (88% of the 1,063 who had an available viral load measurement), including 909 individuals with RNA levels below 200 copies/ml (86%) and 868 with RNA levels below 50 copies/ml (82%).

Figure 1.2: *(A) Annual number of individuals newly diagnosed with HIV-1 in the Netherlands or while living in the Netherlands (by year of diagnosis, reported as of 1 September 2026) or with documented diagnosis abroad before moving to the Netherlands (by year of arrival in the Netherlands), (B) annual number of individuals newly diagnosed with HIV-1 in the Netherlands and aged 15 years or older at the time of diagnosis, reported as of 1 September 2026, according to key population, and (C) annual number of new diagnoses in men who have sex with men (MSM) and trans individuals stratified by whether or not prior use of PrEP was reported. In 2025, MSM accounted for 51% of the annual number of new diagnoses, other men for 26%, women for 19%, and trans individuals for 4%. VL <200: individuals with documented diagnosis abroad before moving to the Netherlands who already had a suppressed viral load below 200 copies/ml by the time they entered HIV care in the Netherlands. NB: individuals diagnosed in the Netherlands may include people born abroad for whom the date of arrival has not yet been recorded.*







Legend: *MSM = men who have sex with men; VL = viral load; PrEP = pre-exposure prophylaxis.*

Individuals newly diagnosed in the Netherlands

Of the 28,516 individuals who were living in the Netherlands at the time of their HIV-1 diagnosis, or whose date of arrival in the country had not yet been recorded in the SHM database, 235 (1%) were diagnosed as children under 15 years of age: they are described in more detail in Chapter 8. Among the 28,373 individuals for whom the date or period of diagnosis was known, 28,140 (99%) were diagnosed at 15 years of age or older. Of these 28,140 individuals, 16,730 (59%) were men who have sex with men, 6,022 (21%) were other men, 5,060 (18%) were women, and 328 (1%) were trans individuals (*Table 1.1A and 1.1B*).

***Table 1.1A:** Annual number of HIV-1 diagnoses as of 1 May 2026 among men who have sex with men (MSM), other men, women, trans individuals, and children below 15 years of age.*

Year of diagnosis	MSM	Other men	Women	Trans individuals	<15 years of age	Total
≤2001	4,311	1,817	1,514	42	128	7,812
2002	446	249	264	6	15	980
2003	430	256	278	11	21	996
2004	565	262	269	8	13	1,117
2005	603	261	258	12	11	1,145
2006	630	221	204	7	4	1,066
2007	746	212	208	9	4	1,179
2008	814	223	175	12	9	1,233
2009	749	219	178	9	6	1,161
2010	753	214	164	9	8	1,148
2011	745	200	149	10	1	1,105
2012	689	183	152	13	3	1,040
2013	722	165	124	10	1	1,022
2014	599	156	127	8	2	892
2015	569	173	126	15	1	884
2016	527	146	105	6	2	786
2017	504	145	95	12	1	757
2018	445	134	82	16	1	678
2019	349	142	108	18	1	618
2020	260	89	76	15	0	440
2021	240	101	68	15	1	425
2022	239	108	83	15	0	445
2023	263	124	80	15	0	482
2024	287	99	83	15	0	484
2025	245	123	90	20	0	478
Total	**16,730**	**6,022**	**5,060**	**328**	**233**	**28,373**

***Legend:** MSM = men who have sex with men*

***Table 1.1B:** Annual number of HIV-1 diagnoses as of 1 September 2026 among among men who have sex with men (MSM), other men, women, trans individuals, and children below 15 years of age.*

Year of diagnosis	MSM	Other men	Women	Trans individuals	<15 years of age	Total
≤2001	4,312	1,817	1,521	43	128	7,821
2002	445	250	264	6	15	980
2003	430	255	278	11	21	995
2004	565	264	269	8	13	1,119
2005	603	260	258	12	11	1,144
2006	630	220	204	7	4	1,065
2007	746	212	208	9	4	1,179
2008	814	223	174	13	9	1,233
2009	750	219	178	9	6	1,162
2010	758	214	164	9	8	1,153
2011	751	200	148	10	1	1,110
2012	688	184	152	14	3	1,041
2013	721	166	124	11	1	1,023
2014	599	155	127	8	1	890
2015	573	173	126	15	1	888
2016	537	146	105	10	2	800
2017	505	146	95	12	1	759
2018	444	135	84	16	1	680
2019	349	142	108	18	1	618
2020	258	91	76	16	0	441
2021	240	100	68	16	1	425
2022	240	108	83	15	0	446
2023	264	124	81	15	0	484
2024	289	102	83	15	0	489
2025	255	130	95	20	0	500
Total	**16,766**	**6,036**	**5,073**	**338**	**232**	**28,445**

***Legend:** MSM = men who have sex with men*

Number of new diagnoses

The annual registered number of new HIV diagnoses steadily fell from approximately 1,200 in 2008 to 425 in 2021 (*Table 1.1A; Table 1.1B; Figure 1.2A*). Thereafter, the number of diagnoses increased, and, so far, 478 (1 September 2026: 500) new HIV diagnoses have been registered for 2025[a].

In MSM, the annual number of diagnoses peaked at 814 in 2008, and then fell to 239 (1 September 2026: 240) in 2022. By 2024, diagnoses had increased to 287 (1 September 2026: 289) before falling to 245 (1 September 2026: 255) in 2025 (*Figure 1.2B*). Among other men and among women, the annual number of new diagnoses has decreased to 123 (1 September 2026: 130) and 90 (1 September 2026: 95), respectively, in 2025. Finally, the number of new diagnoses among trans individuals varied between 15 and 20 in most recent calendar years.

SHM collects data on prior use of pre-exposure prophylaxis (PrEP) in all individuals newly diagnosed with HIV since 2018. Among MSM and trans individuals, who are the primary target groups of the national PrEP programme, the proportion of people reporting prior use of PrEP has steadily increased over calendar time (*Figure 1.2C*). In 2025, 55 (21%) of the 265 observed new diagnoses in MSM and trans individuals were in people who reported prior use of PrEP, while 135 (51%) people reported never to have used PrEP. For 75 individuals, or 28%, information on prior use of PrEP was not available, down from 65% in 2019 (see Chapter 2 for more details).

Number of newly acquired infections

The observed changes over time in the number of HIV diagnoses are, in part, a consequence of changes in the annual number of newly acquired HIV infections[1]. The estimated number of infections in people living in the Netherlands at the time they acquired HIV decreased from 880 (95% confidence interval [CI] 850-915) in 2010 to 315 (285-345) in 2020. Thereafter, the number of infections appeared to rise, albeit with considerable uncertainty, to 425 (345-510) in 2025 (*Figure 1.3A*). During the same period, the number of newly acquired HIV infections among MSM fell from 685 (655-715) in 2010 to 175 (145-200) in 2020, and was 275 (215-335) in 2025 (*Figure 1.3B*).

In other men and in women, the estimated numbers of newly acquired infections in 2010 were 115 (95% CI 105-125) and 85 (75-90), respectively. In 2025, the number of newly acquired infections were estimated at 105 (65-145) in other men and 45 (15-80) in women (*Figure 1.3C and 1.3D*).

a As it takes some time before people with HIV are registered in the SHM database by their treating physician and, subsequently, can have their data collected, there may be a backlog for the most recent calendar years. Previously, numbers of diagnoses were adjusted based on past trends in registration. Following changes in data collection from 2025 onwards, part of the backlog may have been cleared. However, as a result, historical trends are not comparable anymore, and adjustment factors cannot be estimated.

Figure 1.3: Observed annual number of HIV diagnoses reported as of 1 September 2026 (red) and estimated annual number of newly acquired HIV infections (blue) in: the total population (A), in men who have sex with men (B), in other men (C), in women (D), according to the European Centre for Disease Prevention and Control (ECDC) HIV Platform tool[1]. The shaded bands are the uncertainty bounds. The dashed lines indicate that estimates in 2022 and later are still uncertain, as these are quite sensitive to the observed number of diagnoses in those years. Estimates are based on numbers of diagnoses reported as of 1 May 2026 excluding migrants with a documented pre-arrival diagnosis and other migrants who were likely to have acquired their HIV infection before arrival in the Netherlands.

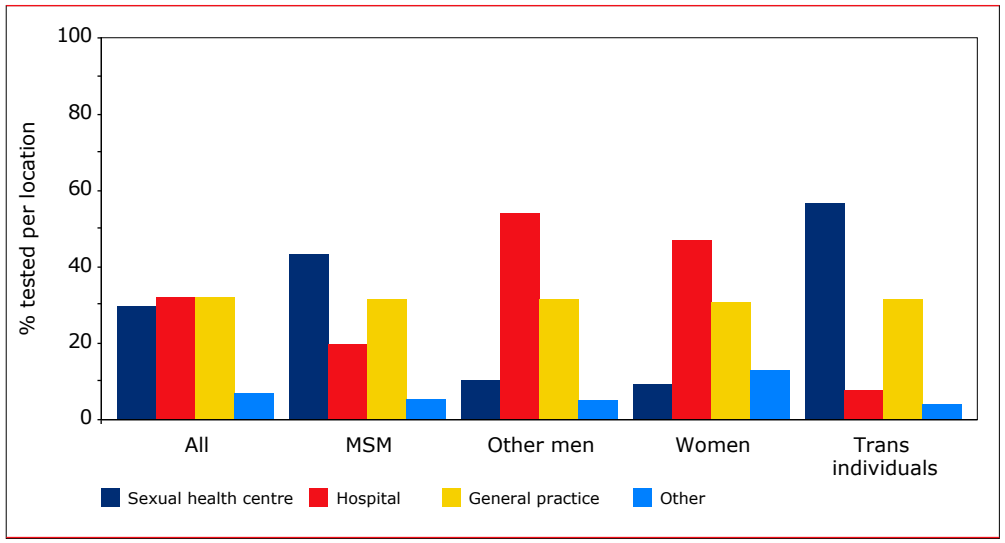


Legend: MSM = men who have sex with men

Location of testing

Information on the testing location where HIV was first diagnosed was available for 1,371 (95%) of the 1,444 people with an HIV diagnosis in 2023-2025, while the location of testing was unknown for eight (1%) individuals. The remaining 65 (5%) individuals, including 27 (42%) born in the Netherlands, reported to have been diagnosed abroad. Overall, 407 (30%) of the 1,371 individuals received their first HIV-positive test result at a sexual health centre, 437 (32%) at a hospital, 437 (32%) at a general practice, and 90 (7%) at another location (*Figure 1.4*). Among the 407 individuals diagnosed at sexual health centres, 327 (80%) were MSM, 30 (7%) were other men, 23 (6%) were women, and 27 (7%) were trans individuals, which was similar to the proportions directly reported by sexual health centres for 2025[2]. Among the 437 individuals diagnosed in a hospital, 153 (35%) were MSM, 168 (38%) were other men, 112 (26%) were women, and 4 (1%) were trans individuals, while among the 437 people diagnosed at a general practice 246 (56%) were MSM, 100 (23%) were other men, 76 (17%) were women, and 15 (3%) were trans individuals.

Figure 1.4: *Proportion of individuals diagnosed in 2023–2025, stratified by location of testing and key population. Location of testing in the Netherlands was known for 1,371 (95%) of 1,444 individuals diagnosed, of whom 767 (56%) MSM, 313 (23%) other men, 243 (18%) women, and 48 (4%) trans individuals, while 65 (5%) individuals were diagnosed abroad.*



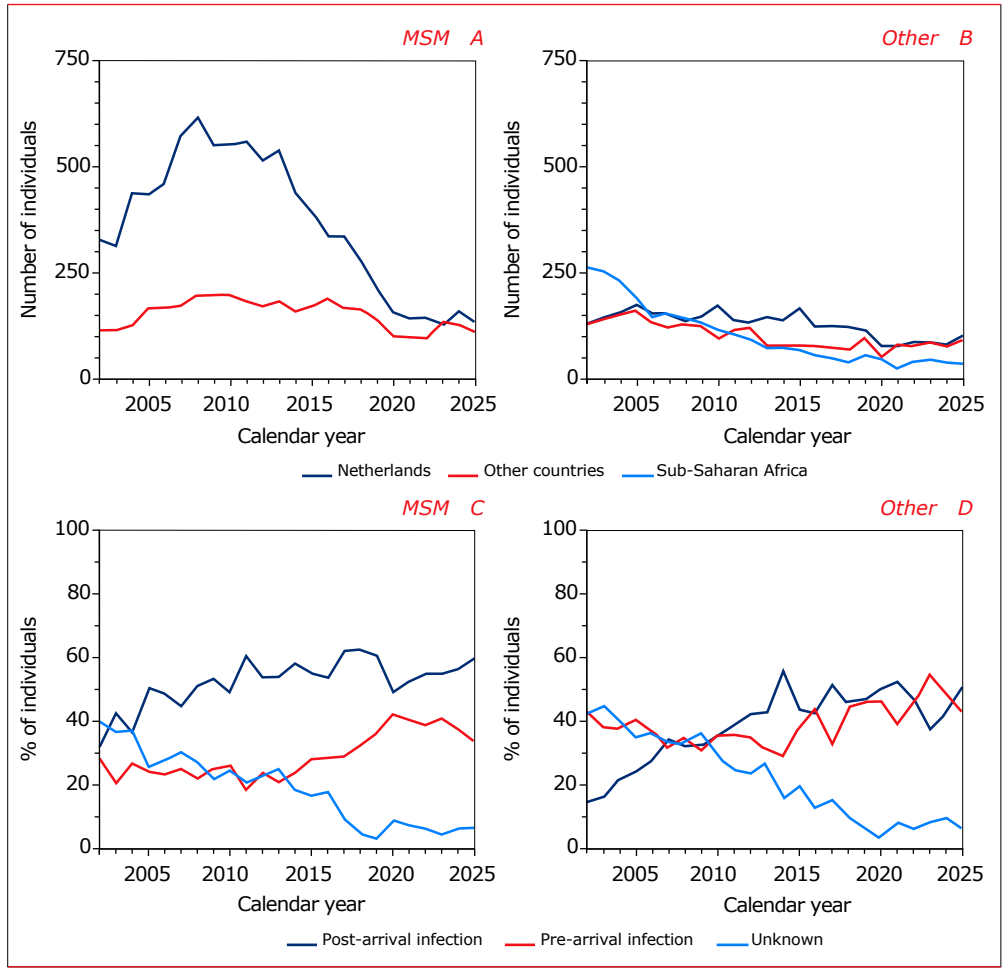
Legend: *MSM = men who have sex with men*

Geographical region of origin

Of the 20,456 people diagnosed with HIV-1 in the Netherlands in 2002-2025 at 15 years of age or older, 11,860 (58%) were born in the Netherlands and 8,596 (42%) outside the Netherlands. Of the 12,419 MSM, 71% originated from the Netherlands, 11% from other European countries, 6% from South America, 4% from the Caribbean, and 3% from south and southeast Asia (*Figure 1.5A*). In 2023-2025, the proportion of MSM of Dutch origin was 53%, down from 72% before 2023. The proportion of MSM born abroad increased from 28% before 2023 to 47% in 2023-2025, with 11% originating from central Europe (4% before 2023), 8% from South America (6% before 2023), and 5% from the Caribbean (4% before 2023).

Among the 8,037 individuals other than MSM diagnosed in 2002-2025, 39% originated from the Netherlands, while 31% originated from sub-Saharan Africa, 9% from South America, 9% from other European countries, 5% from the Caribbean, and 4% from south and southeast Asia (*Figure 1.5B*). Between 2023 and 2025, 41% were of Dutch origin (38% before 2023), and 19% originated from sub-Saharan Africa (32% before 2023), while 7% were from central Europe (3% before 2023), and 10% from Eastern Europe (2% before 2023).

Figure 1.5: *Annual number of diagnoses by region of origin and, for individuals born outside the Netherlands, proportion of pre- and post-arrival infections among: (A, C) men who have sex with men (MSM), and (B, D) other people aged 15 years or older at the time of diagnosis. Of the 795 MSM diagnosed in 2023–2025, 422 (53%) originated from the Netherlands, 146 (18%) from other European countries, 64 (8%) from South America, 40 (5%) from the Caribbean, and 34 (4%) from south and southeast Asia. Of the other 649 people diagnosed in 2023–2025, 269 (41%) originated from the Netherlands, 123 (19%) from sub-Saharan Africa, 118 (18%) from other European countries, 60 (9%) from South America, 19 (3%) from the Caribbean, and 19 (3%) from south and southeast Asia.*

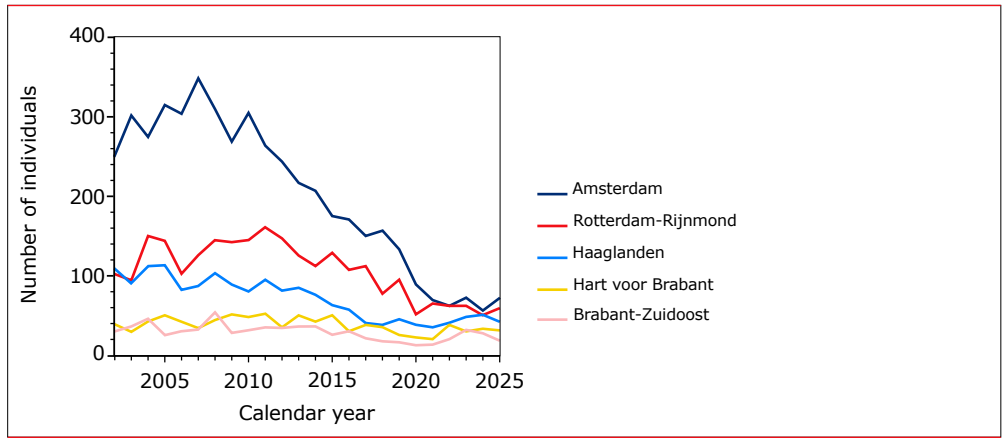


Legend: *MSM = men who have sex with men.*

Region of residence

Overall, 14% of individuals newly diagnosed in 2023-2025 were living in the Amsterdam public health service (PHS) region at the time of diagnosis, and 12% were living in the Rotterdam-Rijnmond PHS region (*Figure 1.6*). Other PHS regions with at least 5% of the new diagnoses in 2023-2025 were Haaglanden (10%, including Den Haag), Hart voor Brabant (7%, including Den Bosch and Tilburg), Utrecht (5%), and Brabant-Zuidoost (5%, including Eindhoven).

Figure 1.6: *Annual number of diagnoses by public health service (PHS) region. Only PHS regions with at least 5% of the new diagnoses in 2023–2025 are shown.*



HIV infections acquired before arrival in the Netherlands

Among the 1,444 individuals who were diagnosed with HIV in the Netherlands in 2023-2025, 753 (52%) were born outside the Netherlands, of whom 373 MSM and 380 other men, women, or trans individuals. For each of these 753 individuals, the likelihood of pre- or post-arrival was determined based on whether the individual was diagnosed with a recent HIV infection, on the CD4 cell count at the time of diagnosis, on the time of arrival in the Netherlands, and on the rate of decline in CD4 cell counts after acquiring HIV[3,4]. Overall, 325 (43%) most likely acquired their HIV infection before arrival in the Netherlands and 377 (50%) after arrival. For 51 (7%) individuals, there was not enough information to determine whether they acquired HIV before or after arrival.

In MSM born outside the Netherlands, the proportion with likely pre-migration infection appears to have increased since 2010 (*Figure 1.5C*). Of the 373 MSM born outside the Netherlands and diagnosed in 2023-2025, 140 (38%) most likely acquired their HIV infection before moving to the Netherlands, 212 (57%) most likely acquired their infection after arrival, while for 21 (6%) the likelihood of pre- or post-migration could not be determined. Among individuals other than MSM, there were no changes over time since 2010 and in 2023-2025, 185 (49%) most likely acquired HIV before arrival in the Netherlands, 165 (43%) after arrival, and for 30 (8%) the likelihood could not be determined (*Figure 1.5D*).

Age at time of HIV diagnosis

In 2002-2025, the median age at the time of diagnosis was 38 years (interquartile range [IQR] 30-47); in 2025, it was 37 years (IQR 29-50). During the same period, 20% of individuals who received an HIV diagnosis were aged 50 years or older; in 2025, 24% were 50 years or older (*Figure 1.7*).

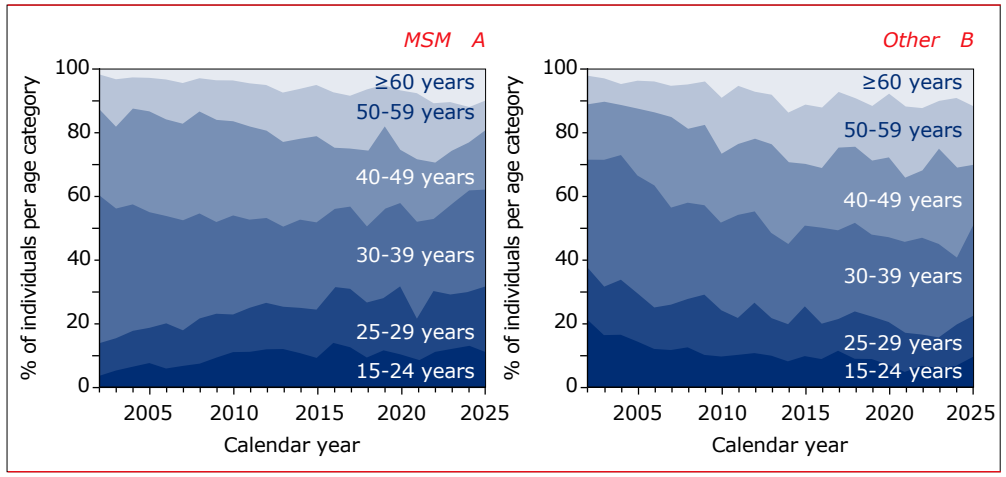
Although the median age at diagnosis in MSM (39 years) did not change between 2002 and 2025, both the proportion diagnosed below 30 years of age and the proportion diagnosed above 50 years of age increased during this period. In 2002, 14% of MSM were younger than 30 years at the time of their diagnosis while 13% were 50 years of age or older; these proportions were 32% and 19%, respectively, in 2025, although they have been around these levels since 2020. The increases in the proportions do, however, not reflect increases in the annual number of HIV diagnoses but rather a steeper decrease in diagnoses in the group between 30 and 50 years of age. Between 2010 and 2025, the annual number of diagnoses among MSM 30 to 50 years of age decreased by 74%, from 457 to 121. During the same period, the number of diagnoses decreased from 172 to 78, or 55%, in MSM younger than 30 years, and from 146 to 46, or 63%, in MSM 50 years of age or older.

There were some age differences between MSM, other men, and women diagnosed in 2023-2025. MSM born in the Netherlands were diagnosed at a median age of 40 years (IQR 30-55), while MSM of foreign origin were diagnosed at a younger median age of 33 years (28-41). Men other than MSM were 43 years (33-54) of age at the time of diagnosis, which was similar to the median age of 42 years (33-51) for women. In 2025, 19% of MSM, 34% of other men, and 31% of women were 50 years or older at the time of diagnosis.

HIV diagnoses in people under 25 years of age

Between 2002 and 2025, 2,144 (10%) individuals who received an HIV diagnosis at 15 years of age or older were under 25 years of age (*Figure 1.7*). In 2025, 51 people under 25 years of age were diagnosed with HIV, which amounted to 11% of all people diagnosed with HIV that year. The number of individuals under 25 years of age diagnosed in 2025 was 28 (11%) among MSM, 10 (8%) among other men, and 12 (13%) among women. Of the 51 young people, 23 (45%) were born in the Netherlands, while six originated from the Caribbean, five from central Europe, five from Middle East and North Africa, and twelve from elsewhere.

Figure 1.7: *Age distribution at the time of diagnosis among: (A) men who have sex with men (MSM), and (B) other men and women with HIV-1. In 2002–2025, the proportion of individuals between 15 and 29 years of age changed from 14% to 32% for MSM, and from 38% to 23% for other individuals. During the same period, the proportion of MSM aged 50 years or older at the time of diagnosis changed from 13% to 19%, while these proportions were 11% and 30% for other individuals.*



Legend: *MSM = men who have sex with men.*

HIV diagnoses in MSM by birth decades

Over time, MSM from younger generations become involved in HIV transmission although successive generations had lower maximum annual numbers that were reached at younger ages (*Figure 1.8A and 1.8B*). However, while overall numbers decreased, there was a resurgence in new diagnoses among MSM born in the 1990s. Separating the curves by region of origin shows that the number of diagnoses among MSM born in the Netherlands and abroad currently show a similar pattern (*Figure 1.8C*).

Among other men there was also an increase in new diagnoses in the 1990s birth decade (*Figure 1.8D*), while among women diagnoses in the 1990s birth decade remained at similar levels as in previous years. Among trans individuals, diagnoses in the 1990s birth decade increased to 12 in 2025, or 60% of the 20 trans individuals diagnosed in that year. Overall, people born from 2000 onwards were increasingly observed with an HIV diagnosis in recent years, in earlier birth cohorts the decrease in diagnoses stagnated, and in the earliest birth decades the number of diagnoses decreased further. Almost half of MSM born in 1990 or later were diagnosed at a recent stage of infection (*Table 1.2*).

Figure 1.8: *(A) Annual number of new HIV diagnoses among men who have sex with men by birth decade, (B) annual number of diagnoses by age of each birth decade, (C) annual number of HIV diagnoses by birth decade stratified by being born in the Netherlands (solid lines) or abroad (dashed lines), and annual number of new HIV diagnoses among (D) other men and (E) women by birth decade. Age of a birth decade is defined as the age of individuals born in the first year of the decade.*

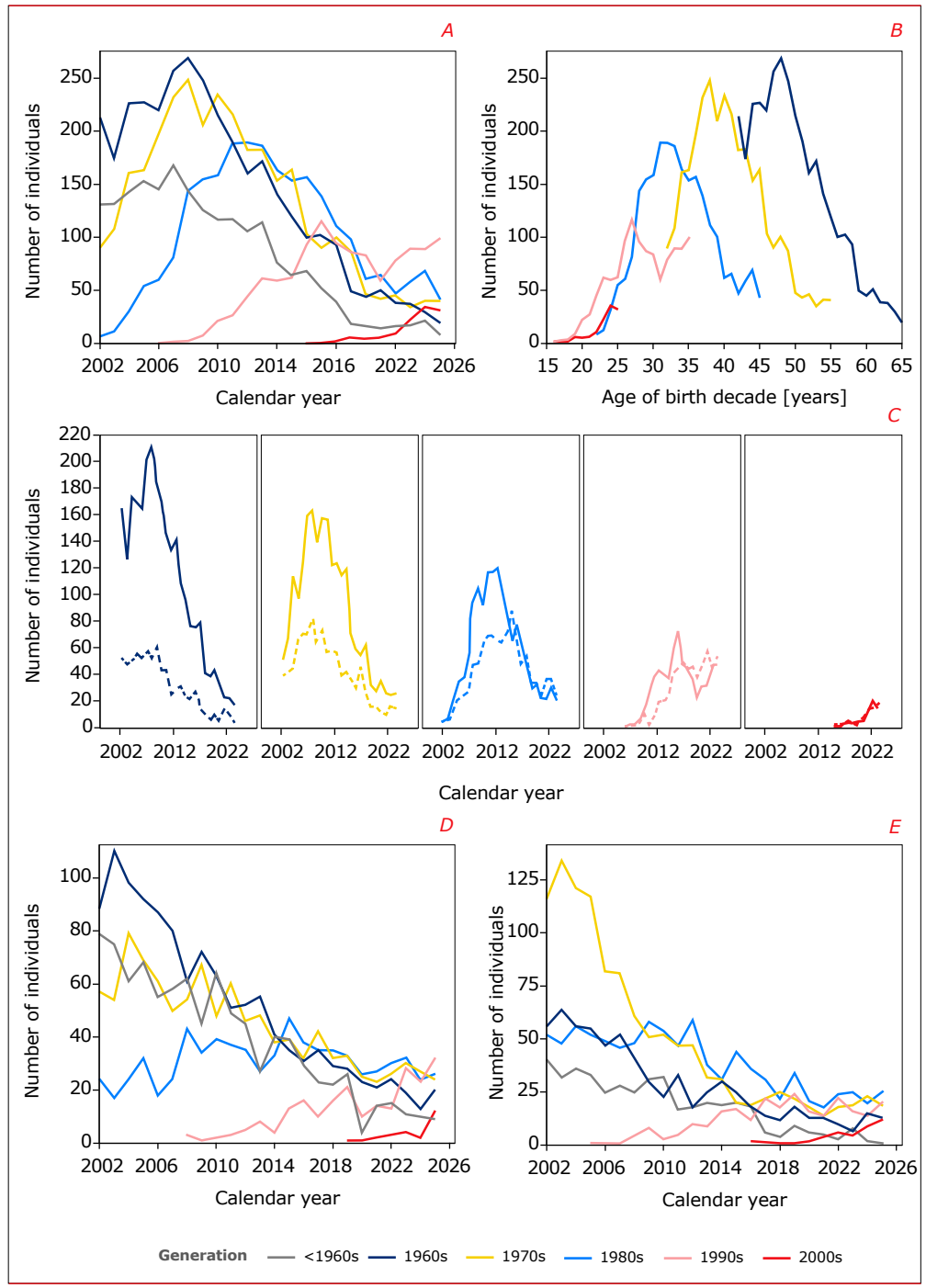


Table 1.2: Characteristics at the time of diagnosis of the youngest two birth decades (1990s and 2000s) and the older birth decades (1980s and earlier) with HIV diagnosis in 2023–2025, stratified by group.

	MSM		Other men		Women	
	Born ≥1990 (n=370, 47%)	Born <1990 (n=425, 53%)	Born ≥1990 (n=101, 29%)	Born <1990 (n=245, 71%)	Born ≥1990 (n=76, 30%)	Born <1990 (n=177, 70%)
Region of origin						
The Netherlands	166 (45%)	256 (60%)	60 (60%)	126 (51%)	22 (29%)	52 (29%)
Abroad	204 (55%)	169 (40%)	41 (41%)	119 (49%)	54 (71%)	125 (71%)
Living in Amsterdam or Rotterdam	113 (31%)	103 (24%)	29 (29%)	58 (24%)	16 (21%)	39 (22%)
Median (IQR) age (years)	28 (25–31)	47 (39–57)	30 (26–32)	48 (41–57)	27 (23–31)	48 (41–55)
Stage of infection						
Recent	177 (48%)	129 (30%)	22 (22%)	25 (10%)	6 (8%)	11 (6%)
Established	116 (31%)	131 (31%)	41 (41%)	56 (23%)	33 (43%)	46 (26%)
Late-stage	71 (19%)	152 (36%)	33 (33%)	150 (61%)	29 (38%)	113 (64%)
Unknown	6 (2%)	13 (3%)	5 (5%)	14 (6%)	8 (11%)	7 (4%)
Median (IQR) CD4 count (cells/mm³)	469 (317–639)	414 (204–599)	429 (280–570)	200 (50–490)	390 (266–590)	230 (76–499)
Location of HIV diagnosis						
Sexual health centre	202 (55%)	125 (29%)	14 (14%)	16 (7%)	14 (18%)	9 (5%)
Hospital	30 (8%)	123 (29%)	32 (32%)	136 (56%)	18 (24%)	94 (53%)
General practitioner	102 (28%)	145 (34%)	40 (40%)	60 (24%)	18 (24%)	58 (33%)
Pregnancy screening	–	–	–	–	21 (29%)	5 (3%)
Other / unknown	36 (10%)	32 (8%)	15 (15%)	33 (13%)	5 (7%)	11 (6%)
Prior use of PrEP						
Yes	75 (20%)	62 (15%)	0 (0%)	1 (0%)	0 (0%)	0 (0%)
No	191 (52%)	209 (49%)	44 (44%)	101 (41%)	23 (30%)	56 (32%)
Unknown	104 (28%)	154 (36%)	57 (56%)	143 (58%)	53 (70%)	121 (68%)

Entry into care

Of the 1,371 individuals diagnosed with HIV in 2023-2025 for whom the diagnosis setting was known, 61% entered HIV care within a week of diagnosis, 84% within two weeks, 95% within four weeks, and 98% within six weeks. For individuals diagnosed in 2025, these proportions were 64%, 86%, 95%, and 97%, respectively. The proportion in care within four weeks was 95% for individuals who received their first HIV-positive test at a sexual health centre, and similar for those who tested HIV-positive in a hospital (98%), at a general practice (95%), or at other locations (88%). The proportion in care within four weeks did not differ between MSM, other men, and women, nor by age at the time of diagnosis. The proportion in care within four weeks of diagnosis was higher among individuals born in the Netherlands (97%) than among those born abroad (94%).

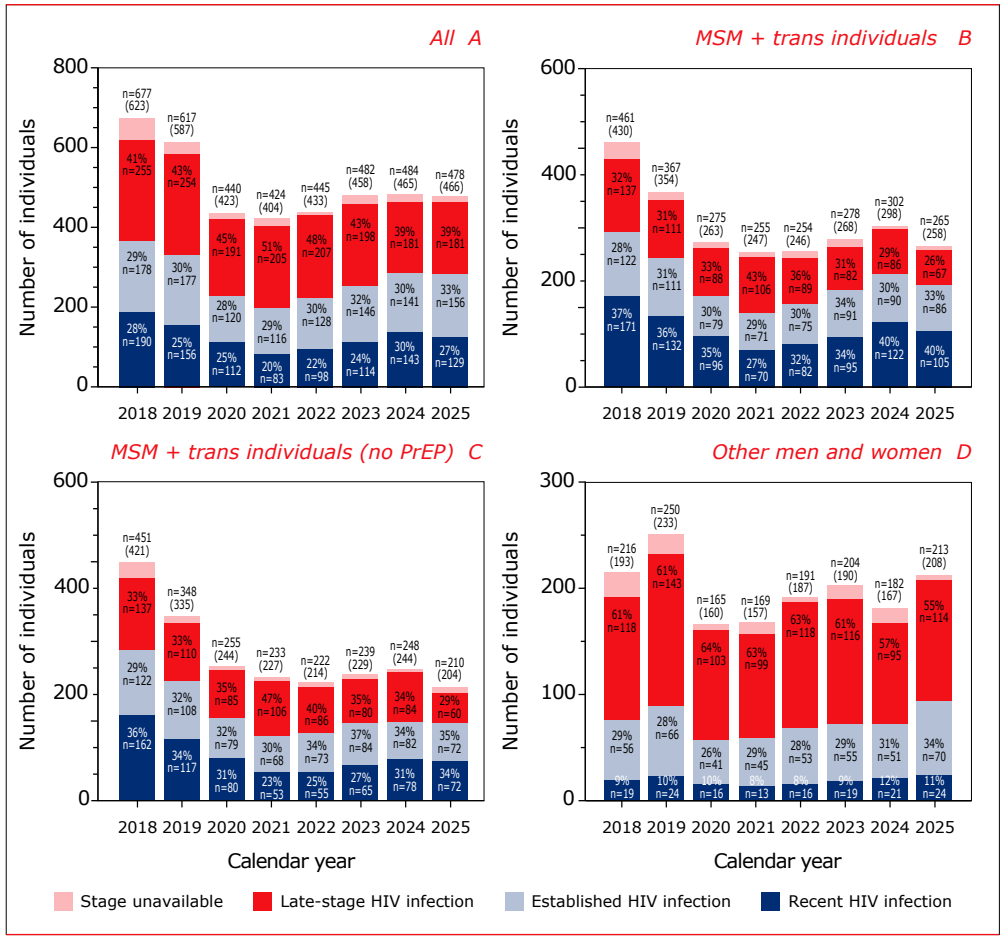
Stage at time of HIV diagnosis

Individuals newly diagnosed with HIV were classified into the following four mutually exclusive stages:

- Recent HIV infection: evidence of having acquired HIV in the 12 months prior to diagnosis, based on having (i) a negative or indeterminate blot at the time of diagnosis, or (ii) a last negative test at most 12 months prior to diagnosis.
- Established HIV infection: diagnosed with a CD4 count above 350 cells/mm³, no AIDS-defining event at the time of diagnosis, and no evidence of having acquired HIV in the previous 12 months.
- Late-stage HIV infection: diagnosed with a CD4 count below 350 cells/mm³ or an AIDS-defining event regardless of CD4 count, and no evidence of having acquired HIV in the previous 12 months[5].
- Stage unavailable: no evidence of having acquired HIV in the previous 12 months, no AIDS-defining event at the time of diagnosis, and no CD4 count available at the time of diagnosis.

The proportion of individuals diagnosed with recent HIV infection decreased from 28% in 2018 to 20% in 2021 and then increased to 27% in 2025, while the proportion with late-stage HIV was 41% in 2018, increased to 51% in 2021, and was 39% in 2025 (*Figure 1.9A*). Meanwhile, there were only minor changes in the proportion with established HIV infection. On closer inspection, these changes were to some extent the result of a decreasing number of MSM and trans individuals relative to the total annual number of newly diagnosed HIV infections, from 68% in 2018 to 55% in 2025. Besides, changes in the number and proportion of MSM and trans individuals diagnosed with recent, established, or late-stage HIV were also the result of the increasing share of people reporting prior use of PrEP among the annual number of new HIV diagnoses (*Figure 1.9B and 1.9C*). In other men and women, changes in the proportion diagnosed in each of these three stages were less pronounced (*Figure 1.9D*).

Figure 1.9: *Annual number and proportion of individuals diagnosed with recent, established, or late-stage HIV infection in 2018–2025 (A) in the total population aged 15 years or older at the time of diagnosis, (B) in men who have sex with men (MSM) and trans individuals, (C) in MSM and trans individuals excluding those who reported prior use of pre-exposure prophylaxis, and (D) in other men and women. Recent HIV infection was (i) a negative or indeterminate blot at the time of diagnosis, or (ii) a last negative test at most 12 months prior to diagnosis; established HIV infection: no recent HIV infection, CD4 counts above 350 cells/mm³, and not having AIDS at the time of diagnosis; late-stage HIV infection: no recent HIV infection, CD4 counts below 350 cells/mm³ or having AIDS, regardless of CD4 count. Numbers above the bars are the total number of diagnoses in each year, while numbers in brackets are the number of diagnoses excluding individuals whose stage at diagnosis is unavailable. Percentages inside the bars are relative to the number in brackets for late-stage and established infection, and relative to the total number of diagnoses for recent HIV infection.*

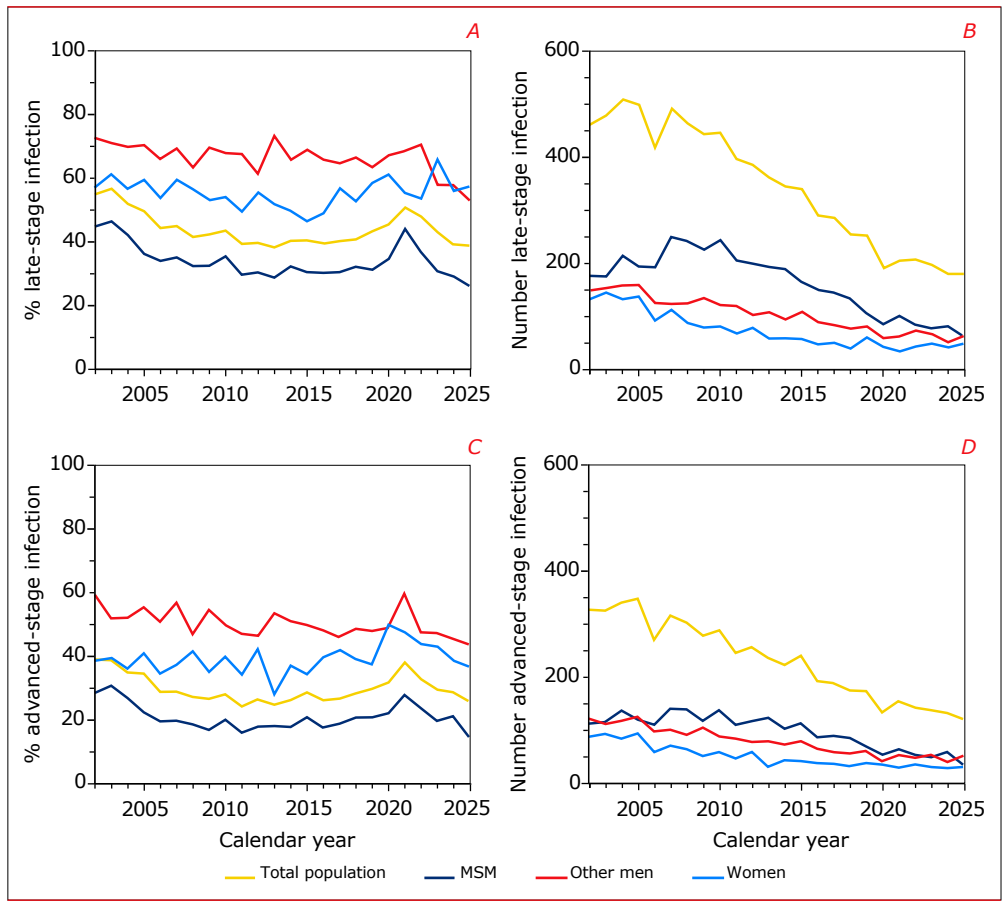


Legend: *MSM = men who have sex with men; PrEP = pre-exposure prophylaxis.*

Late diagnosis

Overall, 40% of the individuals diagnosed in 2023-2025 had a late-stage HIV infection at the time of diagnosis. Over time, the proportion of late-stage HIV diagnoses decreased from 55% in 2002 to a nadir of 38% in 2013, increased to 51% in 2021, and then again decreased to 39% in 2025 (*Figure 1.10A*). This increase between 2013 and 2021 was mainly due to changes in the proportion of MSM diagnosed with late-stage HIV (see also *Figure 1.9B*). The proportion of individuals diagnosed with advanced HIV disease (i.e. with a CD4 count below 200 cells/mm³ or AIDS-defining event, and no evidence of having acquired HIV in the previous 12 months), has followed a similar pattern, and reached 26% in 2025 (*Figure 1.10C*). Although the downward trend in these proportions appears to have halted after 2013, the number of individuals diagnosed with late-stage or advanced-stage HIV infection continued to decrease, albeit gradually (*Figure 1.10B and 1.10D*). It is worth noting that although newly diagnosed MSM had the lowest proportion of late-stage HIV infections, they accounted for 223 (40%) of all 560 individuals diagnosed with late-stage HIV in 2023-2025.

Figure 1.10: *Proportion and number of individuals classified as having: (A, B) late-stage, or (C, D) advanced-stage HIV infection at the time of diagnosis. In 2025, 181 (39%) individuals were diagnosed with late-stage HIV infection: 63 (26%) men who have sex with men (MSM), 64 (53%) other men, 50 (57%) women, and 4 (22%) trans individuals. During the same year, 121 (26%) individuals were diagnosed with advanced-stage HIV infection: 35 (15%) MSM, 53 (44%) other men, 32 (37%) women, and 1 (6%) trans individuals. Late-stage HIV infection: CD4 counts below 350 cells/mm3 or having AIDS, regardless of CD4 count. Advanced-stage HIV infection: CD4 counts below 200 cells/mm³ or having AIDS. As a CD4 count measurement close to the time of diagnosis and before start of therapy was sometimes missing, the stage of the HIV infection could not be determined for all individuals. In 2023-2025, the stage of infection was unknown for 55 (4%) individuals.*



Legend: MSM = men who have sex with men.

Late diagnosis by region of origin, age, and setting of diagnosis

Among individuals diagnosed with HIV in 2023-2025, 223 (29%) MSM, 183 (56%) other men, 142 (60%) women, and 12 (25%) trans individuals had a late-stage HIV infection. Late-stage HIV infections, in relative terms, were most common among people originating from sub-Saharan Africa (61%, or 89 individuals), Eastern Europe and Central Asia (56%, 45 individuals), or from south and southeast Asia (53%, 27 individuals) (*Table 1.3*).

Older age at the time of diagnosis was also associated with a higher proportion of late-stage HIV infection. Of those diagnosed in 2023-2025, late-stage HIV was seen in 50% of MSM, 58% of other men, and 62% of women aged 60 years or older, compared with 18% of MSM, 19% of other men, and 33% of women diagnosed below the age of 30 years (*Table 1.3; Figure 1.11*).

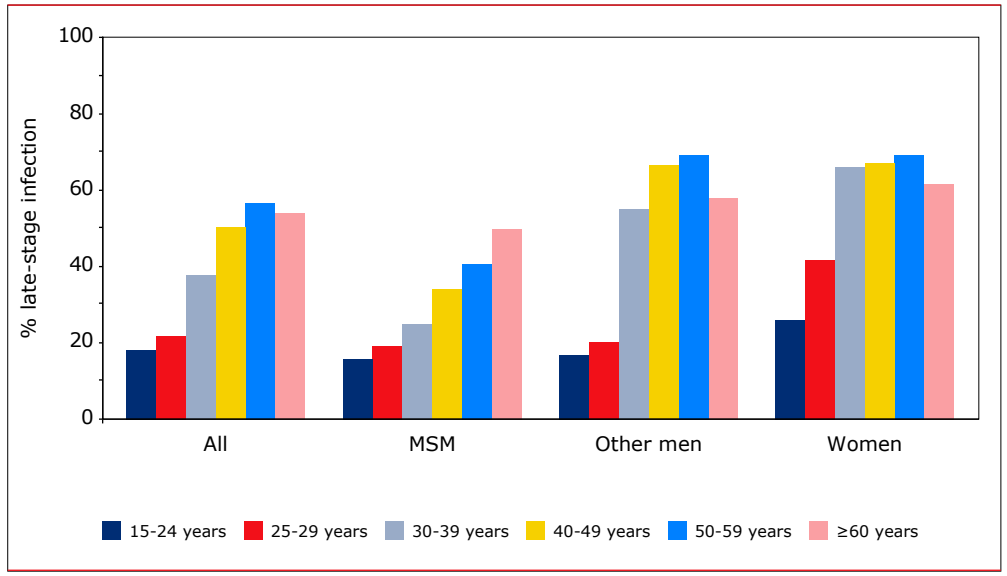
Table 1.3: *Characteristics of the 560 individuals with a late-stage HIV infection among the 1,346 individuals diagnosed with HIV in 2023-2025. In total, as a result of missing CD4 cell counts at diagnosis, it was not possible to classify whether 55 (4%) individuals (19 MSM, 19 other men, 15 women, and 2 trans individuals) had a late-stage HIV infection. For each of the five groups (MSM, other men, women, trans individuals, and total), percentages represent the proportion with late-stage infection of the total number of individuals diagnosed in each category listed in the first column.*

	MSM (n=776)		Other men (n=327)		Women (n=238)		Trans individuals (n=48)		Total (n=1,389)	
	n	%	n	%	n	%	n	%	n	%
Overall	223	29	183	56	142	60	12	25	560	40
Age at diagnosis (years)										
15-24	15	16	3	17	7	26	1	25	26	18
25-29	27	19	6	21	10	42	3	19	46	22
30-39	59	25	50	55	35	66	6	35	150	38
40-49	45	34	56	67	41	67	1	11	143	50
50-59	37	41	43	69	36	69	1	50	117	57
60-69	28	45	19	54	10	63	0	0	57	50
≥70	12	67	6	75	3	60	0	0	21	68
Region of origin										
Western	*121*	*27*	*94*	*50*	*32*	*44*	*1*	*11*	*248*	*34*
The Netherlands	111	27	90	50	32	45	1	11	234	35
Other western*	10	24	4	57	0	0	0	0	14	28

	MSM (n=776)		Other men (n=327)		Women (n=238)		Trans individuals (n=48)		Total (n=1,389)	
	n	%	n	%	n	%	n	%	n	%
Non-Western	*102*	*32*	*89*	*64*	*110*	*66*	*11*	*28*	*312*	*47*
Sub-Saharan Africa	12	39	28	70	49	65	0	0	89	61
Central Europe	20	26	11	48	7	58	1	25	39	33
Eastern Europe and Central Asia	4	17	12	63	29	78	0	0	45	56
South America	19	30	13	76	10	59	8	32	50	41
Caribbean	10	26	3	50	6	60	1	33	20	34
South and southeast Asia	18	53	5	50	3	60	1	50	27	53
Middle East and North Africa	11	31	12	67	3	50	0	0	26	43
Other/unknown	8	50	5	71	3	75	0	0	16	57
Location of HIV diagnosis										
Sexual health centre	47	15	7	24	6	29	7	27	67	17
Hospital	96	64	128	79	85	78	0	0	309	73
General practice	62	26	32	34	35	47	3	21	132	31
Other/unknown	18	28	16	39	16	48	2	50	52	37
Last negative test†										
(1–2] years	21	26	1	13	3	25	2	50	27	26
(2–4] years	18	32	8	47	10	53	4	40	40	39
>4 years	68	60	26	62	39	71	1	25	134	63
Never tested / not available	116	52	148	69	90	67	5	36	359	62

Legend: *MSM = men who have sex with men; *includes western Europe, North America, Australia and New Zealand; †all individuals with a negative test within 1 year prior to diagnosis are classified as recent HIV infection.*

Figure 1.11: Proportion of individuals diagnosed with late-stage HIV infection stratified by age category at the time of diagnosis for those diagnosed in 2023–2025 or later.



Legend: *MSM = men who have sex with men.*

Late-stage HIV was also observed more frequently in people who received their HIV diagnosis at a hospital (73%) than among those who were tested at a general practice (31%), a sexual health centre (17%), or another testing location (37%). Late diagnosis was less common (33%) among people who had a most recent negative HIV test one to four years prior to their diagnosis than among individuals whose last negative test was more than four years previously (63%) or who did not report ever having tested for HIV before (62%).

Late diagnosis and hospitalisation

Hospitalisation around the time of HIV diagnosis was more frequently reported for individuals diagnosed with late-stage HIV infection than for those with recent or established HIV infection (*Table 1.4*). Among the 560 people diagnosed with late-stage HIV infection in 2023-2025, 247 (44%) were hospitalised within a year of diagnosis, including 204 (36%) as a direct result of their HIV infection. In contrast, only 80 (10%) of the 829 individuals diagnosed with recent or established HIV infection were hospitalised within a year of diagnosis, including 29 (3%) hospitalisations due to HIV. Within the group of people with late-stage HIV infection, hospitalisation was most frequently recorded among those who were diagnosed with AIDS (*Table 1.4*).

Late diagnosis and mortality

Of the 560 individuals diagnosed with late-stage HIV infection in 2023-2025, 14 (3%) died within a year of diagnosis, including 11 (2%) who died of AIDS (*Table 1.4*). Among the 829 people diagnosed with recent or established HIV infection, 3 (0%) died within a year of diagnosis, including no one who died of AIDS.

Table 1.4: *Number and proportion of individuals diagnosed in 2023–2025 who were hospitalised or who died within a year of diagnosis, stratified by stage of infection; [a]one heart/vascular, one psychiatric disease, and one unknown/unclassifiable cause; [b]eleven AIDS-related deaths, and three unknown/unclassifiable causes. Note: AIDS = AIDS-defining event.*

Year of diagnosis		Hospitalisation				Death			
		Total		HIV-related		Total		AIDS-related	
Stage	n	n	%	n	%	n	%	n	%
Recent or established HIV infection	829	80	10	29	3	[a]3	0	0	0
Late-stage HIV infection	560	247	44	204	36	[b]14	3	11	2
CD4 200–349, no AIDS	168	27	16	9	5	1	1	0	0
CD4 <200, no AIDS	170	45	26	29	17	1	1	1	1
AIDS	222	175	79	166	75	12	5	10	5

Late diagnosis and prior use of PrEP

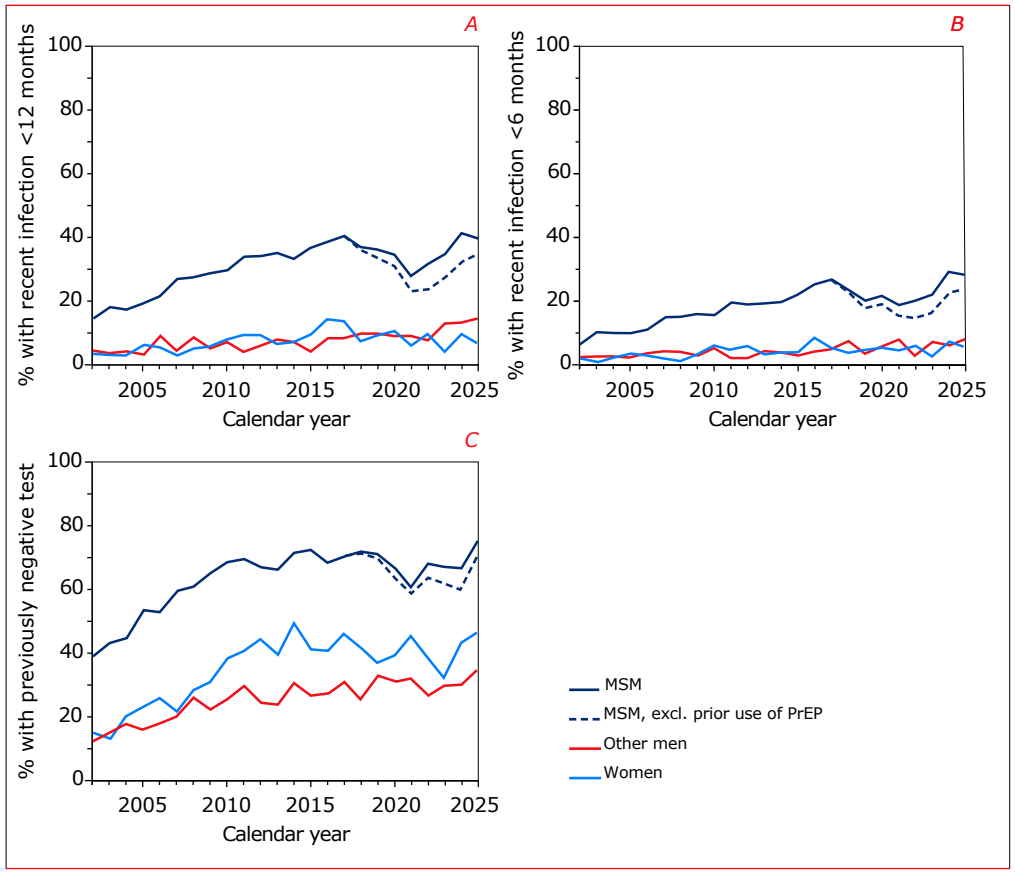
Among MSM and trans individuals diagnosed in 2023-2025, 235 (29%) were diagnosed with a late-stage HIV infection (*Figure 1.9B*). When people who reported prior use of PrEP were excluded, the number diagnosed with late-stage HIV reduced to 224, but this represented a slightly higher proportion, 33%, of those diagnosed (*Figure 1.9C*).

Recent infection

Although many individuals were diagnosed with a late-stage HIV infection, a considerable proportion of people received their HIV diagnosis early in the course of their infection. In total, among the individuals diagnosed in 2023-2025, 27% had evidence of having acquired their HIV infection in the 12 months prior to diagnosis, while 18% had evidence of having acquired HIV in the six months prior to diagnosis (*Figure 1.12A and 1.12B*). For MSM, these proportions were 38% and 27%, respectively, while they were somewhat lower for trans individuals, 32% and 18%, respectively. Among other men and among women these proportions were considerably lower (11% and 6%, respectively).

Among the 306 MSM who were diagnosed in 2023-2025 and had evidence of having acquired their HIV infection in the 12 months prior to diagnosis, 57 (19%) had a negative or indeterminate blot at the time of diagnosis, indicating that they acquired their infection very recently. In total, 281 individuals, or 35% of all MSM diagnosed in 2023-2025, had a negative test within the 12 months prior to their diagnosis. These proportions were 45% (168) among MSM born in 1990 or later, and 27% (113) among MSM before 1990. Among other men, 17 (17%) of those born in 1990 or later and 17 (7%) of those born before 1990 had a negative test at most 12 months before their diagnosis, while these numbers were 5 (7%) and 9 (5%), respectively, among women.

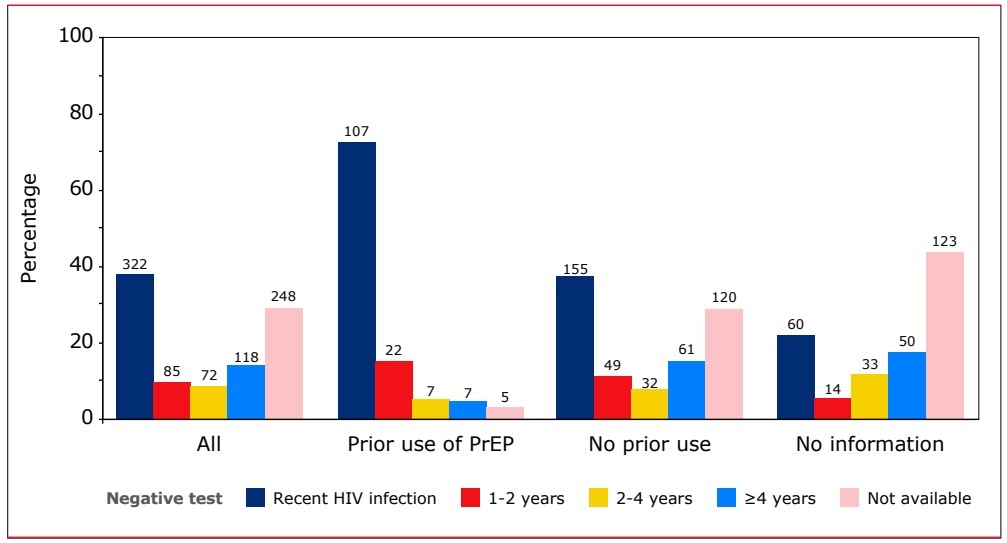
Figure 1.12: *Proportion of people diagnosed (A) with evidence of having acquired their HIV infection at most 12 months prior to their diagnosis, (B) at most 6 months prior to their diagnosis, (C) with a previously negative test at any time prior to their diagnosis. Evidence of a recent infection was (i) a negative or indeterminate blot at the time of diagnosis, or (ii) a last negative test at most 12 months or 6 months prior to diagnosis. In total, 97 (40%) men who have sex with men (MSM), or 68 (35%) MSM when excluding those who reported prior use of pre-exposure prophylaxis (PrEP), 18 (15%) other men, 6 (7%) women, 8 (40%) trans individuals, and 129 (27%) of all 478 individuals diagnosed in 2025 had evidence of having acquired HIV at most 12 months before diagnosis. In the same year, 69 (28%) MSM, or 47 (24%) MSM when excluding those who reported prior use of PrEP, 10 (8%) other men, 5 (6%) women, 5 (25%) trans individuals, and 89 (19%) of all 478 individuals had evidence of having acquired HIV at most six months before diagnosis.*



Legend: *MSM = men who have sex men; PrEP = pre-exposure prophylaxis.*

It is worth noting that the proportion of MSM with evidence of having acquired their HIV infection in the 12 months prior to diagnosis was 36% in 2018-2020, appeared to be lower, 28%, in 2021, and then increased to 40% in 2025 (*Figure 1.12A*). The lower proportion in 2021 may have been, in part, a consequence of disrupted testing services due to the (partial) lockdowns in response to the COVID-19 pandemic and/or changes in sexual behaviour during the pandemic. The increase after 2021 appeared to be to a large extent due to the growing proportion of MSM reporting prior use of PrEP. When these MSM were excluded the proportions with a recent HIV infection were considerably lower, 23% in 2021 and 35% in 2025. A similar reduction in the proportion with recent HIV infection after excluding individuals reporting prior use of PrEP was seen in the combined population of MSM and trans individuals (*Figure 1.9B and 1.9C*). The reason that the proportion with recent HIV infection decreased after excluding people reporting prior use of PrEP is that in this group of former PrEP users, the proportion diagnosed with recent HIV infection was much higher, 72%, than in people who never used PrEP or for whom no information on PrEP use was available (*Figure 1.13*).

Figure 1.13: *Proportion of men who have sex with men (MSM) and trans individuals diagnosed in 2023-2025 whose most recent negative HIV test was less than 1 year (i.e. recent HIV infection, including those with negative or indeterminate blot at the time of diagnosis), 1 to 2 years, 2 to 4 years, or more than 4 years prior to their HIV diagnosis, or who reported never having tested for HIV, overall and stratified by whether or not they reported prior use of PrEP. Numbers at the bottom are the number of individuals diagnosed in each category and represented by each bar.*



The proportion of people with a recorded previously negative HIV test any time before their HIV diagnosis increased from 26% in 2002 to 60% in 2025. MSM were more likely to have a previously negative HIV test than other men and women. In 2025, 76% of MSM newly diagnosed with HIV had a previously negative test, while this proportion was 35% in other men and 47% in women (*Figure 1.12C*). Overall, of MSM diagnosed in 2023-2025, 70% reported a previously negative test, meaning that almost a third (30%) never had an HIV test before their HIV diagnosis (see also *Figure 1.13*). In all three groups (MSM, other men, and women), the proportion of people without a reported previously negative HIV test has remained around the same level since 2010. In 2025, the proportion with a known previously negative test was highest among those diagnosed at a sexual health centre (80%), compared with 38% of those diagnosed in a hospital, and 63% of those diagnosed at a general practice.

Time between HIV infection and viral suppression

Individuals with a suppressed viral load below 200 copies/ml cannot sexually transmit HIV to other people (undetectable equals untransmittable, or U=U)[6-9]. Hence it is crucial to minimise the time between the moment a person acquires HIV and the point at which they achieve this threshold, not only for people with HIV, but also from a public health perspective. However, people with HIV must first be diagnosed, then linked to care, and subsequently start therapy in order to be able to reach viral suppression.

Over time there have been significant improvements in several of these steps in the HIV care continuum. Between 2010 and 2025, the median time from diagnosis to reaching a viral load level below 200 copies/ml decreased from 10.1 months (IQR 4.5-31.2) to 2.1 months (IQR 1.4-3.5). This decrease in time to viral suppression was achieved mainly as a result of starting therapy sooner after entry into care, and individuals with HIV reaching viral suppression faster once therapy had begun. The estimated time between infection to diagnosis was the greatest contributing factor to the delay between acquiring HIV and achieving viral suppression. In 2025, this was estimated to be a median of 2.7 years (IQR 1.3-5.2).

Population in care

In total, 23,491 (70%) of the 33,523 individuals with HIV-1 ever registered in the Netherlands were known to be in clinical care by the end of 2025 (*Figure 1.1*; *Table 1.5*). People were considered to be in clinical care if they had visited their treating physician in 2025, or had a CD4 count or HIV RNA measurement in that year, and were still living in the Netherlands. Of the 10,032 people who were not in care by the end of 2025, 4,743 (47%) had died, of whom 2,621 (55%) died before the end of 2015. Another 2,914 (29%) had moved abroad, including 1,283 (44%) who did so before the end of 2015. The remaining 2,375 (24%) individuals:

- were lost to care (2,217, 93%);
- were only diagnosed with HIV in 2026 (87, 4%);
- had only moved to the Netherlands in 2026 (19, 1%); or
- had newly entered care in 2026 (52, 2%).

Of the people who moved abroad, 2,387 (82%) had RNA levels below 200 copies/ml at their last viral load measurement; in those lost to care, that figure was 1,456 (66%).

Table 1.5: Characteristics of the 23,491 people with HIV-1 in clinical care by the end of 2025.

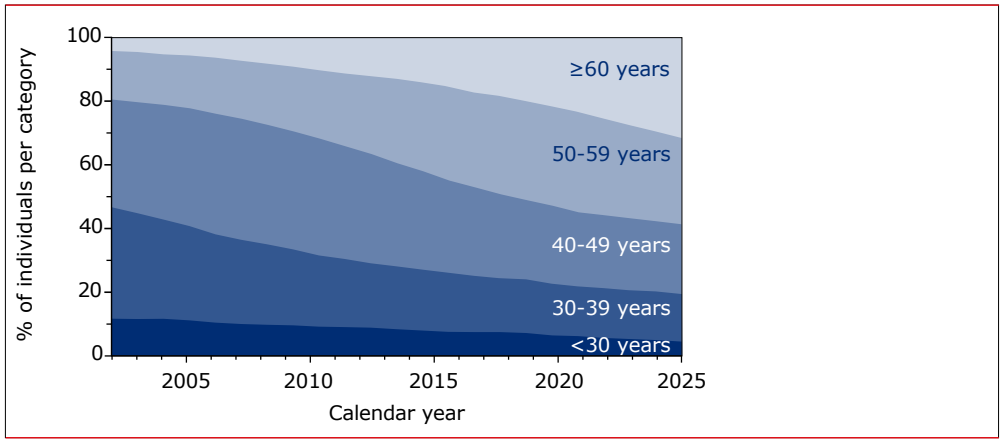
	MSM (n=14,332, 61%)		Other men (n=4,281, 18%)		Women (n=4,475, 19%)		Trans individuals (n=403, 2%)		Total (n=23,491)	
	n	%	n	%	n	%	n	%	n	%
Transmission										
Sex with men	13,235	92	–	–	3,887	87	314	78	17,436	74
Sex with women	14	0	2,721	64	4	0	11	3	2,750	12
Sex, unspecified	981	7	147	3	0	0	45	11	1,173	5
IDU	12	0	198	5	80	2	1	0	291	1
Blood/blood products	1	0	97	2	65	1	1	0	164	1
Other/unknown	89	1	1,118	26	439	10	31	8	1,677	7
Current age (years)										
0-14	0	0	35	1	39	1	0	0	74	0
15-24	89	1	89	2	110	2	7	2	301	1
25-29	416	3	99	2	125	3	44	11	684	3
30-39	2,266	16	507	12	577	13	145	36	3,495	15
40-49	2,878	20	854	20	1,289	29	95	24	5,116	22
50-59	3,820	27	1,217	28	1,346	30	80	20	6,463	28
60-69	3,467	24	1,035	24	721	16	25	6	5,248	22
70-79	1,213	8	376	9	218	5	7	2	1,184	8
≥80	183	1	69	2	50	1	0	0	302	1
Region of origin										
The Netherlands	9,214	64	1,905	44	1,230	27	76	19	12,425	53
Sub-Saharan Africa	271	2	975	23	1,739	39	12	3	2,997	13
Western Europe	890	6	148	3	110	2	8	2	1,156	5
Central Europe	622	4	178	4	119	3	12	3	931	4
Eastern Europe and Central Asia	274	2	211	5	300	7	5	1	790	3
South America	1,166	8	306	7	385	9	159	39	2,016	9
Caribbean	652	5	195	5	212	5	71	18	1,130	5
South and southeast Asia	526	4	110	3	263	6	39	10	938	4
Middle East and North Africa	302	2	187	4	75	2	18	4	582	2
Other	331	2	36	1	27	1	1	0	395	2
Unknown	84	1	30	1	15	0	2	0	131	1
Years aware of HIV infection										
<1	241	2	126	3	91	2	19	5	477	2
1-2	570	4	227	5	172	4	32	8	1,001	4
3-4	553	4	227	5	168	4	39	10	987	4
5-9	2,342	16	665	16	581	13	84	21	3,672	16
10-19	6,398	45	1,544	36	1,627	36	141	35	9,710	41
20-29	3,087	22	1,198	28	1,497	33	71	18	5,853	25
≥30	1,132	8	277	6	322	7	15	4	1,746	7
Unknown	9	0	17	0	17	0	2	0	45	0

Legend: MSM = men who have sex with men; IDU = injecting drug use.

Ageing population

The median age of the population in clinical care by the end of 2025 was 54 years (IQR 43-62). This figure has been increasing since 2002 (*Figure 1.14*), which is mainly a result of the improved life expectancy of people with HIV following the introduction of combination antiretroviral therapy (ART). Moreover, individuals are being diagnosed at an increasingly older age, as discussed earlier in this chapter. Consequently, more than half of those currently in care (59%) are 50 years or older (61% of MSM, 63% of other men, 52% of women, and 28% of trans individuals), and 31% are 60 years or older, with 6% 70 years or older. As the population with HIV continues to age, the number of individuals with age-related comorbidities also increases. These conditions are known to complicate the management of people with HIV (see Chapter 6).

***Figure 1.14:** Increasing age of the population with HIV-1 in clinical care over calendar time. In 2002, 12% of the individuals in care were younger than 30 years of age, whereas 20% were 50 years or older. In 2025, these proportions were 4% and 59%, respectively, while 31% of individuals in care were 60 years of age or older. The proportion of individuals in clinical care as of 31 December each calendar year is shown according to age category: <30 years of age, 30-39 years, 40-49 years, 50-59 years, and 60 years or older.*



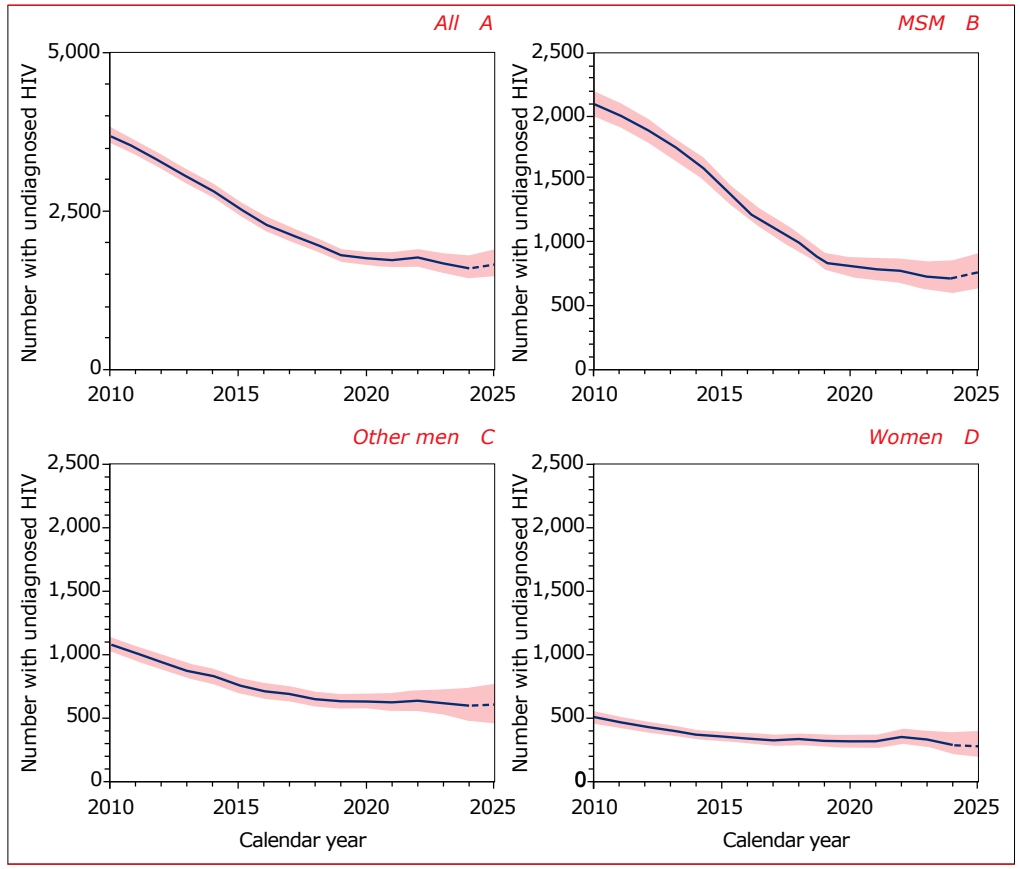
Duration since diagnosis

People in clinical care by the end of 2025 were known with HIV for a median of 15.7 years (IQR 9.6-22.1). Therefore, a large group (74%) of those in care have been living with HIV for more than 10 years, including 32% who have done so for more than 20 years. The median time since diagnosis was 15.3 years for MSM, 15.6 years for other men, 17.7 years for women, and 11.5 years for trans individuals.

Undiagnosed population

The estimated number of people with an undiagnosed HIV infection, according to the ECDC HIV Platform tool, decreased from 3,675 (95% CI 3,565-3,810) in 2010 to 1,650 (1,470-1,900) in 2025 (*Figure 1.15A*). The 1,650 individuals with an undiagnosed HIV infection comprised 1,480 (1,300-1,730), or 90%, who most likely acquired their HIV infection while living in the Netherlands and an estimated 170 (10%) individuals who acquired their HIV infection before migrating to the Netherlands. This decrease was mostly driven by MSM, among whom the number of undiagnosed HIV cases fell from 2,090 (1,995-2,195) in 2010 to 765 (635-920) by the end of 2025 (*Figure 1.15B*). Among other men, the estimated number with undiagnosed HIV was 1,080 (1,025-1,135) in 2010 and 605 (460-770) in 2025, while in women these numbers were 505 (450-555) and 280 (195-395), respectively (*Figures 1.15C and 1.15D*).

Figure 1.15: *Estimated number of people with undiagnosed HIV in the Netherlands: (A) overall, (B) men who have sex with men (MSM), (C) other men, and (D) women, according to the European Centre for Disease Prevention and Control (ECDC) HIV Platform tool. Estimates for the overall population do not include trans individuals and children.*



Legend: *MSM = men who have sex with men.*

Continuum of HIV care – national level

The estimated total number of people with HIV in the Netherlands by the end of 2025 was 26,225 (95% CI 26,045-26,475), including 1,650 (1,470-1,900) who remained undiagnosed (*Figure 1.16A*)[1]. Of these 26,225 individuals with HIV:

- 24,575 (94% of the total number of people with HIV) had been diagnosed, linked to care, and registered by SHM;
- 23,491 (90%, or 96% of those diagnosed and linked to care) were retained in care (i.e. they had at least one documented HIV RNA or CD4 count measurement, or a clinic visit in 2025);
- 23,405 (89%, or 95% of those diagnosed and linked to care) had started ART;
- 22,774 (87%, or 97% of those treated) had a most recent HIV RNA measurement below 1,000 copies/ml;
- 22,262 (86%, or 97% of those treated) had a most recent HIV RNA measurement below 200 copies/ml; and
- 22,004 (84%, or 94% of those treated) had a most recent measurement below 50 copies/ml.

Overall, 86% of the total estimated population with HIV and 92% of those diagnosed and ever linked to care had a suppressed viral load below 200 copies/ml. This means that by 2025 the Netherlands had almost reached the Joint United Nations Programme on HIV/AIDS (UNAIDS) 95-95-95 targets for 2025[10]; with the estimate standing at 94-95-97, or 94-95-97 if 1,000 copies/ml, and 94-95-94 if 50 copies/ml is used as a threshold of viral suppression[11]. Of the 21,260 (91%) people still in care by the end of 2025 who had at least one CD4 count measurement in 2023-2025, 17,063 (80%) had a most recent CD4 count of 500 cells/mm3 or higher.

Viral suppression

In total, 803 individuals had started therapy but did not have a suppressed viral load below 200 copies/ml by the end of 2025. On closer inspection, 362 (45%) of these individuals did not have an HIV RNA measurement available in 2025; 304 (84%) of these 362 individuals had an HIV RNA level below 200 copies/ml at their last measurement in 2024, 14 (4%) had an HIV RNA level of 200 copies/ml or above, and 44 (12%) also had no HIV RNA measurement in 2024. At the time of analysis, 135 (37%) of the 362 individuals had an RNA measurement in 2026, of which 127 (94%) below 200 copies/ml.

The median HIV RNA level among the 441 (55%) people with a viral load measurement and a viral load level above 200 copies/ml was 3,095 copies/ml (IQR 422-54,000). Of these 441 people, 64 (15%) started therapy after their last available viral load measurement in 2025. Another 38 (9%) had only started therapy in the six months prior to that last measurement and may not have had sufficient follow up to achieve a documented suppressed viral load.

Lost to care

Of the people diagnosed and linked to care, 2,217 individuals were lost to care by the end of 2025, and of these:

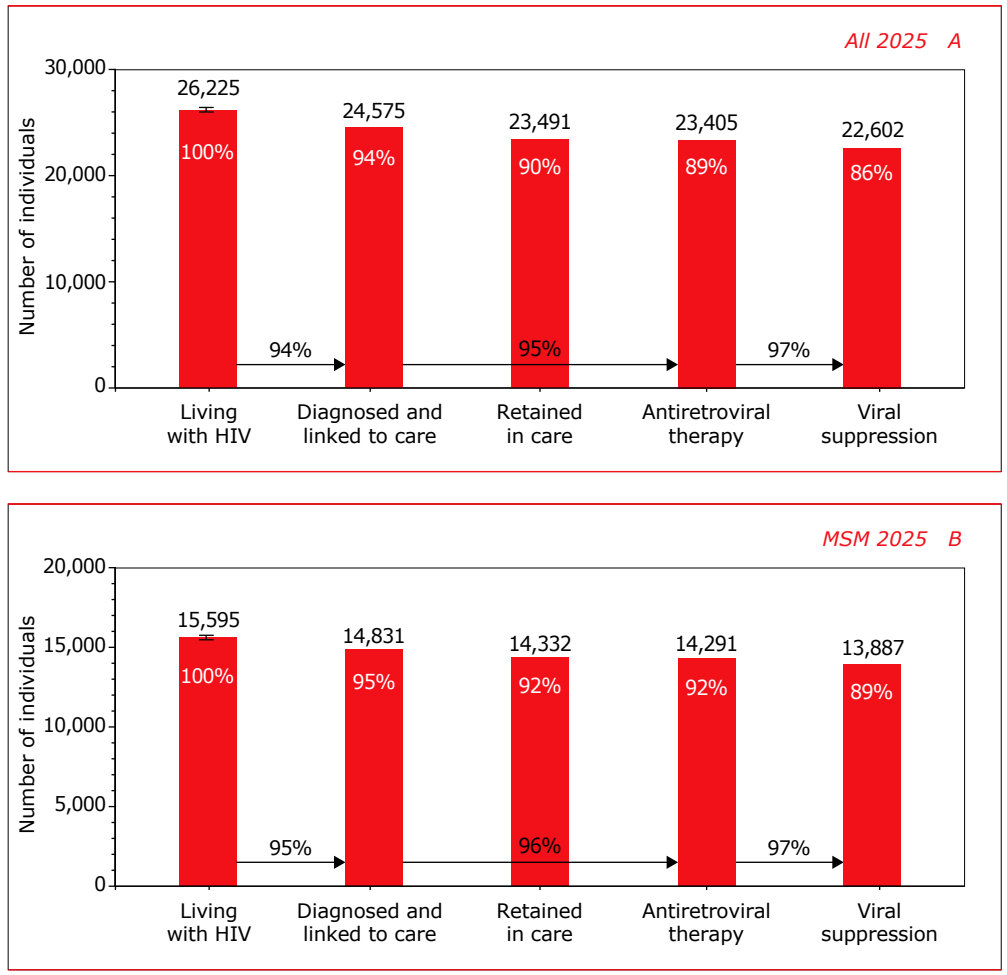
- 1,185 (53%) were last seen for care before the end of 2015;
- 455 (21%) in 2016-2021;
- 114 (5%) in 2022;
- 157 (7%) in 2023; and
- 306 (14%) in 2024[b].

The 1,185 individuals who were lost to care in or before 2015, were excluded from the estimated number of people with HIV and the number of people diagnosed and linked to care. It was assumed to be unlikely that these 1,185 individuals were still living in the Netherlands by the end of 2025 without requiring care or ART during that ten-year period.

Of the 1,032 individuals lost to care after 2015, 71% were born outside the Netherlands; this proportion was only 47% for those who were still in care by the end of 2025. This suggests that some of those lost to care may have moved abroad; in particular, back to their country of birth. It should be pointed out that 100 (10%) of the 1,032 individuals were lost to care because they had planned transfer of care to another treatment centre, but there was no confirmation that they did indeed register at a new centre. Of the 463 individuals last seen for care in 2023 or 2024, 359 (78%) had a suppressed viral load below 200 copies/ml, 68 (15%) had a viral load level above 200 copies/ml, and 38 (8%) had no measurement available. At the time of analysis, 89 (19%) of the 463 individuals had a documented HIV RNA or CD4 count measurement, or a clinic visit in 2026.

b In addition to the 2,217 individuals lost to care there were 52 individuals who had already been diagnosed by the end of 2025 and were living in the Netherlands but entered care in 2026. These 52 individuals, as well as the 1,032 lost to care after 2015, are counted in the first and second stage of the continuum but not in the other stages.

Figure 1.16: *Continuum of HIV care for people with HIV in the Netherlands by the end of 2025: (A) the total population with HIV-1, (B) men who have sex with men (MSM), (C) other men, and (D) women. Viral suppression was defined as an HIV RNA measurement below 200 copies/ml. Percentages at the top of the bars are calculated relative to the number with HIV, while percentages at the bottom correspond to the UNAIDS' 95-95-95 targets for 2025.*



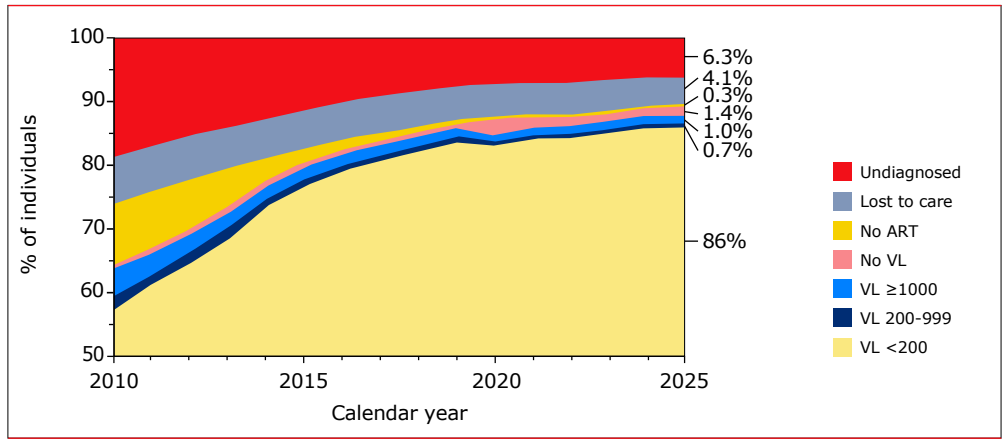
Legend: *MSM = men who have sex with men.*

Transmittable levels of HIV

The proportion of people with HIV living in the Netherlands (at the end of each calendar year) who were using ART and had a confirmed viral load level below 200 copies/ml, grew steadily between 2010 and 2025 (*Figure 1.17*). In 2010, 58% of the estimated 19,770 (95% CI 19,655-19,905) people with HIV had a suppressed viral load below 200 copies/ml, while this proportion was 86% in 2025. During the same period, the proportion using ART with a viral load below 1,000 copies/ml grew from 60% in 2010 to 87% in 2025. This increase was mainly the result of a reduction in the proportion of people unaware of their infection, from 19% in 2010 to 6% in 2025, and, to a lesser extent, of a smaller proportion not yet on ART (10% in 2010, 0.3% in 2025).

The number of individuals with HIV who were likely to have an unsuppressed viral load of 1,000 copies/ml or higher by the end of 2025 was estimated to be 3,450, or 13% of all people with HIV, which is the difference between the first and the last stage in the HIV care continuum. These individuals could theoretically still pass HIV onto individuals without HIV. The number of 3,450 individuals includes the 1,650 (48%) people who were not yet diagnosed by the end of 2025. The remaining 1,800 (diagnosed) individuals are likely to be an overestimate of the true number with an unsuppressed viral load in the Netherlands because, as discussed above, some of the people who were lost to care may have moved abroad and may be receiving HIV care outside the Netherlands.

Figure 1.17: *Estimated proportions of people with HIV across the various stages in the HIV care continuum. The numbers to the right of the graph are the proportions in 2025.*



Legend: *ART = antiretroviral therapy; VL = viral load*

Continuum of care in MSM, other men, and women

The number of MSM with HIV at the end of 2025 was estimated at 15,595 (95% CI 15,470-15,755), of whom 765 (635-920) had yet to be diagnosed. Of these:

- 14,831 (95%) had been diagnosed and linked to care;
- 14,332 (92%) were still in care;
- 14,291 (92%) had started ART; and
- 13,887 (89%) had a most recent HIV RNA below 200 copies/ml, while 13,966 (90%) had a viral load below 1,000 copies/ml.

In terms of the 2025 UNAIDS 95-95-95 targets, this translates to 95-96-97, meaning that in MSM, the UNAIDS targets have been met (*Figure 1.16B*). In total, 10,877 (76%, or 83% of those with a CD4 measurement) of MSM still in care by the end of 2025 had a CD4 count of 500 cells/mm3 or higher at their last measurement in 2023-2025.

Among other men, the estimated number with HIV in 2025 was 5,200 (95% CI 5,055-5,365), including 605 (460-770) who were not yet diagnosed (*Figure 1.16C*). Of these:

- 4,596 (88%) men had been diagnosed and linked to care;
- 4,281 (82%) were still in care;
- 4,264 (82%) had started ART; and
- 4,086 (79%) had a suppressed viral load below 200 copies/ml, while 4,120 (79%) had a viral load below 1,000 copies/ml,

which translates to 88-93-96 in term of the 2025 UNAIDS 95-95-95 targets.

The number of women with HIV was estimated to be 4,985 (95% CI 4,900-5,105), of whom 280 (195-395) were not yet diagnosed (*Figure 1.16D*). Of these women:

- 4,706 (94%) had been diagnosed and linked to care;
- 4,475 (90%) were still in care;
- 4,450 (89%) had started ART; and
- 4,253 (85%) had a suppressed viral load below 200 copies/ml, while 4,306 (86%) had a viral load below 1,000 copies/ml,

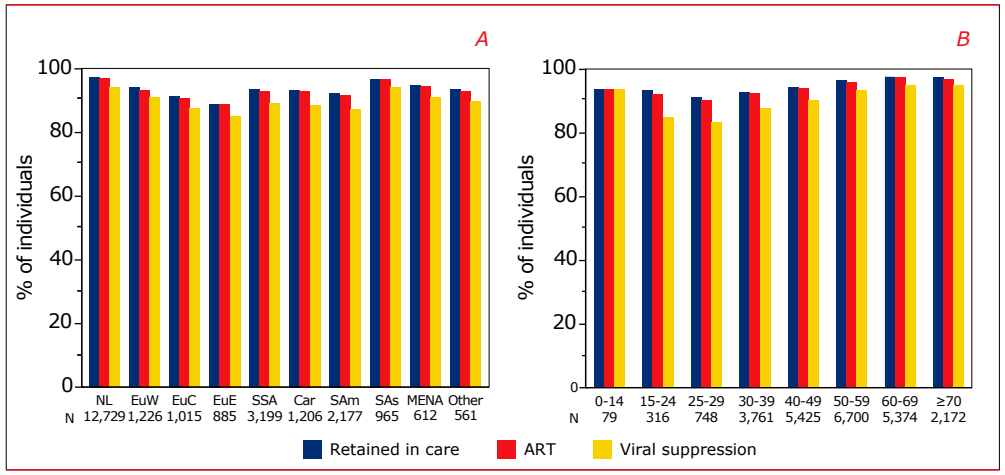
which translates to 94-95-96 in term of the 2025 UNAIDS 95-95-95 targets.

Among women and other men still in care by the end of 2025, the proportion with viral suppression was 95%, which was somewhat lower than among MSM (97%).

Continuum of care by region of origin and age

Individuals originating from the Netherlands and south and southeast Asia generally engaged more with the various stages of the care continuum than people from other countries (*Figure 1.18A*). Engagement with all stages of the care continuum was generally lower in individuals between 15 and 49 years of age. Both the proportion of people who were still in care and the proportion who had started ART by the end of 2025, increased with age, and exceeded 95% in people aged 50 years or older (*Figure 1.18B*). As a consequence, the proportion of people with viral suppression also increased with age; rising from 85% among those aged 15 to 24 years, to more than 90% for people aged 40 years or older.

Figure 1.18: *Continuum of HIV care: (A) by region of origin, and (B) by age group (in years) for the total population with HIV-1. Proportions are given relative to the number of people diagnosed and linked to care, which are shown below the figures.*



Legend: *NL = the Netherlands; EuW = western Europe; EuC = central Europe; EuE = eastern Europe and Central Asia; SSA = sub-Saharan Africa; Car = Caribbean; SAm = South America; SAs = south and southeast Asia; MENA = Middle East and north Africa; Other = other regions of origin; ART = antiretroviral therapy.*

Continuum of HIV care – regional level

We also determined the continuum of care (including the first stage: estimated number of people with HIV) for the eight STI surveillance regions[c] in the Netherlands, and for the five largest cities in the country (*Table 1.6*, see also https://dashboard.hiv-monitoring.nl/en). By the end of 2025, more than half (53%) of all estimated people with HIV were living in Noord-Holland/Flevoland and in Zuid-Holland Zuid, which include the cities of Amsterdam and Rotterdam. In total, an estimated 710 (43%) people with undiagnosed HIV were living in these two regions. All eight regions had reached or were close to reaching most of the UNAIDS' 95-95-95 targets for 2025, and the proportion of all people with HIV who had a suppressed viral load below 200 copies/ml varied between 85% and 89%, or between 85% and 90% when considering a viral load below 1,000 copies/ml. Those diagnosed and linked to care showed similar levels of engagement in the various stages of the care continuum across all 25 public health service regions in the Netherlands (*Table 1.7*).

c Reporting to the national STI surveillance system is organised in eight regions, which each consist of one or more public health service regions (see also Table 1.7).

Table 1.6: Continuum of care by the end of 2025 for the total population with HIV-1 living in the Netherlands in each of the eight sexually-transmitted infection (STI) surveillance regions, or in one of the five most populous cities. For each region or city, percentages on the first row are relative to the estimated number of people with HIV, while those on the second row correspond to UNAIDS' 95-95-95 targets. For 208 individuals diagnosed and linked to care, region of residence was unknown.

	Estimated population with HIV		Diagnosed and linked to care		Retained in care		Antiretroviral therapy		Viral suppression	
	Undiagnosed	Total								
	n	n	n	%	n	%	n	%	n	%
Region										
Noord	100	1,600	1,498	94	1,428	89	1,421	89	1,383	86
	50-260	1,545-1,760		94				95		97
Oost	320	3,150	2,829	90	2,753	87	2,745	87	2,677	85
	230-425	3,060-3,250		90				97		98
Noord-Holland/Flevoland	400	9,555	9,156	96	8,723	91	8,701	91	8,359	87
	315-515	9,475-9,670		96				95		96
Utrecht	60	1,450	1,388	96	1,347	93	1,343	93	1,295	89
	35-115	1,420-1,505		96				97		96
Zuid-Holland Noord	135	1,980	1,845	93	1,780	90	1,766	89	1,706	86
	90-220	1,935-2,065		93				96		97
Zuid-Holland Zuid	310	4,150	3,842	93	3,668	88	3,649	88	3,524	85
	215-445	4,055-4,285		93				95		97
Zeeland/Brabant	235	2,955	2,721	92	2,623	89	2,618	89	2,524	85
	165-325	2,890-3,045		92				96		96
Limburg	85	1,175	1,088	93	1,029	88	1,023	87	997	85
	35-165	1,120-1,255		93				94		97
Total	1,655	26,025	24,367	94	23,351	90	23,266	89	22,465	86
	1,460-1,965	25,830-26,330		94				95		97
City										
Amsterdam	185	6,600	6,411	97	6,116	93	6,100	92	5,883	89
	135-265	6,540-6,675		97				95		96
Rotterdam	200	2,340	2,143	91	2,044	87	2,030	87	1,951	83
	125-285	2,270-2,425		91				95		96
Den Haag	50	1,345	1,295	96	1,253	93	1,243	92	1,195	89
	30-95	1,323-1,390		96				96		97
Utrecht	20	600	579	97	564	94	563	94	541	91
	10-50	590-630		97				97		96
Eindhoven	45	475	430	90	408	86	407	86	395	83
	20-75	450-505		90				95		97
Total	**500**	**11,360**	**10,858**	**96**	**10,385**	**91**	**10,343**	**91**	**9,965**	**88**
	405-620	11,260-11,480		96				95		96

In total, 11,360 (95% CI 11,260-11,480) people with HIV were estimated to be living in the five largest cities in the Netherlands, which amounts to 43% of the total number of people in the country with HIV. Of these 11,360 people, 500 (405-620) were estimated to be undiagnosed (30% of the national estimate of 1,650 individuals with an undiagnosed HIV infection). Of the five cities, Amsterdam had the largest population of people with HIV; an estimated 6,600 (6,545-6,675) individuals, of whom 185 (135-265) were still undiagnosed (*Table 1.6*). Of the 11,360 people with HIV in the five largest cities:

- 10,858 (96%) had been diagnosed and linked to care;
- 10,385 (91%, or 96% of those diagnosed) had started ART; and
- 9,965 (88%, or 96% of those on therapy) had a suppressed viral load below 200 copies/ml.

Most cities had reached or were close to reaching the UNAIDS' 95-95-95 targets for 2025 with the current combined estimate for the cities standing at 96-95-96.

As shown in *Tables 1.6 and 1.7*, some of the regions have relatively small numbers of people with HIV. Estimates of the undiagnosed population are based on observed annual numbers of newly diagnosed HIV infections and on the CD4 count distribution at the time of diagnosis. With an increasingly smaller annual number of diagnoses, estimates become more sensitive to year-on-year fluctuations in newly diagnosed infections. As a result, the relative uncertainty in the estimates becomes larger. In this respect, it is reassuring that the total estimated number of 1,655 (95% CI 1,460-1,965) individuals living with undiagnosed HIV across the eight STI surveillance regions, is reasonably close to the number of 1,650 (1,470-1,900) we have estimated for the total nationwide population.

Table 1.7: *Continuum of HIV care for the total population with HIV-1 in the Netherlands diagnosed and linked to care, stratified by the public health service region in which people were living at the end of 2025. Proportions are given relative to the number of people diagnosed and linked to care.*

	Diagnosed and linked to care	Retained in care		Antiretroviral therapy		Viral suppression	
Public health service region	**n**	**n**	**%**	**n**	**%**	**n**	**%**
Noord							
Groningen	717	683	95	680	95	660	92
Fryslân	431	411	95	407	94	401	93
Drenthe	350	334	95	334	95	322	92
Oost							
IJsselland	421	409	97	408	97	402	95
Twente	503	490	97	488	97	485	96
Noord- en Oost-Gelderland	572	552	97	549	96	538	94
Gelderland Midden	844	825	98	823	98	795	94
Gelderland-Zuid	489	477	98	477	98	457	93
Noord-Holland/Flevoland							
Flevoland	647	615	95	613	95	588	91
Gooi & Vechtstreek	279	269	96	268	96	261	94
Hollands Noorden	487	461	95	459	94	437	90
Zaanstreek-Waterland	435	408	94	408	94	393	90
Amsterdam	6,663	6,357	95	6,340	95	6,114	92
Kennemerland	645	613	95	613	95	566	88
Utrecht							
Regio Utrecht	1,388	1,347	97	1,343	97	1,295	93
Zuid-Holland Noord							
Haaglanden	1,845	1,780	96	1,766	96	1,706	92
Zuid-Holland Zuid							
Hollands Midden	646	617	96	616	95	597	92
Rotterdam-Rijnmond	2,833	2,710	96	2,695	95	2,600	92
Dienst Gezondheid & Jeugd ZHZ	363	341	94	338	93	327	90
Zeeland/Brabant							
Zeeland	265	247	93	246	93	227	86
West-Brabant	633	619	98	618	98	604	95
Hart voor Brabant	1,002	974	97	972	97	936	93
Brabant-Zuidoost	821	783	95	782	95	757	92
Limburg							
Limburg-Noord	468	440	94	437	93	428	91
Zuid Limburg	620	589	95	586	95	569	92
Unknown	208	140	67	139	67	137	66
Total	**24,575**	**23,491**	**96**	**23,405**	**95**	**22,602**	**92**

Trans people

Geographical region of origin

Of the 33,523 individuals with an HIV-1 infection, 503 were trans people: 487 (97%) trans women and 16 (3%) trans men. In this group of 503 individuals, the most commonly-reported regions of origin were South America (205, 41%), the Caribbean (90, 18%), the Netherlands (89, 18%), and south and southeast Asia (45, 9%). Interestingly, many of the trans people originated from only a few specific countries. Among the 205 individuals from South America, there were 57 people from Colombia, 36 from Ecuador, 35 from Brazil, 29 from Venezuela, and 19 from Suriname. Most frequently reported countries of origin in the Caribbean were the former Netherlands Antilles (39) and Cuba (19), while 20 people from south and southeast Asia originated from Thailand.

In total, 168 trans people, or 41% of those born abroad, had a documented HIV-1 diagnosis before moving to the Netherlands. The majority (119, or 71%) of these 168 people had already started ART before arrival. By the time these 119 people entered HIV care in the Netherlands, 85 (71%) had HIV RNA levels below 200 copies/ml.

Diagnosis

In 2023-2025, 50 trans people were newly diagnosed with HIV in the Netherlands. These 50 individuals were relatively young, with a median age of 31 years (IQR 27-37) at the time of their HIV diagnosis, and most of them (41, 82%) were born abroad. Similar to MSM, the majority of the trans individuals, 56%, received their HIV diagnosis at a sexual health centre (*Figure 1.4*). Among the 50 people, 16 had a recent HIV infection at the time of diagnosis, 20 had an established infection (CD4 counts above 350 cells/mm^3), and 12 had a late-stage HIV infection (CD4 counts below 350 cells/mm^3 or AIDS), which was comparable to the distribution across these stages among MSM.

Population in care

In total, 403 (80%) of the 503 trans people with HIV-1 were known to be in clinical care by the end of 2025. Of the 100 people who were not in care anymore, 23 had died, including seven who died of AIDS, while another 30 had moved abroad. The remainder were either lost to care (41), were only diagnosed in 2026 (two), or only entered HIV care in 2026 (four). In total, 24 of the people who moved abroad and 28 of those lost to care had HIV RNA levels below 200 copies/ml at their last viral load measurement.

Clinical condition

The majority of trans people in clinical care (400, or 99%), had started ART by the end of 2025. Of the 394 people in care and on treatment with a viral load measurement in 2025, 376 (95%) had a last measurement in that year below 200 copies/ml. The most recent CD4 count in 2023-2025 of those in care stood at a median of 734 (IQR 550-1060) cells/mm^3, which was comparable to the CD4 counts in the total population in care.

HIV-2

In total, 102 of the 34,752 registered individuals with HIV acquired an HIV-2 infection (12 MSM, 34 other men, and 56 women); 6 of these were diagnosed in 2015 or later. HIV-2 is endemic in West Africa, and 64 people originated from this region, mostly from Ghana (25 people) or Cape Verde (23 people). Twenty-three individuals were born in the Netherlands.

Population in care

By the end of 2025, a total of 56 people were still in clinical care, i.e., they visited their treating physician in 2025, or had a CD4 count or HIV RNA measurement in that year, and were still living in the Netherlands. Of the other 46 individuals, 24 had died, seven had moved abroad, and 15 had no contact with HIV care during that year. The median age of those still in care was 66 years (IQR 58-70); 49 (88%) individuals were 50 years or older. The majority (93%) of those in care had been living with HIV-2 for more than 10 years, while 68% had been living with it for more than 20 years.

Clinical condition

Of the 56 people still in care, 46 had a most recent viral load measurement below 200 copies/ml, and 8 people had no available HIV-2 RNA result in 2025; there were two individuals with a viral load above 200 copies/ml. Most people in care (41, 73%) had started ART. Of the 15 individuals who were still in care but had not started therapy, 11 had a viral load measurement below 200 copies/ml, 1 had a viral load above 200 copies/ml, while the other 3 people had no HIV-2 RNA measurement in 2025. CD4 counts in people in care were a median of 710 (IQR 470-889) cells/mm^3.

Conclusions

The annual number of new HIV diagnoses has been increasing since 2021, with so far 500 new diagnoses recorded for 2025. This increase in HIV diagnoses can, in part, be attributed to a rise in the estimated annual number of newly acquired HIV infections. The increase in the number of diagnoses was most prominent in people born in 1990 or later, including almost half of diagnoses in MSM and approximately 30% in other men and in women. Two in five of all newly diagnosed MSM, and almost half of those born in 1990 or later, have evidence of having acquired their infection at most one year before. Late-stage HIV infection continues to be a concern among other men, women, and people with certain migratory backgrounds, including sub-Saharan Africa, Eastern Europe and Central Asia, and south and southeast Asia.

In 2025, 21% of the new HIV diagnoses among MSM and trans individuals occurred in people who reported prior use of PrEP. This proportion has been increasing over time. People with prior use of PrEP accounted for a large share of the rise in the proportion of individuals diagnosed with a recent HIV infection compared with 2021. These trends underscore the need to enhance PrEP adherence support and regular HIV testing, thus maximising the effectiveness of PrEP programmes. Our data further indicate that there may be missed opportunities in uptake of PrEP. Among MSM diagnosed with a recently acquired HIV infection, 81% had a negative HIV test within a year prior to diagnosis and were likely aware of being at risk of acquiring HIV.

Apart from the 500 new HIV diagnoses in 2025, there were 260 people born abroad who arrived in the Netherlands in 2025 and had a documented HIV-1 diagnosis prior to arrival. The large majority of this group had already started antiretroviral therapy before arriving in the Netherlands and had a suppressed viral load. This highlights the importance of cross-border continuity of care, to ensure seamless integration into the Dutch healthcare system for migrants with HIV, and to reach national and international HIV elimination goals.

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2. Prior use of pre-exposure prophylaxis

Ferdinand Wit, Elske Hoornenborg, Fleur van Aar, Eline Op de Coul, Marc van der Valk

Summary

The proportion of men who have sex with men (MSM) and transgender (TG) persons newly diagnosed with HIV in the Netherlands for whom information is recorded in their electronic medical records about use of PrEP prior to being diagnosed with HIV continues to increase and has reached 71.7% in 2025. The number and proportion of MSM and TG people newly diagnosed with HIV in the Netherlands who reported prior use of PrEP continued to increase from 7.3% (20 of 275 individuals) in 2020 to 20.8% (55 of 265 individuals) in 2025.

For 407 MSM and transgender people there was information available why they did not use PrEP: 38.6% of these individuals had indicated they would have wanted to do so, but either had no access to PrEP (18.2%), were on a PrEP waiting list when they tested HIV positive (3.7%), or tested HIV positive during screening for HIV before initiating PrEP (16.7%). A further 16.7% of MSM and TG people indicated they did not know that PrEP existed. These proportions were fairly stable over time.

Of the 222 individuals who had used PrEP prior to their HIV diagnosis in the Netherlands, 205 had used PrEP while living in the Netherlands, and 17 prior to migrating to the Netherlands. Of these 205 individuals who had used PrEP in the Netherlands, 23 (11.2%) had obtained PrEP through informal means, and 27 (13.2%, most of whom obtained PrEP through informal means) did not receive medical check-ups during PrEP-use.

Of the 205 individuals who reported prior use of PrEP while living in the Netherlands, 172 received a genotypic resistance test prior to initiation of antiretroviral therapy (ART), showing that 16 (9.3%) of them harboured resistance-associated mutations (RAMs) in the reverse transcriptase (RT) gene that are associated with the use of PrEP. All individuals in whom PrEP-associated RAMs had been detected, were still using PrEP at the moment they tested positive for HIV, or had discontinued PrEP only a few months earlier. When limiting this analysis to 83 individuals who had tested HIV-positive while still using PrEP or within 3 months of discontinuing PrEP, 14 (16.9%) harboured PrEP-associated RAMs. Reassuringly, the virological treatment response after initiation of ART appears to be largely unaffected by the prior use of PrEP, also in those individuals where PrEP-associated RT RAMs had been detected.

Aims

Pre-exposure prophylaxis (PrEP) is the use of antiretroviral drugs by people without HIV, to prevent HIV acquisition. In the Netherlands, individuals at high risk of HIV acquisition are eligible for PrEP care at the Sexual Health Centers (SHC) of the municipal Public Health Services (GGD), via a national programme from 2019 to 2024, followed by a structural care provision. General practitioners can also voluntary prescribe PrEP, but this is not included in standard primary care services. The primary target groups are men who have sex with men (MSM) and transgender (TG) persons. Prior to this national programme, PrEP use prescribed by other healthcare providers (mainly general practitioners) or accessed via informal routes like buyers' clubs, was monitored through demonstration programmes such as the AMPrEP study in Amsterdam.

In this section we describe time trends in the proportion of MSM and transgender persons, who constitute the main target populations for PrEP in the Netherlands, aged 15 years and older who were newly diagnosed with HIV-1 in the Netherlands and who reported prior use of PrEP at the time of entry into HIV care in the Netherlands. We compared demographic and other characteristics of MSM and transgender persons who reported prior use of PrEP with those who did not.

Among MSM and transgender persons who did not report prior use of PrEP, we investigated their reasons and barriers for not having used PrEP.

Among MSM and transgender persons who did report prior use of PrEP, we evaluated if HIV acquisition occurred while using PrEP or after discontinuation. Furthermore, we report on acquired HIV drug resistance as a potential consequence of acquiring HIV while still using PrEP, and we investigate possible impairment of the initial treatment response on first-line ART in this group.

Data collection

SHM collects data on prior use of PrEP in all people diagnosed with HIV who have entered care in one of the 24 Dutch HIV treatment centers since 1 January 2018. SHM has prospectively collected PrEP-related data from the electronic medical records (EMRs) of individuals with HIV first entering care, since July 2019. This is done in consultation and collaboration with the Dutch Association of HIV-Treating Physicians (Nederlandse Vereniging van HIV Behandelaren, NVHB), and the Dutch Nurses Association's HIV/AIDS nurse consultants unit ('Verpleegkundigen & Verzorgenden Nederland – Verpleegkundig Consulenten Hiv', V&VN VCH).

The population of interest for this report consists of the primary target groups for PrEP in the Netherlands: MSM and transgender men and women. In this report, cisgender men were classified as MSM when the recorded mode of HIV acquisition was 'sexual contact with other men' or 'sexual contact with men and women'. Whenever cisgender men had another or unknown mode of HIV acquisition recorded but were known to have male sex partners, they were also included in the MSM group. Because the national PrEP programme was first operational for a full calendar year in 2020, all analyses start from that year.

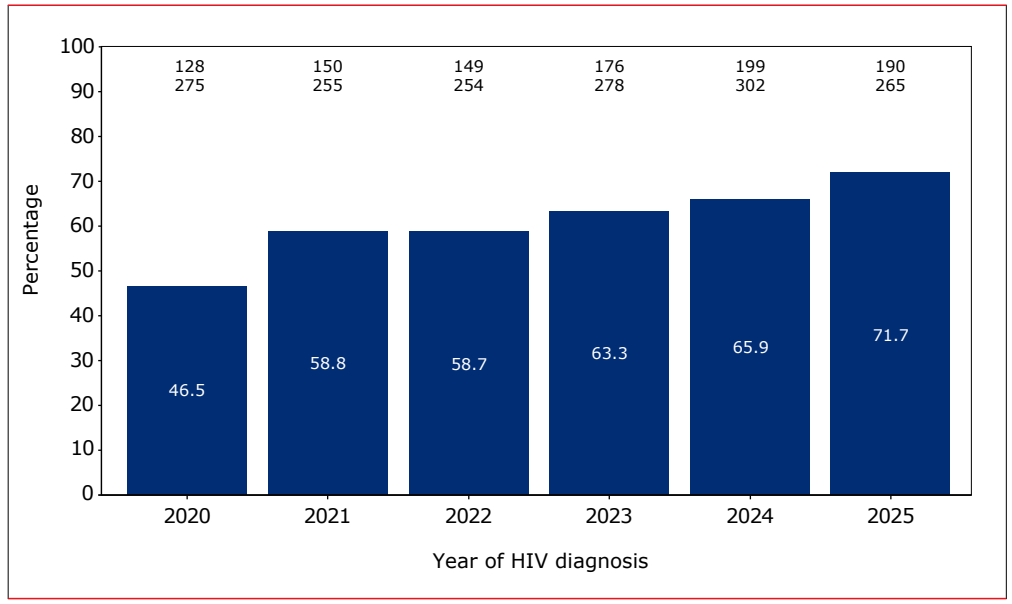
A substantial proportion of individuals entering HIV care in the Netherlands, were not born in the Netherlands, and some of them were already diagnosed with HIV before migrating to the Netherlands. Furthermore, some had used PrEP prior to migrating to the Netherlands, while others used PrEP while living in the Netherlands. When appropriate, the analyses take these factors into account.

Of note, SHM does not record data about a person's race / ethnicity, nor can we identify second or third generation migrants. In our analyses, we make a distinction between those who are born in the Netherlands and those born in another country, irrespective of race / ethnicity and migrant status of their (grand)parents.

Population of interest

Between 1 January 2020 and 31 December 2025 1,629 individuals (1,534 MSM and 95 TG persons aged 15 years and older were diagnosed with HIV-1 in the Netherlands and entered into HIV care. In the EMR of 992 (60.9%) individuals, information was recorded on prior use of PrEP. The proportion of individuals for whom this information was available in the EMR increased from 46.6% in 2020, to 71.7% in 2025 (*Figure 2.1*).

Figure 2.1: Number and proportion of MSM and TG individuals diagnosed with HIV in the Netherlands per calendar year for whom information on prior use of PrEP is available.



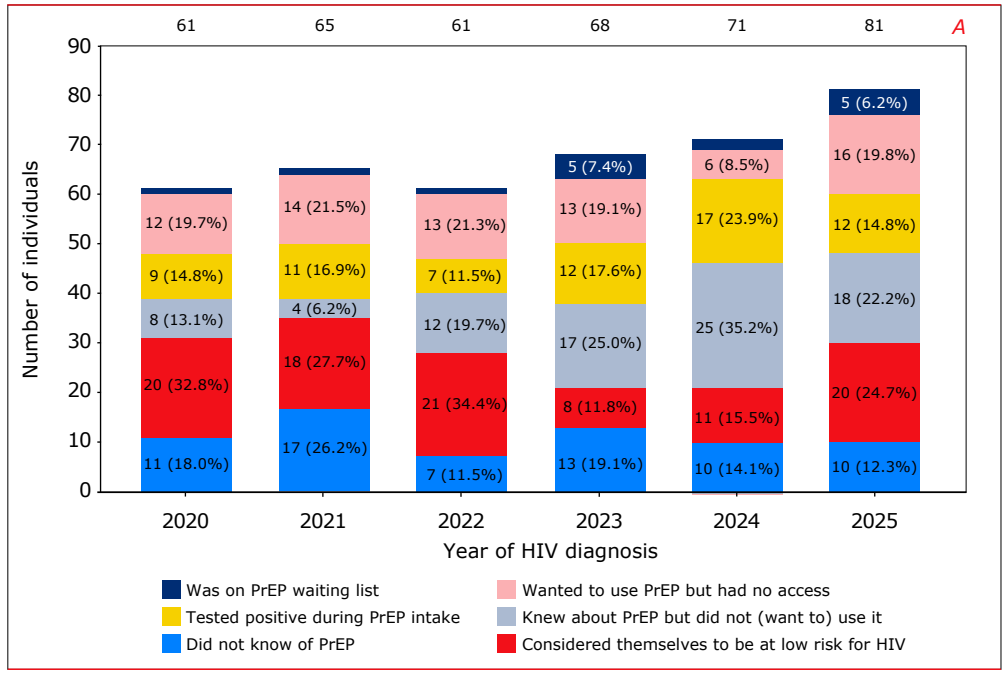
Legend: *The numbers in the top line are the number of MSM and TG individuals for whom information on prior use of PrEP is available in their electronic medical records. The second line is the total cohort size of each calendar year.*

PrEP awareness and uptake

For 407 (52.9%) of the 770 MSM and transgender people who reported no prior PrEP use and who had been newly diagnosed with HIV in the Netherlands, information was available on their reasons for not using PrEP. 'Presumed to be at low risk for HIV' (24.1%), 'Knew about PrEP but did not (want to) use it' (20.6%), and 'Wanted to use PrEP but had no access' (18.2%), were the most commonly reported reasons. In total, 68 (16.7%) individuals had wanted to start using PrEP but tested positive for HIV at screening before entry into PrEP care. Fifteen individuals (3.7%) reported that they tested HIV positive while on a PrEP programme waiting list.
Of the 68 individuals who reported they tested positive for HIV at screening before entry into PrEP care, 32 (47.1%) had evidence of a recent infection. Of the 15 individuals who reported they tested positive for HIV while on a waiting list for PrEP care, 9 (60.0%) had evidence of a recent infection.

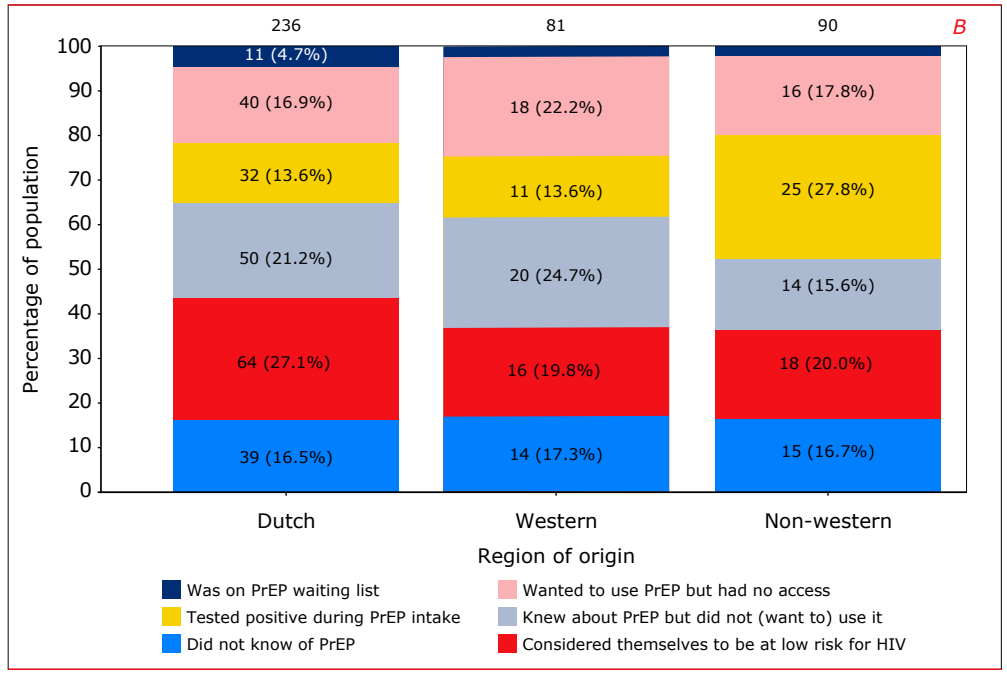
We compared the reasons for not having used PrEP between people born in the Netherlands, and those originating from western or non-western countries (*Figure 2.2B*). People born in the Netherlands most frequently reported 'Presumed to be at low risk for HIV'. People born in non-western countries most often reported 'Not knowing PrEP existed'.

Figure 2.2A: Time trends in the reported reasons for not having used PrEP in MSM and transgender persons newly diagnosed with HIV in the Netherlands.



***Legend:** The numbers in the top line are the total number of MSM and transgender persons per calendar year for whom the reason was known why they had not used PrEP.*

Figure 2.2B: Reported reasons for not having used PrEP in MSM and transgender persons newly diagnosed with HIV in the Netherlands, stratified by region of birth.



***Legend:** The numbers in the top line are the total number of people born in the Netherlands, in western countries, and in non-western countries for whom the reason was known why they had not used PrEP.*

Prior use of PrEP

Of the 992 MSM and TG individuals for whom information on prior use of PrEP was available in the EMR, the majority (770, 77.6%) reported no prior use, whereas 222 (22.4%) reported having used PrEP previously (*Table* 2.1).

Table 2.1: Comparison of individuals with and without prior use of PrEP.

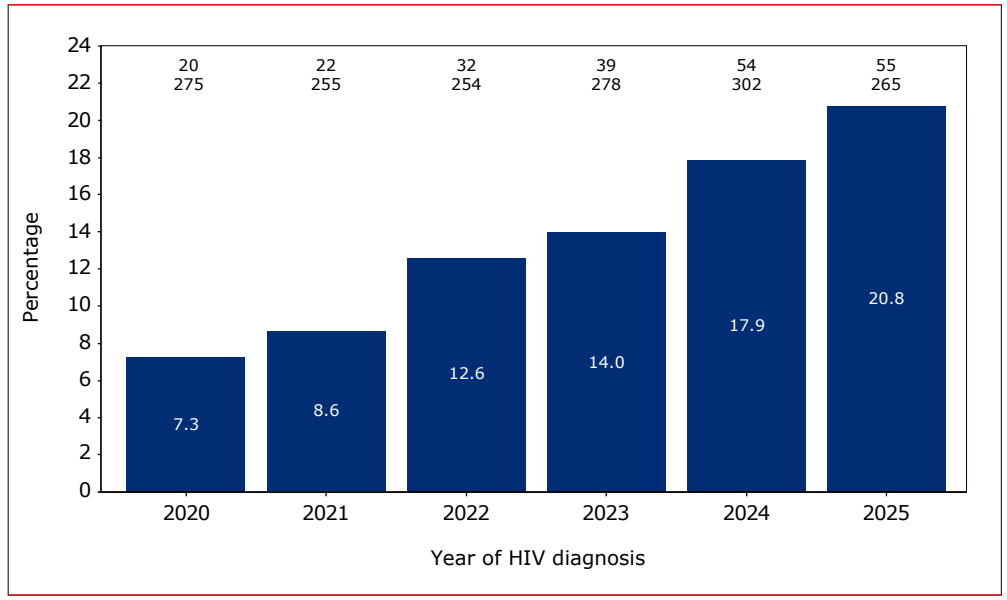
	Prior use of PrEP	No prior PrEP use	No info on prior PrEP use	p-value
Number of subjects	222 (13.6%)	770 (47.3%)	637 (39.1%)	
Age,median (IQR)	32.9 (27.9-43.7)	36.7 (28.5-50.2)	37.1 (28.9-51.1)	<.001
HIV acquisition group				0.423
MSM	207 (93.2%)	731 (94.9%)	596 (93.6%)	
Transgender people	15 (6.8%)	39 (5.1%)	41 (6.4%)	
Region of birth				0.141
Born in the Netherlands	104 (46.8%)	433 (56.2%)	348 (54.6%)	
Migrant, western background	54 (24.3%)	159 (20.6%)	127 (19.9%)	
Migrant, non-western background	64 (28.8%)	178 (23.1%)	162 (25.4%)	
Recent HIV acquisition				
tested pos. <365 days after last neg. test	157 (70.7%)	223 (29.0%)	115 (18.1%)	<.001
tested pos. <180 days after last neg. test	103 (46.4%)	126 (16.4%)	63 (9.9%)	<.001
CD4 at HIV diagnosis	538 (380-697)	440 (260-620)	350 (170-537)	<.001
Late presenter (CD4<350)	45 (20.5%)	283 (36.8%)	314 (49.6%)	<.001
Very late presenter (CD4<200 or AIDS)	17 (7.7%)	148 (19.2%)	198 (31.1%)	<.001
Reason known for not having used PrEP		407 (52.9%)		
Reasons for not having used PrEP				
Did not know of PrEP		68 (16.7%)		
Presumed to be at low risk for HIV		98 (24.1%)		
Knew PrEP but did not want to use it		84 (20.6%)		
Tested positive at PrEP intake		68 (16.7%)		
Wanted PrEP but had no access		74 (18.2%)		
Was on PrEP waiting list		15 (3.7%)		

***Legend:** target group = MSM and transgender people; n.a. = not applicable.*

Of the 222 people who reported prior use of PrEP, 207 were MSM and 15 transgender persons. 104 (46.8%) were born in the Netherlands, 54 (24.3%) came from Western and 64 (28.8%) from non-Western countries. Individuals who reported prior use of PrEP were younger and had higher CD4 counts at diagnosis compared to those diagnosed in the Netherlands who did not use PrEP.

We calculated percentages of prior PrEP use of all 1,629 MSM and transgender people who were newly diagnosed with HIV in the Netherlands between 2020 and 2025. We conservatively assumed that when no explicit mention was made in the EMR about prior use of PrEP, the individuals had not used it. The percentage of MSM and transgender people newly diagnosed with HIV in the Netherlands for whom prior PrEP use was recorded in the EMR has increased since 2020 (P_{trend}<0.0001, see *Figure 2.3*), with 7.3% in 2020, 8.6% in 2021, 12.6% in 2022, 14.0% in 2023, 17.9% in 2024 and 20.8% in 2025.

Figure 2.3: *Time trends in the number and proportion of MSM and TG people newly diagnosed with HIV in the Netherlands who reported prior use of PrEP.*



Legend: *The numbers in the top line are the number of people who reported prior use of PrEP. The numbers in the second line are the cohort size of that calendar year.*

Access to PrEP and usage patterns

The characteristics of all 222 individuals who reported prior use of PrEP are shown in *Table 2.2*, with a stratification by those who used PrEP in the Netherlands and those who used it while still living abroad. Migrants who initiated PrEP before they migrated to the Netherlands but continued PrEP after they migrated to the Netherlands are included in the former group.

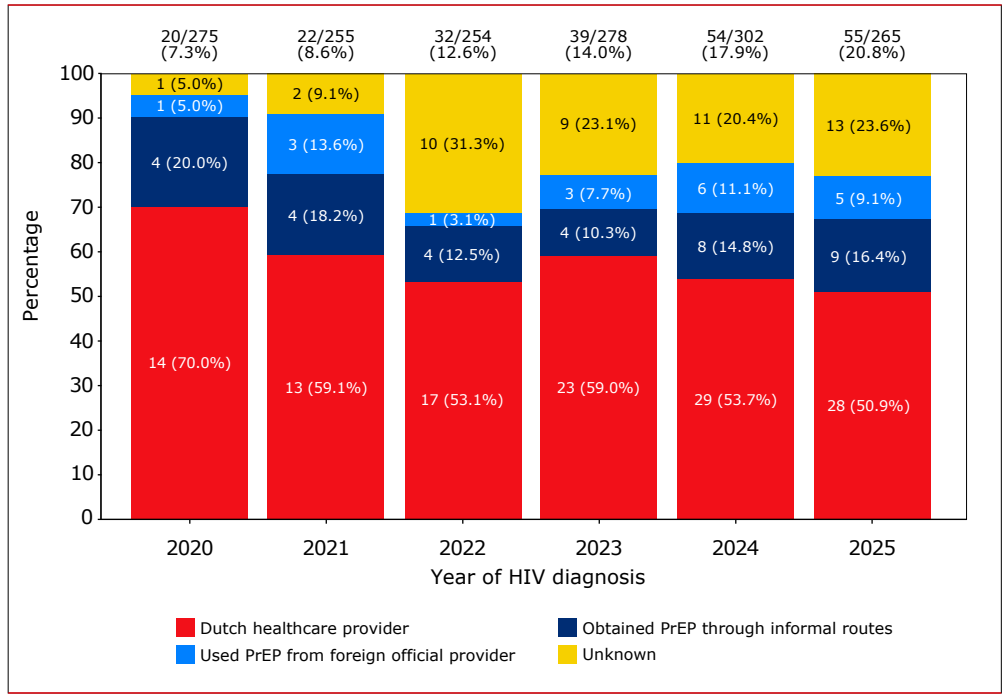
Of the 222 individuals who reported prior PrEP use, 17 (7.7%) were migrants who had used PrEP before moving to the Netherlands. The remaining 205 individuals had used PrEP in the Netherlands, among them 7 had started PrEP prior to migration but continued using it after they arrived in the Netherlands. In the remainder of this chapter we will report on these 205 individuals who used PrEP while living in the Netherlands.

Of the 205 individuals who had used PrEP in the Netherlands, 124 (60.5%) obtained it from a healthcare provider in the Netherlands (see *Table 2.2*). The remaining individuals for whom this information was recorded, obtained their PrEP: through informal routes like buyers' club/internet/store outside the Netherlands (23); from a healthcare provider outside the Netherlands (7); or from a friend living with HIV who had donated some of their own antiretroviral medication (4). There was no information available about the PrEP provider for the remaining 47 individuals.

Dosage schedule information was available for 132 of 205 individuals: 93 (45.4%) reported on-demand use, 36 (17.6%) reported daily use, and 3 (1.5%) reported having used PrEP less than a week. For the remaining 73 individuals (35.6%), no dosage schedule information was available.

Of the 205 individuals who had used PrEP in the Netherlands, 115 (56.1%) had regular medical check-ups, 27 (13.2%) reported that they did not have any medical check-ups, and there was no information available for the remaining 63 (30.7%) individuals. Most of the 27 individuals who reported they had received no medical check-ups had obtained PrEP via informal means (n=15, 55.7%), only 6 (22.2%) of them had received PrEP from a healthcare provider in the Netherlands. *Figure 2.4* shows the time trends in the PrEP providers of the MSM and transgender people who had used PrEP.

Figure 2.4: Time trends in the number and proportion of MSM and transgender people newly diagnosed with HIV in the Netherlands reporting prior use of PrEP, stratified by PrEP provider.



The median (IQR) number of days between the last dose of PrEP and testing HIV-positive was calculated only for those individuals for whom the relevant dates were known with sufficient precision (to within a month), and was 32 (0-165) days. A total of 47 (22.9%) individuals tested HIV-positive while still using PrEP. Of the 158 individuals who did not test HIV-positive while taking PrEP, 64 reported having tested HIV-seronegative after their last use of PrEP, while 66 reported that they did not have an HIV-test shortly after discontinuing PrEP. There was no information available for the remaining 28 individuals.

Table 2.2: Characteristics of MSM and TG individuals who reported prior use of PrEP.

	PrEP used in the Netherlands	PrEP used abroad	p-value
Number of subjects	205 (92.3%)	17 (7.7%)	
Age	32.7 (27.9-43.7)	34.1 (29.5-39)	0.878
HIV acquisition group			0.322
MSM	192 (93.7%)	15 (88.2%)	
Transgender people	13 (6.3%)	2 (11.8%)	
Region of birth			<.001
Born in the Netherlands	104 (50.7%)	0 (0.0%)	
Migrant, western background	50 (24.4%)	4 (23.5%)	
Migrant, non-western background	51 (24.9%)	13 (76.5%)	
STD diagnosed at entry into care			
HBV (HBV surface antigen positive)	2 (1.0%)	1 (5.9%)	0.092
HBV (HBV core antibody positive)	29 (14.1%)	3 (17.6%)	0.693
HCV (antibody positive)	4 (2.0%)	2 (11.8%)	0.016
Syphilis (RPR/VDRL positive)	70 (34.1%)	6 (35.3%)	0.924
PrEP started before migrating to the Netherlands	7 (3.4%)	17 (100%)	
PrEP provider			<.001
Provider in the Netherlands	124 (60.5%)	0 (0.0%)	
Provider outside of the Netherlands	7 (3.4%)	8 (47.1%)	
Obtained PrEP through informal routes	23 (11.2%)	4 (23.5%)	
From friend living with HIV	4 (2.0%)	1 (5.9%)	
No information	47 (22.9%)	4 (23.5%)	
Seroconversion during PrEP use			
Tested HIV-positive while on PrEP	47 (22.9%)	0 (0.0%)	
HIV-negative test performed after last dose of PrEP	64 (31.2%)	4 (23.5%)	
No HIV-negative test performed after last dose of PrEP	66 (32.2%)	12 (70.6%)	
Unknown if HIV test was performed after last dose of PrEP	28 (13.7%)	1 (5.9%)	
Days between last PrEP use and testing HIV-positive **	32 (0-165)	306 (97-536)	0.001
Recent HIV acquisition			
tested pos. <365 days after last neg. test	152 (74.1%)	5 (29.4%)	<.001
tested pos. <180 days after last neg. test	102 (49.8%)	1 (5.9%)	<.001
CD4 at HIV diagnosis	540 (382-708)	472 (340-592)	0.239
ARVs used for PrEP			0.220
TDF/FTC	101 (49.3%)	7 (41.2%)	
Genvoya	0 (0.0%)	1 (5.9%)	
Dolutegravir	1 (0.5%)	0 (0.0%)	
Unspecified	102 (49.8%)	9 (52.9%)	

	PrEP used in the Netherlands	PrEP used abroad	p-value
PrEP schedule			0.075
On demand	93 (45.4%)	3 (17.6%)	
Daily	36 (17.6%)	6 (35.3%)	
No data	73 (35.6%)	8 (47.1%)	
Used PrEP <1 week	3 (1.5%)	0 (0.0%)	
Duration of PrEP use (days)	182 (30-459)	180 (15-304)	0.984
Routine medical check-ups while on PrEP			0.001
Dutch healthcare provider	115 (56.1%)	3 (17.6%)	
No medical check-ups	27 (13.2%)	2 (11.8%)	
No data	63 (30.7%)	12 (70.6%)	
Resistance test performed after testing HIV-positive	**172 (83.9%)**	**9 (52.9%)**	**0.002**
Resistance mutations documented	**16 (9.3%)**	**1 (11.1%)**	**0.856**
Resistance associated mutations in RT			
M184VI	14 (8.1%)	1 (11.1%)	
K65R	4 (2.3%)	0 (0.0%)	
K70EG	0 (0.0%)	0 (0.0%)	

Legend: ** Calculated for migrants only; ** Zero days means person was diagnosed with HIV during PrEP use*
STI sexually transmitted infection.

Prior use of PrEP and HIV drug resistance

Genotypic resistance tests were performed in 172 (83.9%) of the 205 individuals who reported having used PrEP in the Netherlands when first entering HIV care. Reverse transcriptase (RT) resistance-associated mutations (RAM)[a], associated with the use of PrEP, were detected in 16 individuals (9.3%). Fourteen individuals harboured an M184VI RT RAM, which reduces susceptibility to lamivudine and emtricitabine, and 4 individuals harboured a K65REN RT RAM (2 K65R and another 2 K65N), which is selected for by tenofovir and reduces susceptibility to tenofovir, abacavir, lamivudine and emtricitabine. Two of these 16 individuals harboured both the M184V and K65R mutations. Because M184V and K65R carry a fitness cost and are quickly overgrown by faster-replicating wild-type virus once drug pressure is removed, finding either mutation in someone still on TDF/FTC PrEP is more consistent with de novo selection than with transmitted resistance.

a All RT RAMs mentioned in this chapter start and end with capital letters; i.e. M184VI ends in the capital letter 'i' and should not be confused with the number 1.

Among the 96 individuals who had tested HIV-positive while still using PrEP or within 3 months of discontinuing PrEP, 83 (86.5%) had received a genotypic resistance test, and 14 of these 83 (16.9%) harboured PrEP-associated RAMs.
In the 17 individuals who had used PrEP prior to migrating to the Netherlands, 9 had genotypic resistance test results available. Of these, 1 showed M184VI RT resistance-associated mutations.

For ease of comparing individuals with and without detected RAMs and those not tested, we provide Appendix *Table 2.1*, which contains the same data as *Table 2.2* but stratified by presence of RAMs.

Prior use of PrEP and response to antiretroviral therapy (ART)

We investigated the virological treatment response to first-line antiretroviral therapy in 218 individuals who reported prior use of PrEP, were diagnosed with HIV in the Netherlands, and subsequently initiated ART. Data on at least 4 months of virological treatment response were available for 215 of these 218 individuals, including 16 of 17 individuals with M184VI and/or K65REN RT RAMs, all of whom started a regimen containing an integrase inhibitor. Nine of these 16 individuals with baseline RAMs received a combination of an integrase inhibitor and a protease inhibitor, with or without additional nucleoside-analogue RT inhibitors (NRTIs). And 1 individuals combined and integrase inhibitor with a non-nucleoside RT inhibitor (NNRTI).

Of the individuals with either no baseline resistance test results, or whose test showed no evidence of the M184VI or K65R RT RAM, 202 initiated a first-line regimen consisting of:

- an integrase inhibitor plus two NRTIs (n=133)
- a protease inhibitor plus two NRTIs (n=1)
- an integrase inhibitor plus a protease inhibitor, with or without additional NRTIs (n=45)
- an integrase inhibitor plus a non-nucleoside RT inhibitor (n=1)
- a non-nucleoside RT inhibitor plus two NRTIs (n=12)
- lamivudine / dolutegravir (n=10)

The 16 individuals with an RT RAM had a median follow-up time of 164 weeks (IQR 72-223) after initiating ART. All 16 individuals with RAMs achieved an optimal treatment response with sustained viral suppression below 200 copies/ml after initiating cART.

Of the 202 individuals with no evidence of RAMs in the baseline resistance test, or for whom no test data were available, and with one or more viral load measurements available at least four months after the initiation of ART, 21 individuals showed a viral rebound (defined as having a viral load measurement above 200 copies/ml following an initial treatment response) was recorded, mostly because of treatment interruptions and/or they spontaneously re-suppressed without a change of the regimen. In two individuals virological failure occurred: both were switched to a second line regimen after which the viral load durably re-suppressed.

Summary and Conclusions

The number and proportion of newly diagnosed MSM and transgender individuals entering HIV care who reported prior use of PrEP has continued to rise over time. In 2025, 20.8% (n=55) of newly diagnosed MSM and transgender people reported prior use of PrEP (see also Chapter 1). However, this is probably a conservative estimate, as individuals for whom no explicit information about prior PrEP use was recorded in their EMR were considered not to have used PrEP. The observed increase over time is likely only partly explained by greater awareness or improved documentation by health care providers, suggesting a true rise in PrEP use among this population. The total number of people who use PrEP in the Netherlands is increasing, both through SHCs and via general practitioners, thereby contributing to more reports of prior PrEP use among people diagnosed with HIV.

The group of individuals who reported prior PrEP use is highly heterogeneous. Of the 222 individuals who reported prior PrEP use, 17 (7.7%) were migrants who had used PrEP before moving to the Netherlands. Among the 205 individuals who used PrEP in the Netherlands, 124 (60.5%) obtained it from a healthcare provider in the Netherlands, while others accesses PrEP through informal channels or from providers abroad.

Of the 205 MSM and TG individuals who had used PrEP in the Netherlands, 47 (22.9%) were diagnosed with HIV while still using PrEP. Of the 205 individuals who reported prior use of PrEP, 172 (83.9%) received a genotypic resistance test prior to initiation of ART, of which 16 (9.3%) were found to harbour resistance mutations that were probably associated with continued PrEP use after seroconversion. Reassuringly, the virological response to ART initiation appeared to be largely unaffected by prior PrEP use, even in those with detected resistance associated mutations; almost all achieved and maintained viral suppression after starting ART.

A substantial proportion (38.6%) of MSM and transgender people who reported not using PrEP, and for whom information on reasons was available, indicated they would have wanted to use PrEP, but either had no access to PrEP (18.2%), were on a PrEP waiting list at the time when they tested HIV positive (3.7%), or tested HIV positive during screening process before initiating PrEP (16.7%). HIV screening during the intake for PrEP care contributes to earlier detection of HIV.

These findings highlight the importance of improving access to PrEP and ensuring timely initiation for those at risk, as well as the continued need for education, monitoring, and support for individuals using PrEP—both to prevent HIV acquisition and to manage potential drug resistance if HIV infection occurs during PrEP use.

Appendix Table 2.1: *characteristics of individuals who reported use of PrEP, stratified by presence of resistance associated mutations.*

	RAMs detected	No RAMs detected	Not tested, no data	p-value
Number of subjects	17 (7.7%)	164 (73.9%)	41 (18.5%)	
Age	30.9 (27.1-50)	32.4 (27.5-42.1)	34.3 (30.9-46.6)	0.326
HIV acquisition group				0.801
MSM	17 (100%)	152 (92.7%)	38 (92.7%)	
Transgender people	0 (0.0%)	12 (7.3%)	3 (7.3%)	
Region of birth				0.340
Born in the Netherlands	10 (58.8%)	80 (48.8%)	14 (34.1%)	
Migrant, western background	4 (23.5%)	39 (23.8%)	11 (26.8%)	
Migrant, non-western background	3 (17.6%)	45 (27.4%)	16 (39.0%)	
STD diagnosed at entry into care				
HBV (HBV surface antigen positive)	0 (0.0%)	3 (1.8%)	0 (0.0%)	0.584
HBV (HBV core antibody positive)	2 (11.8%)	27 (16.5%)	3 (7.3%)	0.312
HCV (antibody positive)	0 (0.0%)	5 (3.0%)	1 (2.4%)	0.757
Syphilis (RPR/VDRL positive)	5 (29.4%)	56 (34.1%)	15 (36.6%)	0.871
PrEP started before migrating to the Netherlands	1 (5.9%)	14 (8.5%)	9 (22.0%)	
PrEP provider				0.180
Provider in the Netherlands	14 (82.4%)	93 (56.7%)	17 (41.5%)	
Provider outside of the Netherlands	0 (0.0%)	11 (6.7%)	4 (9.8%)	
Obtained PrEP through informal routes	2 (11.8%)	20 (12.2%)	5 (12.2%)	
From friend living with HIV	0 (0.0%)	4 (2.4%)	1 (2.4%)	
No info	1 (5.9%)	36 (22.0%)	14 (34.1%)	
Seroconversion during PrEP use				
Tested HIV-positive while on PrEP	11 (64.7%)	29 (17.7%)	7 (17.1%)	<.001
HIV-testing following end of PrEP				<.001
HIV-negative test performed after last dose of PrEP	5 (83.3%)	54 (40.0%)	9 (26.5%)	
No HIV-negative test performed after last dose of PrEP	0 (0.0%)	60 (44.4%)	18 (52.9%)	
Unknown if HIV test was performed after last dose of PrEP	1 (16.7%)	21 (15.6%)	7 (20.6%)	
Days between last PrEP use and testing HIV-positive **	0 (0- 2)	56 (3.5-184)	70 (0-306)	0.002
Recent HIV acquisition				
tested pos. <365 days after last neg. test	13 (76.5%)	117 (71.3%)	27 (65.9%)	0.680
tested pos. <180 days after last neg. test	12 (70.6%)	74 (45.1%)	17 (41.5%)	0.105
CD4 at HIV diagnosis	618 (472-708)	511 (370-667)	591 (370-740)	0.343
ARVs used for PrEP				0.034
TDF/FTC	13 (76.5%)	81 (49.4%)	14 (34.1%)	
Genvoya	0 (0.0%)	0 (0.0%)	1 (2.4%)	
Dolutegravir	0 (0.0%)	0 (0.0%)	1 (2.4%)	
Unspecified	4 (23.5%)	82 (50.0%)	25 (61.0%)	
PrEP schedule				<.001
On demand	8 (47.1%)	74 (45.1%)	12 (29.3%)	
Daily	7 (41.2%)	31 (18.9%)	4 (9.8%)	
No data	0 (0.0%)	54 (32.9%)	25 (61.0%)	
Used PrEP <1 week	0 (0.0%)	3 (1.8%)	0 (0.0%)	
Duration of PrEP use (days)	92 (30-191)	190 (36-471)	124 (15-509)	0.752
Routine medical check-ups while on PrEP				0.288
Dutch health care provider	12 (70.6%)	89 (54.3%)	17 (41.5%)	
No medical check-ups	1 (5.9%)	23 (14.0%)	5 (12.2%)	
No data	4 (23.5%)	52 (31.7%)	19 (46.3%)	
Resistance test performed after testing HIV-positive	17 (100%)	164 (100%)	0 (0.0%)	<.001
Resistance associated mutations in RT				
Resistance mutations documented	17 (100%)	0 (0.0%)		<.001
M184VI	15 (88.2%)	0 (0.0%)		
K65R	4 (23.5%)	0 (0.0%)		
K70EG	0 (0.0%)	0 (0.0%)		

3. Antiretroviral therapy

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Summary

Starting ART and the initial regimen

- Between 2016 and 2025, 6,484 newly diagnosed individuals aged 15 years and older entered into HIV care in the Netherlands and initiated first-line ART.
- Since 2015, guidelines have recommended starting ART as soon as possible after HIV diagnosis, irrespective of CD4 count. In line with this, the median time from diagnosis to ART initiation has continued to fall, reaching 15 (IQR 8–26) days in 2025. The median time between entry into care in an HIV treatment centre and start of ART in 2025 was 8 (IQR 3-14) days.
- Between 2016 and 2021 there was a slowly decreasing trend in the CD4 count at ART initiation. However, since 2022 the CD4 count at the start of ART has slightly risen again. In 2025, 25.3% of individuals initiating ART had a CD4 count below 200 cells/mm^3, and another 20.2% had a CD4 count between 200 and <350 cells/mm^3. Immunological recovery (i.e. reaching a CD4 count of ≥500 cells/mm^3) was faster and more frequent when ART was started at a higher baseline CD4 count.
- In 2025, 85.3% of initial regimens contained an integrase inhibitor in combination with one or two nucleoside-analogue RT inhibitors (87.8% when including other integrase inhibitor-containing regimens). In 2025, the most frequently used initial regimens were TDF/FTC/DTG (39.5%), TAF/FTC/BIC (33.3%), 3TC/DTG (7.2%), and TDF/3TC/DOR (10.4%).

In care and receiving ART

- The number of people on ART and in active follow-up in the cohort grew from 18,972 individuals in 2016 to 23,094 individuals in 2025.
- In 2025, the vast majority (90.6%) of individuals received a regimen based on one or two nucleoside-analogue reverse transcriptase inhibitors (NRTIs), combined with an integrase inhibitor (59.0%), a non-nucleoside reverse transcriptase inhibitor (24.4%) or a protease inhibitor (7.2%).
- Long-acting injectables (cabotegravir/rilpivirine) were used by 3.8%.
- The population had been diagnosed with HIV a median of 15.4 (IQR 9.3-21.7) years ago, and started their first-line ART regimen a median of 13.3 (IQR 8.5-19.2) years ago.
- Their last measured viral load was <50 c/ml in 95.3% (<200 c/ml in 97.9%), and 80.4% had a last measured CD4 count of 500 cells/mm^3 or higher.
- ART regimens were modified often, with the most common reasons for regimen modification being (mostly mild) toxicity (17.6%), treatment simplification (16.5%), patient decision/compliance (7.2%), and preventive modifications (6.7%). In only 1,078 (1.4%) regimen changes the reported reason for modification was virological treatment failure. The rate of ART regimen modifications continued to decrease over time from a peak of 336.2 modifications per 1,000 person years of follow-up in 2016 to 139.6 in 2025.
- The proportion of the treated population that at any moment temporarily interrupted ART continued to decrease, from 1.9% in 2016 to 0.7% in 2025, likely reflecting the improved ease of use and tolerability of modern ART regimens.
- In 2,577 individuals a total of 4,203 treatment interruptions of 14 days or longer were recorded between 2016 and 2025. The median duration of the recorded treatment interruptions was 12.3 (IQR 4.6-30.9) weeks. Many long interruptions constituted temporary disengagement from care. During longer treatment interruptions the CD4 count often dropped substantially, and such interruptions were strongly associated with death due to advanced HIV/AIDS. Women and people with a non-Western migration background were overrepresented among individuals in whom treatment interruptions were recorded.

Virological and immunological outcomes

- Virological suppression improved further over the decade: among individuals on ART for more than 6 months, the proportion with a viral load <50 c/ml rose from 93.1% in 2016 to 95.1% in 2025 (97.5% <200 c/ml).
- Sustained low-level viraemia was uncommon: 76.3% of individuals never had a viral load between 50-199 c/ml, and only 2.1% had more than 20% of their measurements in this range.
- Loss of viral suppression (≥200 c/ml) occurred in two settings: during treatment interruptions (2,084 episodes) and while ART was continued (4,569 episodes). Most episodes resolved (90.5% and 92.3%, respectively), but a minority ended in death, with advanced HIV/AIDS-defining conditions as the predominant cause, which is a markedly higher proportion than in the overall population in care.
- Emergence of drug resistance was more likely with higher and more sustained viraemia: a genotypic resistance test was performed in 25.9% of episodes, and an increased resistance score was detected in 34.0% of those tested, rising with both the maximum viral load and the number of consecutive measurements >200 c/ml.
- Immunological recovery continued: the proportion of people on ART with a normalised CD4 count (≥500 cells/mm^3) rose from 73.7% in 2016 to 80.4% in 2025, while the proportion below 350 cells/mm^3 fell from 10.4% to 7.3%.
- Recovery depended strongly on the CD4 count at ART initiation: five years after starting ART, only 11.7% of those who began with a CD4 count below 50 cells/mm^3, and 3.4% of those beginning at 50-199 cells/mm^3, still had a CD4 count below 200 cells/mm^3.

Introduction

The primary goals of antiretroviral therapy (ART) are to prevent HIV disease progression, improve clinical outcomes, and prevent HIV transmission[1,2]. Treatment guidelines across the globe recommend the initiation of ART as soon as possible in all people diagnosed with HIV, irrespective of CD4 count, HIV viral load or clinical disease stage. In people with very low CD4 counts or with active opportunistic infections, ART is often started as soon as possible, while in others ART is started after the initial evaluation (complete medical history, physical examination, and laboratory testing) has been completed. The decision to initiate ART should always include consideration of a person's comorbid conditions, possible antiretroviral drug resistance, as well as readiness to start and maintain ART[3-7]. In general, the guidelines of the Dutch Association of HIV Treating Physicians (Nederlandse Vereniging van HIV Behandelaren, NVHB) follow the US Department of Health and Human Services guidelines[5,8].

Rapid initiation of ART not only prevents clinical events such as opportunistic infections and malignancies, but also reduces HIV transmission more effectively than deferred initiation[9,10]. People with HIV on ART with an undetectable viral load in their blood have no risk of sexual transmission of HIV, (i.e. "undetectable equals untransmittable", or "U = U"[11-16]). Sustained suppression of HIV replication requires selection of appropriate treatment, and reliable access and good adherence to treatment.

In this chapter, we describe trends over time in the use of ART, and trends in the virological and immunological responses to ART during the last 10 calendar years, in adults registered by "Stichting hiv monitoring" (SHM) and enrolled in the ATHENA cohort[17].

Time from diagnosis to ART initiation

In total, 6,484 ART-naïve people with HIV were aged 15 years or above at the time of diagnosis and initiated first-line ART in the Netherlands between January 2016 and December 2025. Of the 6,484 people known to have initiated ART since January 2016, 3,857 (59.5%) were men who have sex with men (MSM), 1,389 (21.4%) men other than MSM, 1,054 (16.3%) women, and 184 (2.8%) were transgender / non-binary people. Overall, 3,350 (51.7%) were born in the Netherlands. In Table 3.1, we have grouped people by calendar year of ART initiation: 3,948 started in 2016-2020, 474 in 2021, 503 in 2022, 540 in 2023, 536 in 2024, and 483 in 2025. SHM systematically collects the date of entry into the Netherlands for people born in other countries. For an increasing proportion of these people, it is known if they have been diagnosed with HIV and started ART before or after entering the Netherlands. People known to have been diagnosed with HIV in other countries and who had already initiated ART prior to arriving in the Netherlands are not included in this analysis.

Prompt initiation of ART following HIV diagnosis has increased over time, reflecting implementation and uptake of evolving HIV treatment guidelines (Figure 3.1A). Among people with an accurate date of HIV diagnosis in our database who started ART in the Netherlands, the median time between HIV diagnosis and ART initiation shifted from 31 days (interquartile range [IQR] 16-53) for those who entered care in 2016, to 19 days (IQR 9-35) in 2020, to 15 days (IQR 8-26) in 2025. Likewise, the time between entering care in an HIV treatment centre and starting ART decreased over time (*Figure 3.1B*). The vast majority of newly diagnosed, ART-naïve people entering care in the Netherlands initiated ART within one month (95.8% in 2025), or even within one day (19.7% in 2025).

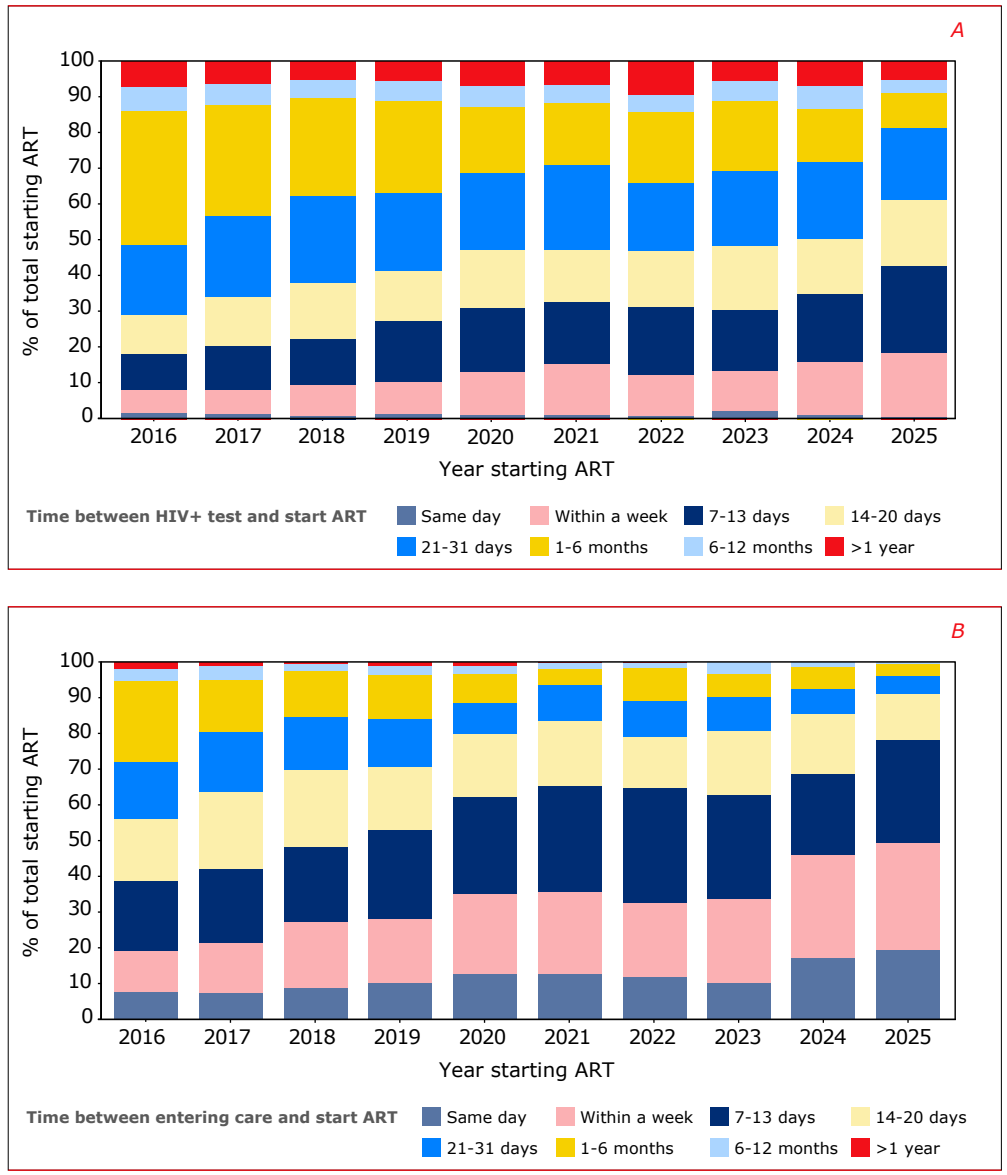
Table 3.1 Characteristics of people starting antiretroviral therapy in 2016–2025.

Year of ART initiation		2016–2020	2021	2022	2023	2024	2025	2016–2025
Number of individuals		3,948	474	503	540	536	483	6,484
DEMOGRAPHICS								
Age at ART initiation (years)	Median	39.2	39.6	39.7	39.5	38.4	36.9	39
	Q1	29.9	31.2	30.9	30.8	29.3	28.9	30.1
	Q3	50.1	52.2	51.3	50.6	50.3	48.9	50.3
Male sex (at birth)	n	3,357	397	401	439	447	384	5,425
	%	85	83.8	79.7	81.3	83.4	79.5	83.7
HIV acquisition group								
MSM	n	2,503	272	253	288	304	237	3,857
	%	63.4	57.4	50.3	53.3	56.7	49.1	59.5
Men other than MSM	n	769	106	131	137	116	130	1,389
	%	19.5	22.4	26	25.4	21.6	26.9	21.4
Women	n	591	76	102	100	88	97	1,054
	%	15	16	20.3	18.5	16.4	20.1	16.3
Transgender people	n	85	20	17	15	28	19	184
	%	2.2	4.2	3.4	2.8	5.2	3.9	2.8
Region of origin								
The Netherlands	n	2,185	227	236	237	241	224	3,350
	%	55.3	47.9	46.9	43.9	45	46.4	51.7
Western Europe/North America/	n	180	24	14	19	25	15	277
Australia	%	4.6	5.1	2.8	3.5	4.7	3.1	4.3
Eastern/central Europe	n	314	60	88	81	85	79	707
	%	8	12.7	17.5	15	15.9	16.4	10.9
Latin America and the Caribbean	n	556	80	52	83	64	53	888
	%	14.1	16.9	10.3	15.4	11.9	11	13.7
Sub-Saharan Africa	n	377	36	62	64	67	58	664
	%	9.5	7.6	12.3	11.9	12.5	12	10.2
Other	n	336	47	51	56	54	54	598
	%	8.5	9.9	10.1	10.4	10.1	11.2	9.2
CLINICAL								
Recent infection (within 12 months of diagnosis)	n	1010	80	89	112	142	113	1,546
	%	25.6	16.9	17.7	20.7	26.5	23.4	23.8
Ever having tested HIV-negative	n	2203	237	235	278	291	267	3,511
	%	55.8	50	46.7	51.5	54.3	55.3	54.1
CD4 count at start of ART	Median	380	300	352	351	409	390	370
	Q1	180	130	150	160	180	194	170
	Q3	570	543	556	568	598	560	570
HIV RNA (log_{10} cp/ml) at start of ART	Median	4.8	5.2	5	5.2	5	5.1	4.9
	Q1	4.1	4.5	4.2	4.3	4.3	4.4	4.2
	Q3	5.4	5.8	5.6	5.8	5.7	5.8	5.6
(Prior) AIDS at start of ART	n	588	91	81	97	79	72	1,008
	%	14.9	19.2	16.1	18	14.7	14.9	15.5
Hepatitis B status at start of ART								
HBV-negative (HBsAg-negative)	n	3,724	450	468	513	508	449	6,112
	%	94.3	94.9	93	95	94.8	93	94.3
HBV-positive (HBsAg-positive)	n	111	9	28	15	15	15	193
	%	2.8	1.9	5.6	2.8	2.8	3.1	3
Unknown	n	113	15	7	12	13	19	179
	%	2.9	3.2	1.4	2.2	2.4	3.9	2.8
Hepatitis C status at start of ART								
HCV-negative	n	3,769	446	473	510	508	455	6,161
	%	95.5	94.1	94	94.4	94.8	94.2	95
HCV RNA-positive	n	68	6	17	15	9	9	124
	%	1.7	1.3	3.4	2.8	1.7	1.9	1.9
HCV Ab seropositive, HCV RNA negative or unknown	n	56	10	5	11	10	8	100
	%	1.4	2.1	1	2	1.9	1.7	1.5
Unknown	n	55	12	8	4	9	11	99
	%	1.4	2.5	1.6	0.7	1.7	2.3	1.5
ART started during pregnancy*	n	77	9	8	14	7	8	123
	%	2	1.9	1.6	2.6	1.3	1.7	1.9

Legend: *ART = antiretroviral therapy; HBV = hepatitis B virus; HCV = hepatitis C virus; NRTI = nucleoside analogue reverse transcriptase inhibitor.*

** These are mainly women first diagnosed with HIV during pregnancy.*

Figure 3.1A&B: *Time between HIV diagnosis and initiation of antiretroviral therapy (ART) in 2016-2025 (A) and time between entry into HIV care and initiation of ART in 2016-2025 (B).*



Legend: *ART = antiretroviral therapy.*

There was a slight decrease in the median CD4 count at the start of ART from 380 cells/mm^3 (IQR 180-570) in 2016-2020, to a low of 300 (130-543) in 2021 during COVID-19 lockdowns, followed by an increase to 390 (194-560) cells/mm^3 in 2025. Chapter 1 provides more detailed information on changing trends in the CD4 count at the start of ART, and additional aspects of the continuum of HIV care.

Changes in initial ART regimen

Data from clinical trials on contemporary antiretroviral drugs have shown good outcomes in terms of viral suppression, convenience, tolerability, and toxicity. Over the past years, several new antiretroviral drugs and new, once-daily, fixed-dose combination regimens have been approved in the Netherlands (*Box 3.1*). In this section, we evaluate the post-approval implementation of these new drugs/regimens in HIV treatment.

Box 3.1: *Approval dates of new antiretroviral drugs/regimens for HIV treatment in the Netherlands in 2013-2025.*

Medicine	Authorisation date
TDF/FTC/elvitegravir/cobicistat (Stribild®)	24 May 2013
Dolutegravir (Tivicay®)	16 January 2014
ABC/3TC/dolutegravir (Triumeq®)	01 September 2014
DRV/cobicistat (Rezolsta®)	19 November 2014
TAF/FTC/elvitegravir/cobicistat (Genvoya®)	19 November 2015
TAF/FTC (Descovy®)	21 April 2016
TAF/FTC/rilpivirine (Odefsey®)	21 June 2016
TAF (Vemlidy®)	09 January 2017
TAF/FTC/darunavir/cobicistat (Symtuza®)	21 September 2017
Dolutegravir/rilpivirine (Juluca®)	21 May 2018
TAF/FTC/bictegravir (Biktarvy®)	25 June 2018
Doravirine (Pifeltro®)	22 November 2018
TDF/3TC/doravirine (Delstrigo®)	22 November 2018
3TC/dolutegravir (Dovato®)	03 July 2019
Cabotegravir (Vocabria®, oral and intramuscular administration)	17 December 2020
Rilpivirine (Rekambys®, intramuscular administration)	17 December 2020
Fostemsavir (Rukobia®)	04 February 2021
Lenacapavir (Sunlenca®)	17 August 2022

Legend: *3TC = lamivudine; ABC = abacavir; FTC = emtricitabine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate.*

Source: *Medicines Evaluation Board http://english.cbg-meb.nl/ and European Medicines Agency http://www.ema.europa.eu/*

In the period 2016-2025, all guideline-recommended first-line ART regimen consist of a nucleoside-analogue reverse transcriptase inhibitor (NRTI) backbone, plus one anchor-drug. The NRTI-backbone usually consists of two NRTIs, except for the regimen lamivudine(3TC)/ dolutegravir(DTG). In the period 2016-2025, the recommended anchor-drugs are from the integrase inhibitor (INSTI), non-nucleoside RT inhibitor (NNRTI), or protease inhibitor (PI) class. The use of other ART regimen, i.e. dual-anchor class regimen with or without the addition of NRTI, have become more common in recent years, but only as maintenance therapy in treatment-experienced individuals.

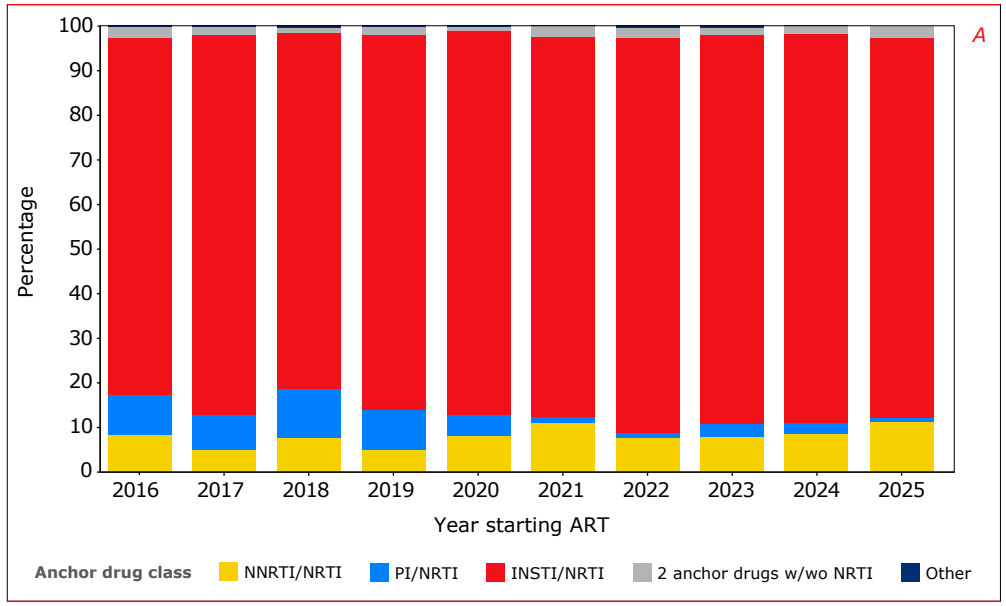
In the studied period, in certain groups of newly diagnosed individuals, a 2-step 'induction-maintenance' approach has sometimes been used, where at the time of ART initiation it is the explicit intention to replace the first ART regimen as soon as possible with another regimen. For the purpose of our analyses here, when the switch happened within 6 months and there was explicit mention of the 'induction-maintenance' approach in the electronic medical records, the starting regimens of the individuals who initiated therapy using this strategy have been set to their second simplified guideline-recommended regimen.
Common examples of this 'induction-maintenance' approach are ART initiation with a regimen containing 2 anchor-drugs plus 2 NRTI in individuals initiating ART during acute HIV infection (often as part of a study protocol) or individuals with low CD4 counts and opportunistic infections who quickly initiate ART before the results of HIV genotypic resistance testing (and HBV testing) have become available. In these individuals, ART is subsequently simplified to a guideline-recommended regimen as soon as the first undetectable viral load measurement and/or the results of the genotypic resistance testing have become available. Another common similar strategy is that individuals are started on a dolutegravir-based regimen combined with 2 NRTI, which is then quickly 'simplified' to either 3TC/DTG or TDF/3TC/doravirine(DOR), as soon as the first undetectable viral load measurement and/or the results of genotypic resistance testing have become available. Also in these cases, we considered their second simplified guideline-recommended regimen as their starting regimen when the switch occurred with 6 months and when the reason for the switch was not documented as 'virological failure' or 'toxicity'.

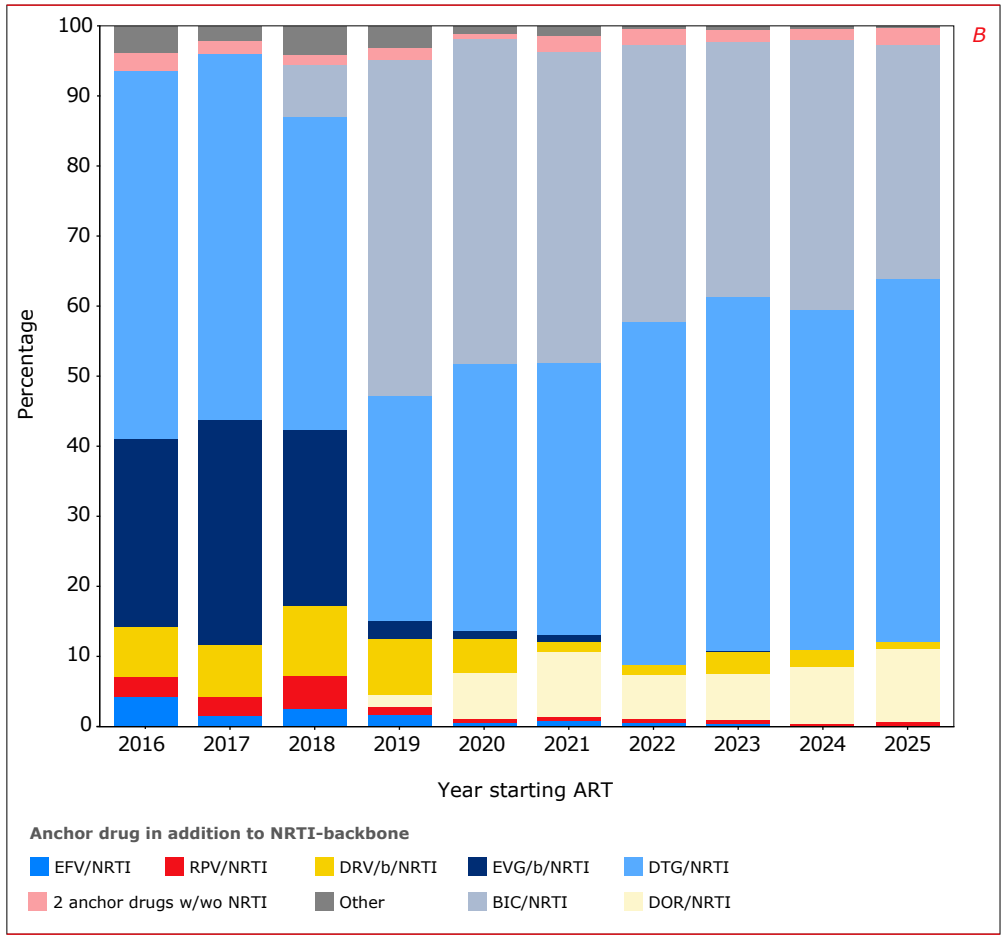
For the 6,484 ART-naïve people who initiated first-line ART between 2016 and 2025, Figures 3.2A&B show the trends over time in anchor-drug additions to the NRTI backbone used as part of the initial ART regimen. The use of INSTI in combination with a (mono- or dual-) NRTI backbone as initial therapy fluctuated between 79% and 88.5% and was 85.3% in 2025. The use of NNRTIs in combination with a NRTI backbone as the initial regimen was fairly stable over time and was 11.2% in 2025. The use of PIs in combination with a NRTI backbone as the initial regimen decreased from 9.1% in 2016 to 1.0% in 2025.

In the period 2016-2025, between 0.8% and 2.5% of individuals (2.5% in 2025) initiated ART with a dual anchor-drug regimen. As explained above, this excludes individuals in whom the abovementioned strategy was implemented of starting with a dual anchor-drug regimen quickly followed by a simplification to a standard guideline-recommended regimen when this was deemed to be safe.

Figure 3.2B shows all individual anchor-drug additions to the NRTI backbone that were used as part of the initial regimen in at least 5% of individuals during one or more calendar years between 2016-2025. The regimens that were used less frequently have therefore been included in the category 'other' in *Figure 3.2B*. Full details on the initial regimens are shown in *Table 3.2*.

Figure 3.2A&B: *Anchor-class (A) and individual anchor-drug (B) plus nucleoside reverse transcriptase backbone used as part of the initial regimen in 2016-2025.*

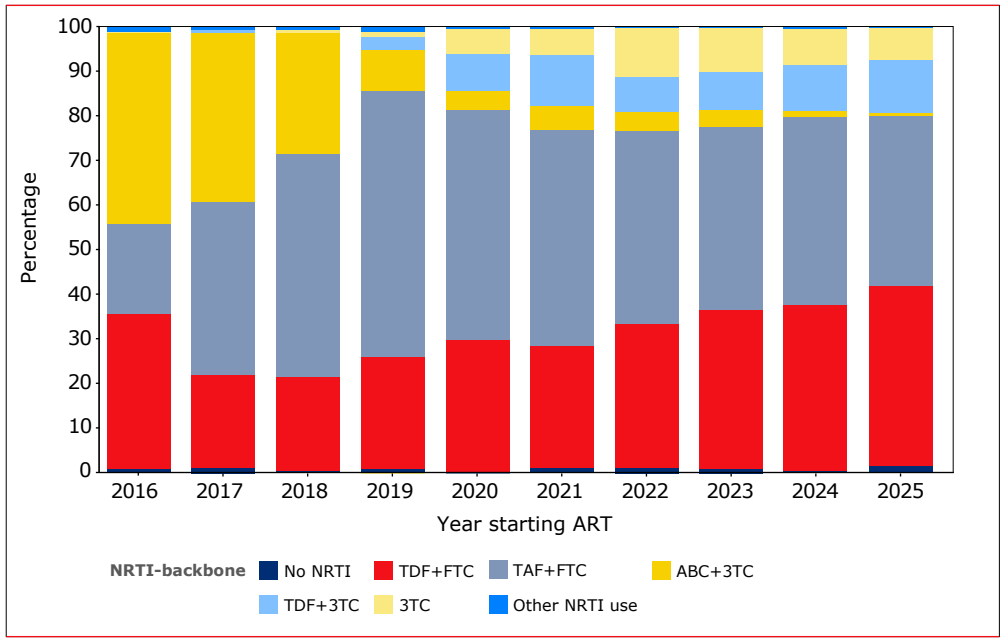




Legend: *ART = antiretroviral therapy; b = boosted (cobicistat or ritonavir); BIC = bictegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; INSTI = integrase inhibitor; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; PI = protease inhibitor; RPV = rilpivirine.*

Figure 3.3 provides an overview of the NRTI backbone components of the initial regimens used in 2016-2025. The combination of tenofovir disoproxil fumarate (TDF) or alafenamide (TAF) with emtricitabine (FTC) was the predominant backbone prescribed. Following its introduction at the end of 2015, use of TAF in in initial ART regimens rapidly increased with a maximum of 60.1% in 2019, but has since slowly declined to 38.1% in 2025. At the same time, TDF use increased from a low of 21.1% in 2018, after which its use increased again to 52.6% in 2025. The use of abacavir steadily decreased from a high of 43.0% of all initial regimens in 2016 to 1.0% in 2025.

Figure 3.3: Nucleoside analogue reverse transcriptase inhibitor backbone used as part of the initial regimen in 2016-2025.



Legend: *ART = antiretroviral therapy; 3TC = lamivudine; ABC = abacavir; FTC = emtricitabine; NRTI = nucleoside analogue reverse transcriptase inhibitor; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate.*

The most common ART regimens initiated in 2016-2025 are presented in *Table 3.2*. In 2025, the most frequently used initial regimen was TDF/FTC/DTG (39.5%). TAF/FTC/bictegravir (BIC) was used in 33.3% and TDF/3TC/doravirine (DOR) in 10.4% of initial regimens (*Figure 3.4*). *Table 3.2* provides more detail on the other initial regimens and other calendar years that are not further specified in *Figures 3.2A&B, 3.3 and 3.4*. In 2025 97.3% of people initiating ART used a DHHS guideline recommended regimen or a regimen recommended in certain clinical situations.

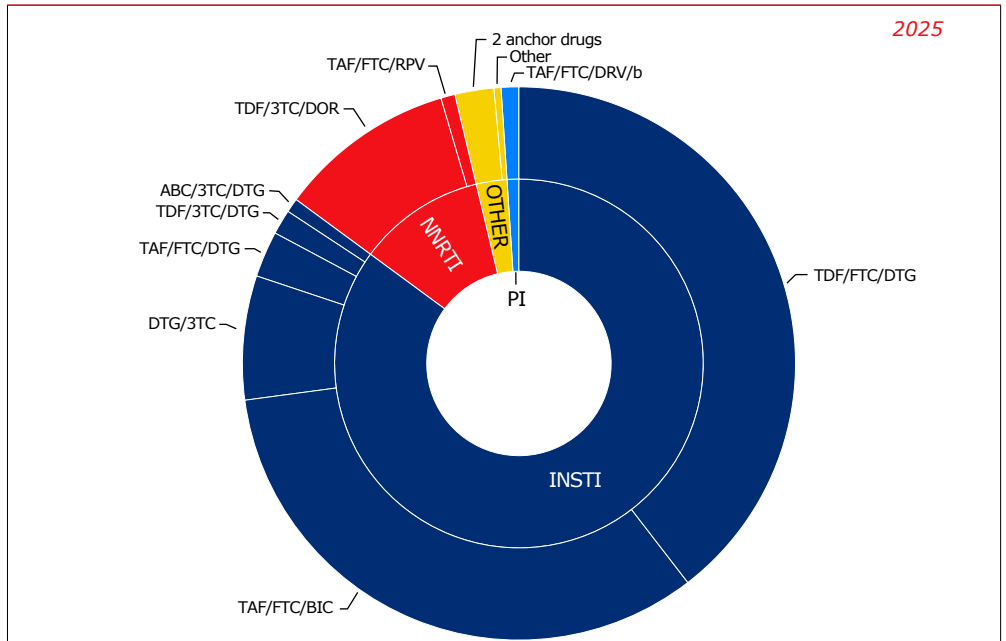
Table 3.2: Initial regimens in 2016-2025.

		2016-2020	2021	2022	2023	2024	2025	2016-2025
	n	3,948	474	503	540	536	483	6,484
INSTI + NRTI								
TAF/FTC/BIC	n	640	210	198	196	207	161	1,612
	%	16.2	44.3	39.4	36.3	38.6	33.3	24.9
TDF/FTC/DTG	n	529	115	152	182	191	191	1,360
	%	13.4	24.3	30.2	33.7	35.6	39.5	21
ABC/3TC/DTG	n	1,062	25	21	20	7	4	1,139
	%	26.9	5.3	4.2	3.7	1.3	0.8	17.6
3TC/DTG	n	44	28	54	53	43	35	257
	%	1.1	5.9	10.7	9.8	8	7.2	4
TAF/FTC/DTG	n	127	9	10	9	5	13	173
	%	3.2	1.9	2	1.7	0.9	2.7	2.7
TDF/3TC/DTG	n	13	7	9	9	13	7	58
	%	0.3	1.5	1.8	1.7	2.4	1.4	0.9
TAF/FTC/EVG/b	n	645	2	.	1	.	.	648
	%	16.3	0.4	.	0.2	.	.	10
TDF/FTC/EVG/b	n	146	2	.	.	.	.	148
	%	3.7	0.4	.	.	.	.	2.3
TDF/FTC/RAL	n	29	4	1	1	.	.	35
	%	0.7	0.8	0.2	0.2	.	.	0.5
Other NRTI + INSTI	n	32	2	.	1	2	.	37
	%	0.8	0.4	.	0.2	0.4	.	0.6
NNRTI + NRTI								
TDF/3TC/DOR	n	46	44	31	36	43	50	250
	%	1.2	9.3	6.2	6.7	8	10.4	3.9
TDF/FTC/EFV	n	82	2	4	1	1	.	90
	%	2.1	0.4	0.8	0.2	0.2	.	1.4
TAF/FTC/RPV	n	68	1	3	2	2	4	80
	%	1.7	0.2	0.6	0.4	0.4	0.8	1.2
TDF/FTC/RPV	n	36	2	.	1	.	.	39
	%	0.9	0.4	.	0.2	.	.	0.6
TDF/FTC/NVP	n	12	1	.	.	.	.	13
	%	0.3	0.2	.	.	.	.	0.2
Other NRTI + NNRTI	n	18	2	.	2	.	.	22
	%	0.5	0.4	.	0.4	.	.	0.3

PI + NRTI								
TAF/FTC/DRV/b	n	146	5	5	13	11	5	185
	%	3.7	1.1	1	2.4	2.1	1	2.9
TDF/FTC/DRV/b	n	140	2	2	2	2	.	148
	%	3.5	0.4	0.4	0.4	0.4	.	2.3
TDF/FTC/ATV/b	n	30	.	.	.	.	.	30
	%	0.8	.	.	.	.	.	0.5
TDF/FTC/LPV/b	n	1	.	.	.	.	.	1
	%	0	.	.	.	.	.	0
Other NRTI + PI	n	26	.	.	1	.	.	27
	%	0.7	.	.	0.2	.	.	0.4
2 anchor-drugs								
DTG/DRV/b	n	23	4	5	3	1	3	39
	%	0.6	0.8	1	0.6	0.2	0.6	0.6
DTG/RPV	n	1	.	.	.	1	1	3
	%	0	.	.	.	0.2	0.2	0
CAB/RPV-LA	n	.	.	.	1	.	1	2
	%	.	.	.	0.2	.	0.2	0
2 anchor-drugs w/wo NRTI	n	46	7	7	5	6	6	77
	%	1.2	1.5	1.4	0.9	1.1	1.2	1.2
Other ART	n	6	.	1	1	1	2	11
	%	0.2	.	0.2	0.2	0.2	0.4	0.2

Legend: *b = boosted (cobicistat or ritonavir); 3TC = lamivudine; ABC = abacavir; ART = antiretroviral therapy; ATV = atazanavir; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; LPV = lopinavir; INSTI = integrase inhibitor; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; NVP = nevirapine; PI = protease inhibitor; RPV = rilpivirine; RAL = raltegravir; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate.*

Figure 3.4: The initial antiretroviral therapy regimens given in 2025.



Legend: *3TC = lamivudine; ABC = abacavir; b = boosted (cobicistat or ritonavir); BIC = bictegravir; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; INSTI = integrase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; NRTI = nucleoside analogue reverse transcriptase inhibitor; PI = protease inhibitor; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate.*

In care and on ART

A total of 27,108 people with HIV were in care and on ART at some point during the 10-year period from January 2016 to December 2025. The number of people who had initiated ART and were in active follow-up grew from 18,972 individuals in 2016 to 23,094 individuals in 2025. Over time new individuals enrol into the cohort as they enter HIV care in one of the Dutch HIV treatment centres, or they leave the cohort when they die, move abroad, withdraw consent, or otherwise become lost to follow-up. In this section we have not excluded people who (temporarily) interrupted ART from the analyses. Most of these individuals had medical, psychiatric, and/or psycho-social issues that temporarily prevented them from continuing ART, and most of them re-started ART when those issues had been sufficiently resolved.

Table 3.3 shows the evolution over the last 10 years of the size, demographical, clinical and ART characteristics of the treated individuals who constitute the cohort. For selected calendar years a cross section of the cohort is shown of all people in active follow-up in the cohort during that particular calendar year. For each included individual the status at the last clinic visit of that calendar year was used. In 2025, 23,094 people on ART were in care at some point during the calendar year. In 2025, 18,821 (81.5%) were men, and 14,345 (62.1%) were MSM. Their median age was 53.7 (IQR 43.2-62.2) years. The majority (53.9%) originated from the Netherlands, followed by Latin America / the Caribbean (13.4%, 3.9% were from Surinam and 3.4% from the Dutch Antilles) and sub-Saharan Africa (12.1%). They had been diagnosed with HIV a median of 15.4 (IQR 9.3-21.7) years ago and started their first-line ART regimen a median of 13.3 (IQR 8.5-19.2) years ago. Their most recently measured viral load was <50 c/ml in 95.3% (97.9% <200 c/ml), and 80.4% had a last measured CD4 count of 500 cells/mm^3 or higher.

Table 3.3: Yearly cross-sectional description of the characteristics of people in care receiving antiretroviral therapy between 2016-2025.

Calendar year		2016	2021	2022	2023	2024	2025
Total population size	n	18,972	21,718	22,212	22,658	22,982	23,094
Age	Median	48.7	51.7	52.1	52.7	53.2	53.7
	Q1	40.2	41.8	42.2	42.5	42.8	43.2
	Q3	56.2	59.5	60.2	60.8	61.5	62.2
Male sex (at birth)	n	15,503	17,822	18,141	18,499	18,748	18,821
	%	81.7	82.1	81.7	81.6	81.6	81.5
HIV acquisition group							
MSM	n	11,887	13,695	13,901	14,133	14,324	14,345
	%	62.7	63.1	62.6	62.4	62.3	62.1
Men other than MSM	n	3,422	3,822	3,918	4,018	4,058	4,097
	%	18	17.6	17.6	17.7	17.7	17.7
Women	n	3,467	3,893	4,067	4,153	4,227	4,265
	%	18.3	17.9	18.3	18.3	18.4	18.5
Transgender people	n	196	308	326	354	373	387
	%	1	1.4	1.5	1.6	1.6	1.7
Region of origin							
The Netherlands	n	11,452	12,482	12,484	12,499	12,518	12,455
	%	60.4	57.5	56.2	55.2	54.5	53.9
Western Europe/North	n	1,243	1,356	1,350	1,371	1,374	1,359
America/Australia	%	6.6	6.2	6.1	6.1	6	5.9
Eastern/central Europe	n	617	1,008	1,313	1,447	1,544	1,614
	%	3.3	4.6	5.9	6.4	6.7	7
Latin America/Caribbean	n	2,137	2,777	2,848	2,978	3,060	3,091
	%	11.3	12.8	12.8	13.1	13.3	13.4
Sub-Saharan Africa	n	2,367	2,583	2,627	2,691	2,765	2,804
	%	12.5	11.9	11.8	11.9	12	12.1
Other	n	1,156	1,512	1,590	1,672	1,721	1,771
	%	6.1	7	7.2	7.4	7.5	7.7
CD4 at start ART							
No data	n	1,470	2,318	2,666	2,876	3,081	3,203
	%	7.7	10.7	12	12.7	13.4	13.9
<50	n	1,921	2,100	2,123	2,146	2,151	2,142
	%	10.1	9.7	9.6	9.5	9.4	9.3
50-199	n	3,928	4,140	4,146	4,158	4,138	4,113
	%	20.7	19.1	18.7	18.4	18	17.8
200-349	n	5,622	5,856	5,848	5,878	5,839	5,793
	%	29.6	27	26.3	25.9	25.4	25.1
350-499	n	3,226	3,645	3,680	3,732	3,760	3,767
	%	17	16.8	16.6	16.5	16.4	16.3
500+	n	2,805	3,659	3,749	3,868	4,013	4,076
	%	14.8	16.8	16.9	17.1	17.5	17.6

Calendar year		2016	2021	2022	2023	2024	2025
Viral load at start ART	Median	4.9	4.9	4.9	4.9	4.9	4.9
	Q1	4.3	4.3	4.3	4.3	4.3	4.3
	Q3	5.3	5.3	5.4	5.4	5.4	5.4
Years known HIV+	Median	9.7	12.8	13.4	14.1	14.7	15.4
	Q1	5.2	7.4	7.9	8.3	8,8	9.3
	Q3	15.5	18.9	19.6	20.3	21	21.7
Years since start ART	Median	7.5	10.7	11.3	12	12.5	13.3
	Q1	3.5	6.4	6.9	7.4	8	8.5
	Q3	13.5	16.5	17.2	17.9	18.5	19.2
Current CD4 count							
Missing*	n	20	29	28	30	18	11
	%	0.1	0.1	0.1	0.1	0.1	0
<50	n	68	61	63	61	54	50
	%	0.4	0.3	0.3	0.3	0.2	0.2
50–199	n	468	418	430	426	406	386
	%	2.5	1.9	1.9	1.9	1.8	1.7
200–349	n	1,432	1,441	1,481	1,399	1,315	1,257
	%	7.5	6.6	6.7	6.2	5.7	5.4
350–499	n	3,018	3,117	2,992	2,865	2,783	2,820
	%	15.9	14.4	13.5	12.6	12.1	12.2
500–749	n	6,811	7,336	7,399	7,281	7,259	7,271
	%	35.9	33.8	33.3	32.1	31.6	31.5
750+	n	7,155	9,316	9,819	10,596	11,147	11,299
	%	37.7	42.9	44.2	46.8	48.5	48.9
Viral load <50 c/ml							
Missing	n	12	15	20	14	6	5
	%	0.1	0.1	0.1	0.1	0	0
≥50 c/ml	n	1,670	1,000	1,108	1,022	1,042	1,070
	%	8.8	4.6	5	4.5	4.5	4.6
<50 c/ml	n	17,290	20,703	21,084	21,622	21,934	22,019
	%	91.1	95.3	94.9	95.4	95.4	95.3
Viral load <200 c/ml							
Missing	n	12	15	20	14	6	5
	%	0.1	0.1	0.1	0.1	0	0
≥200 c/ml	n	678	497	548	515	475	473
	%	3.6	2.3	2.5	2.3	2.1	2
<200 c/ml	n	18,282	21,206	21,644	22,129	22,501	22,616
	%	96.4	97.6	97.4	97.7	97.9	97.9

Calendar year		2016	2021	2022	2023	2024	2025
ART regimen							
INSTI + NRTI							
TAF/FTC/BIC	n	9	3,170	3,580	3,973	4,381	4,619
	%	0	14.6	16.1	17.5	19.1	20
TDF/FTC/DTG	n	734	770	919	991	1,050	1,083
	%	3.9	3.5	4.1	4.4	4.6	4.7
ABC/3TC/DTG	n	2,940	2,177	1,891	1,608	1,283	1,016
	%	15.5	10	8.5	7.1	5.6	4.4
3TC/DTG	n	50	1,734	2,374	3,063	3,710	4,284
	%	0.3	8	10.7	13.5	16.1	18.6
TAF/FTC/DTG	n	141	527	498	471	436	432
	%	0.7	2.4	2.2	2.1	1.9	1.9
TDF/3TC/DTG	n	12	24	65	79	73	79
	%	0.1	0.1	0.3	0.3	0.3	0.3
TAF/FTC/EVG/b	n	1,522	2,272	2,016	1,808	1,657	1,562
	%	8	10.5	9.1	8	7.2	6.8
TDF/FTC/EVG/b	n	988	532	458	399	356	322
	%	5.2	2.4	2.1	1.8	1.5	1.4
TDF/FTC/RAL	n	299	161	134	101	91	84
	%	1.6	0.7	0.6	0.4	0.4	0.4
Other INSTI + NRTI	n	157	220	185	168	152	137
	%	0.8	1	0.8	0.7	0.7	0.6
NNRTI + NRTI							
TDF/3TC/DOR	n	2	1,404	1,643	1,853	2,055	2,277
	%	0	6.5	7.4	8.2	8.9	9.9
TDF/FTC/EFV	n	2,513	1,224	1,051	943	854	658
	%	13.2	5.6	4.7	4.2	3.7	2.8
TAF/FTC/RPV	n	176	992	953	922	887	857
	%	0.9	4.6	4.3	4.1	3.9	3.7
TDF/FTC/RPV	n	1,471	434	366	319	269	246
	%	7.8	2	1.6	1.4	1.2	1.1
TAF/FTC/NVP	n	203	722	717	707	681	646
	%	1.1	3.3	3.2	3.1	3	2.8
TDF/FTC/NVP	n	1,912	914	788	698	615	572
	%	10.1	4.2	3.5	3.1	2.7	2.5
ABC/3TC/NVP	n	549	295	254	210	176	133
	%	2.9	1.4	1.1	0.9	0.8	0.6
Other NNRTI + NRTI	n	530	314	274	251	241	237
	%	2.8	1.4	1.2	1.1	1	1

Calendar year		2016	2021	2022	2023	2024	2025
PI + NRTI							
TAF/FTC/DRV/b	n	90	1,275	1,279	1,291	1,290	1,265
	%	0.5	5.9	5.8	5.7	5.6	5.5
TDF/FTC/DRV/b	n	1,369	409	340	269	226	190
	%	7.2	1.9	1.5	1.2	1	0.8
TDF/FTC/ATV/b	n	691	156	121	80	62	49
	%	3.6	0.7	0.5	0.4	0.3	0.2
TDF/FTC/LPV/b	n	76	16	10	5	3	3
	%	0.4	0.1	0	0	0	0
Other PI + NRTI	n	681	242	192	167	135	112
	%	3.6	1.1	0.9	0.7	0.6	0.5
2 anchor-drugs							
DTG/DRV/b	n	191	357	372	383	389	372
	%	1	1.6	1.7	1.7	1.7	1.6
DTG/RPV	n	12	129	138	146	155	162
	%	0.1	0.6	0.6	0.6	0.7	0.7
CAB/RPV injectables #	n	.	69	497	720	805	882
	%	.	0.3	2.2	3.2	3.5	3.8
2 anchor-drugs w/wo NRTI	n	561	428	391	374	357	338
	%	3	2	1.8	1.7	1.6	1.5
Other ART	n	654	352	335	315	301	305
	%	3.4	1.6	1.5	1.4	1.3	1.3
ART temporarily interrupted	n	439	399	371	344	292	172
	%	2.3	1.8	1.7	1.5	1.3	0.7

Legend: *3TC = lamivudine; b = boosted (cobicistat or ritonavir); ABC = abacavir; ART = antiretroviral therapy; ATV = atazanavir; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; LPV = lopinavir; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

** Whenever possible we used last-observation-carried-forward to impute missing values.*

 # Some individuals using this regimen were participating in a clinical trial.

Among the 23,094 individuals in HIV care and on ART in 2025, the vast majority (90.6%) received a regimen based on one or two NRTIs, combined with either (*Figure 3.5A*) an integrase inhibitor (INSTI) (59.0%), a non-nucleoside reverse transcriptase inhibitor (NNRTI) (24.4%), or a protease inhibitor (PI) (7.2%).

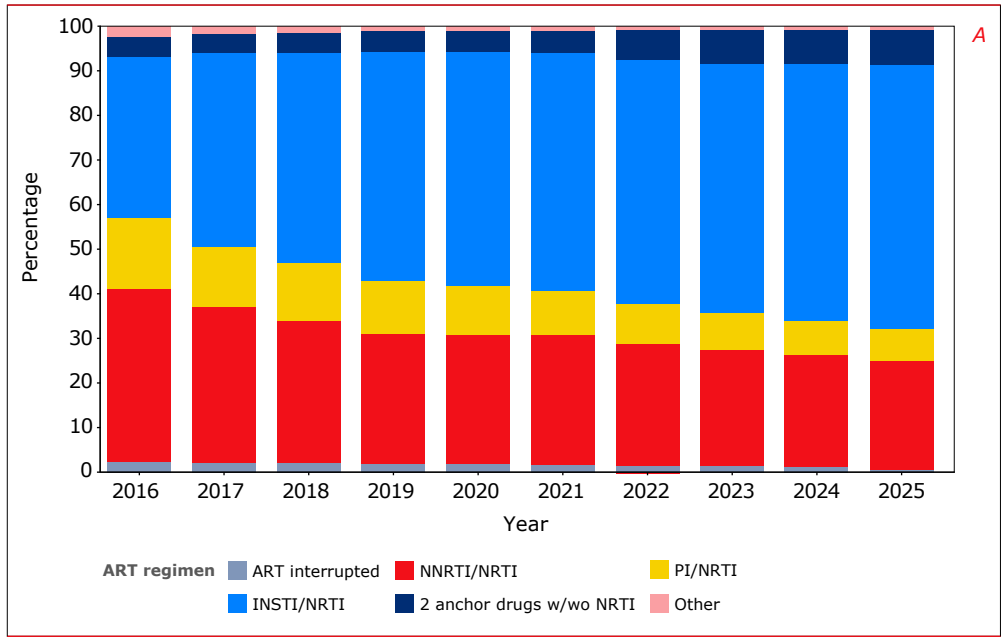
The proportion of individuals who had (temporarily) interrupted ART at the end of the calendar year, decreased from 2.3% in 2016 to 0.7% in 2025. In a later section in this chapter more details are shown about the number, reasons, duration and outcome of these treatment interruptions.

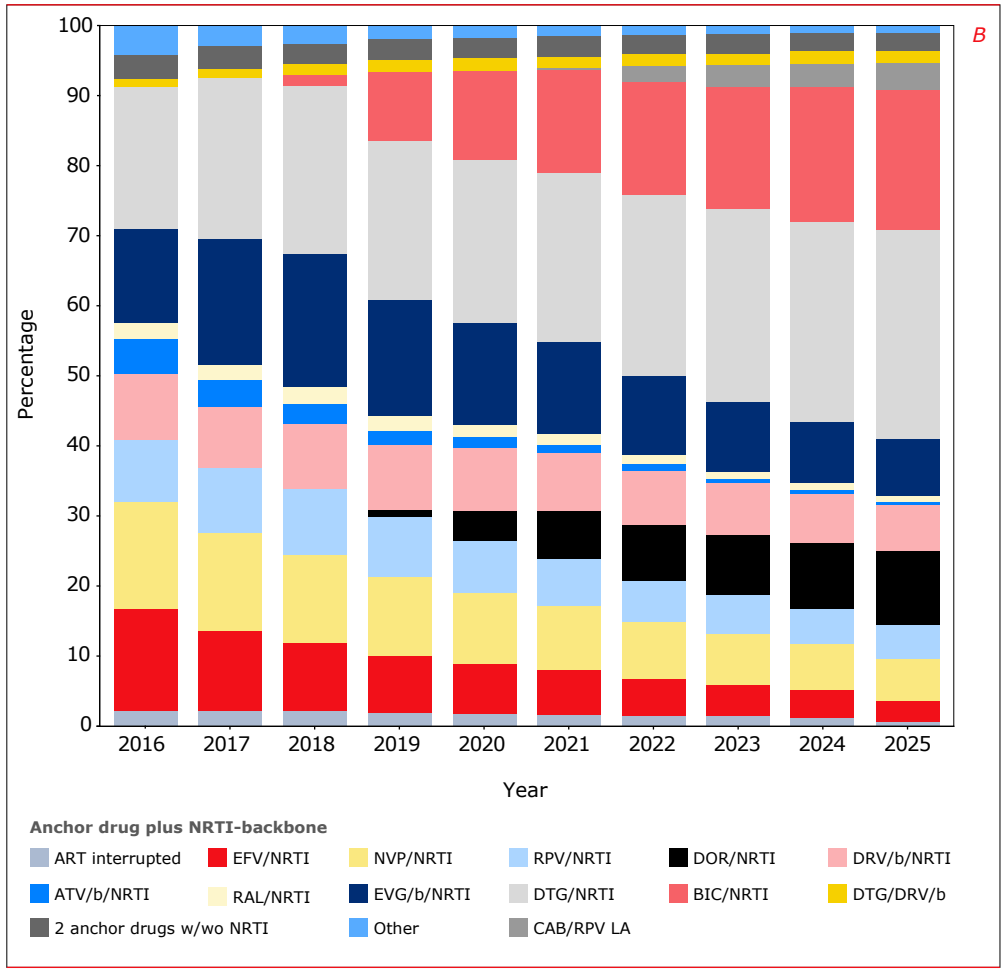
The changes over time in the distribution of specific ART regimens among the population in care in 2016-2025 are presented in *Figure 3.5B* and *3.7* and in *Table 3.3*. The most frequently used regimens in 2025 (used by at least 5% of the cohort) were:

- tenofovir alafenamide (TAF)/emtricitabine (FTC)/bictegravir (BIC) (20.0%);
- dolutegravir (DTG)/lamivudine (3TC) (18.6%);
- tenofovir disoproxil fumarate (TDF)/lamivudine (3TC)/doravirine (DOR) (9.9%);
- tenofovir alafenamide (TAF)/emtricitabine (FTC)/elvitegravir (EVG)/cobicistat (6.8%); and
- tenofovir alafenamide (TAF)/emtricitabine (FTC)/darunavir (DRV)/cobicistat (5.5%)

In 2025, the use of regimens consisting of 2 anchor-drugs (an NNRTI, PI, or INSTI) with or without one or two additional NRTI, was 7.6%. The most common of these regimens were a combination of cabotegravir/rilpivirine injectables (3.8%), dolutegravir/darunavir/cobicistat (1.6%), and dolutegravir/rilpivirine (0.7%).

Figure 3.5A&B: *Anchor-drug class (A) and individual anchor-drugs (B) plus nucleoside reverse transcriptase backbone used as part of the current regimen in 2016-2025.*

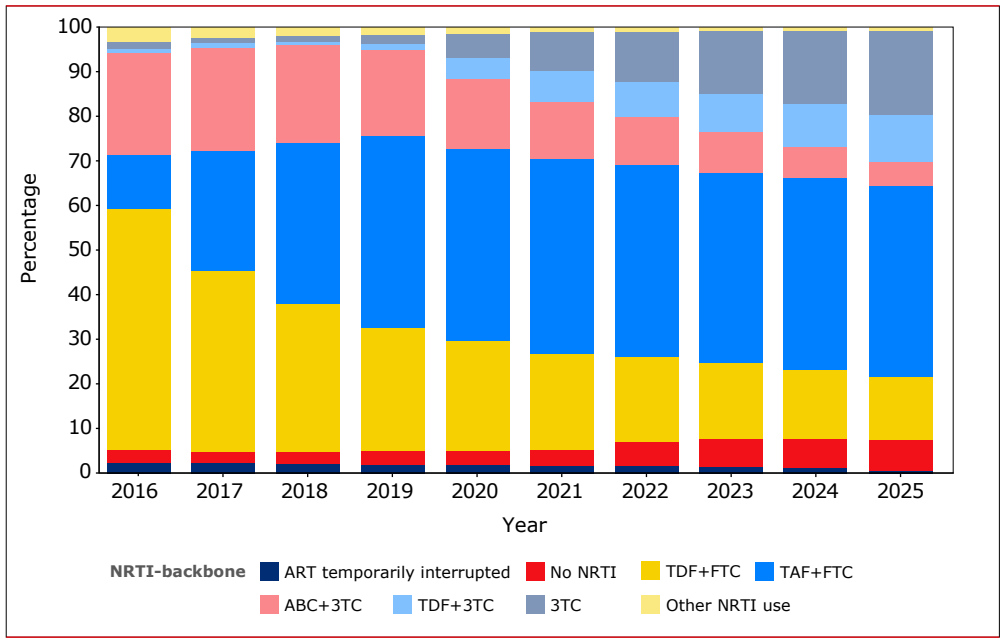




Legend: *ART = antiretroviral therapy; b = boosted (cobicistat or ritonavir); ATV = atazanavir; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; INSTI = integrase inhibitor; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine.*

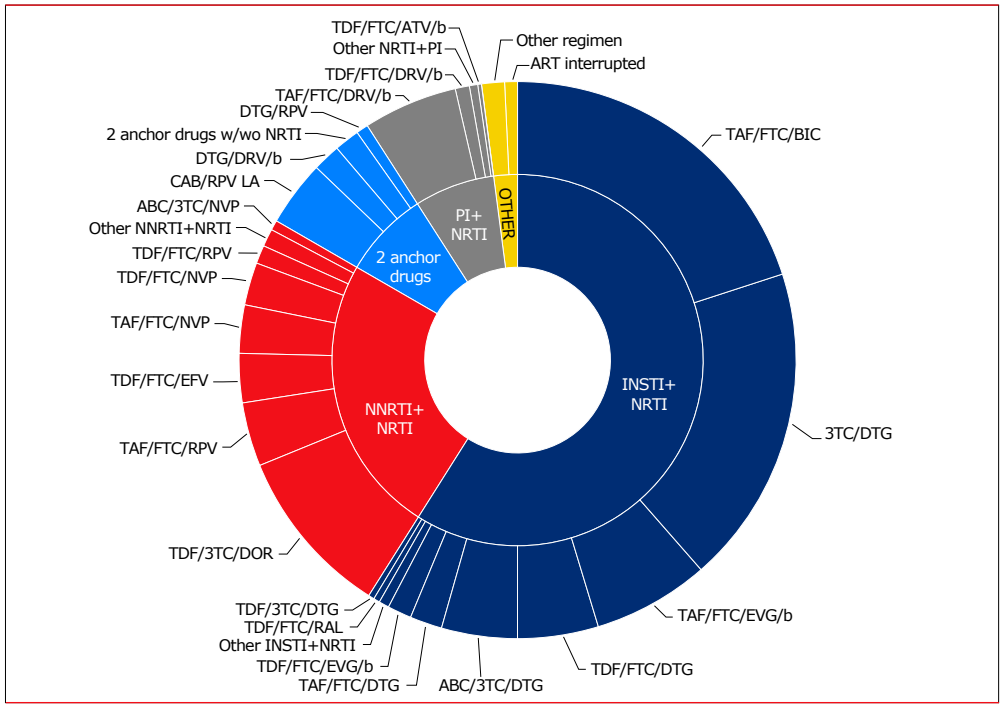
Figure 3.6 provides an overview of the NRTI backbone components of the current ART regimens used in 2016-2025. The combination of tenofovir disoproxil fumarate (TDF) or alafenamide (TAF) with emtricitabine (FTC) or lamivudine (3TC) was the predominant backbone used, being part of 67.7% of the regimen used in 2016, and 67.2% in 2025. Following its introduction at the end of 2015, use of TAF in ART regimens rapidly increased to 42.9% of all regimens used since 2019 and has since remained stable at that level. At the same time, TDF use decreased from 55.7% of all regimens used in 2016 to 29.2% in 2019, after which TDF use slowly continued to decrease to 24.5% in 2025. ABC was used in 22.6% of all regimens in 2016. Following the introduction of the fixed dose combination ABC/3TC/DTG its use increased to 23.1% in 2017, after which its use slowly decreased to 5.6% of all regimens used in 2025.

***Figure 3.6:** Nucleoside analogue reverse transcriptase inhibitor backbone used as part of the current regimen in 2016–2025.*



***Legend:** ART = antiretroviral therapy; 3TC = lamivudine; ABC = abacavir; FTC = emtricitabine; NRTI = nucleoside analogue reverse transcriptase inhibitor; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate.*

***Figure 3.7:** antiretroviral therapy use in 2025.*



***Legend:** 3TC = lamivudine; b = boosted (cobicistat or ritonavir); ABC = abacavir; ART = antiretroviral therapy; ATV = atazanavir; BIC = bictegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

Treatment modifications

For the 27,108 individuals who were on ART between January 2016 and December 2025, we assessed the frequency and reported reasons for modifications and (temporary) interruptions of ART. The unit of analysis for this section is therefore the treatment episodes, and a single individual can contribute multiple treatment episodes with multiple regimens to this analysis.

Modification of ART was defined as a change in, or discontinuation of, one or more of the drugs included in the regimen. Simplification to a fixed-drug combination formulation containing the same antiretroviral agents (in the same dose) was not considered a modification of the regimen. Likewise, the breakup of a (more expensive) single tablet regimen (STR) into separately formulated (cheaper) generic components of the original STR, was also not considered a modification. A switch from one pharmacological booster to another was also ignored. We also ignored treatment interruptions that lasted less than 14 days. Whenever an individual became lost to follow-up (e.g. because they moved abroad) this was not considered to be a regimen discontinuation, instead regimens used at the end of available follow-up were categorized as "treatment episode still ongoing".

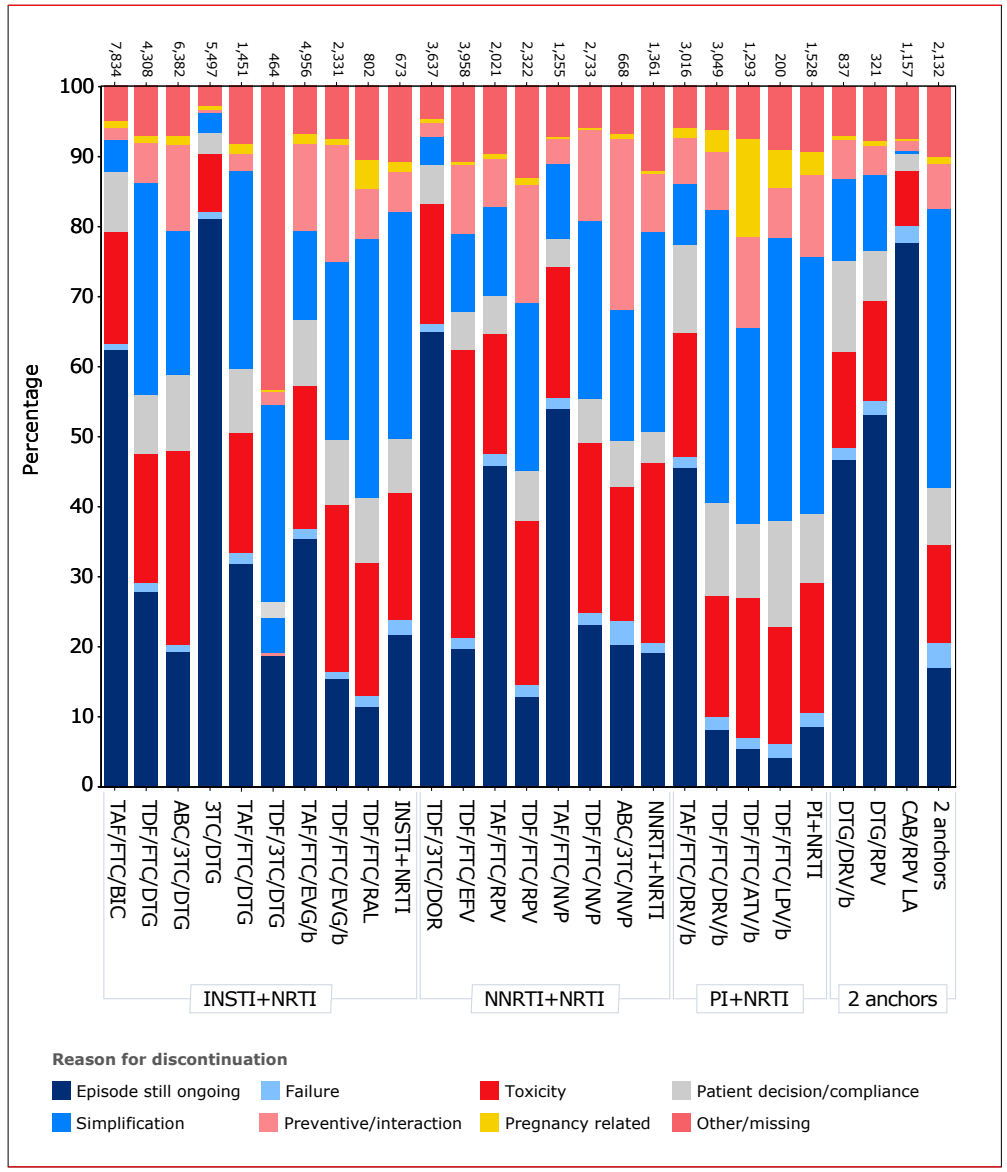
For each commonly used regimen we report the total number of treatment episodes with that regimen, the cumulative persons years of exposure to that regimen, the frequency of treatment modifications, and the distribution of the reasons for modification of that regimen. The denominator for these analyses is the total number of treatment episodes with any particular regimen (*Table 3.4*).

During the period 2016 to 2025, the cohort of 27,108 individuals on ART accrued a total of 198,939 person years of follow-up, during which a total of 75,536 ART regimen episodes were registered. At the end of the follow-up period in 2025 (but for some individuals follow-up ended earlier, i.e. because they died, moved out of the country, or otherwise became disengaged from HIV care), 33.2% of these regimen episodes were still ongoing, and 66.8% of the regimen episodes had ended in a regimen modification. The most common reasons for regimen modification were: toxicity (17.6%), treatment simplification (16.5%), patient decision/compliance (7.2%), and preventive modifications (6.7%). In only 1,078 (1.4%) regimens the reported reason for modification was virological treatment failure. Specific reasons for 'preventive modifications' consist of (CVD) risk optimization, prevention of long term renal, bone and metabolic toxicities, drug-drug interactions, (further) weight gain, etc.

Table 3.4 provides these statistics for all commonly used regimen and *Figure 3.8* provides a visual presentation of the same data. However, it should be noted that the average duration of exposure varies greatly for different regimens, which biases cross-regimen comparisons and making differences difficult to interpret. The apparent persistence of newer regimens is partly an artefact of follow-up time: having been available for less time, there has been less opportunity for discontinuation. Appendix *Table 3.1* provides the rates of the various reasons for treatment modifications for each particular regimen per 1,000 person years of cumulative exposure.

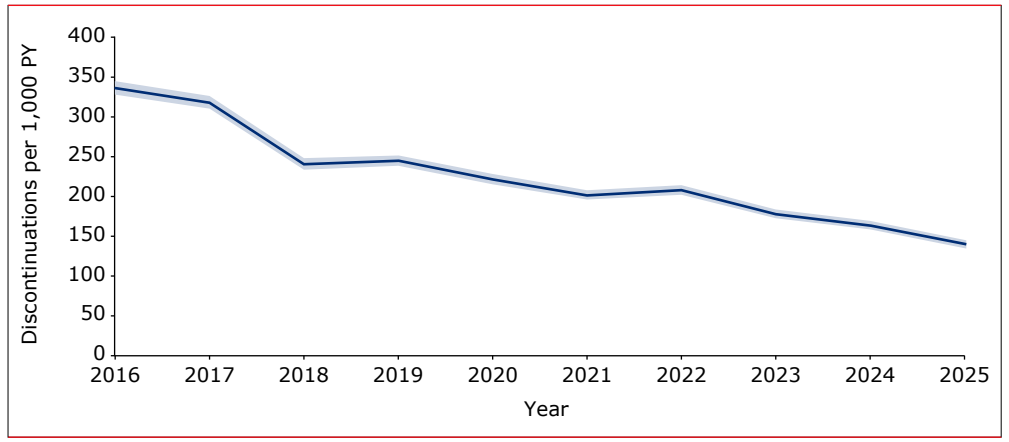
During the period 2016-2025, the overall rate of regimen changes was 222.1 modifications per 1,000 person years of follow-up. This rate peaked in 2016 at 336.2 modifications per 1,000 person years, after which the rate continuously decreased to 139.6 in 2025 (*Figure 3.9*).

Figure 3.8: *Reasons for discontinuation / modification of antiretroviral therapy (ART) used in 2016–2025. The number at the top of each bar represent the total number of treatment episodes with that particular ART regimen.*



Legend: *3TC = lamivudine; b = boosted (cobicistat or ritonavir); ABC = abacavir; ATV = atazanavir; ART = antiretroviral therapy; BIC = bictegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

Figure 3.9: *Rate of regimen modifications in 2016–2025.*



Legend: *Blue band represents the 95% confidence interval.*

Table 3.4: Exposure to various ART regimen and reasons for discontinuation / modification in the period 2016–2025.

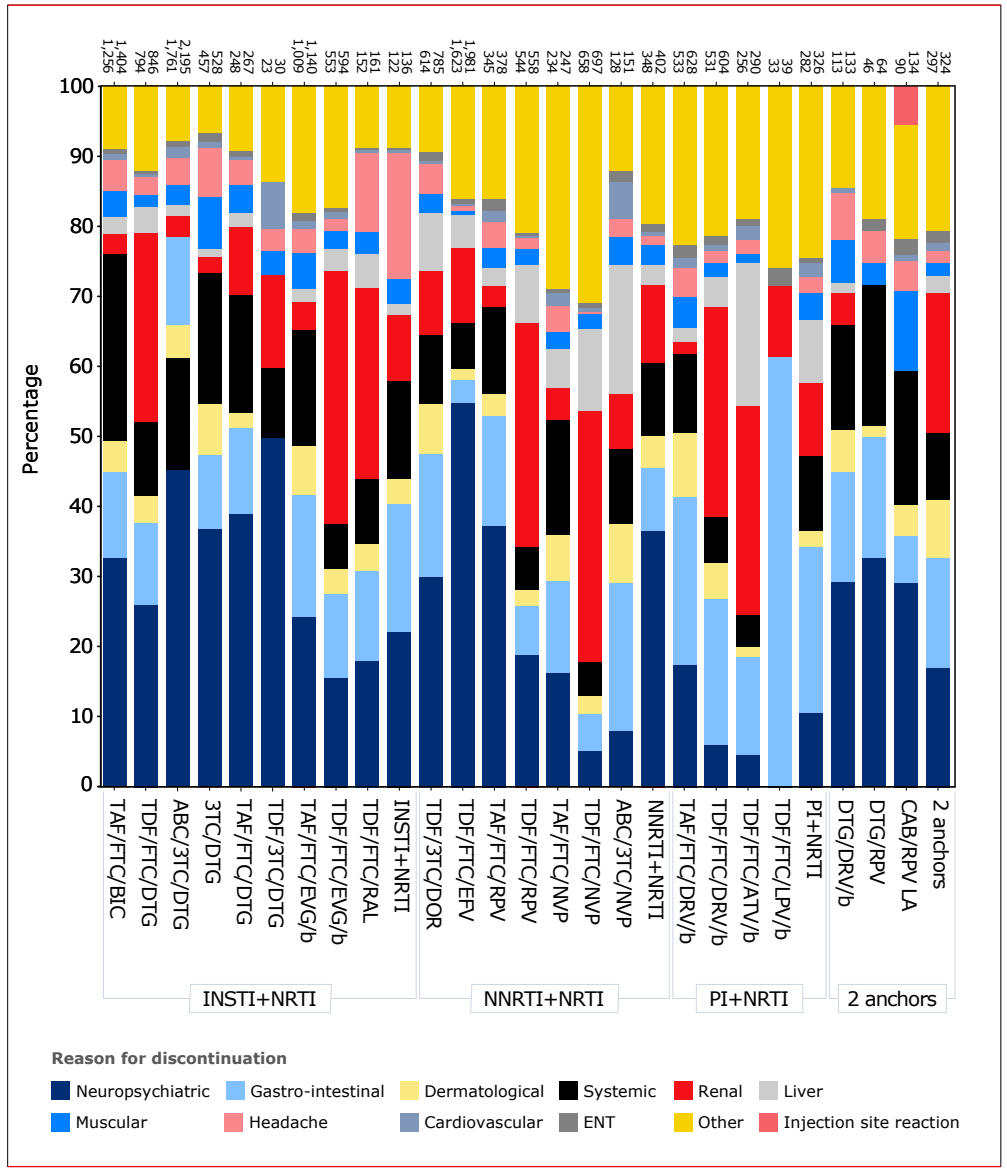
	Person years exposure	Total ART episodes	Reasons for discontinuation / modification				Reasons for discontinuation / modification											
			Episode still ongoing		Failure		Toxicity		Patient decision/ compliance		Simplification		Preventive/ interaction		Pregnancy related		Missing / Other reasons	
	PY	n	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total dataset	198939	75536	25113	33.2	1078	1.4	13318	17.6	5462	7.2	12490	16.5	5081	6.7	776	1	12218	16.2
INSTI + NRTI																		
TAF/FTC/BIC	21072	7834	4892	62.4	68	0.9	1256	16	669	8.5	345	4.4	152	1.9	58	0.7	394	5
TDF/FTC/DTG	7603	4308	1216	28.2	52	1.2	794	18.4	355	8.2	1303	30.2	246	5.7	40	0.9	302	7
ABC/3TC/DTG	22571	6382	1247	19.5	66	1	1761	27.6	687	10.8	1318	20.7	770	12.1	88	1.4	445	7
3TC/DTG	13723	5497	4460	81.1	56	1	457	8.3	159	2.9	153	2.8	25	0.5	37	0.7	150	2.7
TAF/FTC/DTG	4145	1451	465	32	23	1.6	248	17.1	133	9.2	408	28.1	36	2.5	20	1.4	118	8.1
TDF/3TC/DTG	306	464	88	19	2	0.4	23	5	10	2.2	131	28.2	8	1.7	2	0.4	200	43.1
TAF/FTC/EVG/b	20283	4956	1763	35.6	77	1.6	1009	20.4	465	9.4	630	12.7	608	12.3	73	1.5	331	6.7
TDF/FTC/EVG/b	6250	2331	365	15.7	27	1.2	553	23.7	214	9.2	590	25.3	388	16.6	20	0.9	174	7.5
TDF/FTC/RAL	1665	802	94	11.7	13	1.6	152	19	74	9.2	295	36.8	57	7.1	34	4.2	83	10.3
Other INSTI+NRTI	1833	673	148	22	14	2.1	122	18.1	51	7.6	218	32.4	39	5.8	10	1.5	71	10.5
NNRTI + NRTI																		
TDF/3TC/DOR	8738	3637	2366	65.1	47	1.3	614	16.9	204	5.6	143	3.9	73	2	21	0.6	169	4.6
TDF/FTC/EFV	14374	3958	791	20	65	1.6	1623	41	213	5.4	439	11.1	389	9.8	20	0.5	418	10.6
TAF/FTC/RPV	7865	2021	932	46.1	32	1.6	345	17.1	112	5.5	254	12.6	138	6.8	16	0.8	192	9.5
TDF/FTC/RPV	6641	2322	305	13.1	42	1.8	544	23.4	164	7.1	552	23.8	388	16.7	26	1.1	301	13
TAF/FTC/NVP	5581	1255	680	54.2	19	1.5	234	18.6	49	3.9	135	10.8	45	3.6	2	0.2	91	7.3
TDF/FTC/NVP	10656	2733	639	23.4	50	1.8	658	24.1	171	6.3	696	25.5	353	12.9	5	0.2	161	5.9
ABC/3TC/NVP	3224	668	138	20.7	22	3.3	128	19.2	43	6.4	125	18.7	163	24.4	4	0.6	45	6.7
Other NNRTI+NRTI	3199	1361	263	19.3	21	1.5	348	25.6	61	4.5	388	28.5	110	8.1	6	0.4	164	12
PI + NRTI																		
TAF/FTC/DRV/b	9060	3016	1378	45.7	50	1.7	533	17.7	374	12.4	264	8.8	192	6.4	48	1.6	177	5.9
TDF/FTC/DRV/b	5979	3049	256	8.4	57	1.9	531	17.4	400	13.1	1270	41.7	254	8.3	94	3.1	187	6.1
TDF/FTC/ATV/b	2778	1293	73	5.6	23	1.8	256	19.8	138	10.7	528	40.8	137	10.6	42	3.2	96	7.4
TDF/FTC/LPV/b	278	200	9	4.5	4	2	33	16.5	30	15	81	40.5	14	7	11	5.5	18	9
Other PI+NRTI	3406	1528	137	9	30	2	282	18.5	151	9.9	558	36.5	179	11.7	50	3.3	141	9.2
2 anchor-drugs																		
DTG/DRV/b	2880	837	393	47	14	1.7	113	13.5	110	13.1	98	11.7	45	5.4	6	0.7	58	6.9
DTG/RPV	845	321	171	53.3	6	1.9	46	14.3	23	7.2	35	10.9	13	4	2	0.6	25	7.8
CAB/RPV injectables	2460	1157	899	77.7	29	2.5	90	7.8	28	2.4	6	0.5	15	1.3	3	0.3	87	7.5
2 anchor-drugs w/wo NRTI	4098	2132	370	17.4	75	3.5	297	13.9	172	8.1	849	39.8	131	6.1	23	1.1	215	10.1
Other ART	3919	2064	331	16	93	4.5	267	12.9	193	9.4	665	32.2	112	5.4	14	0.7	389	18.8

Legend: *3TC = lamivudine; b = boosted (cobicistat or ritonavir); ABC = abacavir; ART = antiretroviral therapy; ATV = atazanavir; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; LPV = lopinavir; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

The nature and severity of (presumed) ART-related toxicities leading to modification of the regimen have changed considerably over time. Because of the availability of a large number of potent and well-tolerated recommended and alternative regimens, with new treatment options becoming available regularly, as well as the very low risk of viral breakthrough following a switch, the threshold for modifying a regimen has in general become much lower over the years. *Figure 3.10* provides a visual breakdown of the reported ART-related adverse events leading to the modification of the various regimen. As more than one adverse event can be reported for each toxicity-driven regimen modification, the total number of adverse events reported in *Figure 3.10* is greater than the number of regimens.

There were 13,050 toxicity-driven regimen modifications for which specific adverse events were recorded: 15,042 individual adverse effects were recorded. The predominant adverse effects were: neuropsychiatric (mainly insomnia, mood changes, dizziness, and depression) 30.4%; gastrointestinal (mainly diarrhoea and nausea) 13.3%; renal (renal insufficiency and increased serum creatinine) 12.5%; systemic (tiredness, apathy, loss of appetite, weight gain) 12.2%; dermatological (rash due to medication, itching) 4.4%; and liver (increased transaminases) 4.3%.

Figure 3.10: *Adverse effects resulting in toxicity-related modifications of ART regimen used in the period 2016–2025. The bars represent the distribution of all reported adverse effects, by regimen. The numbers above the bars represent 1) the total number of adverse effects reported as reasons for regimen modification (top row), and 2) the total number of times that particular regimen was modified because of adverse effects (bottom row).*



Treatment interruptions

We have analysed treatment interruptions separately from regimen modifications. During the period 2016-2025, the proportion of individuals at any particular time that have interrupted their use of ART has continued to decrease. The proportion of individuals who had started ART at least 6 months ago, who at yearly cross-sectional evaluation of the virological response were observed to have (temporarily) interrupted ART, decreased from 1.9% in 2016 to 0.7% in 2025 (see *Figure 3.11* from the next section on Virological response).

During the period 2016-2025, the cohort of 27,108 individuals accrued a total of 198,939 person years of follow-up, in which a total of 75,536 ART regimens were used. In 2,577 individuals a total of 4,203 treatment interruptions (of 14 days or longer) were recorded (*Table 3.5*). However, it must be assumed that many more treatment interruptions have not been disclosed and hence have gone unrecorded in the medical dossier (see also the next paragraph on loss of viral suppression, where we show evidence of frequent episodes of loss of viral suppression followed by a return to undetectable levels without a change in the treatment regimen).
In most of the treatment interruptions, patients themselves interrupted ART (75.2%), with their treating physicians becoming aware of the interruption only during the next clinic visit. Unfortunately, we cannot with certainty determine from the available data if these treatment interruptions were caused by the circumstances of the patient (e.g. unintentionally running out of medicine while on vacation), or secondly if the patients themselves actively decided to interrupt ART, or thirdly if the interruption was decided on by their treating physician. A further 10.8% of interruptions had ART-associated toxicity as the recorded reason, and 0.6% of interruptions were pregnancy-related.
The median duration of recorded treatment interruptions was 12.3 weeks (IQR 4.6–30.9). During many of the longer interruptions, most of these individuals had also effectively disengaged from care, with no visits to the HIV outpatient clinic for more than six months. In 68.4% of the interruptions the same regimen as that was used at the start of the treatment interruption was restarted.

We evaluated the median change in CD4 count during treatment interruptions of more than 90 days duration (n=2,057). In 935 of these 2,057 treatment interruptions of at least 90 days duration a pre-interruption CD4 count had been measured within 180 days of the start of the interruption (median 470, IQR 260 to 724, cells/mm^3). And in 1,182 episodes there was a CD4 count measured during (and at least 60 days after the start of) the treatment interruption (median 310, IQR 130 to 532 cells/mm^3). For 566 treatment interruptions of more than 90 days, a pre-interruption CD4 count was available and also a CD4 count that had been measured during the interruption. During these 566 interruptions the median change in the CD4 count was -120 (IQR -20 to -253) cells/mm^3.

Table 3.5: Frequency, duration and reasons for treatment interruptions in the period 2016–2025.

	Duration of interruption (weeks)			Patients	Total episodes	Reasons for interruption										Restarted same regimen
						Failure		Toxicity		Patient decision/ compliance		Pregnancy related		Other		
	Median	Q1	Q3	n	n	n	%	n	%	n	%	n	%	n	%	%
Total dataset	12.3	4.6	30.9	2577	4203	42	1.0	456	10.8	3162	75.2	24	0.6	519	12.3	68.4
INSTI + NRTI																
TAF/FTC/BIC	11.7	4.4	30.9	438	591	3	0.5	56	9.5	455	77.0	.	.	77	13.0	81.7
TDF/FTC/DTG	10.9	4.4	30.2	191	256	1	0.4	26	10.2	198	77.3	3	1.2	28	10.9	77.0
ABC/3TC/DTG	14.6	4.6	36.7	394	567	1	0.2	65	11.5	425	75.0	.	.	76	13.4	71.1
3TC/DTG	9.9	4.3	25.9	88	100	.	.	13	13.0	71	71.0	1	1.0	15	15.0	70.0
TAF/FTC/DTG	15.3	4.9	38.9	73	99	1	1.0	9	9.1	80	80.8	.	.	9	9.1	72.7
TDF/3TC/DTG	5.9	4.1	12.4	9	10	.	.	.	.	4	40.0	.	.	6	60.0	10.0
TAF/FTC/EVG/b	12.7	5.0	30.1	277	363	6	1.7	54	14.9	260	71.6	.	.	43	11.8	65.0
TDF/FTC/EVG/b	12.9	6.1	28.9	110	169	3	1.8	15	8.9	137	81.1	1	0.6	13	7.7	63.3
TDF/FTC/RAL	10.7	4.3	34.4	48	58	2	3.4	10	17.2	34	58.6	3	5.2	9	15.5	50.0
Other INSTI+NRTI	8.9	4.3	17.6	32	38	.	.	6	15.8	24	63.2	.	.	8	21.1	50.0
NNRTI + NRTI																
TDF/3TC/DOR	9.4	4.3	26.0	131	158	4	2.5	19	12.0	112	70.9	.	.	23	14.6	71.5
TDF/FTC/EFV	10.9	4.6	28.1	139	172	3	1.7	14	8.1	122	70.9	1	0.6	32	18.6	54.1
TAF/FTC/RPV	9.4	4.3	24.7	74	97	2	2.1	16	16.5	61	62.9	.	.	18	18.6	68.0
TDF/FTC/RPV	11.7	4.7	40.4	100	115	3	2.6	10	8.7	86	74.8	.	.	16	13.9	56.5
TAF/FTC/NVP	12.9	6.0	27.1	31	34	.	.	3	8.8	25	73.5	.	.	6	17.6	55.9
TDF/FTC/NVP	13.9	5.0	46.0	101	118	1	0.8	9	7.6	97	82.2	1	0.8	10	8.5	51.7
ABC/3TC/NVP	11.1	5.1	23.0	22	30	1	3.3	5	16.7	22	73.3	.	.	2	6.7	73.3
Other NNRTI+NRTI	8.6	5.4	19.6	43	51	2	3.9	7	13.7	29	56.9	1	2.0	12	23.5	60.8
PI + NRTI																
TAF/FTC/DRV/b	12.5	4.9	31.4	204	306	2	0.7	35	11.4	239	78.1	.	.	30	9.8	77.5
TDF/FTC/DRV/b	13.9	5.4	39.9	217	280	1	0.4	29	10.4	223	79.6	5	1.8	22	7.9	56.4
TDF/FTC/ATV/b	14.9	5.1	35.7	80	101	.	.	7	6.9	86	85.1	1	1.0	7	6.9	55.4
TDF/FTC/LPV/b	21.6	8.7	57.4	10	17	.	.	.	.	16	94.1	.	.	1	5.9	70.6
Other PI+NRTI	13.3	4.4	33.9	85	116	.	.	15	12.9	87	75.0	5	4.3	9	7.8	67.2
2 anchor-drugs																
DTG/DRV/b	10.6	4.7	25.3	57	73	.	.	3	4.1	64	87.7	.	.	6	8.2	83.6
DTG/RPV	4.4	3.3	22.4	13	18	1	5.6	2	11.1	14	77.8	.	.	1	5.6	72.2
CAB/RPV injectables	5.2	2.9	10.7	18	18	.	.	4	22.2	8	44.4	.	.	6	33.3	38.9
2 anchor-drugs w/wo NRTI	16.1	5.6	31.1	74	112	3	2.7	5	4.5	90	80.4	.	.	14	12.5	80.4
Other ART	7.7	4.4	23.6	96	121	2	1.7	19	15.7	85	70.2	1	0.8	14	11.6	60.3

Legend: *3TC = lamivudine; b = boosted (cobicistat or ritonavir); /r = ritonavir-boosted; /c = cobicistat-boosted; ABC = abacavir; ATV = atazanavir; ART = antiretroviral therapy; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; LPV = lopinavir; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

Virological response

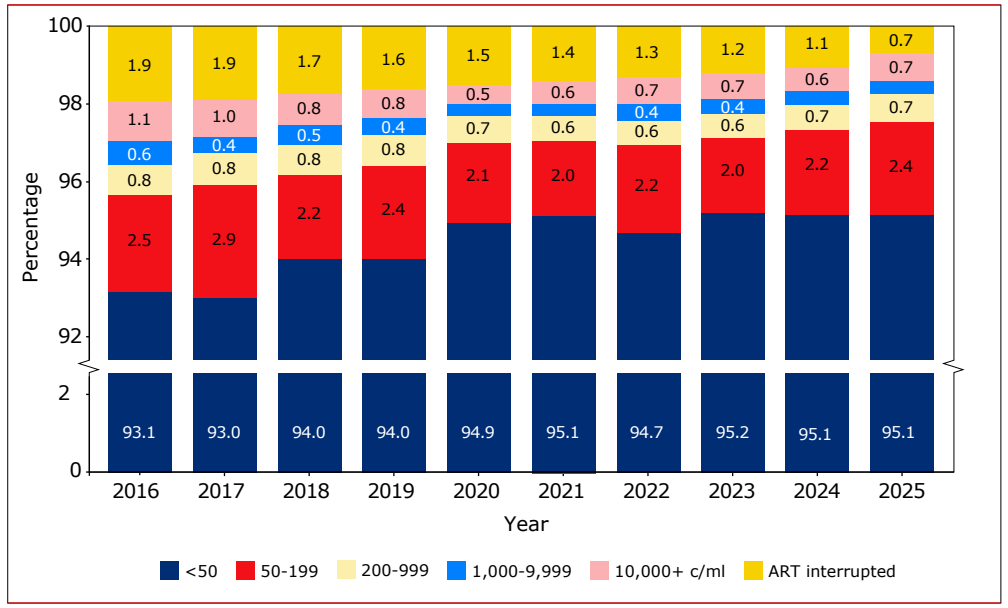
The study population for the analyses in this section consisted of all individuals on ART for more than 6 months who were in care during (part of) the period 2016-2025. For each calendar year between 2016 and 2025 we selected the last measured plasma HIV-RNA load measured in the 24 months prior to 31 December of that year. In the rare cases that no viral load had been measured in the investigated calendar nor in the year prior, that individual was excluded from the analysis of that calendar year.
Viral load measurements were classified into six categories (see also *Box 4.2*).
Five were defined by value:

1. <50 c/ml ("virally suppressed"; including "target not detected/undetectable", values "below the lower limit of quantification of the assay used", and "residual viraemia" below 50 c/ml),
2. 50–199 c/ml ("low-level viraemia", including isolated "blips"),
3. 200–999 c/ml,
4. 1,000–9,999 c/ml, and
5. ≥10,000 c/ml.
6. Measurements taken when ART was known to be interrupted; these were classified separately irrespective of the measured value.

At higher viral loads it becomes increasingly likely that ART had been interrupted at, or shortly before, the measurement, or that adherence was suboptimal — though these possibilities cannot be distinguished.
Figure 3.11 shows the distribution of the yearly cross-sectional viral load evaluations. During the last 10 years of follow-up, the proportion of individuals on ART for more than 6 months who had a viral load <50 c/ml increased from 93.1% in 2016 (95.7% <200 c/ml) to 95.1% (97.5% <200 c/ml) in 2025. Likewise, all viral load categories higher than 50 c/ml, decreased slowly over time (the number of analysed viral load measurements and more precise percentages are shown in Appendix *Table 3.2*).

Quantifiable viral loads between 50-199 c/ml are frequently observed. When a single isolated viral load measurement between 50-199 c/ml occurs preceded by and followed by viral load measurements <50 c/ml this is often referred to as a "blip". We investigated which proportion of the population on ART shows signs of sustained low-level viraemia, i.e. individuals who had multiple consecutive viral load measurements between 50-199 c/ml while on ART. We calculated what proportion of all viral load measurements within individuals classifies as low-level viraemia, in all 23,753 individuals who had started ART more than 6 months earlier, who had not interrupted ART, and who had at least 5 viral load measurements available for analysis in the period 2016-2025. Of all individuals on ART, 76.3% did not have a single viral load measurement between 50-199 c/ml. In 17.0% of individuals the proportion of viral load measurements between 50-199 c/ml was greater than 0% and up to 10%. In a further 4.9% this proportion was greater than 10% and up to 20% of all viral load measurements. And in 2.1% of all individuals there was evidence of sustained low-level viraemia with more than 20% of all their viral load measurements being between 50-199 c/ml.

Figure 3.11: *Yearly cross-sectional analysis of virological treatment response in people on ART for at least 6 months in 2016–2025.*



Box 4.2: Definitions of virological response.

Virological response

Viral suppression
HIV viral load below 50 c/ml in individuals on antiretroviral therapy (ART) for more than six months. This includes residual viraemia between 20-50 c/ml.

The last measured viral load measurement prior to 31 December of each calendar year was included in the analysis, irrespective of (temporary) treatment interruptions.

Viral 'blips'
A single quantifiable viral load measurement between 50-199 c/ml, preceded by and followed by viral load measurements <50 c/ml.

Low-level viraemia
Two or more consecutive viral load measurements between 50-199 c/ml.

Loss of viral suppression
Any viral load measurements of at least 200 c/ml in individuals on ART for more than six months.

Loss of viral suppression

Loss of viral suppression was defined as a viral load measurement of at least 200 c/ml in individuals on ART for more than six months. We assessed the frequency, magnitude, duration and outcome of all episodes of loss of viral suppression in all individuals on ART for more than 6 months and in care in the period 2016-2025.
Each individual could contribute more than one episode of loss of viral suppression to this analysis. We analysed episodes of loss of viral suppression that occurred during an ART interruption separately from those that occurred while ART had been used continuously. All analyses were stratified for MSM plus transgender people, men other than MSM, and women.
In those episodes that occurred while ART use was continued, we investigated whether the episode of loss of viral suppression resolved with or without a change in the ART regimen used. A major limitation is that we have very limited data on adherence. Nevertheless, the maximum viral load measured during episodes of loss of viral suppression is much higher (median 4.6 $\log_{10}$ c/ml) in those individuals who were known to have discontinued ART compared to individuals who indicated to still use ART (median 3.0 $\log_{10}$ c/ml).

Loss of viral suppression occurred in two distinct settings (Table 3.6): during a treatment interruption (2,084 episodes in 1,644 individuals) and while ART was assessed to have been used continuously (4,569 episodes in 3,107 individuals).

During treatment interruptions, most episodes were short: 81.2% (n=1,694) lasted less than 0.5 years, 5.5% (n=115) between 0.5 and <1.0 years, and 13.2% (n=275) longer than 1 year. By the end of follow-up, 90.5% (n=1,885) had resolved after restarting ART (with the same or a different regimen), 7.0% (n=145) were still ongoing, and 2.6% (n=54) had ended in death. Advanced HIV/AIDS-defining conditions were the predominant cause of these deaths (35.2%, n=19), which is a markedly higher proportion than in the overall population in HIV care in the Netherlands (see Chapter 6, Morbidity and mortality).

While ART was used continuously, 72.9% of episodes consisted of a single viral load above 200 c/ml. Among the remainder (two or more consecutive measurements above 200 c/ml), 17.0% lasted less than 0.5 years, 4.6% between 0.5 and <1.0 years, and 5.6% longer than 1 year. By the end of follow-up, 92.3% had resolved — 72.6% without and 19.7% after a regimen modification — 6.4% were still ongoing, and 1.2% (n=58) had ended in death. Here too, advanced HIV/AIDS-defining conditions were the leading cause of death (25.9%, n=15), closely followed by non-AIDS-defining malignancies (22.4%, n=13).
Across both settings, men other than MSM, and women most of all, were strongly overrepresented among those with loss of viral suppression relative to MSM and transgender people. Women also more often modified their ART regimen before the episode finally resolved.

We also analysed the occurrence of all fatal and non-fatal AIDS-defining conditions that occurred during or shortly after (within 90 days) episodes of loss of viral suppression. Similar to the previous analyses, we analysed the occurrence of AIDS-defining events during episodes of loss of viral suppression that occurred during an ART interruption separately from those that occurred while ART had been used continuously. During 152 (7.3%) of 2084 episodes (in 1644 individuals) of loss of viral suppression while ART was discontinued, one or more AIDS-defining events occurred. During 68 (1.5%) of 4569 episodes (in 3107 individuals) of loss of viral suppression while ART was continuously used, one or more AIDS-defining events occurred.

In 1,721 (25.9%) of these 6,653 episodes of loss of viral suppression a genotypic resistance test was performed. Resistance scores were calculated for all available antiretroviral agents using the latest version of the Stanford University HIV Drug Resistance Database (HIVdb). All available genotypes (including all historical genotypes) were scored using the same algorithm. To detect viral evolution, for each genotype we assessed if there was an increase in the resistance score for any antiretroviral agent compared to the maximum value observed in previously measured genotypes in that particular individual. If the genotype measured during the episode of loss of viral suppression was the first measured genotype for that individual, we considered any non-zero resistance score as evidence of viral evolution.

In 586 (34.0%) of these 1,721 genotypes an increase in the resistance score to one or more antiretroviral agents was detected (for a comprehensive analysis of genotypic resistance data see Chapter 5). The likelihood of a genotypic resistance test being performed and detecting an increase in the resistance score was associated with the number of sequential viral load measurements above 200 c/ml, and also with the maximum viral load value measured.

The likelihood that a genotypic resistance test was performed increased with the number of consecutive viral load measurements >200 c/ml:

- 839 of 4,584 episodes (19.3%) with a single measurement >200 c/ml
- 409 of 1,148 episodes (35.6%) with 2 consecutive measurements >200 c/ml
- 200 of 428 episodes (46.7%) with 3 measurements >200 c/ml
- 273 of 493 episodes (53.4%) with at least 4 measurements >200 c/ml

Among the genotypes performed, the probability of detecting an increase in the resistance score likewise rose with the number of consecutive measurements >200 c/ml:

- 243 of 839 genotypes (29.0%) from episodes with a single measurement >200 c/ml
- 166 of 409 genotypes (40.6%) from episodes with 2 consecutive measurements >200 c/ml
- 81 of 200 genotypes (40.5%) from episodes with 3 measurements >200 c/ml
- 96 of 273 genotypes (35.2%) from episodes with at least 4 measurements >200 c/ml

The likelihood that a genotypic resistance test was performed also increased with the maximum viral load reached during the episode:

- 158 of 1,732 episodes (9.1%) with a maximum viral load of 200-499 c/ml
- 162 of 752 episodes (21.5%) with 500-999 c/ml
- 524 of 1,590 episodes (33.0%) with 1,000-9,999 c/ml
- 877 of 2,579 episodes (34.0%) with >10,000 c/ml

Among the genotypes performed, the probability of detecting an increase in the resistance score also rose with the maximum viral load reached:

- 35 of 158 genotypes (22.2%) from episodes with a maximum viral load of 200-499 c/ml
- 57 of 162 genotypes (35.2%) from episodes with 500-999 c/ml
- 190 of 524 genotypes (36.3%) from episodes with 1,000-9,999 c/ml
- 304 of 877 genotypes (34.7%) from episodes with >10,000 c/ml

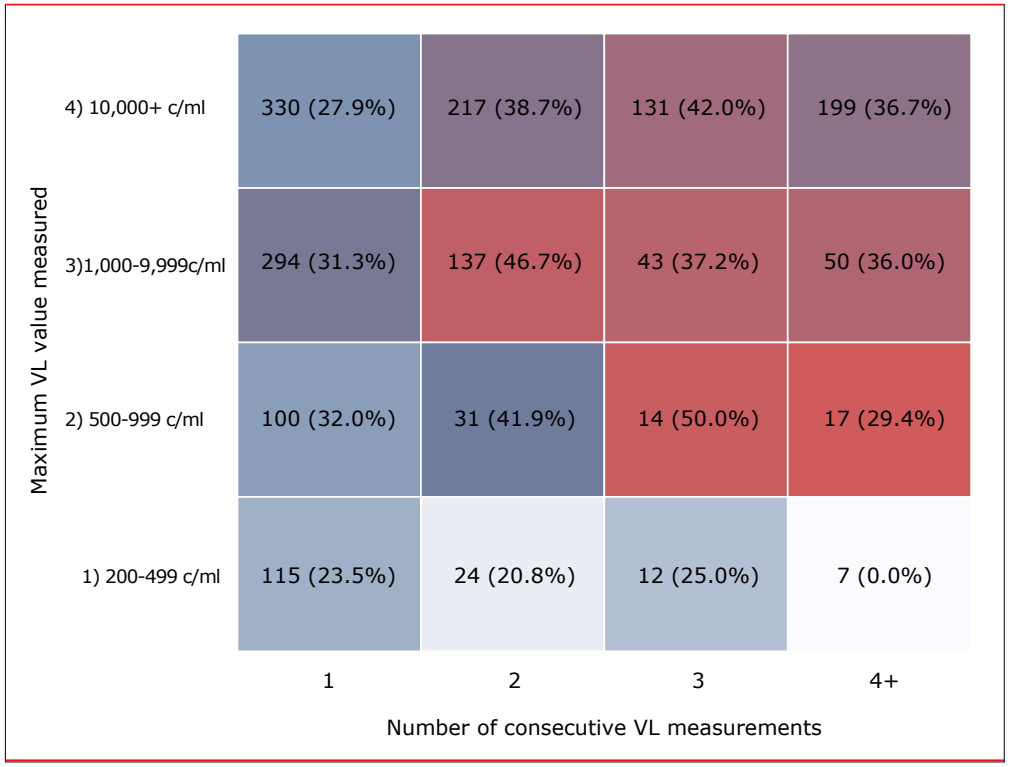
Figure 3.12 shows a heatmap of the probability of detecting an increase in the resistance score when considering both the number of consecutive viral load measurements above 200 c/ml and the maximum viral load value measured. When the maximum viral load value was between 200-499 c/ml the probability of detecting an increase in the resistance score increased was lowest. Higher maximum viral load values carried intermediate risk when the episode consisted of only a single viral load measurement >200 c/ml. The highest risks for detecting at least a single major RAM occurred when the maximum viral load was at least 500 c/ml and there were at least 2 consecutive viral load measurements above 200 c/ml.

Table 3.6: Occurrence of loss of viral suppression during 2016–2025 in individuals on ART for more than 6 months.

	All		MSM + TG		Men other than MSM		Women	
Loss of viral suppression because of ART interruption								
N of subjects	1,644		770		393		481	
N of episodes	2,084		963		507		614	
Duration of failure, n/%								
Single VL measurement	1266	60.7	573	59.5	316	62.3	377	61.4
<0.5 year	428	20.5	205	21.3	121	23.9	102	16.6
0.5 – <1 year	115	5.5	61	6.3	15	3.0	39	6.4
1 – <2 years	125	6.0	56	5.8	30	5.9	39	6.4
2+ years	150	7.2	68	7.1	25	4.9	57	9.3
Highest viral load, log_{10}, median, Q1–Q3	4.6 3.8–5.2		4.6 3.9–5.7		4.7 4.0–5.4		4.4 3.6–5.1	
Outcome, n/%								
Ongoing	145	7.0	77	8.0	32	6.3	36	5.9
Restarted, resolved	1885	90.5	859	89.2	461	90.9	565	92.0
Died while still off ART	54	2.6	27	2.8	14	2.8	13	2.1
Cause of death, n/%								
Advanced HIV / AIDS	19	35.2	10	37.0	5	35.7	4	30.8
Non-AIDS malignancies	8	14.8	2	7.4	3	21.4	3	23.1
Cardiovascular disease	4	7.4	2	7.4	1	7.1	1	7.7
Non-AIDS infection	2	3.7	.	.	1	7.1	1	7.7
Liver disease	2	3.7	1	3.7	1	7.1	.	.
Lung disease	4	7.4	2	7.4	1	7.1	1	7.7
Non-natural death	1	1.9	1	3.7	.	.	.	.
Alcohol and substance use	3	5.6	2	7.4	.	.	1	7.7
Other causes	3	5.6	2	7.4	1	7.1	.	.
Unknown	5	9.3	4	14.8	.	.	1	7.7
Sudden death	3	5.6	1	3.7	1	7.1	1	7.1
Loss of viral suppression while on ART								
N of subjects	3,107		1,485		767		855	
N of episodes	4,569		1,952		1,171		1,446	
Duration, n/%								
Single VL measurement	3331	72.9	1462	74.9	843	72.0	1026	71.0
<0.5 year	775	17.0	320	16.4	210	17.9	245	16.9
0.5 – 1 year	211	4.6	78	4.0	51	4.4	82	5.7
1 – 2 years	135	3.0	48	2.5	38	3.2	49	3.4
2+ years	117	2.6	44	2.3	29	2.5	44	3.0
Highest viral load during episode, median, Q1–Q3	3.0 2.5–4.0		2.8 2.5–3.6		3.1 2.6–4.2		3.2 2.6–4.1	
Outcome, n/%								
Resolved, no switch	3315	72.6	1454	74.5	846	72.2	1015	70.2
Ongoing, no switch	253	5.5	108	5.5	72	6.1	73	5.0
Resolved, switched	902	19.7	355	18.2	224	19.1	323	22.3
Ongoing, switched	41	0.9	16	0.8	8	0.7	17	1.2
Died, no switch	33	0.7	11	0.6	11	0.9	11	0.8
Died, switched	25	0.5	8	0.4	10	0.9	7	0.5
Cause of death, n/%								
advanced HIV / AIDS	15	25.9	5	26.3	7	33.3	3	16.7
Non-AIDS malignancies	13	22.4	3	15.8	5	23.8	5	27.8
Cardiovascular disease	3	5.2	.	.	.	.	3	16.7
Non-AIDS infection	3	5.2	2	10.5	.	.	1	5.6
Liver disease	.	.	.	.	.	.	.	.
Lung disease	2	3.4	1	5.3	1	4.8	.	.
Non-natural death	2	3.4	1	5.3	.	.	1	5.6
Alcohol and substance use	2	3.4	1	5.3	1	4.8	.	.
Other causes	6	10.3	3	15.8	2	9.5	1	5.6
Unknown	9	15.5	2	10.5	3	14.3	4	22.2

Legend: *MSM = men who have sex with men; TG = transgender people; PY = person years; ART = antiretroviral therapy; VL = viral load.*

Figure 3.12: Number and percentage of genotypic resistance tests detecting an increase in the resistance score to at least one antiretroviral agent stratified by maximum viral load measured and by the number of consecutive viral load measurements above 200 c/ml during an episode of loss of viral suppression while continuing ART.



Immunological response

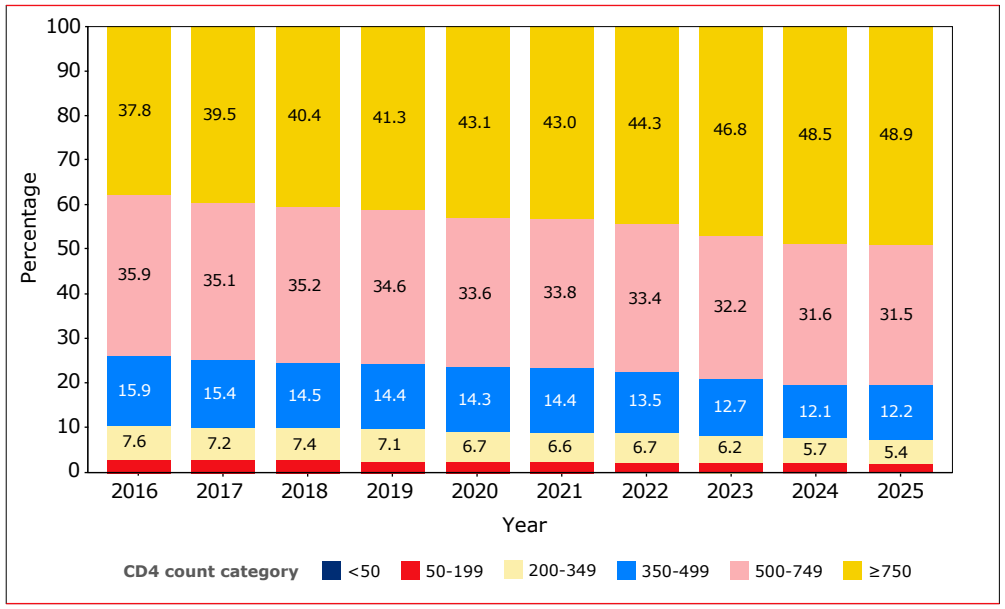
After initiation of ART, most people get durably suppressed plasma HIV RNA to levels below <50 c/ml, and this is accompanied by recovery of the CD4 count. Failure to durably suppress HIV replication is associated with poorer recovery of the CD4 count[18,19]. In case of frequent and/or prolonged loss of viral suppression, HIV disease progression can develop with a significant decrease of the CD4 count and the occurrence of opportunistic diseases. In people with prolonged viral suppression, CD4 recovery is the norm, but in a minority it remains protracted and/or incomplete, with the CD4 count plateauing below 350 cells/mm^3. This is a situation reported to be associated with an increased risk of progression to AIDS and development of non-AIDS-defining diseases[20]. Median CD4 counts in men without HIV are on average approximately 830 cells/mm^3 and around 1000 cells/mm^3 in women, but this varies according to factors such as age, ethnicity, and smoking behaviour[21,22]. The level of recovery of the immune system is strongly correlated to the risk for adverse health outcomes, i.e. morbidity and mortality because of AIDS-defining and other clinical events (also see Chapter 6)[23-27].

For people with a low-to-moderate CD4 count (below 350 cells/mm^3), CD4 count testing is recommended at least twice a year. When a person has a CD4 count above 350 cells/mm^3, the testing frequency may be reduced. For each individual, we obtained the last measured CD4 count in each calendar year, and used last-observation-carried-forward to impute missing values using the CD4 counts measured during the previous years.

Trends in the CD4 distribution

Of all individuals who were on ART in the period 2016-2025, CD4 count data are shown in Figure 3.13. The percentage of individuals on ART with a normalised CD4 count (i.e. with a CD4 count ≥500 cells/mm3) increased from 73.7% in 2016 to 80.4% in 2025. The percentage of individuals on ART with CD4 counts below 350 cells/mm^3 slowly continued to decrease from 10.4% in 2016 to 7.3% in 2025. These favourable changes in the distribution of the CD4 count in the treated population are the consequence of 1) the current guidelines recommending ART initiation as soon as possible after HIV diagnosis and irrespective of the CD4 count, 2) a more pronounced immune recovery with longer ART use, 3) increasing virological suppression rates, and 4) attrition through the higher mortality rates in individuals with low CD4 counts.

Figure 3.13: Last available CD4 count of the population on ART by calendar year.



Immunological response 5 years after ART initiation (2016–2021)

The distribution of pre-ART CD4 counts in ART-naïve individuals initiating first-line ART has remained fairly constant in the period between 2016 and 2025 (*Figure 3.14*). In 2025, 25.3% of individuals initiating ART had a CD4 count below 200 cells/mm^3, and another 20.2% had a CD4 count between 200 and <350 cells/mm^3. This distribution closely resembles the CD4 counts at HIV diagnosis as the large majority of individuals are initiating ART shortly after diagnosis (see *Figure 3.1A&B* as well as Chapter 1).

We also assessed the immunological response in individuals who started first-line ART in 2016-2020 to allow for a potential duration of follow-up of 5 years. The level of viral suppression after initiating ART was not taken into account in this analysis, but is generally very high (see *Table 3.3* and *Figure 3.11*). Nor were temporary treatment interruptions taken into account. The changes in the CD4 count distribution following ART initiation are visualized in Figure 3.15A. Whereas at the initiation of ART 26.2% of individuals had a CD4 count below 200 cells/mm^3 and 18.7% had a CD4 count between 200 and <350 cells/mm^3, these proportions had decreased after 5 years of ART to 1.9% with a CD4 count below 200 cells/mm^3 and 6.3% between 200 and <350 cells/mm^3.

The speed and magnitude of the changes of the CD4 count after ART initiation strongly depend on the pre-ART CD4 count. The 'heatmap' in *Figure 3.15B* shows the 5-year evolution of the CD4 count distribution stratified by the baseline CD4 count. The CD4 count distributions in all pre-ART CD4 count strata show favourable changes over time, but fail to converge even after 5 years of ART. Virtually all individuals who initiate ART while in the higher CD4 count strata remain in these higher strata, or increase their CD4 counts even further. The vast majority of individuals who initiate ART in the lower CD4 count strata have reached the higher CD4 count strata after 5 years of ART: only 11.7% of individuals who initiate ART with a CD4 below 50 remain below 200 after 5 years of ART, and only 3.4% of individuals who initiate ART with a CD4 between 50 and <200 remain below 200 after 5 years of ART. A limitation of this analysis is that attrition because of increased mortality in those who fail to increase their CD4 count is not taken into account.

Figure 3.14: The pre-ART CD4 count in ART-naïve individuals initiating first-line ART by calendar year.

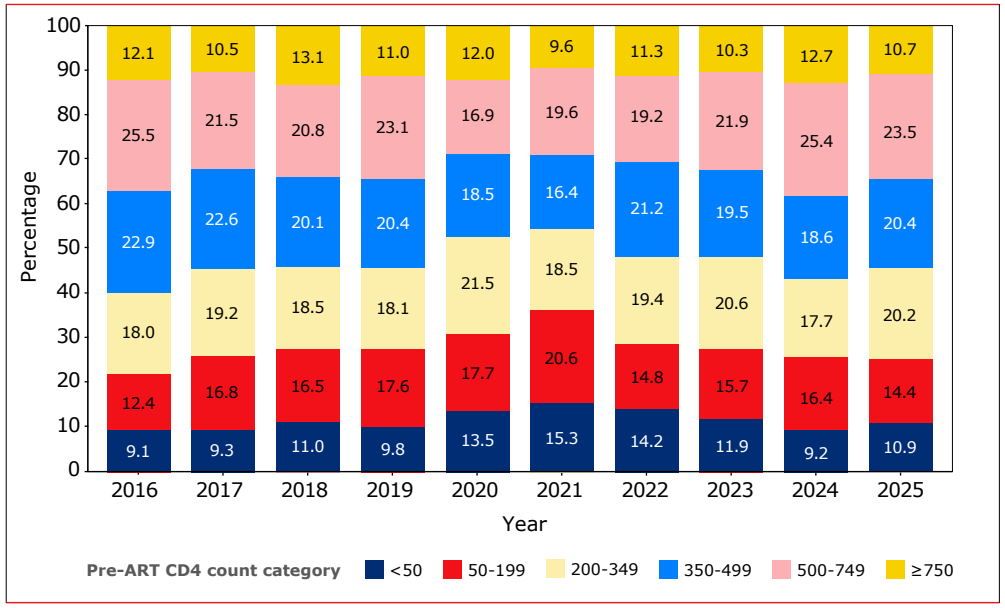
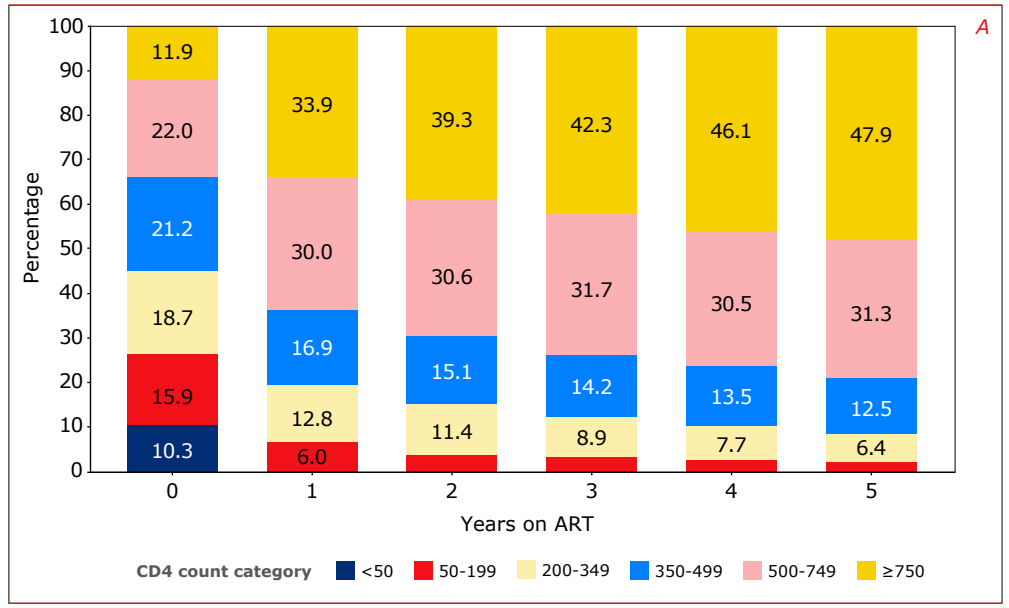


Figure 3.15A&B: Changes in CD4 count distribution over 5 years following the start of antiretroviral therapy (ART) in 2016-2020 (A) and stratified for the last measured CD4 count prior to start of ART (B). Column percentages add up to 100%.



B

CD4 count category	<50						50-199					
750+		0.6	1.7	2.3	4.6	8.7		2.3	4.7	7.4	11.3	12.9
500-749		5.0	10.1	18.5	19.6	23.3		16.4	24.1	29.5	31.5	34.0
350-499		15.7	27.7	27.8	31.4	26.5		28.7	29.0	31.2	31.1	33.0
200-349		39.8	37.2	33.0	31.1	29.7		38.2	35.1	26.6	21.8	16.7
50-199		36.2	21.8	17.3	11.8	10.8	100	13.9	6.7	4.8	3.9	3.1
<50	100	2.8	1.7	1.1	1.4	0.9		0.5	0.4	0.6	0.4	0.4

CD4 count category	200-349						350-499					
750+		13.1	20.6	23.4	28.5	33.2		34.1	42.6	47.0	51.9	54.6
500-749		42.7	46.6	49.6	48.7	47.3		43.6	42.1	41.5	38.9	37.9
350-499		29.8	22.1	19.8	17.1	15.8	100	21.3	14.2	10.0	8.0	6.5
200-349	100	13.8	10.3	6.6	5.2	3.2		0.9	0.8	1.1	1.1	0.8
50-199		0.6	0.4	0.4	0.5	0.5		0.1	0.0	0.3	0.1	0.1
<50		0.0	0.0	0.1	0.0	0.0		0.0	0.3	0.1	0.0	0.0

CD4 count category	500-749						750+					
750+		57.5	64.9	69.8	72.1	71.8	100	93.4	92.6	91.4	94.2	91.8
500-749	100	39.7	32.2	27.0	24.7	25.7		6.3	7.4	8.1	5.3	7.7
350-499		2.6	2.7	2.7	2.4	1.8		0.2	0.0	0.5	0.5	0.5
200-349		0.0	0.1	0.3	0.4	0.3		0.0	0.0	0.0	0.0	0.0
50-199		0.1	0.1	0.1	0.3	0.4		0.0	0.0	0.0	0.0	0.0
<50		0.0	0.0	0.1	0.1	0.0		0.0	0.0	0.0	0.0	0.0

0 1 2 3 4 5 0 1 2 3 4 5

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Appendix Table 3.1: *Frequency of and reasons for discontinuation / modification of various ART regimen in the period 2016–2025.*

						Stop reasons (n & rate per 1,000PY)											
	Exposure (PY)	Total episodes (n)	Ongoing episodes (n)	Failure		Toxicity		Patient choice		Simplification		Prevention		Pregnancy		Other reasons	
Calendar year				n	rate	n	rate	n	rate	n	rate	n	rate	n	rate	n	rate
INSTI + NRTI																	
TAF/FTC/BIC	21072	7834	4892	68	3.2	1256	59.6	669	31.7	345	16.4	152	7.2	58	2.8	394	18.7
TDF/FTC/DTG	7603	4308	1216	52	6.8	794	104.4	355	46.7	1303	171.4	246	32.4	40	5.3	302	39.7
ABC/3TC/DTG	22571	6382	1247	66	2.9	1761	78.0	687	30.4	1318	58.4	770	34.1	88	3.9	445	19.7
3TC/DTG	13723	5497	4460	56	4.1	457	33.3	159	11.6	153	11.1	25	1.8	37	2.7	150	10.9
TAF/FTC/DTG	4145	1451	465	23	5.5	248	59.8	133	32.1	408	98.4	36	8.7	20	4.8	118	28.5
TDF/3TC/DTG	306	464	88	2	6.5	23	75.0	10	32.6	131	427.4	8	26.1	2	6.5	200	652.5
TAF/FTC/EVG/b	20283	4956	1763	77	3.8	1009	49.7	465	22.9	630	31.1	608	30.0	73	3.6	331	16.3
TDF/FTC/EVG/b	6250	2331	365	27	4.3	553	88.5	214	34.2	590	94.4	388	62.1	20	3.2	174	27.8
TDF/FTC/RAL	1665	802	94	13	7.8	152	91.3	74	44.4	295	177.1	57	34.2	34	20.4	83	49.8
Other INSTI+NRTI	1833	673	148	14	7.6	122	66.6	51	27.8	218	118.9	39	21.3	10	5.5	71	38.7
NNRTI + NRTI																	
TDF/3TC/DOR	8738	3637	2366	47	5.4	614	70.3	204	23.3	143	16.4	73	8.4	21	2.4	169	19.3
TDF/FTC/EFV	14374	3958	791	65	4.5	1623	112.9	213	14.8	439	30.5	389	27.1	20	1.4	418	29.1
TAF/FTC/RPV	7865	2021	932	32	4.1	345	43.9	112	14.2	254	32.3	138	17.5	16	2.0	192	24.4
TDF/FTC/RPV	6641	2322	305	42	6.3	544	81.9	164	24.7	552	83.1	388	58.4	26	3.9	301	45.3
TAF/FTC/NVP	5581	1255	680	19	3.4	234	41.9	49	8.8	135	24.2	45	8.1	2	0.4	91	16.3
TDF/FTC/NVP	10656	2733	639	50	4.7	658	61.7	171	16.0	696	65.3	353	33.1	5	0.5	161	15.1
ABC/3TC/NVP	3224	668	138	22	6.8	128	39.7	43	13.3	125	38.8	163	50.6	4	1.2	45	14.0
Other NNRTI+NRTI	3199	1361	263	21	6.6	348	108.8	61	19.1	388	121.3	110	34.4	6	1.9	164	51.3
PI + NRTI																	
TAF/FTC/DRV/b	9060	3016	1378	50	5.5	533	58.8	374	41.3	264	29.1	192	21.2	48	5.3	177	19.5
TDF/FTC/DRV/b	5979	3049	256	57	9.5	531	88.8	400	66.9	1270	212.4	254	42.5	94	15.7	187	31.3
TDF/FTC/ATV/b	2778	1293	73	23	8.3	256	92.2	138	49.7	528	190.1	137	49.3	42	15.1	96	34.6
TDF/FTC/LPV/b	278	200	9	4	14.4	33	118.7	30	107.9	81	291.4	14	50.4	11	39.6	18	64.7
Other PI+NRTI	3406	1528	137	30	8.8	282	82.8	151	44.3	558	163.8	179	52.6	50	14.7	141	41.4
2 anchor-drugs																	
DTG/DRV/b	2880	837	393	14	4.9	113	39.2	110	38.2	98	34.0	45	15.6	6	2.1	58	20.1
DTG/RPV	845	321	171	6	7.1	46	54.4	23	27.2	35	41.4	13	15.4	2	2.4	25	29.6
CAB/RPV LA	2460	1157	899	29	11.8	90	36.6	28	11.4	6	2.4	15	6.1	3	1.2	87	35.4
2 anchors w/wo NRTI	4098	2132	370	75	18.3	297	72.5	172	42.0	849	207.2	131	32.0	23	5.6	215	52.5

Legend: *PY = person years of exposure; 3TC = lamivudine; b = boosted (cobicistat or ritonavir); ABC = abacavir; ART = antiretroviral therapy; ATV = atazanavir; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; LA = long acting; LPV = lopinavir; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

Appendix Table 3.1: Frequency of and reasons for discontinuation / modification of various ART regimen in the period 2016–2025.

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TDF/FTC/LPV/b	278	200	9	4	14.4	33	118.7	30	107.9	81	291.4	14	50.4	11	39.6	18	64.7
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2 anchor-drugs																	
DTG/DRV/b	2880	837	393	14	4.9	113	39.2	110	38.2	98	34.0	45	15.6	6	2.1	58	20.1
DTG/RPV	845	321	171	6	7.1	46	54.4	23	27.2	35	41.4	13	15.4	2	2.4	25	29.6
CAB/RPV LA	2460	1157	899	29	11.8	90	36.6	28	11.4	6	2.4	15	6.1	3	1.2	87	35.4
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Legend: *PY = person years of exposure; 3TC = lamivudine; b = boosted (cobicistat or ritonavir); ABC = abacavir; ART = antiretroviral therapy; ATV = atazanavir; BIC = bictegravir; CAB = cabotegravir; DOR = doravirine; DRV = darunavir; DTG = dolutegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; LA = long acting; LPV = lopinavir; NVP = nevirapine; PI = protease inhibitor; RAL = raltegravir; RPV = rilpivirine; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; NRTI = nucleoside analogue reverse transcriptase inhibitor; NNRTI = non-nucleoside reverse transcriptase inhibitor; INSTI = integrase inhibitor.*

Appendix Table 3.2: *Virological treatment response in 2016–2025 in people who started ART at least months earlier.*

	Total population	Viral load categories (c/ml)											
		<50		50–199		200–999		1,000–9,999		10,000+		ART interrupted	
	N	N	%	N	%	N	%	N	%	N	%	N	%
Calendar year													
2016	18,728	17,444	93.14	473	2.53	144	0.77	111	0.59	199	1.06	357	1.91
2017	19,421	18,061	93.00	569	2.93	158	0.81	80	0.41	185	0.95	368	1.89
2018	20,115	18,909	94.00	438	2.18	157	0.78	99	0.49	162	0.81	350	1.74
2019	20,732	19,494	94.03	497	2.40	162	0.78	88	0.42	160	0.77	331	1.60
2020	21,146	20,071	94.92	442	2.09	144	0.68	66	0.31	105	0.50	318	1.50
2021	21,374	20,329	95.11	419	1.96	135	0.63	60	0.28	133	0.62	298	1.39
2022	21,930	20,765	94.69	493	2.25	140	0.64	92	0.42	157	0.72	283	1.29
2023	22,418	21,336	95.17	438	1.95	136	0.61	90	0.40	146	0.65	272	1.21
2024	22,815	21,705	95.13	500	2.19	149	0.65	77	0.34	142	0.62	242	1.06
2025	23,014	21,896	95.14	553	2.40	167	0.73	78	0.34	161	0.70	159	0.69

4. Trends in costs of HIV therapy and care

Danielle Ratsma, Stanislav Avdeev, Vita Jongen, Jan den Hollander, Judith Branger, Rosan van Zoest, Michiel Heidenrijk, Marc van der Valk

Summary

An HIV diagnosis carries costs for the healthcare system that go beyond the direct costs of HIV care itself. This chapter maps out those costs for the Netherlands: how the direct, HIV-specific healthcare costs have evolved over time and how per-person costs develop in the years after an HIV diagnosis.

In a collaboration between the Amsterdam health & technology institute (ahti) and Stichting hiv monitoring (SHM), this chapter combines person-level SHM data with non-public microdata from Statistics Netherlands (CBS) and Vektis C.V.

We selected everyone registered with SHM who was alive and in HIV care in the Netherlands in a given calendar year and who could be successfully linked to CBS microdata. Between 2016 and 2024, the number of people in our study population grew from 17,930 to 21,000. In that same period the total nominal costs barely moved (from €190 million to €191 million, +0.8%), but after adjusting for inflation they are down 24.6% (from €254 million to €191 million), and down 35.6% if also adjusted for the increasing number of people receiving HIV care. The overall reduction is mainly due to a decrease in costs of antiretroviral treatment. Beyond these overall trends, an HIV diagnosis also has a clear effect on overall healthcare spending: total healthcare costs rise on average by €13,177 (95%-confidence interval (CI): €12,248 - €14,106) per person per year over the first seven years after an HIV diagnosis, of which €10,691 (95%-CI: €10,506 - €10,876) is HIV-specific medical specialist care. The remainder reflects a temporary spike in medical specialist care not registered as HIV-specific, though in practice likely partly HIV-related, around the time of diagnosis. This spike is more than ten times larger for people diagnosed with HIV at a very late stage of HIV infection (average effect size in the year of diagnosis: €12,629 (95%-CI: €9,512 - €15,746)) than for those with a timely diagnosis (€1,237 (95%-CI: €573 - €1,900)).

Together, these findings show that while HIV-specific care has become markedly less expensive per person in care since 2016, a new HIV diagnosis still causes a substantial increase in healthcare spending, an increase that is far larger when HIV is diagnosed at a late stage. They also suggest that monitoring the quality of HIV care and auditing the compliance with national treatment guidelines by the Dutch society of HIV treating physicians (NVHB) not only improves clinical outcomes but can also reduce HIV-related healthcare costs over time.

Aim

The aim of this chapter is to present a full cost perspective on HIV-related healthcare spending in the Netherlands, by (1) quantifying the direct, HIV-specific healthcare costs and how they are composed, (2) separating nominal from real (inflation-adjusted) cost trends between 2016 and 2024, at both the population and per-person level, and (3) isolating the effect of an HIV diagnosis on healthcare costs, including how that effect differs by HIV stage at diagnosis.

Methods

The results in this chapter are based on calculations by the Amsterdam health & technology institute (ahti), in collaboration with Stichting hiv monitoring (SHM), combining person-level SHM data with non-public microdata from Statistics Netherlands (CBS) and healthcare claims data from Vektis C.V. CBS is an independent government organization that collects, processes, and publishes statistical data on residents of the Netherlands; the linkage between SHM, Vektis, and CBS data is carried out by CBS itself, within its secure environment, and researchers only access aggregated, non-identifiable output. Moreover, no group of fewer than ten people is ever reported separately.

The analyses include everyone registered with SHM (registration in SHM is voluntary/opt-in) who was alive and in HIV care in the Netherlands in a given calendar year between 2016 and 2024, and who could be successfully linked to CBS microdata. The study population used to map the total costs of HIV grew from n=17,930 in 2016 to n=21,000 in 2024. All costs are adjusted to 2024 price level using the Nederlandse Zorgautoriteit (NZa) price index for medical specialist care[1]. Because claims data in Vektis have a reporting delay, data for 2025 were not yet available at the time of this analysis; therefore, the analysis is based on the period 2016–2024.

Box 1: Methods used to estimate HIV-specific costs and the effect of an HIV-diagnosis

Estimation of ART costs

HIV-related pharmacy costs (mainly ART) cannot be calculated directly, for two reasons: pharmacy costs are only available as an annual total per person, aggregated over all medication use, while medication use itself is only identified by broad medication class (ATC level 3), without costs per class. In addition, hepatitis C is treated with medication from the same ATC3 class as ART, so these costs cannot be separated at the class level. We therefore estimate HIV-related pharmacy costs using a two-step regression of annual pharmacy costs on ≈200 ATC3 medication-use indicators, and a hepatitis C diagnosis indicator. We first estimate a non-HIV baseline cost structure among people without HIV; then we re-estimate this structure within the HIV sample, additionally allowing hepatitis C-related costs to vary with medication use and demographics. The HIV-specific cost assigned to each person-year is then the observed pharmacy cost, minus the cost predicted by the non-HIV baseline structure, minus the hepatitis-related cost component.

Difference-in-differences design

For the causal analyses, each person diagnosed with HIV was matched 1:10 to control individuals without HIV, based on year of birth, sex, migration background, highest level of education attended, and neighborhood code. Outcomes were tracked from five years before to six years after the year of diagnosis (t -5 to t = +6). Cost amounts were adjusted to 2023 price levels using the NZa healthcare price index.

For each year, the gap between the HIV group and the control group was calculated relative to the pre-existing gap at t = -2, isolating the effect attributable to the diagnosis itself. The parallel trends assumption was assessed using the pre-diagnosis period. Unless stated otherwise, the reported total effect size is the average of the year-specific difference-in-difference estimates over years 0-6. Outcomes are additionally stratified by HIV stage at diagnosis, defined as timely presentation (CD4 count at time of diagnosis >350 cells/μL without an AIDS-defining illness), late presentation (CD4 200–350 cells/μL, or >350 cells/μL with an AIDS-defining illness), or very late presentation (CD4 count <200 cells/μL with or without an AIDS-defining illness).

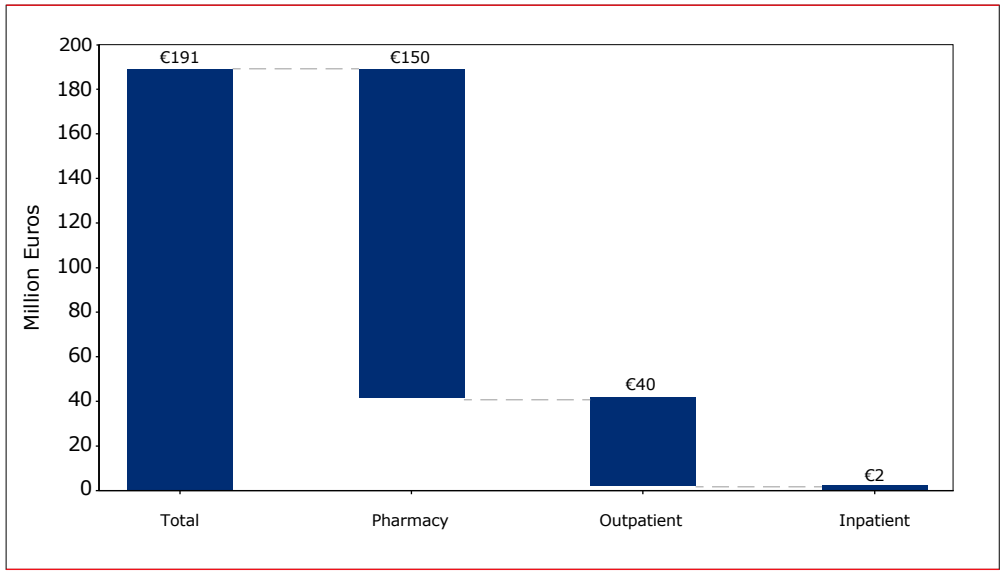
Outcomes

Variable	Description
Total HIV-specific costs	Estimated costs directly attributable to HIV: HIV-related pharmacy costs (mainly ART), HIV-specific outpatient hospital care, and HIV-specific inpatient hospital care.
ART / HIV-related pharmacy costs	Estimated using a two-step regression approach (see methods: Estimation of ART costs): observed pharmacy costs in the HIV sample, minus the cost predicted by a non-HIV baseline cost structure and minus a hepatitis-related cost component.
HIV-specific outpatient hospital care	Hospital outpatient costs (excl. pharmacy) registered under an HIV-specific treatment code (DBC/DOT), i.e. outpatient specialist care billed as HIV care. Care related to HIV but registered under other specialties or diagnosis codes – for example, an admission for what later proves to be an HIV-related condition – is not included here and is captured under non-HIV medical specialist care.
HIV-specific inpatient hospital care	Hospital admission costs registered under an HIV-specific treatment code (DBC/DOT).
Total Zvw healthcare costs	All healthcare costs reimbursed under the Health Insurance Act (Zorgverzekeringswet), i.e. total healthcare consumption, not limited to HIV-specific care.
Non-HIV specialist medical care	Costs of medical specialist care not classified as HIV-specific care.

Results

HIV-specific healthcare costs in the Netherlands totaled €191.3 million in 2024 (n=21,000 people with HIV). Pharmacy costs, mainly ART, accounted for 78% of this total (€149.9 million), with outpatient hospital care contributing 21% (€39.5 million) and inpatient care around 1% (€1.9 million).

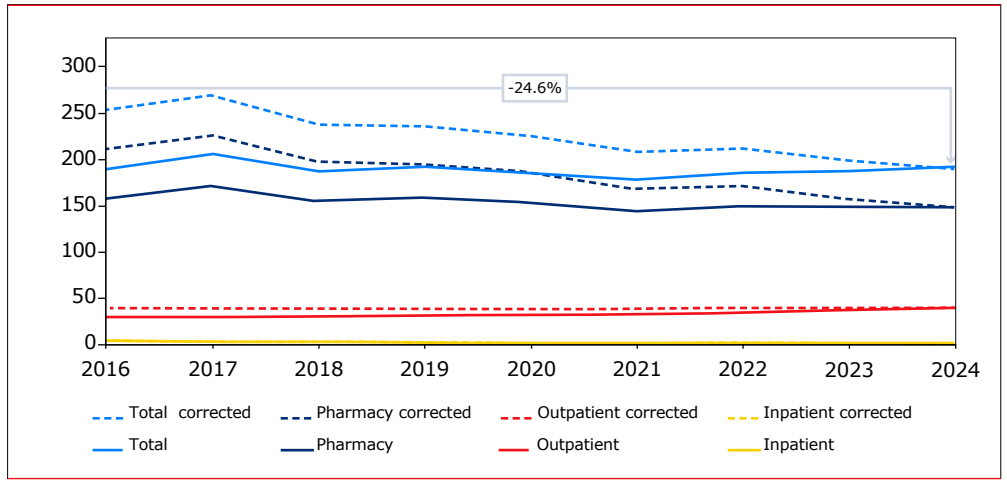
Figure 4.1: Composition of HIV-specific healthcare costs in the Netherlands in 2024, in million euros.



Cost trends in HIV care between 2016 and 2024

In nominal terms, total HIV-specific costs barely changed between 2016 and 2024 (+0.8%, Figure 4.2). Once corrected for healthcare-specific price inflation (NZa index), however, the same costs fell by 24.6%, driven mainly by the decline in pharmacy costs (-29.0%). Outpatient costs showed the opposite pattern: they rose 35.2% in nominal terms but were flat once corrected for inflation (+1.2%). Inpatient costs fell the most of all three care types, both nominally (-28.1%) and in real terms (-46.2%).

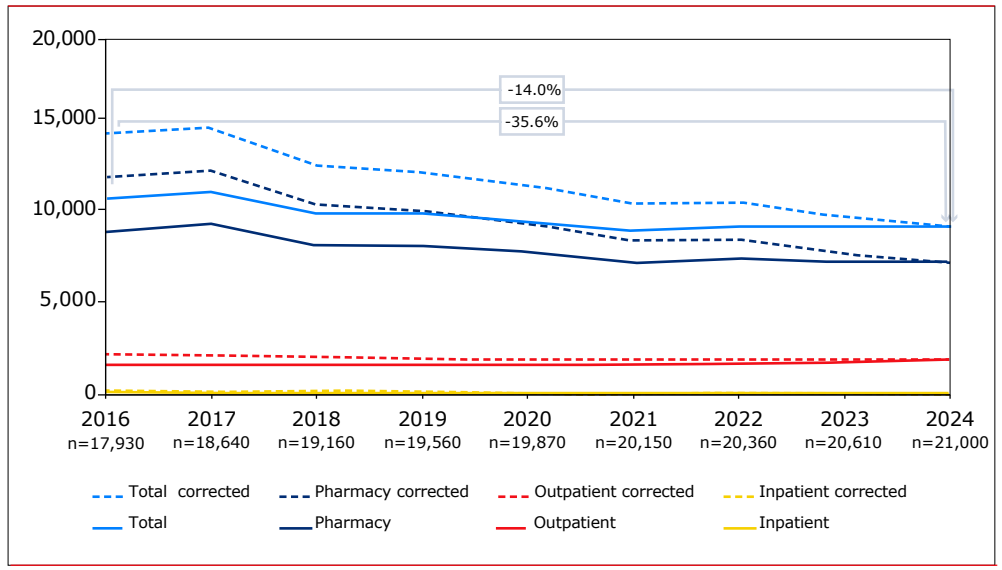
Figure 4.2: Total HIV-specific healthcare costs, ART costs, outpatient costs and inpatient costs nominal (solid lines) versus real (dashed lines) in million euros (2024 price level, corrected with NZa inflation index), 2016-2024.



Costs per person with HIV

Because the population of people with HIV grew throughout this period, the population-level trend understates the change in cost per person. In real terms, the average cost per person with HIV fell by 35.6% between 2016 and 2024, to €9,108 (a nominal decline of 14.0%); the nominal ART cost per person fell by 19.0% over the same period and this decline in real terms was 39.4%. Outpatient costs per person showed the same divergence seen at the population level: up 15.5% nominally, but down 13.6% once corrected for inflation. Inpatient costs per person fell the most of any category, both nominally (-38.6%) and in real terms (-54.0%) (*Figure 4.3*).

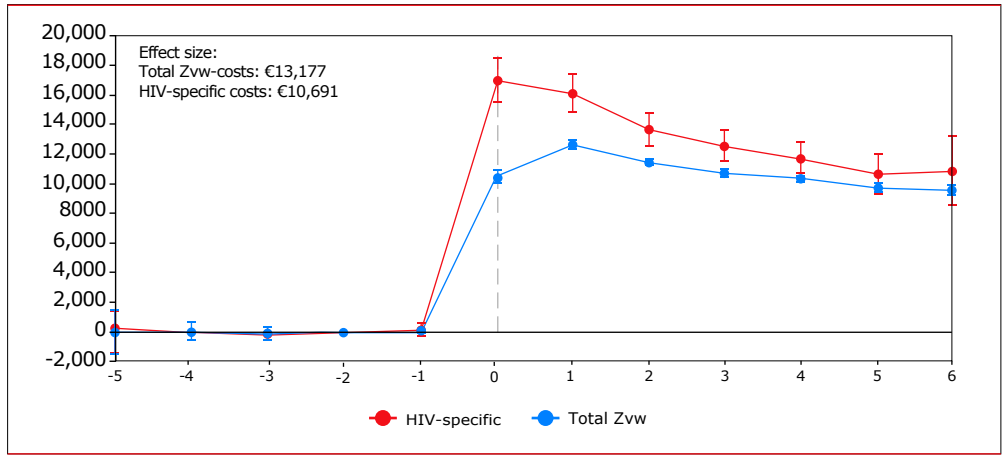
Figure 4.3: HIV-specific healthcare cost per person with HIV receiving care in a given year, nominal (solid lines) versus real (dashed lines) (2024 price level, corrected with NZa inflation index), 2016-2024.



The effect of an HIV diagnosis on healthcare costs

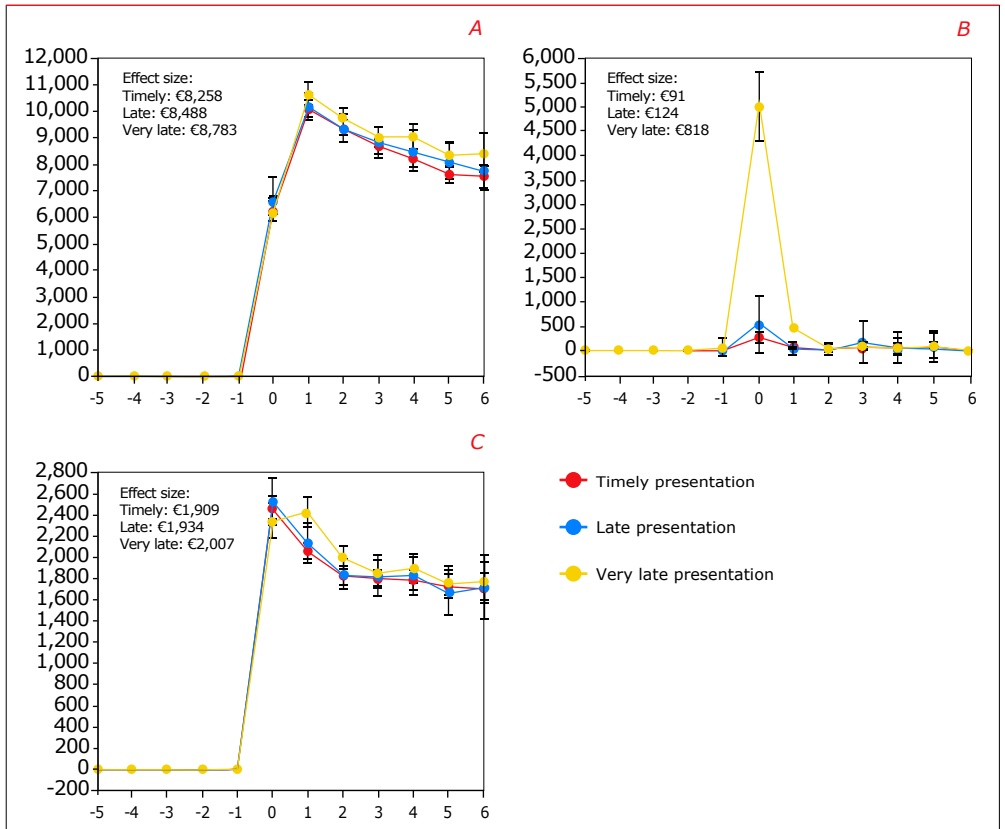
The cost trends described above show how healthcare spending has evolved over time, but not to what extent that spending is caused by an HIV diagnosis, as opposed to broader trends that would have occurred regardless. To isolate this effect, we compare the matched cohort of people newly diagnosed with HIV between 2015 and 2023. In this period, 3,400 people were newly diagnosed with HIV in the Netherlands and linked to Vektis and CBS microdata (2,900 men (85%), 500 women (15%)). These individuals were matched to 30,200 individuals from the general population (25,840 men (86%), 4,360 women (14%)). Of the people with HIV, 1,150 (34%) men and women had a first-generation migration background and 370 (11%) had a second-generation migration background. Furthermore, 2,380 (70%) people with HIV had not attained higher education, and 1,420 (42%) were aged 45 years or older.

Figure 4.4: Difference-in-differences effect of an HIV diagnosis on total Zvw healthcare costs and HIV-specific healthcare costs, relative to matched controls without HIV, shown for each year from t = -5 to t = +6 since diagnosis. The reported "effect size" in the graph is the average of these year-by-year difference-in-difference estimates over years 0-6 after HIV diagnosis.



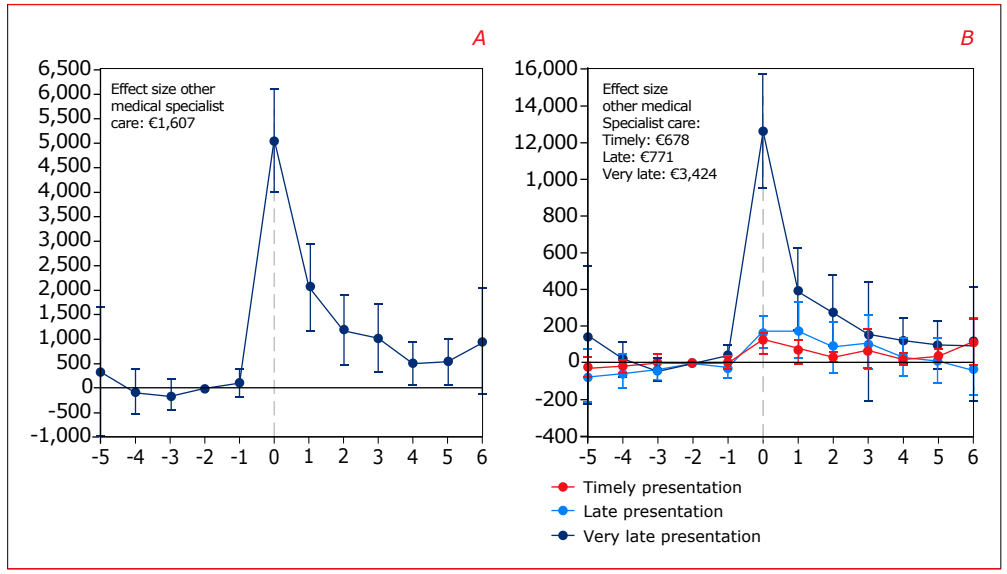
Total Zvw healthcare costs (all reimbursed healthcare use, not limited to HIV-specific care) track closely with the control group before HIV diagnosis and diverge sharply at t = 0. Averaged over years 0-6, an HIV diagnosis increases total Zvw healthcare costs by €13,177 (95%-CI: €12,248 - €14,106) per person per year, of which €10,691 (95%-CI: €10,506 - €10,876) is directly HIV-specific (*Figure 4.4*). The remaining gap reflects a temporary increase in healthcare use not registered as HIV-specific around diagnosis, part of which is likely HIV-related in practice.

Figure 4.5: *Year-by-year difference-in-difference effect of an HIV diagnosis on HIV-specific healthcare costs, relative to matched controls, stratified by HIV stage at time of diagnosis (years -5 to +6): pharmacy (panel A), inpatient (panel B), and outpatient (panel C) costs. The "effect sizes" reported in each panel are the average of the year-by-year estimates over years 0-6.*



The HIV-specific cost effect differs by HIV stage at diagnosis, and the pattern varies across its three components (*Figure 4.5*). Pharmacy costs (mainly ART) show a sustained increase from the year of diagnosis onwards that persists through year 6 and is broadly similar across stages (means over years 0-6 - timely: €8,258 (95%-CI: €8,055 - €8,462); late: €8,488 (95%-CI: €8,134 - €8,843); very late: €8,783 (95%-CI: €8,497 - €9,069), Figure 4.5, panel A). Inpatient costs, by contrast, show a sharp one-off spike concentrated almost entirely in the diagnosis year, which is far larger for people diagnosed very late (€5,000, 95%-CI: €4,287 - €5,712) than for those diagnosed on time or late (€264 (95%-CI: €147 - €380) and €535 (95%-CI: -€42 - €1,111) respectively; *Figure 4.5*, panel B), reflecting the higher likelihood of hospital admission when HIV is discovered at an advanced stage. After the first year, inpatient costs decline to nearly zero for all groups. Outpatient costs rise at diagnosis and then decline gradually over the following years, again similarly across stages (mean effect size over years 0-6 - timely: €1,909 (95%-CI: €1,851 - €1,966); late: €1,934 (95%-CI: €1,818 - €2,050); very late: €2,007 (95%-CI: €1,929 - €2,086); *Figure 4.5*, panel C) consistent with more intensive monitoring shortly after diagnosis that eases as patients stabilize on treatment.

Figure 4.6: *Year-by-year difference-in-difference effect of an HIV diagnosis on costs of medical specialist care not registered as HIV-specific, relative to matched controls: total population (panel A, years -5 to +6) and stratified by HIV stage at diagnosis (panel B, years -5 to +6). The "effect sizes" reported in each panel are the average of the year-by-year estimates over years 0-6.*



Part of the cost increase around diagnosis, however, falls outside HIV-specific care altogether. Diagnosis also triggers a temporary spike in other medical specialist care, for example diagnostic work-up, referrals or treatment of conditions related to the new diagnosis but not registered as HIV-specific care. Averaged across the total population, this effect is €1,607 (95%-CI: €1,218 - €1,996) per year (years 0-6), concentrated almost entirely in the diagnosis year itself (€5,044 (95%-CI: €3,989 - €6,099), *Figure 4.6*, panel A). This spike in the year of diagnosis differs sharply by

HIV stage at diagnosis: from €1,237 (95%-CI: €573 - €1,900) for a timely diagnosis, to €1,682 (95%-CI: €454 - €2,910) for a late diagnosis, up to €12,629 (95%-CI: €9,512 - €15,746), more than ten times higher than the timely-diagnosis effect, for a very late diagnosis (*Figure 4.6*, panel B). Note that this category includes care for conditions that may in fact be HIV-related but were not registered under an HIV-specific treatment code.

Conclusions

HIV-specific healthcare costs in the Netherlands totaled €191 million in 2024, nearly 80% of which was pharmacy expenditure (mainly ART). While total nominal costs have barely changed since 2016, real costs have fallen substantially, both at the population level (-24.6%) and per person with HIV (-35.6%, to €9,108 in 2024), reflecting a growing population combined with falling treatment costs per person, most likely driven by increasing availability of less expensive ART options, including generic substitution[2].

Beyond these overall cost trends, a new HIV diagnosis has a clear effect on healthcare spending: total Zvw healthcare costs rise by €13,177 per person per year on average over the first seven years after diagnosis, of which €10,691 is directly HIV-specific. Much of this reflects a sustained, lifelong increase in pharmacy (ART) costs that begins immediately after diagnosis and is broadly similar regardless of how advanced the disease was at diagnosis, consistent with Dutch HIV treatment guidelines. At the same time, the real cost of that lifelong treatment has been falling: increasingly efficient treatment guidelines, together with growing generic substitution of ART, have steadily reduced the per-person cost of this increase since 2016, even as the underlying effect of a diagnosis on healthcare spending has remained substantial. The remaining share of the cost increase falls outside the pre-defined HIV-specific cost categories but is likely still substantially attributable to the diagnosis itself: it is concentrated in a temporary spike in other medical specialist care around the time of diagnosis, registered under other specialisms or diagnosis codes, for example the treatment of opportunistic infections and other comorbidities that follow directly from a new HIV diagnosis[3]. This spike is far more pronounced for people diagnosed late: a very late diagnosis drives an increase in this "other" medical specialist care more than ten times as large (€12,629 in the year of diagnosis) as a timely one (€1,237 in the year of diagnosis), consistent with more extensive comorbidity treatment required when HIV is diagnosed at an advanced stage.

Taken together, these findings suggest that the total cost of an HIV diagnosis is not fixed and point to three distinct ways of containing it. The most direct way is prevention: since the lifelong step-up in pharmacy costs begins only once someone is diagnosed, preventing new HIV infections altogether avoids the full cost documented in this chapter, including that of lifelong treatment. Among people who are diagnosed, the cost of other medical specialist care is highly sensitive to timing: in the year of diagnosis, it is more than ten times larger for a very late diagnosis than for a timely one, meaning that earlier testing and diagnosis can substantially reduce the avoidable share of the cost, even where prevention is not possible or does not succeed. Finally, even the lifelong cost of pharmacy treatment itself is not fixed: the real cost per person of this treatment has fallen substantially since 2016, most likely driven by increasingly efficient treatment guidelines and mandatory audits of the quality of HIV care by the Dutch society of HIV treating physicians (NVHB). These data show that monitoring the quality of HIV care and compliance with national treatment guidelines not only improves clinical outcomes (chapter 1) but can also reduce the costs of HIV care over time.

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5. HIV drug resistance

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Key findings

Baseline drug resistance

- Between 2016 and 2025, 45.5% of individuals with newly diagnosed HIV in the Netherlands and no known history of pre-exposure prophylaxis use underwent baseline screening for HIV drug resistance. The proportion of screened participants increased from 36.6% in 2016 to 58.8% in 2025.
- Low-level or greater resistance was detected in 8.4% of screened participants; intermediate-level or greater resistance was detected in 6.1%. The prevalence of intermediate-level or greater baseline drug resistance increased from 4.2% in 2016 to 7.1% in 2025.
- Between 2016 and 2025, the overall prevalence of low-level or greater integrase inhibitor resistance was 0.7%. When the resistance-associated integrase polymorphism IN L74I in participants with subtype A6 was included in the analysis, baseline integrase resistance increased to 8.0%.
- In 2025, two cases of intermediate- and high-level baseline resistance to all available integrase inhibitors was identified in the Netherlands for the first time.
- We found no differences in the rate of virological suppression at 48 weeks following ART initiation between participants with and without baseline drug resistance.

Acquired drug resistance

- Of 27,703 participants in HIV care between 2016 and 2025, 3,873 (14.0%) had at least one genotype performed after initiating antiretroviral therapy.
- Low-level or greater acquired resistance was identified in 7.3% of participants in care. Intermediate-level or greater resistance was identified in 7.1%, and was most frequently due to the cytidine analogue mutations RT M184V/I.
- Low-level or greater resistance to rilpivirine and doravirine was identified in 2% and 3% of patients in care, respectively. Low-level or greater resistance to bictegravir, dolutegravir, or darunavir was identified in <1% of patients in care.
- Of 1,154 participants ever treated with long-acting cabotegravir/rilpivirine (CAB/RPV), 27 had a genotype performed after treatment initiation. Of these, 19 (70.4%) had low-level or greater resistance to CAB, RPV, or both.

Introduction

Monitoring HIV drug resistance is integral to HIV prevention and care. In this chapter, we describe trends in the prevalence of baseline and acquired HIV drug resistance in the Netherlands.

Baseline resistance refers to the detection of antiretroviral resistance-associated mutations (RAMs) prior to the initiation of antiretroviral therapy (ART). Baseline resistance may occur due to transmission of a drug-resistant HIV strain and/or due to naturally occurring polymorphisms associated with specific HIV subtypes. Acquired resistance may emerge in the setting of incomplete virological suppression during antiretroviral treatment. People who acquire HIV while taking pre-exposure prophylaxis (PrEP) may develop drug resistance due to selective pressure exerted by antiretroviral agents (ARVs) used in HIV prevention. Drug resistance among people with a history of PrEP use is discussed in Chapter 2 of this report.

Dutch guidelines[1] recommend baseline drug resistance screening in all people with newly HIV at entry to care. Testing for acquired resistance is recommended in the setting of loss of virological control or virological failure during antiretroviral treatment.

Methods

We used data from 27,703 ATHENA participants with HIV-1 infection who had at least one HIV care visit between 2016 and 2025 and were 15 years of age or older at HIV diagnosis.

Stanford HIV Drug Resistance Database penalty scores (HIVdb version 10.2) were used to calculate predicted resistance for each antiretroviral agent, based on all relevant RAMs identified in each genotype[2]. Relevant RAMs were defined as those conferring resistance to ARVs currently used in the management of HIV (for a list of excluded drugs, see Appendix Table 1). We used the HIVdb drug resistance interpretation rubric to convert drug penalty scores into estimated resistance levels, as follows: 0-9, susceptible; 10-14, potential low-level resistance; 15-29, low-level resistance; 30-59, intermediate resistance; >= 60, high-level resistance.

We determined the resistance level for each antiretroviral class by taking the maximal resistance score across agents within that class. We assessed for resistance to the following antiretroviral drug classes: nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), protease inhibitors (PIs) and integrase strand transfer inhibitors (INSTIs). In 2025, the International AIDS Society-USA added the integrase (IN) L74I RAM in

subtype A6 as the first subtype-specific major mutation[3]. The IN L74I RAM is a potential mediator of the increased risk of virological failure on long-acting cabotegravir/rilpivirine (LA CAB/RPV) observed in people with subtype A6[4-6]. Since IN L74I is considered a facilitator of the evolution of cabotegravir resistance in HIV-1 subtype A6 rather than a RAM that directly reduces cabotegravir susceptibility, analyses including this polymorphism are discussed separately in this year's report.

Findings

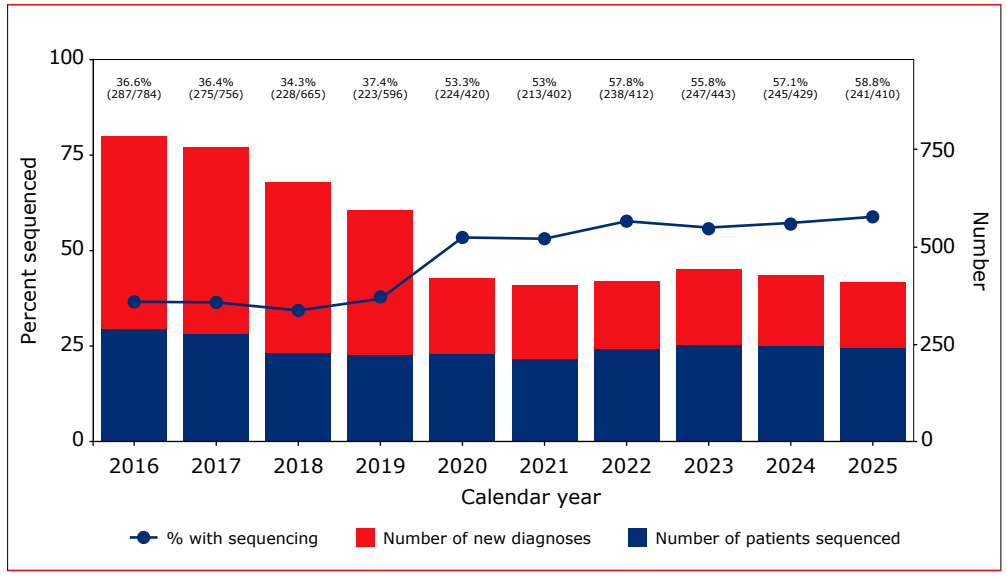
Baseline resistance

In our analysis of baseline resistance, we include participants who (in addition to the criteria described above), were diagnosed with HIV in the Netherlands between 2016 and 2025, had a genotype performed prior to initiating ART, and had no known history of PrEP use.

Screening for baseline resistance

Between 2016 and 2025, 5,317 individuals were diagnosed with HIV-1 in the Netherlands, of whom 2,421 (45.5%) were screened for baseline drug resistance. A total of 2,411 reverse transcriptase, 1,997 protease, and 980 integrase sequences were available for analysis. Baseline screening increased over time (*Figure 5.1*).

Figure 5.1: Proportion of newly diagnosed participants screened for baseline resistance, 2016-2025 (n=5,317).



Of the 2,421 participants screened for baseline resistance, 1,375 (56.8%) were MSM, 1,946 (80.4%) were cisgender men, and 1,205 (49.8%) were born in the Netherlands. The demographic characteristics of screened and unscreened participants are shown in *Table 5.1*.

***Table 5.1:** Characteristics of participants with newly diagnosed HIV in the Netherlands, by baseline resistance screening, 2016–2025 (n=5,317).*

	Not screened (N=2,896)	Screened (N=2,421)
Transmission group		
MSM	1679 (55.0%)	1375 (45.0%)
MSW	444 (56.5%)	342 (43.5%)
WSM	390 (50.6%)	380 (49.4%)
Other	383 (54.2%)	324 (45.8%)
Gender		
Cisgender man	2373 (54.9%)	1946 (45.1%)
Cisgender woman	438 (50.5%)	429 (49.5%)
Transgender woman	82 (65.1%)	44 (34.9%)
Transgender man	3 (60.0%)	2 (40.0%)
Age at first HIV visit		
Mean (range)	41.0 (16.0 - 79.7)	41.2 (15.3 - 80.6)
Birth region		
Netherlands	1704 (58.6%)	1205 (41.4%)
Latin America and Caribbean	319 (47.3%)	355 (52.7%)
Central and Eastern Europe	289 (53.8%)	248 (46.2%)
Sub-Saharan Africa	251 (50.1%)	250 (49.9%)
South and East Asia	132 (51.4%)	125 (48.6%)
W Eur, N America, Australia	85 (41.7%)	119 (58.3%)
N Africa and Middle East	81 (48.2%)	87 (51.8%)
Unknown	35 (52.2%)	32 (47.8%)

MSM, men who have sex with men; MSW, men who have sex with women; WSM, women who have sex with men; W Eur, Western Europe; N America, North America; N Africa, Northern Africa.

In a multivariable model adjusted for age at first HIV visit, transmission group, and birth region, we found no association between transmission group or age on the odds of baseline screening. The odds of baseline screening were higher in people born in all regions other than the Netherlands.

Integrase sequencing was performed in 980 (40.5%) of 2,421 participants with baseline screening. People born in Central and Eastern Europe (CEE), had 1.7 (95% CI 1.3-2.3) times the odds of integrase sequencing compared to people born in the Netherlands. Participants belonging to "Other" transmission groups had 2.2 times the odds (95% CI 1.7-2.8) of baseline screening than MSM; no other differences by transmission group were noted.

HIV-1 subtypes

Among 2,421 participants with baseline genotypes, 1,366 (56.4%) had HIV-1 subtype B. Subtypes A1 and A6 (including circulating recombinant forms, CRFs) were identified in 112 (4.6%) and 104 (4.3%) individuals, respectively. An additional 317 participants (13.1%) had other subtype-A associated CRFs, predominantly CRF01_AE and CRF02_AG. HIV-1 subtype differed significantly by region of birth (*Table 5.2*). Subtype A6 was identified in 27.8% of participants born in CEE, compared with 2.2% of those born in the Netherlands[7, 8].

Table 5.2: HIV subtype by region of birth among people screened for baseline drug resistance, 2016–2025 (n = 2,421).*

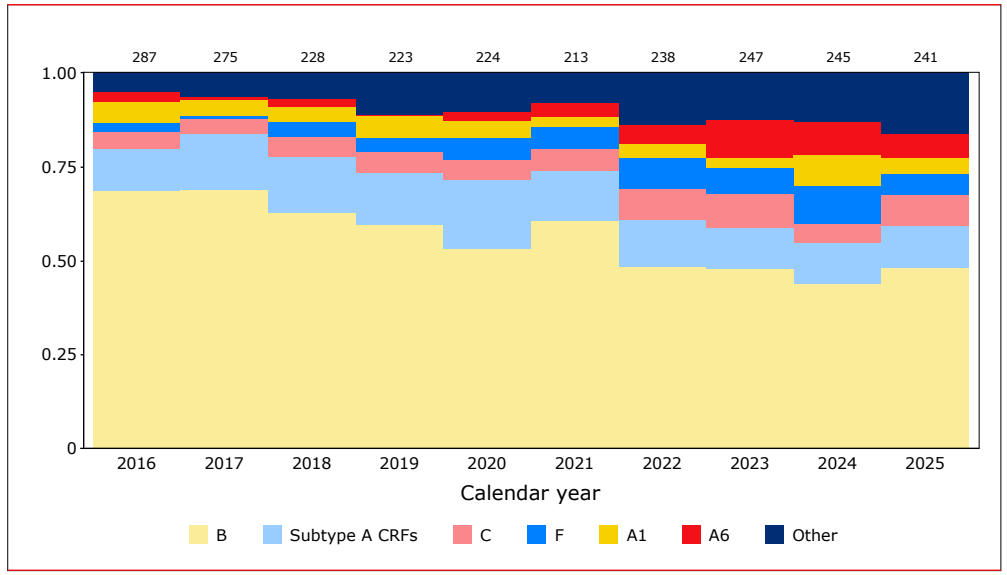
	B (N=1366)	A CRFs (N=317)	C (N=149)	F (N=124)	A1 (N=112)	A6 (N=104)	Other (N=249)
Netherlands	760 (63.1%)	144 (12.0%)	44 (3.7%)	76 (6.3%)	48 (4.0%)	26 (2.2%)	107 (8.9%)
Latin America and Caribbean	276 (77.7%)	23 (6.5%)	10 (2.8%)	12 (3.4%)	7 2.0%)	2 (0.6%)	25 (7.0%)
Sub-Saharan Africa	15 (6.0%)	83 (33.2%)	68 (27.2%)	5 (2.0%)	23 9.2%)	1 (0.4%)	55 (22.0%)
Central and Eastern Europe	113 (45.6%)	7 (2.8%)	6 (2.4%)	23 (9.3%)	8 (3.2%)	69 (27.8%)	22 (8.9%)
South and East Asia	54 (43.2%)	40 (32.0%)	7 (5.6%)	0 (0.0%)	9 (7.2%)	2 (1.6%)	13 (10.4%)
W Eur, N America, Australia	83 (69.7%)	7 (5.9%)	2 (1.7%)	5 (4.2%)	6 (5.0%)	4 (3.4%)	12 (10.1%)
N Africa and Middle East	46 (52.9%)	10 (11.5%)	10 (11.5%)	2 (2.3%)	9 (10.3%)	0 (0.0%)	10 (11.5%)
Unknown	19 (59.4%)	3 (9.4%)	2 (6.2%)	1 (3.1%)	2 (6.2%)	0 (0.0%)	5 (15.6%)

**HIV subtyping in the ATHENA database is performed using the COMET algorithm. A CRF: subtype A-related circulating recombinant forms; W Eur, Western Europe; N America, North America; N Africa, Northern Africa.*

We observed notable shifts in the distribution of HIV-1 subtype over time (*Figure 5.2*). Over the past decade, a decrease in the proportion of subtype B was complemented by an increase in A subtypes and recombinant forms. In 2016, subtype B accounted for 68.6% of new infections compared to 48.1% in 2025 ($p < 0.001$ for trend).

Subtype A6, which has been associated with increased risk of virological failure on long-acting CAB/RPV (see Introduction) was detected in 104 (4.3%) screened individuals. The proportion of participants with subtype A6 increased over time, from 2.8% in 2016 to 6.6% in 2025 ($p < 0.001$), peaking at 10.1% in 2023.

Figure 5.2: Changes in HIV-1 subtype identified in baseline genotypes, 2016–2025 (n = 2,421).



Prevalence of baseline resistance

Of 2,421 individuals screened for baseline resistance, 1,859 (76.8%) were fully susceptible to all ARVs included in the analysis while 358 (14.8%) had potential low-level resistance, 57 (2.4%) had low-level, 38 (1.6%) had intermediate-level, and 109 (4.5%) had high-level resistance to at least one ARV. *Table 5.3* shows the proportion of participants with low-level or greater and intermediate-level or greater resistance by drug class.

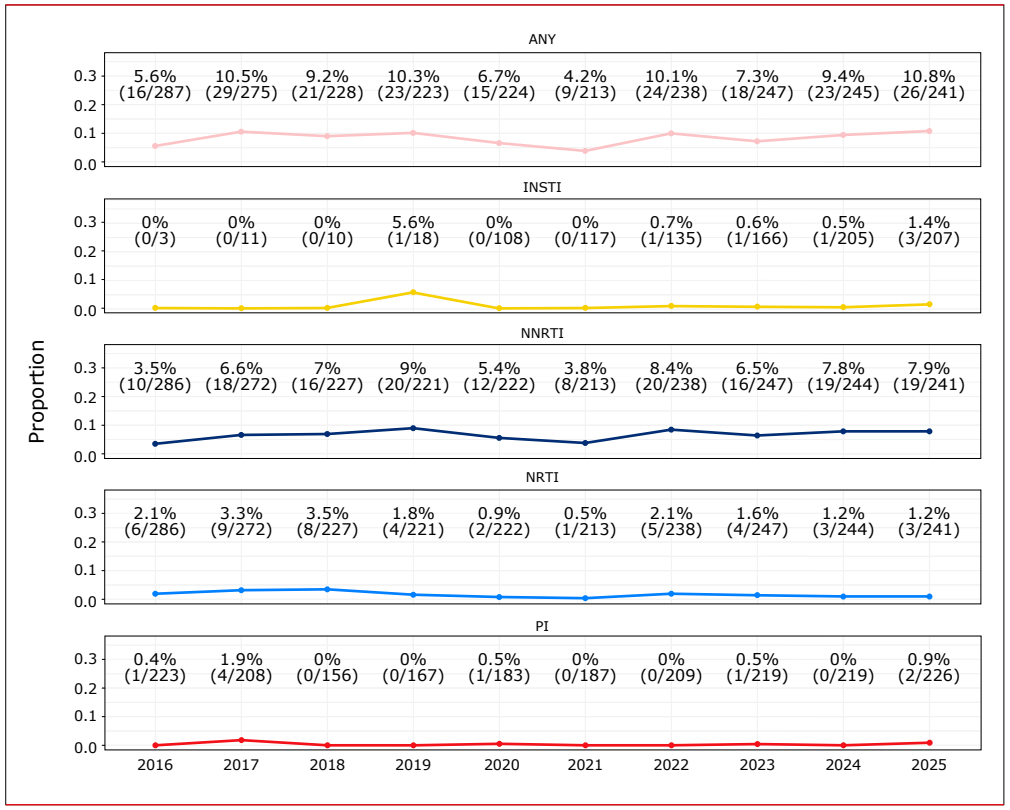
Table 5.3: Prevalence of baseline resistance by drug class, 2016–2025 (n = 2,421).

Drug class	Low-level or greater	Intermediate-level or greater
Any	8.4% (204/2421)	6.1% (147/2421)
NRTI	1.9% (45/2411)	0.8% (20/2411)
NNRTI	6.6% (158/2411)	5.2% (126/2411)
PI	0.5% (9/1997)	0.3% (6/1997)
INSTI	0.7% (7/980)	0.3% (3/980)

Intermediate-level or greater resistance to multiple drug classes was observed in eight participants: seven had evidence of NRTI and NNRTI resistance and one had INSTI and NNRTI resistance.

Figure 5.3 shows changes in the prevalence of baseline resistance between 2016 and 2025. The proportion of participants with low-level resistance or greater to any drug class increased from 5.6% in 2016 to 10.8% in 2025. The proportion of participants with any intermediate-level or greater resistance increased from 4.2% in 2016 to 7.1% in 2025 over the past decade.

Figure 5.3: *Proportion of participants with low-level or greater baseline resistance, by drug class, 2016–2025 (n = 2,421).*



Class- and drug-specific resistance patterns

Figures 5.4A and 5.4B show the proportion of participants with low-level or greater baseline resistance and intermediate-level or greater baseline resistance, respectively, by drug and drug class over time. *Table 5.4* shows the most frequently identified baseline RAMs.

Figure 5.4A: *Low-level or greater baseline resistance to antiretroviral agents, 2016–2025 (n = 2,421).*

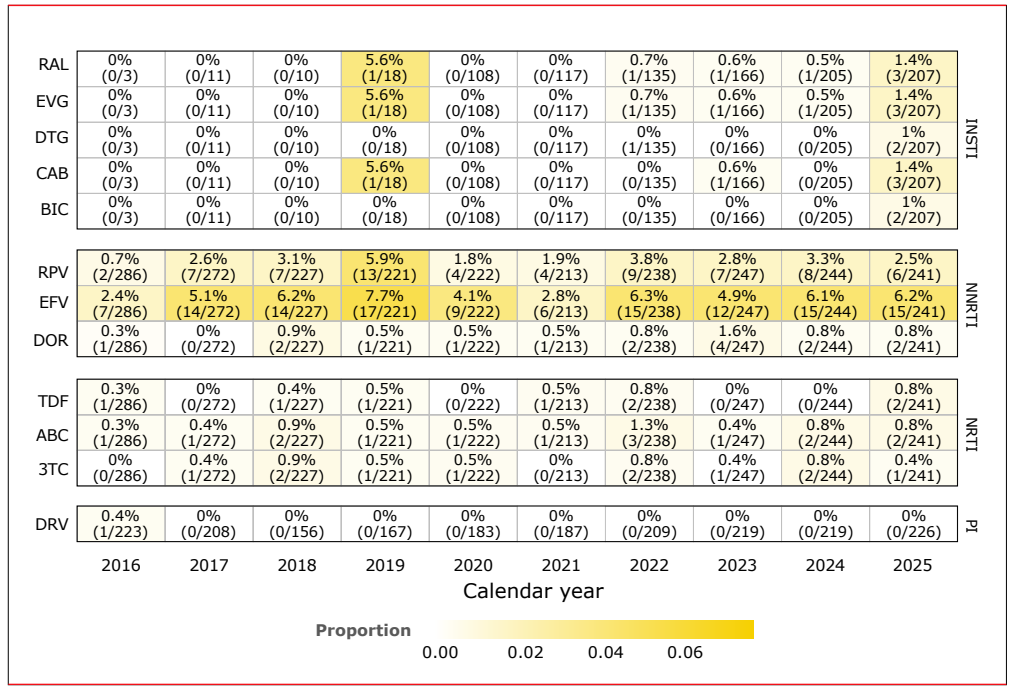
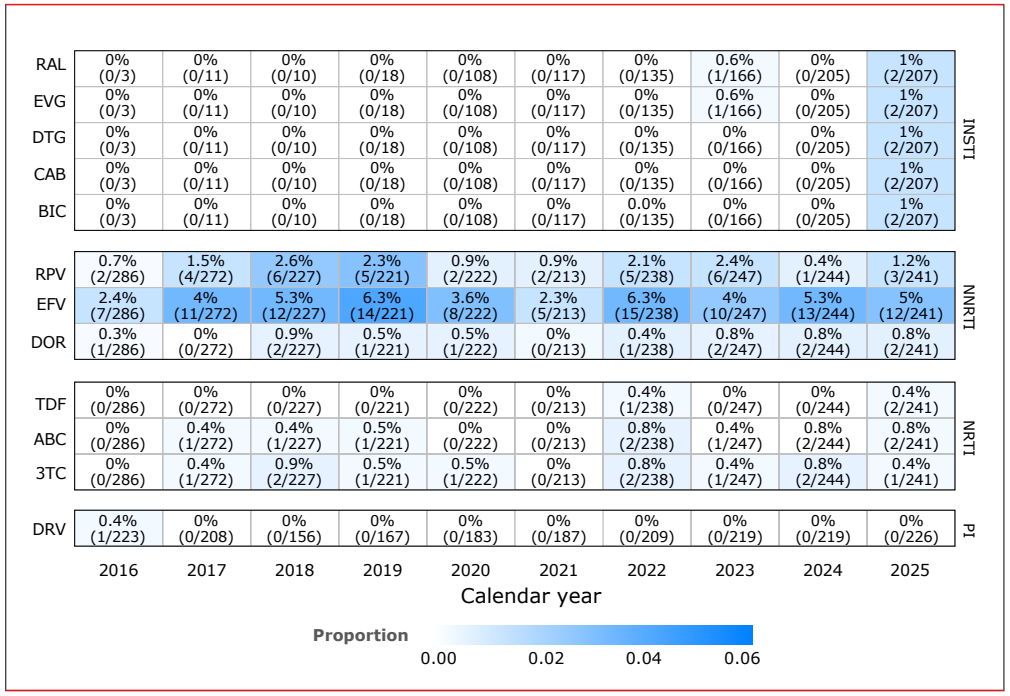


Figure 5.4B: Intermediate-level or greater baseline resistance to antiretroviral agents, 2016–2025 (n = 2,421).



Within each cell, the numerator represents the number of sequences with RAMs, and the denominator represents the number of available sequences.

Table 5.4: Most frequent RAMs identified on baseline resistance screening, 2016–2025.*

RAM	Class	Number	Percent
K103N	NNRTI	66	32.4
V108I	NNRTI	18	8.8
K101E	NNRTI	16	7.8
M41L	NRTI	14	6.9
K103S	NNRTI	11	5.4
Y181C	NNRTI	11	5.4
E138G	NNRTI	11	5.4
K238T	NNRTI	10	4.9
G190A	NNRTI	10	4.9
M184V	NRTI	9	4.4
E138K	NNRTI	7	3.4
L210W	NRTI	6	2.9
P225H	NNRTI	5	2.5
E138Q	NNRTI	5	2.5
V82A	PI	4	2.0
D67G	NRTI	4	2.0
A98G	NNRTI	4	2.0
K70N	NRTI	3	1.5
D67N	NRTI	3	1.5
T215I	NRTI	3	1.5
E138K	INSTI	3	1.5
M184I	NRTI	3	1.5

**IN L74I in subtype A6 not included in tabulation.*

Integrase resistance

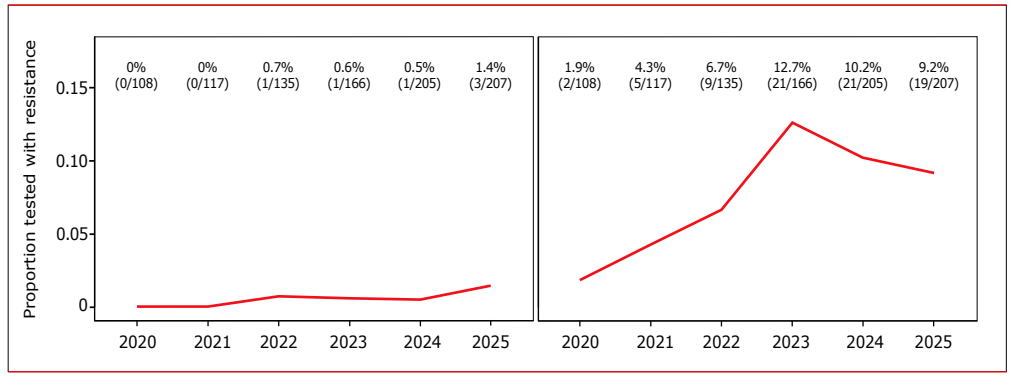
Of 980 participants with baseline integrase sequencing, low-level or greater resistance was identified in seven (0.7%), and intermediate-level or greater resistance was identified in three.

In 2025, two cases of intermediate to high-level baseline resistance to all available INSTIs were identified in the Netherlands for the first time. Both participants had subtype B infection. One participant harboured RAMs IN G140S and IN Q148H, and the second harboured RAMs IN E138K and IN Q148K. These RAMs confer intermediate resistance to bictegravir (BIC) and dolutegravir (DOL), and high-level resistance to cabotegravir (CAB), raltegravir (RAL), and elvitegravir (EVG). The second participant also harboured NNRTI RAMs K101E, Y181C and H221Y, conferring high-level resistance to rilpivirine (RPV). Neither participant reported a history of oral or injectable PrEP use prior to HIV diagnosis. A detailed description of the two cases has been published previously[9].

An additional 5 participants harboured single low- or intermediate-level INSTI RAMs: 2 had an E138K conferring low-level resistance to CAB, EVG and RAL; 2 had G163R conferring low level resistance to EVG and RAL, 1 had a G140S conferring low-level CAB and intermediate level EVG and RAL resistance.

Of 104 participants with subtype A6, integrase sequencing data was unavailable in 32 (30.8%). Among the remaining 72 participants, 68 had substitution IN L74I, 3 had IN L74LI mixture, and 1 participant had wild-type IN L74. *Figure 5.5* compares the prevalence of low-level or greater baseline integrase resistance with and without IN L74I subtype A6 resistance-associated polymorphism included in the analysis. Due to the low number of integrase sequences available prior to 2020, the analysis is restricted to the years 2020-2025.

Figure 5.5: Prevalence of baseline integrase inhibitor resistance, with and without IN L74I in subtype A6, 2020–2025.



NRTI resistance

Of 2,411 participants with baseline reverse transcriptase (RT) sequencing, low-level or greater NRTI resistance was detected in 45 (1.9%) participants; intermediate-level or greater resistance was detected in 20 participants. RAMs RT M184V/I, conferring high-level resistance to the cytidine analogues lamivudine and emtricitabine (3TC/FTC), were identified in 11 participants (0.5%) of which 7 had M184V/I as the sole RAM. Low-level tenofovir RAMs RT Y115F and RT K70ENT were identified in 1 and 6 participants respectively; a single participant had a RT K65R, conferring intermediate resistance to tenofovir.

NNRTI resistance

Low-level or greater NNRTI resistance was identified in 158 (6.6%) participants; intermediate-level or greater resistance was identified in 126 (5.2%). The most frequent NNRTI RAMs occurred at codon position RT 103 (n = 76) followed by RT 138 (n = 23).

Seventy-two participants had resistance to efavirenz only (49.7%). Low-, intermediate- and high-level resistance to rilpivirine was identified in 31, 23, and 5 participants, respectively. Low-, intermediate- and high-level resistance to doravirine was identified in 4, 8 and 4 participants respectively. Three participants had intermediate- or high-level resistance to both RPV and DOR.

Protease inhibitor resistance

Low-level or greater resistance to protease inhibitors was detected in nine participants and intermediate-level or greater resistance was detected in six. Only one participant had intermediate-level or greater resistance to the protease inhibitor darunavir.

Predictors of resistance and impact on treatment response

Table 5.5 shows the demographic and clinical characteristics of participants with any low-level or greater drug resistance, by drug class.

***Table 5.5:** Demographic and clinical characteristics of participants screened for baseline resistance, by type of resistance identified, 2016–2025 (n=2,421).*

	Any 204/2421	INSTI 7/980	NNRTI 158/2411	NRTI 45/2411	None 2217/2421
Transmission group					
MSM	90 (44.1%)	3 (42.9%)	62 (39.2%)	23 (51.1%)	1285 (58.0%)
WSM	42 (20.6%)	1 (14.3%)	35 (22.2%)	10 (22.2%)	338 (15.2%)
MSW	29 (14.2%)	2 (28.6%)	25 (15.8%)	4 (8.9%)	313 (14.1%)
Other	43 (21.1%)	1 (14.3%)	36 (22.8%)	8 (17.8%)	281 (12.7%)
Gender					
Cisgender man	146 (71.6%)	6 (85.7%)	108 (68.4%)	34 (75.6%)	1800 (81.2%)
Cisgender woman	48 (23.5%)	1 (14.3%)	41 (25.9%)	10 (22.2%)	381 (17.2%)
Transgender woman	10 (4.9%)	0 (0.0%)	9 (5.7%)	1 (2.2%)	34 (1.5%)
Transgender man	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (0.1%)
Age at first HIV visit (mean, years)	41.5	38.3	40.6	42.1	41.1
Birth region					
Netherlands	94 (46.1%)	2 (28.6%)	70 (44.3%)	23 (51.1%)	1111 (50.1%)
Latin America and Caribbean	38 (18.6%)	4 (57.1%)	29 (18.4%)	6 (13.3%)	317 (14.3%)
Sub-Saharan Africa	29 (14.2%)	0 (0.0%)	24 (15.2%)	10 (22.2%)	221 (10.0%)
Central and Eastern Europe	13 (6.4%)	0 (0.0%)	13 (8.2%)	0 (0.0%)	235 (10.6%)
South and East Asia	10 (4.9%)	0 (0.0%)	9 (5.7%)	1 (2.2%)	115 (5.2%)
W Eur, N America, Australia	9 (4.4%)	0 (0.0%)	7 (4.4%)	2 (4.4%)	110 (5.0%)
N Africa and Middle East	9 (4.4%)	1 (14.3%)	4 (2.5%)	2 (4.4%)	78 (3.5%)
Unknown	2 (1.0%)	0 (0.0%)	2 (1.3%)	1 (2.2%)	30 (1.4%)

MSM, men who have sex with men; MSW, men who have sex with women; WSM, women who have sex with men; W Eur, Western Europe; N America, North America; N Africa, Northern Africa.

In a multivariable model adjusted for transmission group, age at first visit, and region of birth, participants in "Other" risk groups had higher odds of any intermediate-level or greater resistance compared to MSM (aOR 2.4, 95% CI 1.5-3.8), driven by higher odds of NNRTI resistance in this heterogenous group. Participants born in Sub-Saharan Africa had higher odds of NRTI resistance than those born in the Netherlands (aOR 5.0, 95% CI 1.5-16.0). When L74I in subtype A6 was included as a RAM in the analysis, participants born in CEE had 19.0 (95% CI 10.9, 34.0) times the odds of integrase resistance than those born in other regions.

Viral load data at 48 weeks post-ART initiation was available in 1,989 (82.2%) of 2,421 participants with baseline genotyping. Of these, 115 (5.6%) had intermediate-level or greater resistance to any antiretroviral agent. Viral suppression was observed in 84.2% of participants without baseline resistance and in 84.1% of participants with intermediate-level or greater baseline resistance (p = 1).

Acquired resistance

In the following sections, we describe patterns of acquired drug resistance in ATHENA participants with genotyping performed more than 14 days after their first ART initiation date.

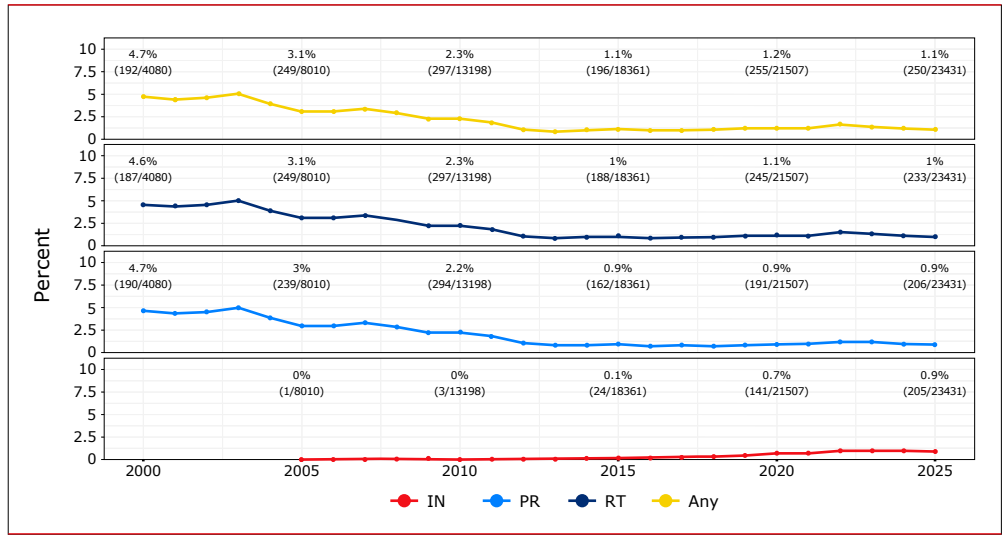
Because RAMs may be retained as integrated ("archived") proviral sequences in host cells, data from all available genotypes was used to determine the impact of cumulative RAMs in each participant. We included genotypes performed between cohort inception in 1996 and database closure on December 31, 2025. The cabotegravir resistance-associated polymorphism INL74I was not included in the overall analysis but is reported in the section on treatment-emergent CAB/RPV resistance.

Testing frequency and baseline characteristics

Between 1996 and 2025, 6,833 HIV-1 sequences were obtained in 3,873 participants. The mean number of sequences per participant was 1.8 (range 1-16) and the mean time from ART initiation to first sequence was 6.1 years (range 14 days – 32 years). Reverse transcriptase, protease, and integrase sequencing was obtained in 6,678, 6,150, and 1,443 samples, and 3,832, 3531, and 1,073 participants, respectively.

The number of sequences obtained per year, and the proportion of participants sequenced per year is shown in Figure 5.6. The proportion of sequences performed annually as a fraction of the number of participants in care has decreased, from 4.7% in 2000 to 1.1% in 2025.

Figure 5.6: *Number and proportion of participants in care tested for acquired drug resistance annually, 2000–2025.*



Of 3,873 participants evaluated for acquired RAMs, 2,759 (71.2%) were cis-gender men; 1,894 (48.9%) were MSM, 910 (23.5%) were WSM, 563 (14.5%) were MSW and 506 (13.1%) belonged to other transmission groups. One thousand six-hundred and eighty-eight participants (43.6%) were born in the Netherlands, 809 (20.9%) were born in Sub-Saharan Africa, and 713 (18.4%) in Latin America and the Caribbean. HIV-1 subtype B was identified in 2,649 (68.4%) participants.

Prevalence of acquired resistance

Among 27,703 participants in care over the past decade, low-level or greater acquired resistance was identified in 7.3%; intermediate-level or greater resistance was identified in 7.1%

Of the 6,833 genotypes obtained in 3,873 participants, 3,412 (50.0.%) sequences from 2,019 (52.1%) individuals had low-level or greater resistance to at least one ARV; 1,926 sequenced participants (49.7%) had intermediate-level resistance or greater to at least one ARV.

The most frequent patterns of low-level or greater resistance observed were dual-class NRTI + NNRTI resistance (n = 710, 35.2%), single class NRTI resistance (n = 482, 23.9%), single class NNRTI resistance (n = 293, 14.5%), and triple class NRTI, NNRTI and PI resistance (n = 252, 12.5%); similar patterns were observed for intermediate-level or greater resistance. Five participants had low-level or greater resistance to all four treatment classes and three participants had intermediate-level or greater resistance to all four treatment classes.

Figures 5.7A and 5.7B show the proportion of sequences with low-level or greater and intermediate-level or greater acquired resistance, respectively, by class and drug.

Figure 5.7A: *Proportion of sequences with low-level acquired resistance or greater, by class and drug, 2015–2026.*

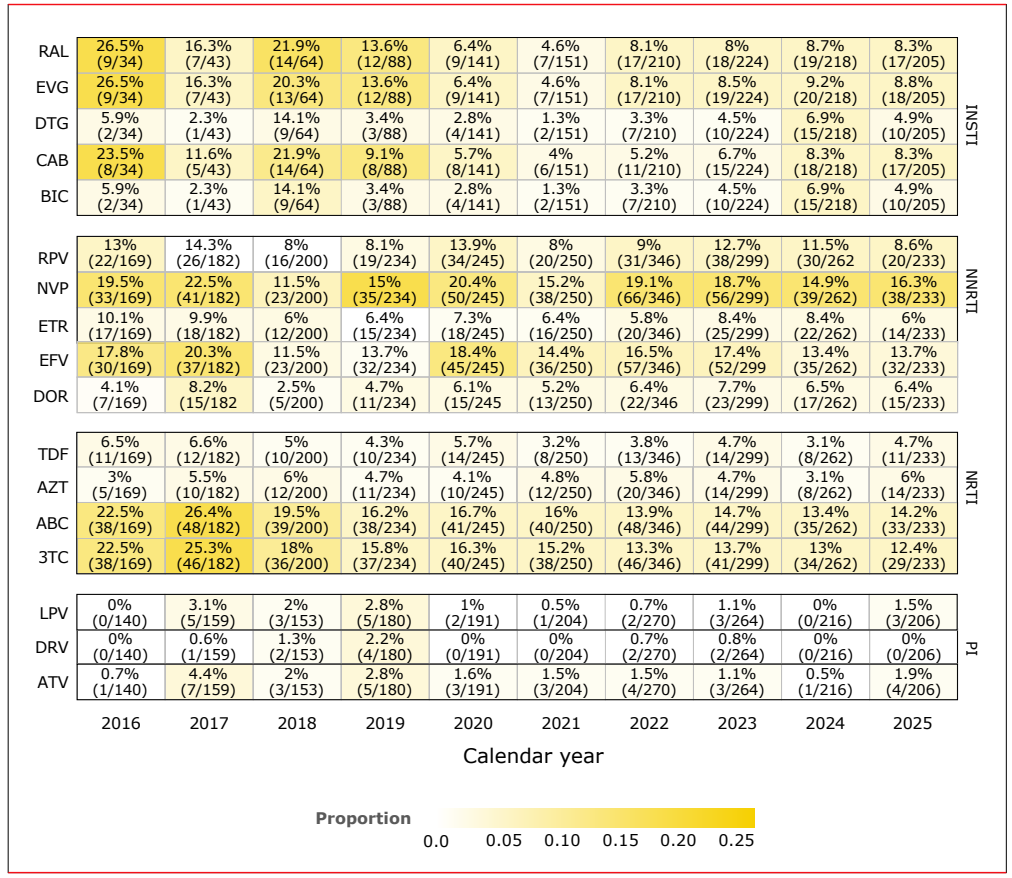
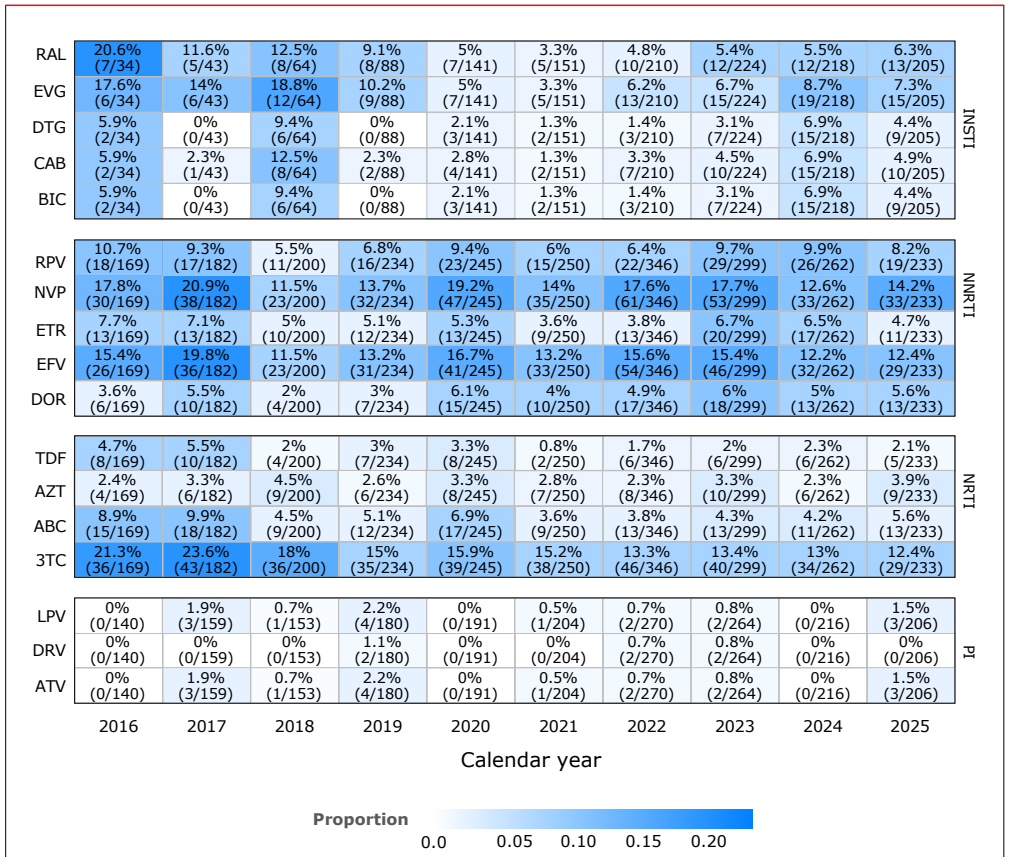


Figure 5.7B: *Proportion of sequences with intermediate-level acquired resistance or greater, by class and drug, 2015–2026*



Within each cell, the numerator represents the number of sequences with resistance, and the denominator represents the number of available sequences for the associated enzyme.

Table 5.7 shows the proportion of participants with low-, intermediate-, and high-level resistance to the main antiretroviral agents used in current HIV management. Resistance to 3TC/FTC was most frequent. Of 3,832 participants with RT sequencing, 36.0% had high-level 3TC/FTC resistance, representing 5.0% of 27,703 participants in care.

RPV and DOR resistance was identified in 3.2% and 2.1% of participants in care, respectively. DTG, BIC, and DRV resistance was identified in <1% of patients in care.

Table 5.7: *Acquired resistance to key antiretroviral agents among participants in care (n = 27,703).*

Class	Seq (n)	Drug	Resistance	Resistant	Resistant (% seq)	Resistant (% care)	Total (n)	Total (% care)
INSTI	1073		Low	15	1.4	0.05		
		BIC	Intermediate	33	3.1	0.12	59	0.21
			High	11	1.0	0.04		
			Low	15	1.4	0.05		
		DTG	Intermediate	28	2.6	0.1	59	0.21
			High	16	1.5	0.06		
NNRTI	3832		Low	170	4.4	0.61		
		DOR	Intermediate	185	4.8	0.67	590	2.13
			High	235	6.1	0.85		
			Low	199	5.2	0.72		
		RPV	Intermediate	238	6.2	0.86	891	3.22
			High	454	11.8	1.64		
NRTI	3832		Low	94	2.5	0.34		
		3TC/FTC	Intermediate	13	0.3	0.05	1485	5.36
			High	1378	36.0	4.97		
			Low	200	5.2	0.72		
		TDF/TAF	Intermediate	322	8.4	1.16	764	2.75
			High	242	6.3	0.87		
PI	3531		Low	117	3.3	0.42		
		DRV	Intermediate	36	1.0	0.13	163	0.59
			High	10	0.3	0.04		

Seq = number of participants with available sequences; % care, proportion of participants in care with resistance.

Resistance to long-acting regimens

A total of 1,154 ATHENA participants received at least one dose of the long-acting injectable INSTI/NNRTI combination agent LA CAB/RPV. Of these, 27 (2.3%) underwent genotyping at least 14 days after starting LA CAB/RPV and within a year of the last recorded LA CAB/RPV dose. Of these, pre-treatment RT sequencing data was available in seven and IN sequencing data in six.

Post-treatment CAB/RPV RAMs were detected in 19 participants (*Table 5.8*). Of these, one had pre-treatment RPV resistance (RT Y188L). Among the six participants with pre-treatment IN sequencing, no RAMs were identified. Post-treatment CAB resistance was identified in ten participants and RPV resistance in 18; nine had resistance to both CAB and RPV. Two participants with subtype A6 had an IN L74I polymorphism.

An analysis of predictors of virological failure on LA CAB/RPV within the ATHENA cohort has been published previously[10].

Table 5.8: RAMs observed in participants with genotypes performed after LA CAB/RPV initiation (n = 27).

Index	Subtype	RPV pre-treatment	CAB pre-treatment	RPV post-treatment	CAB post-treatment
1	02_AG	--	--	None	Q148R
2	02_AG	--	--	K101P	Q148R
3	02_AG	None	None	E138K	None
4	43_02G	--	--	None	None
5	A1	None	None	None	--
6	A6	--	--	E138K	L74I
7	A6	--	--	K101E	L74I, Q148R
8	B	--	--	E138K	Q148R
9	B	--	--	E138K, K101E, M230L	None
10	B	--	--	None	--
11	B	--	--	K101P	G118R, Q148R
12	B	--	--	E138K	None
13	B	--	--	E138K	None
14	B	--	--	K101E, Y181C	None
15	B	--	--	E138K, K101E	Q148R
16	B	--	--	E138K	None
17	B	--	--	None	None
18	B	--	--	K101E	None
19	B	None	--	--	None
20	B	None	None	None	None
21	C	--	--	Y181C	R263K
22	C	None	None	None	None
23	C	Y188L	None	Y188L	Q148R
24	REC	--	--	E138K	None
25	REC	--	--	Y181C	F121C
26	REC	--	--	K101E	None
27	REC_B	None	None	--	None

RPV, rilpivirine; CAB, cabotegravir; --, No sequence available; REC, circulating recombinant form, not otherwise specified.

Conclusions

Over the past decade, intermediate-level or greater baseline HIV drug resistance in the Netherlands increased from 4.2% to 7.1%. Most baseline resistance was due to NNRTI mutations. In 2025, two cases of intermediate-level or greater baseline resistance to all available INSTIs were identified for the first time, highlighting the need for continued monitoring of baseline INSTI resistance in the Netherlands. To date, baseline drug resistance has had no impact on treatment response.

Acquired drug resistance to core antiretroviral drugs used in the current management of HIV remains low in the Netherlands. Among the small number of participants who experienced treatment failure on long-acting CAB/RPV, the proportion with acquired resistance to CAB/RPV was 70%. Ongoing evaluation of predictors of long-acting CAB/RPV treatment failure is needed.

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Appendix

***Appendix table 5.1:** Drugs excluded from the resistance analysis*.*

Drug name	Class
Fosamprenavir	PI
Indinavir	PI
Nelfinavir	PI
Saquinavir	PI
Tipranavir	PI
Stavudine	NRTI
Zalcitabine	NRTI
Didanosine	NRTI
Dapivirine	NNRTI

**RAMs and RAM combinations conferring resistance exclusively to drugs in this table were not included in the analysis.*

6. Morbidity and mortality

Ferdinand Wit, Berend van Welzen and Marc van der Valk

Summary

AIDS, mortality and causes of death

AIDS-related deaths have fallen dramatically since ART became available in the Netherlands in 1996, and the deaths from AIDS that still occur are concentrated among people who present late for care with advanced immunodeficiency; the number therefore still falls short of the target of zero AIDS-related deaths by 2027 set in the Netherlands' Updated National Action Plan on STIs, HIV and Sexual Health. Death is now far more often due to a non-AIDS cause: in 2023-2025, non-AIDS malignancies accounted for 27.5% and cardiovascular disease for 10.5% of all deaths, against 9.2% for AIDS. This reflects both the higher risk of non-AIDS morbidity in people with more advanced HIV infection and the continuously increasing age of the population in care. Mortality among people with HIV consequently remains higher than in the general Dutch population, although the excess has diminished: the ratio of observed over age- and sex-standardised expected mortality fell from 8.9 in 1996 to 3.0 in 2010, 2.3 in 2015, and has remained at around 2.0 since 2017, with a ratio of 1.9 in 2025. Several studies have found that mortality in individuals on ART who achieve CD4 cell counts above 500 cells/mm^3 may even drop below general population rates[1,2], but in the total Dutch population of people with HIV the decline in excess mortality has clearly slowed. In all subgroups examined the ratio declined over time yet remained substantially above one in 2025; it was lowest among the native Dutch, men who have sex with men, and those with higher pre-ART nadir CD4 counts.

The crude mortality rate fell from 18.1 per 1,000 person years of follow up (PYFU) in 1996 to 8.9 in 2010 and remained at that level until 2020. It rose to 10.8 per 1,000 PYFU in 2021 during the COVID-19 pandemic – an increase driven mainly by non-AIDS infectious causes of death and proportional to the excess mortality of around 10% observed in the general Dutch population in 2020 and 2021[3] – and had increased further to 11.9 per 1,000 PYFU in 2025. Because the ratio of observed over expected mortality remained stable throughout this period, the recent increase is most plausibly explained by the rising average age of the population in care rather than by a deteriorating prognosis. Two further observations warrant attention: 'sudden death', a category recently introduced for individuals who died suddenly and unexpectedly without a precise cause being established, accounted for 14.3% of deaths in 2023-2025; and the suicide rate among people with HIV, at over 40 per 100,000 person years, remains roughly four times that in the general Dutch population.

Cardiovascular disease, diabetes and chronic kidney disease

The crude incidence of diabetes mellitus remained stable in men but increased slightly in women, and was 4.1 and 6.3 per 1,000 PYFU, respectively, in 2025. The age-standardised incidence declined significantly in men, whereas in women it increased significantly over the observation period. Compared with the general Dutch population in 2024, the prevalence of diabetes was lower in men in nearly all age strata, but higher in women up to the age of 65. Multivariable analysis indicates that the higher age-adjusted incidence in women is largely explained by their higher BMI, which makes the continuing rise in obesity among women with HIV the most plausible driver of this trend. In our cohort, each of the three unboosted oral integrase inhibitors (dolutegravir, bictegravir and raltegravir) was individually associated with incident type 2 diabetes mellitus, whereas no such association was observed with cobicistat-boosted elvitegravir or with long-acting injectable cabotegravir. This association was independent of time-updated BMI, consistent with findings from other cohorts[4,5].

The crude incidence of cardiovascular disease (CVD) remained stable and the age-standardised incidence declined over time in both men and women, while the age- and sex-stratified prevalence of coronary artery disease was comparable to that in the general Dutch population in all age strata. This decline may reflect improved awareness and prevention – including switching away from drugs associated with an increased risk of diabetes mellitus[6] and myocardial infarction[7-11] – better management of traditional risk factors, and an increasing proportion of individuals living with high CD4 cell counts. The risk factors identified for diabetes and CVD (age, hypertension, smoking and obesity) are similar to those reported in other studies[6,12,13], and several of them are more prevalent among people with HIV[14]. Secondary cardiovascular events became significantly less frequent over time in men but more frequent in women; this difference remains unexplained and needs further study.

The crude incidence of chronic kidney disease (CKD) was approximately 10 per 1,000 PYFU in both men and women, and the age-standardised incidence was significantly lower in 2020-2025 than in 2008-2019. The apparent increase in CKD in recent years disappeared, and even reversed, once current use of cobicistat, rilpivirine, dolutegravir and bictegravir was added to the model. This strongly suggests that it reflects drug-induced inhibition of tubular creatinine secretion rather than a true decline in glomerular filtration.

Overweight and obesity

The distribution of BMI has continued to shift upwards in both sexes. Men aged 35 and over were significantly less often overweight or obese than men in the general Dutch population, and the overall proportion of obese men (14.0%) was similar to the national figure (13.7%). In women, by contrast, obesity was about twice as common as in the general female population (34.0% versus 17.7%) and was highest among migrant women from non-Western countries (40.8%); the clinical significance of this continuing increase requires further study. In our cohort, being overweight or obese was independently associated with an increased risk of new-onset diabetes mellitus and CKD, but not with CVD or non-AIDS-defining malignancies. Other studies have reported that weight gain after starting ART is associated with lower mortality in individuals of normal weight, with no clear benefit in those already overweight or obese[15], while also increasing the risk of diabetes and, in those with a normal pre-ART BMI, of cardiovascular disease[16]. Prospective longitudinal monitoring of weight, lipid levels, blood pressure and smoking status remains essential to optimise cardiovascular risk assessment in our ageing population and to evaluate the impact of interventions such as statins and antihypertensive therapy.

Non-AIDS-defining malignancies

The most common non-AIDS-defining malignancies (NADM) are lung, intestinal, prostate and anal cancer, and haematological malignancies. In men, the age-stratified incidence of NADM (including non-melanoma skin cancer) was significantly higher than the cancer incidence observed in the general Dutch male population; in women it appeared similar to that in the general female population, although the limited follow-up time and number of events restricts the statistical power of that comparison. Despite the increasing average age of the cohort, the crude incidence of NADM remained stable and the age-standardised incidence declined significantly in men, and to a lesser extent in women, which is in line with data from other cohorts, including the Swiss HIV and RESPOND cohorts[17-21]. In addition to older age, risk factors were current or past smoking, a CD4 cell count below 350 cells/mm^3, a low BMI, chronic hepatitis B virus co-infection and a prior AIDS diagnosis; other studies have reported that the effect of immunodeficiency may be stronger for infection-related malignancies[22]. Five-year survival changed little over time and remains poor for lung (22%) and liver (14%) cancer.

Multimorbidity and polypharmacy

The prevalence of non-AIDS multimorbidity continues to increase slowly, driven mainly by the increasing age of the cohort, with women experiencing more comorbidities (driven by a much higher prevalence of obesity) than men in every age group. Multimorbidity is strongly and independently associated with mortality (RR 2.01 per additional comorbidity diagnosed).

Polypharmacy, defined as the concomitant use of five or more medications in addition to ART, is also becoming more prevalent: from 3.4% of adults in active follow up in 2000 to 18.0% in 2025. The main drivers are, again, the increasing age of the population and the accompanying rise in the number of chronic comorbidities per individual. Polypharmacy was likewise strongly and independently associated with an increased risk of death (RR 2.35), independent of demographic and HIV-related parameters, chronic HBV and HCV co-infections, smoking status and the number of comorbidities. The most notable recent change in comedication use is the continued increase in lipid-lowering therapy, used by 7,400 individuals in 2025 compared with 6,209 in 2024 and 5,155 in 2023, following the change in guidance on primary cardiovascular prevention prompted by the REPRIEVE study[9].

Introduction

Since the introduction of combined antiretroviral therapy (ART) in 1996, the life expectancy of people with HIV (PWH) has markedly improved[23]; in a subgroup of recently-diagnosed, effectively-treated individuals, it was shown to be similar to that of the general population in the Netherlands[24]. Whereas the incidence of AIDS-defining infections and malignancies has markedly decreased[25], morbidity and/or mortality associated with non-AIDS-related diseases has increased among PWH during the ART era[26-31]. Examples of these include renal and liver disease, diabetes mellitus, myocardial infarction, stroke, osteoporosis, and non-AIDS-defining malignancies.

Various reports suggest that the risk of non-AIDS-related morbidity may be higher in individuals with HIV treated with ART, than in individuals without HIV of comparable age[32-34]. For example pulmonary hypertension[35], bone disease, and non-traumatic bone fractures[36-38] have each been reported to be more common in PWH. Just as with individuals without HIV, traditional risk factors (such as tobacco use[14], alcohol abuse, and viral hepatitis co-infection[39]) also contribute to the increased risk of certain non-AIDS-related comorbidities in people with HIV.

One of the most prevalent comorbidities is cardiovascular disease (CVD). In addition to traditional risk factors such as smoking, probable additional risk factors with high prevalence among PWH include metabolic abnormalities such as dyslipidaemia; insulin resistance; hypertension; diabetes; and changes in body composition, which may be driven partly by the use of ART, as well as by sustained, residual HIV-associated immune activation and inflammation, despite effective ART[40, 41].

In this chapter, we report on mortality and its causes for adult (18 years and over) PWH using updated stichting hiv monitoring (SHM) data. We look at a total of 33,071 adult individuals ever registered by SHM – which includes 751 individuals who were diagnosed with HIV as children and have since become adults. In addition, we report on the incidence of AIDS and non-AIDS comorbidities, particularly diabetes mellitus, cardiovascular disease, chronic kidney disease (CKD), and non-AIDS malignancies in PWH.

Definitions

AIDS is defined as having experienced any of the United States' Centers for Disease Control (CDC) category C conditions[42]. In contrast to the US approach, a CD4 cell count below 200 cells/mm^3 in the absence of an AIDS-defining condition, does not qualify as AIDS in our analyses.

The following are defined according to criteria established by the Data Collection on Adverse Events of Anti-HIV Drugs (D:A:D) study: diabetes mellitus; CVD (including myocardial infarction, stroke, coronary artery bypass grafting, coronary angioplasty or stenting, and carotid endarterectomy); and non-AIDS-defining malignancies (excluding precancerous stages of anal and cervical cancer, basal cell carcinoma, and squamous cell carcinoma of the skin). In addition, Castleman's disease is also considered a non-AIDS-defining malignancy.

Histological confirmation of malignancies is part of standard clinical practice in the Netherlands. As a result, pathology reports, wherever possible, have been used to establish the presence of any malignancy.

Chronic kidney disease (CKD) is defined as an estimated glomerular filtration rate (eGFR) below 60 ml/min (estimated with the Cockcroft-Gault equation), confirmed after six months or longer. We use this period of time because of the large number of episodes of renal dysfunction that revert shortly after three months, and therefore do not represent true CKD.

Methods

For the analyses of incidence per calendar year and calendar period, we have considered all events after an individual entered care following HIV-1 diagnosis, or after the start of routine collection of data on the condition of interest, whichever was most recent. For instance, data on CKD were analysed from April 2007 onwards, because that was when routinely-collected renal laboratory data became available for analysis.

As the average age of the Dutch HIV population has increased over time, we also estimated the incidence rates for the periods 2000-2009, 2010-2019, and 2020-2025. We standardised these estimates according to the age distribution of the population during the period 2020-2025 (divided into the following age classes: 18-29, 30-39, 40-49, 50-59, 60-69, and 70 years and over), using the indirect method[43]. Indirect standardisation compares the incidence rates in the study and reference period (2020-2025) populations by applying the stratum-specific rates in the reference population to the study population. We investigated risk factors for AIDS, death, and each of the non-AIDS events, as well as a combined non-AIDS endpoint (defined as first occurrence of cardiovascular disease, diabetes mellitus, or non-AIDS-defining malignancy). CKD was not included in this combined endpoint as serum creatinine was not part of routine data collection before 2007.

The baseline for treated and untreated PWH was defined as the date of HIV-1 diagnosis or January 2000, whichever was most recent. Subsequent follow-up time was divided into periods of three months. Poisson regression models were used to estimate the independent association between risk factors and each endpoint. Models were adjusted for:

- the most recent CD4 cell count (lagged by three months);
- body mass index;
- gender;
- region of birth;
- most likely mode of HIV-1 transmission;
- current age;
- having started ART within 12 months of the last negative HIV test;
- known time spent with CD4 cell count below 200 cells/mm^3;
- known time spent with plasma HIV RNA above 1,000 copies/ml while on ART;
- time on ART;
- specific antiretroviral drugs used;
- prior diagnosis of AIDS;
- presence of chronic active hepatitis B and/or C virus infection;
- hypertension, diabetes mellitus, and other chronic comorbidities;
- smoking; and
- calendar period.

Mortality

Mortality was investigated in all 33,071 adult PWH ever registered in the SHM database. The mortality rate was 18.1 (95% confidence interval [CI] 13.5-23.9) per 1,000 person years of follow up (PYFU) in 1996 and declined to 8.9 (95% CI 7.4-10.6) per 1,000 PYFU in 2010. It remained stable at that 2010 level up to 2020, but the observed mortality rate was noticeably higher in 2021 during the COVID-19 pandemic with 10.8 (9.4-12.2). In 2025 the observed crude mortality rate had increased to 11.9 (10.5-13.4) per 1,000 PYFU (*Figure 6.1A*). Despite the overall improvement over time, the mortality rate in adult PWH remained well above the age-matched and gender-matched mortality observed in the general population in the Netherlands, which was 6.1 per 1,000 PYFU in 2025. The ratio of the observed mortality among PWH compared to the age/sex-adjusted mortality observed in the general population, decreased from 8.9 in 1996, to 6.5 in 2000, to 5.8 in 2005, to 3.0 in 2010, to 2.3 in 2015 and has remained constant at around 2.0 since 2017. In 2025 the ratio was 1.9.

We repeated the analysis of mortality for various subgroups of interest (*Figure 6.1C*). The analyses were stratified based on region of origin (native Dutch, migrants with Western background, and migrants with non-Western background), HIV acquisition category (men who have sex with men, other men who acquired HIV heterosexually, and women) and pre-ART nadir CD4 count (0-199, 200-499, and 500 and more cells/mm^3). The "Ratio in 2025" mentioned in the top right corner of each panel is the ratio of the observed crude mortality rate over the age/sex-adjusted expected mortality in 2025. In all investigated subgroups, the ratio of the observed over expected mortality declined over time but at the end of follow-up in 2025 remained substantially higher than one. The native Dutch, MSM, and those with higher pre-ART nadir CD4 counts had the lowest excess mortality.

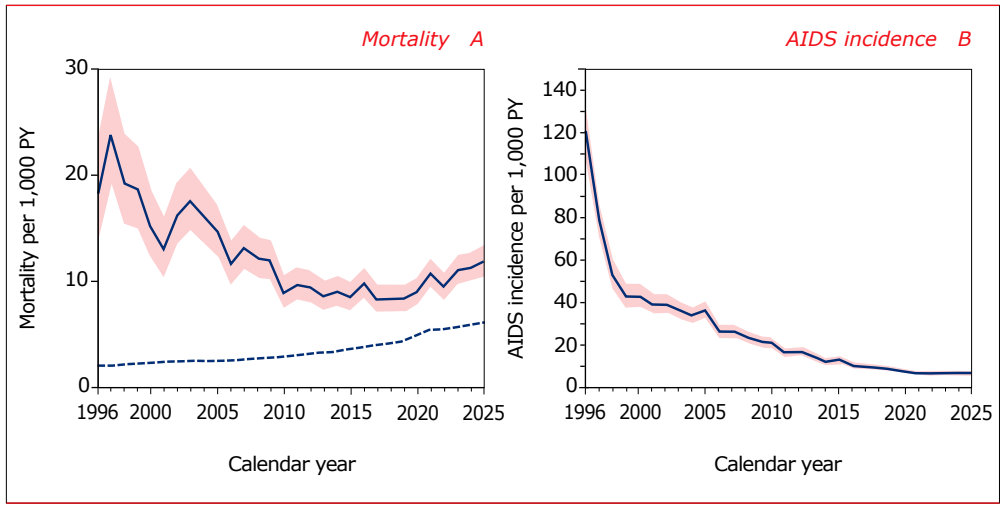
Underlying causes of death

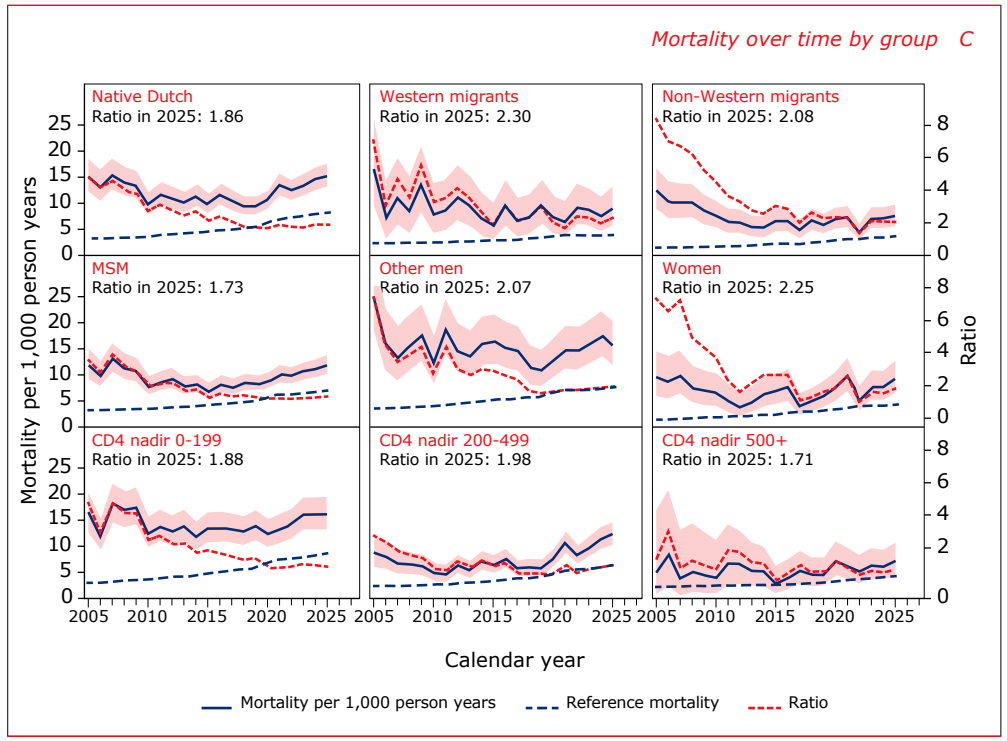
Observed underlying causes of death are presented in *Figure 6.1D* (with exact numbers and percentages presented in *Appendix Table 6.1*). Although the AIDS-related death rate has decreased significantly since the advent of ART, the continued occurrence of deaths due to AIDS is driven largely by the persistent high proportion of newly diagnosed people with HIV who present late for care with advanced immune deficiency. As such, the rate falls short of the aim of zero AIDS-related deaths by 2027, as stated in the Netherlands' Updated National Action Plan on STIs, HIV and Sexual Health, 2023-2027[44]. *Table 6.1* shows the characteristics of adults with HIV who died of AIDS, compared to those who died of non-AIDS causes during the last 10 years, the period 2016-2025. Individuals who died of AIDS were more frequently female, non-MSM males and/or migrants, more recently diagnosed with HIV, had been on ART for a shorter period of time, and had much lower CD4 cell counts at diagnosis (60.3% had advanced HIV at diagnosis with a CD4 cell count below 200 cells/mm^3). In 47.7% of cases, they did not have controlled viremia, and 29.2% of this group was not receiving any ART at the time of death, either because ART had not yet been started or had been discontinued (*Table 6.1*).

Among individuals who died of advanced HIV / AIDS but who did not classify as late or advanced presenters (i.e. they had a CD4 cell count above 350 cells/mm^3 at diagnosis), the cause of death was relatively more likely to be an AIDS-related haematological malignancy, which are also known to occur in people on suppressive ART with high CD4 cell counts. The proportion and absolute number of deaths due to non-AIDS-defining conditions have increased significantly over time (*Figure 6.1D*), primarily as a consequence of the ever increasing size and increasing average age of the population of people with HIV in the Netherlands. In recent years, the category 'Sudden death' has been introduced for individuals

who died suddenly and unexpectedly within a precise cause being known. People with HIV who were born in the Netherlands, MSM and men in general are overrepresented among those who died of non-AIDS causes, because people in these three (overlapping) categories have a higher average age compared to migrants, HIV transmission categories other than MSM, and women. Independent risk factors for death and for being diagnosed with an AIDS-defining condition are listed in *Appendix Table 6.2*.

Figure 6.1A–D: *(A) Annual mortality and (B) incidence of AIDS in 33,071 PWH in the Netherlands after entry into HIV care from 1996 onwards. (C) Annual mortality in various subgroups of interest after entry into HIV care from 2000 onwards. Solid lines represent the incidence, while the shaded areas are the 95% confidence intervals. The dashed line is the mortality rate for age-matched and sex-matched individuals from the general population in the Netherlands. The "ratio" is the ratio of observed over age/sex-standardized mortality in the Netherlands in 2025. (D) Relative changes in causes of death in different calendar periods since the introduction of combination antiretroviral therapy (ART) in the Netherlands. The numbers at the top of each bar represent the total number of deaths and the total number of individuals that were at risk during that calendar period. Mortality attributed to 'alcohol use' refers to deaths due to complications of alcohol-related liver cirrhosis.*





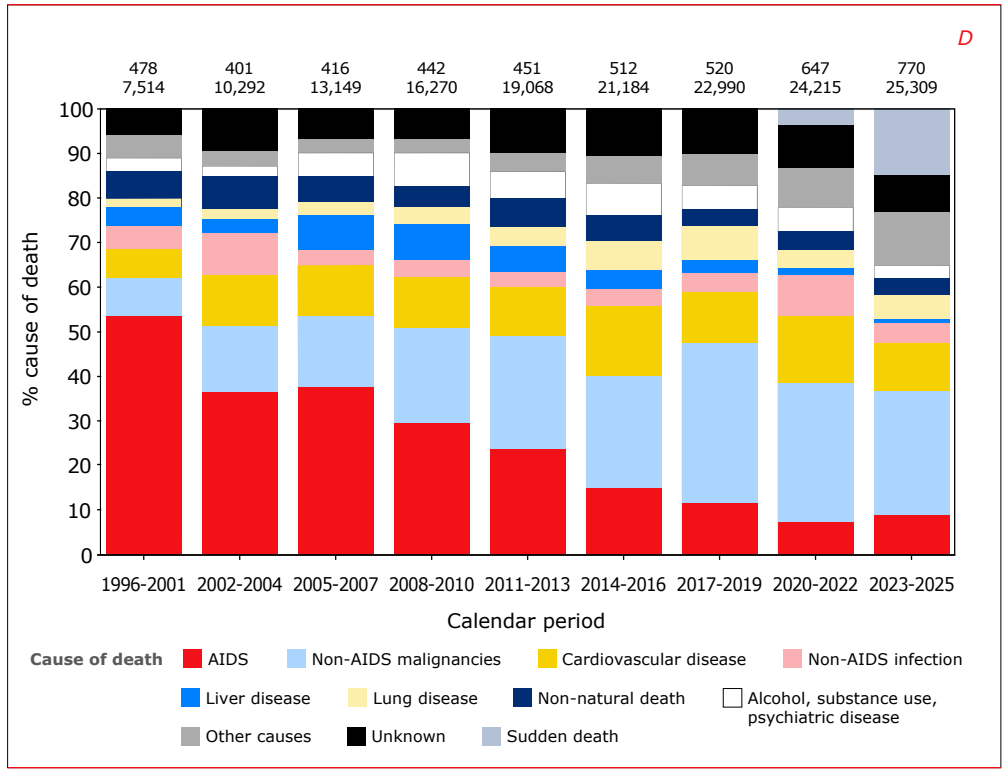


Table 6.1: Characteristics of adults with HIV who died of AIDS compared to adults with HIV who died of non-AIDS causes in the period 2016-2025.

	Died of AIDS	Died of non-AIDS causes	p-value
Number of subjects	209 (9.9%)	1,909 (90.1%)	
Age	56.7 (46.4-67)	62.5 (54.7-70.9)	<.001
Transmission category			<.001
MSM	89 (42.6%)	1,127 (59.0%)	
Other men	71 (34.0%)	403 (21.1%)	
Women	32 (15.3%)	208 (10.9%)	
Transgender	3 (1.4%)	13 (0.7%)	
IDU	7 (3.3%)	121 (6.3%)	
Blood contact	2 (1.0%)	35 (1.8%)	
Pediatric	5 (2.4%)	2 (0.1%)	
Region of origin			<.001
Native Dutch	121 (57.9%)	1,352 (70.8%)	
Western migrants	21 (10.0%)	180 (9.4%)	
non-Western migrants	64 (30.6%)	372 (19.5%)	
Unknown origin	3 (1.4%)	5 (0.3%)	
Years since HIV diagnosis	8.7 (1.03-18.5)	17.4 (10.4-24.3)	<.001
Years since start ART	5.04 (0.46-14.1)	15 (8.69-21)	<.001
CD4 at HIV diagnosis	137 (41-336)	304 (130-530)	<.001
Late HIV diagnosis (CD4<350 at entry in care)	160 (77.3%)	1,051 (55.1%)	<.001
Advanced HIV diagnosis (CD4<200 at entry in care)	126 (60.3%)	660 (34.6%)	<.001
CD4 nadir	60 (20-130)	161 (60-277)	<.001
Last CD4 measured before death	150 (55-344)	530 (336-750)	<.001
Viral load undetectable at date of death	104 (52.3%)	1678 (88.2%)	<.001
Not on ART at date of death*	61 (29.2%)	192 (10.1%)	<.001

**These interruptions likely reflect two different situations: prolonged disengagement from care, which is plausibly more relevant to the AIDS-related deaths, and intentional withdrawal of ART as part of palliative care near the end of life. See also sections "Treatment interruptions" and "Loss of viral suppression" in Chapter 4 Antiretroviral therapy in the Netherlands.*

***Legend:** ART = combination antiretroviral therapy. Data shown are n (%) for categorical variables and median (interquartile ranges) for continuous variables. CD4 cell counts are expressed as cells/mm³, IDU = intravenous drug use.*

Risk factors associated with mortality

We used Poisson regression analysis to examine factors associated with mortality in individuals from the moment they started ART. After correction for all variables listed in *Appendix Table 6.2*, including time-updated age and time-updated lagged CD4 cell counts, we found that, in general, risk of death was higher in (heterosexual) men compared to women, and this risk increased as individuals grew older. It also increased if they:

- belonged to the HIV transmission risk group of people who use/used injecting drugs (PWID);
- had a prior AIDS diagnosis;
- were co-infected with the hepatitis B virus (HBV) or hepatitis C virus (HCV);
- were underweight;
- were current or past smokers;
- had spent more time with an HIV RNA level above 1,000 copies/ml while on ART; or
- had a current CD4 cell count less than 750 cells/mm³, with the risk of death progressively increasing in lower CD4 strata.

In individuals who had initiated early ART (i.e. within 12 months of their last negative HIV test, or within 12 months of a diagnosed acute HIV infection [Fiebig stages I-V]), the risk of death was significantly lower compared to individuals who did not initiate ART early (relative risk 0.75, 95% CI 0.58-0.97, p=0.027). Although a lower mortality risk was observed in individuals of non-Dutch origin, this is likely due to a larger proportion of migrants becoming lost to care (*Appendix Table 6.3*). In native Dutch individuals the risk of becoming lost to care was not linked to their CD4 cell count. In contrast, people from all other non-Dutch groups were far more likely to become lost to care if they had very low CD4 cell counts. One explanation could be that those born overseas often return to their families in their country of origin when they experience a severe deterioration in health. As a result, it is likely that mortality rates in these groups have been considerably underestimated.

Suicide and euthanasia

Individuals who had a psychiatric disease as the recorded underlying cause of death, and for whom the immediate cause of death was recorded as suicide, have been re-classified as 'suicide' for the current analysis (*Appendix Table 6.1*). The number of recorded suicides among people with HIV in the Netherlands in the period 2011 to 2025 was stable at around ten recorded cases per calendar year, which is a much higher rate than the known rates of suicide in the general Dutch population. The latter has been stable in the last 10 years; at between 10.4-11.2 instances per 100,000 individuals per year, compared to more than 40 instances per 100,000 person years in the population with HIV[45, 46].

For patients with a serious somatic condition, who opted for euthanasia in the terminal disease stage, the underlying somatic condition was recorded as the cause of death. In the entire follow-up period from 1996 to 2025, a total of 206 instances of euthanasia were recorded; 14% of cases occurred in patients who died of AIDS, 46% in patients who died of non-AIDS-defining malignancies, and the remaining 40% in patients who died of other diseases. Our definition of euthanasia does not include the use of standard practice palliative care, like palliative sedation in the terminal phase of the underlying disease.

AIDS-defining events

In the group of 33,071 adult PWH ever registered in the SHM database, the incidence of first AIDS-defining events decreased sharply from 121.3 (95% CI 108.7-134.9) in 1996 to 6.4 (5.4-7.6) cases per 1,000 PYFU in 2025 (*Figure 6.1B*). *Appendix Table 6.4* gives an overview of the first AIDS-defining events occurring between 1996 and 2025. The most common first AIDS-defining events between 2020 and 2025 (n=835) were:

- *Pneumocystis jirovecii pneumonia (20% of all events);*
- *esophageal candidiasis (18%);*
- *recurrent bacterial pneumonia (13%);*
- *tuberculosis (9%, of which pulmonary 5% and extrapulmonary 4%);*
- *Kaposi's sarcoma (8%);*
- *AIDS-defining lymphoma (7%);*
- *AIDS-related wasting (5%);*
- *cytomegalovirus-associated end organ disease (4%);*
- *herpes simplex virus chronic ulcer (4%);*
- *AIDS dementia complex / HIV encephalopathy (3%); and*
- *toxoplasmosis of the brain (2%).*

Risk factors for AIDS-defining events are shown in *Appendix Table 6.2*.

In the present analyses, we concentrate on the first occurrence of any AIDS-defining event after the start of ART. The results of these analyses show that individuals were more likely to experience their first AIDS-defining event if:

- they were older;
- were born in a non-Western country;
- had a current CD4 cell count below 500 cells/mm^3 (although the likelihood was even higher if their CD4 cell count was below 200 or 50 cells/mm^3);
- had more than 1,000 HIV RNA copies/ml for a longer period of time while on ART; or
- were co-infected with HCV.

Because the main findings of the analysis of AIDS events after the start of ART were heavily influenced by events occurring shortly after the start of ART and/or while HIV-1 RNA was still detectable, we also analysed the incidence of CDC-B (moderately symptomatic HIV disease) and AIDS-defining events in individuals who had started ART at least one year before and had undetectable viraemia or transient low-level viraemia (i.e. 'blips'; below 200 copies/ml) at the moment the HIV-related event was diagnosed. In other words, we focused on those individuals with an optimal virological response to ART. Events were classified into CD4 strata based on the current or previously measured CD4 cell count, whichever was the lowest. Use of opportunistic infection prophylaxis was not accounted for in this analysis. Only 'definitive' or 'probable' diagnoses were considered; 'possible' events or events with incomplete ascertainment were excluded. Cervical dysplasia was excluded from this analysis.

Between 1 January 2000 and 31 December 2025, 28,415 individuals contributed a total of 315.1 thousand PYFU, during which 4,030 CDC-B and/or CDC-C (AIDS-defining events) were diagnosed. This resulted in an incidence rate of 12.8 events per 1,000 PYFU (2,212 CDC-B events, 7.0 events/1,000 PYFU; 1,818 CDC-C/AIDS events, 5.8 events/1,000 PYFU) (Table 6.2). As expected, the incidence rates were highest in the CD4 strata below 200 cells/mm^3. Although the incidence rates declined sharply in the higher CD4 strata, the incidence rates of AIDS-defining illnesses in the 200-349 and 350-499 cells/mm^3 strata remained substantial, with 10.0 and 5.0 AIDS-defining illnesses/1,000 PYFU, respectively. The incidence rates of AIDS-defining illnesses in the CD4 strata of 500-749 and over 750 cells/mm^3 were 2.8 (95% CI 2.5-3.2) and 1.8 (1.5-2.0) events/1,000 PYFU, respectively. Note that the incidence in the over 750 cells/mm^3 stratum is statistically significantly lower compared to the 500-749 cells/mm^3 stratum. In these highest CD4 strata, the main AIDS-defining events that still occurred were:

- recurrent bacterial pneumonia;
- Kaposi's sarcoma;
- oesophageal candidiasis;
- non-Hodgkin's lymphoma;
- tuberculosis (pulmonary and extrapulmonary); and
- chronic genital Herpes simplex virus (HSV) ulcers

Appendix Table 6.6 shows the type and number of HIV-related diagnoses by CD4 strata. We repeated the Poisson regression for risk factors for AIDS, limited to individuals on ART with undetectable viral load and a current CD4 count of at least 500 cells/mm^3. We found that the main risk factor for incident AIDS-defining conditions in this subgroup was higher age: compared to those aged

30-39 years old, the IRR was significantly increased in those aged 60-69 (RR 1.57, 95%CI 1.15-2.15), over 70 years old (RR 1.90, 95%CI 1.28-2.81). Of note, the nadir pre-ART CD4 count was not statistically significantly associated with incident AIDS-defining conditions in this analysis (IRR 1.02, 95%CI 0.75-1.38).
In the period 2020-2025, Kaposi's sarcoma occurred not much less frequently in people with suppressed viremia (n=41, 40.6%) compared to people not on ART or with poorly controlled viremia (n=60, 59.4%).

***Table 6.2:** CDC-B and CDC-C/AIDS events occurring between 2000 and 2025 in individuals on ART, while having an undetectable viral load.*

CD4 category (cells/mm³)	CDC events (n)	CDC B events (n)	CDC C events (n)	PYFU follow-up (x1,000)	Incidence rate CDC events (/1,000 PY) (95%CI)	Incidence rate CDC-B events (/1,000 PY) (95%CI)	Incidence rate CDC-C events (/1,000 PY) (95%CI)
0-50	452	191	261	1.1	420 (382-460)	177 (153-204)	242 (214-274)
50-199	870	449	421	11.8	73.5 (68.7-78.5)	37.9 (34.5-41.6)	35.6 (32.2-39.1)
200-349	764	413	351	35.2	21.7 (20.2-23.3)	11.7 (10.6-12.9)	9.98 (8.96-11.1)
350-499	705	398	307	61.2	11.5 (10.7-12.4)	6.51 (5.88-7.18)	5.02 (4.47-5.61)
500-749	775	465	310	109.7	7.07 (6.58-7.58)	4.24 (3.86-4.64)	2.83 (2.52-3.16)
750+	464	296	168	96.1	4.83 (4.40-5.29)	3.08 (2.74-3.45)	1.75 (1.49-2.03)
Total	4,030	2,212	1,818	315.1	12.8 (12.4-13.2)	7.02 (6.73-7.32)	5.77 (5.51-6.04)

***Legend:** CDC = Centers for Disease Control and Prevention Classification System for HIV Infection; CDC-B = moderately symptomatic HIV disease; CDC-C = AIDS-defining events; ART = combination antiretroviral therapy; PYFU = person years of follow up.*

Mycobacterial disease: tuberculosis (TB) and non-tuberculous mycobacteria (NTM)

Between 1 January 1996 and 31 December 2025 a cumulative total of 1,252 cases of active TB were diagnosed in 1,036 individuals, of which 731 (58.4%) were pulmonary cases and 521 (41.6%) were extrapulmonary/disseminated cases. During that same period, 609 cases of NTM disease were diagnosed in 536 individuals: 117 pulmonary and 492 extrapulmonary/disseminated cases. *Figures 6.2A&B* and *Appendix Table 6.4* describe the incidence over calendar time of active TB and NTM disease.

Geographical region of origin

Migrants who originated from non-Western regions (72.2% of cases, 34.1% of the population) were strongly overrepresented among the active TB cases, while those who were born in the Netherlands (14.5% of cases, 50.0% of the population) were strongly underrepresented. Migrants originating from Western regions (which includes countries from Eastern Europe) represented 12.5% of cases and 15.3% of the population. Region of origin was not strongly associated with the incidence of NTM disease. Table 6.3 describes some key characteristics of the individuals diagnosed with either active TB or NTM disease. In case individuals had multiple diagnoses, the date of the first event was used.

Disease-related mortality rates

4.8% of the individuals diagnosed with pulmonary TB and 4.4% of the individuals diagnosed with extrapulmonary/disseminated TB died within 365 days of the diagnosis, with the reported cause of death being 'AIDS' or 'infection'. The disease-related mortality rates within 365 days of diagnosis were 5.1% for pulmonary and 17.1% for extrapulmonary/disseminated NTM disease.

Latent tuberculosis infection (LTBI): screening and preventive treatment (TPT)

The current national guidelines recommend performing screening for LTBI in all individuals newly diagnosed with HIV who are at increased risk for TB (migrants from high-endemic regions or individuals who have been in close contact with cases of tuberculosis). The recommended method for LTBI screening is the interferon gamma release assay (IGRA) in combination with a tuberculin skin test (Mantoux test). TPT in individuals in whom LTBI has been diagnosed considerably lowers their risk of developing active TB.

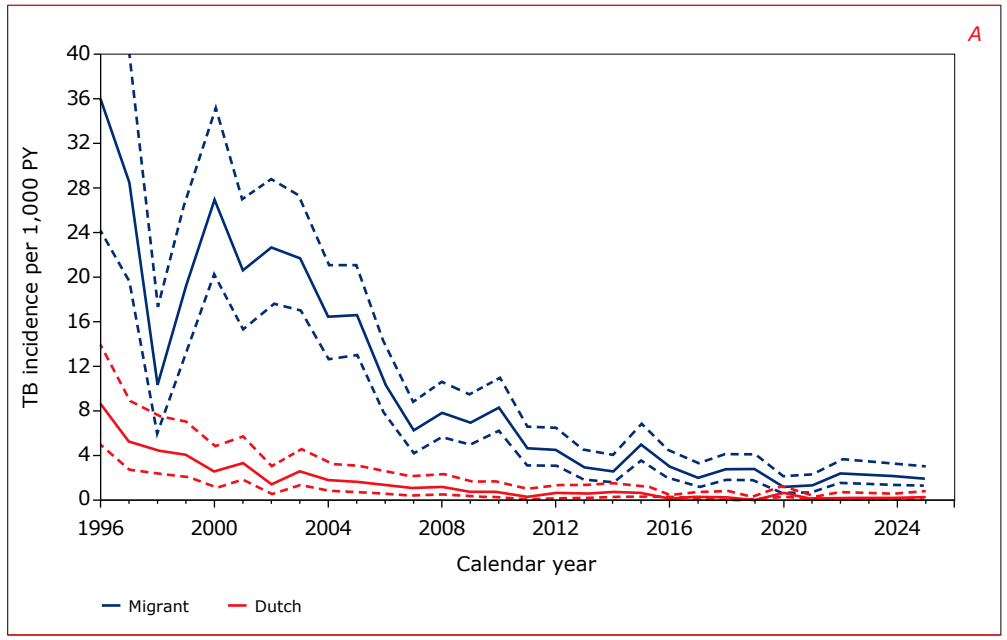
SHM has been collecting data on LTBI screening and TPT since 2018. IGRA testing during an episode in which active TB was diagnosed was excluded from this dataset. A limitation of our analysis of LTBI screening is that we do not have data on whether, at the time of IGRA testing, the individual had complaints that may have been caused by TB, which then prompted the treating physician to perform IGRA testing. In 23.2% of cases a chest X-ray or CT scan was taken, indicating that in some of these instances the individual might also have had pulmonary symptoms at the moment of IGRA testing.

Since 1 January 2018, SHM has recorded LTBI screening using IGRA with or without an additional tuberculin skin test in 3,338 individuals. In 332 (10.0%) of these individuals LTBI testing was positive, and 120 (36.1%) of those 332 individuals received a course of TPT. TPT consisted of:

- isoniazid plus rifampicin (typically for a duration of 3 months) in 37 individuals;
- isoniazid monotherapy (typically for a duration of 6 to 9 months) in 71 individuals; and
- rifampicin monotherapy (typically for a duration of 4 months) in 5 individuals.

A further 7 individuals received another non-standard TPT. In the 332 individuals who tested positive on LTBI screening, 4 cases of pulmonary and 2 cases of extrapulmonary TB were diagnosed later during follow-up. Five of these 6 cases had received a course of TPT. Of the 212 individuals with positive LTBI screening who did not receive TPT, 26 (12.3%) were known to have been diagnosed with and treated for active TB prior to the LTBI screening.

Figure 6.2A–B: Crude incidence rates of active TB and NTM disease in Dutch and migrants per 1,000 person years of follow up (solid lines) and 95% confidence intervals (dashed lines).



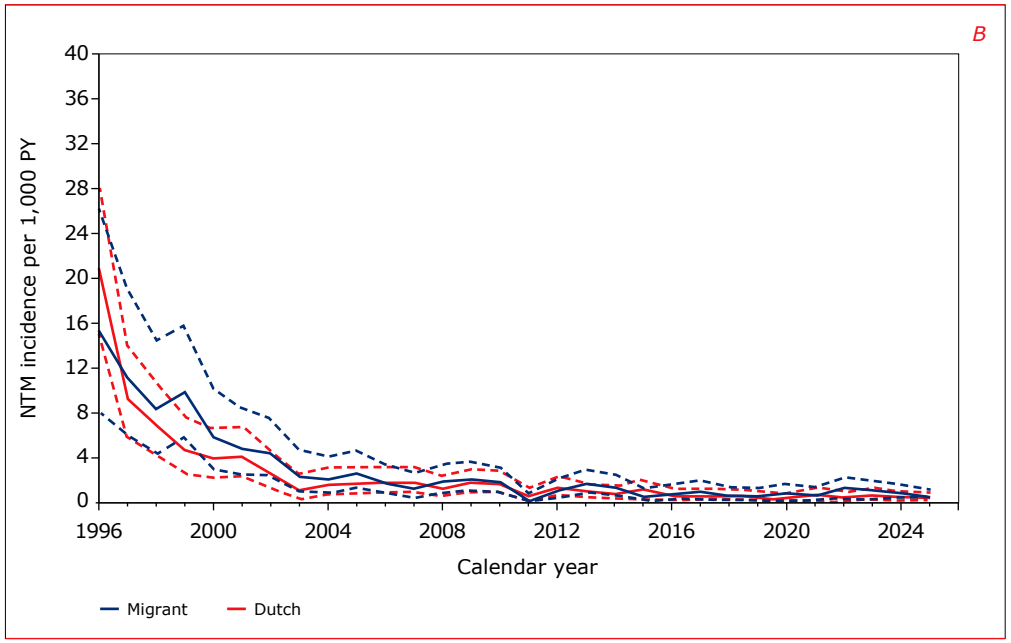


Table 6.3: Characteristics at the time individuals were diagnosed with active TB or NTM disease for the first time.

	Active TB	NTM disease	p-value
Number of subjects	1,036 (65.9%)	536 (34.1%)	
Age	37.1 (30.9–44.8)	40.4 (34.6–48.3)	<.001
Transmission category			<.001
MSM	219 (21.1%)	234 (43.7%)	
Other men	387 (37.4%)	161 (30.0%)	
Women	319 (30.8%)	102 (19.0%)	
Transgender	19 (1.8%)	5 (0.9%)	
IDU	63 (6.1%)	25 (4.7%)	
Blood contact	27 (2.6%)	6 (1.1%)	
Pediatric	2 (0.2%)	3 (0.6%)	
Region of origin			<.001
Native Dutch	182 (17.6%)	295 (55.0%)	
Western migrants	102 (9.8%)	61 (11.4%)	
non-Western migrants	747 (72.1%)	179 (33.4%)	
Unknown origin	5 (0.5%)	1 (0.2%)	
Diagnosed before HIV diagnosis	241 (23.3%)	35 (6.5%)	<.001
Years since HIV diagnosis	0.93 (0.5–4.93)	1.12 (0.57–6.73)	0.011
Years since start ART	0.46 (0–1.37)	0.63 (0.26–1.27)	<.001
CD4 at HIV diagnosis	192 (70–401)	40 (10–200)	<.001
Late stage at HIV diagnosis (CD4<350 at	468 (68.4%)	393 (83.8%)	<.001
Advanced stage at HIV diagnosis (CD4<200	696 (67.2%)	418 (78.0%)	<.001
CD4 nadir	120 (40–250)	20 (10– 50)	<.001
Last CD4 measured before event	200 (88–360)	70 (20–160)	<.001
Undetectable at date of event	191 (18.4%)	133 (24.8%)	0.004
Not on ART at date of event	738 (71.2%)	259 (48.3%)	<.001

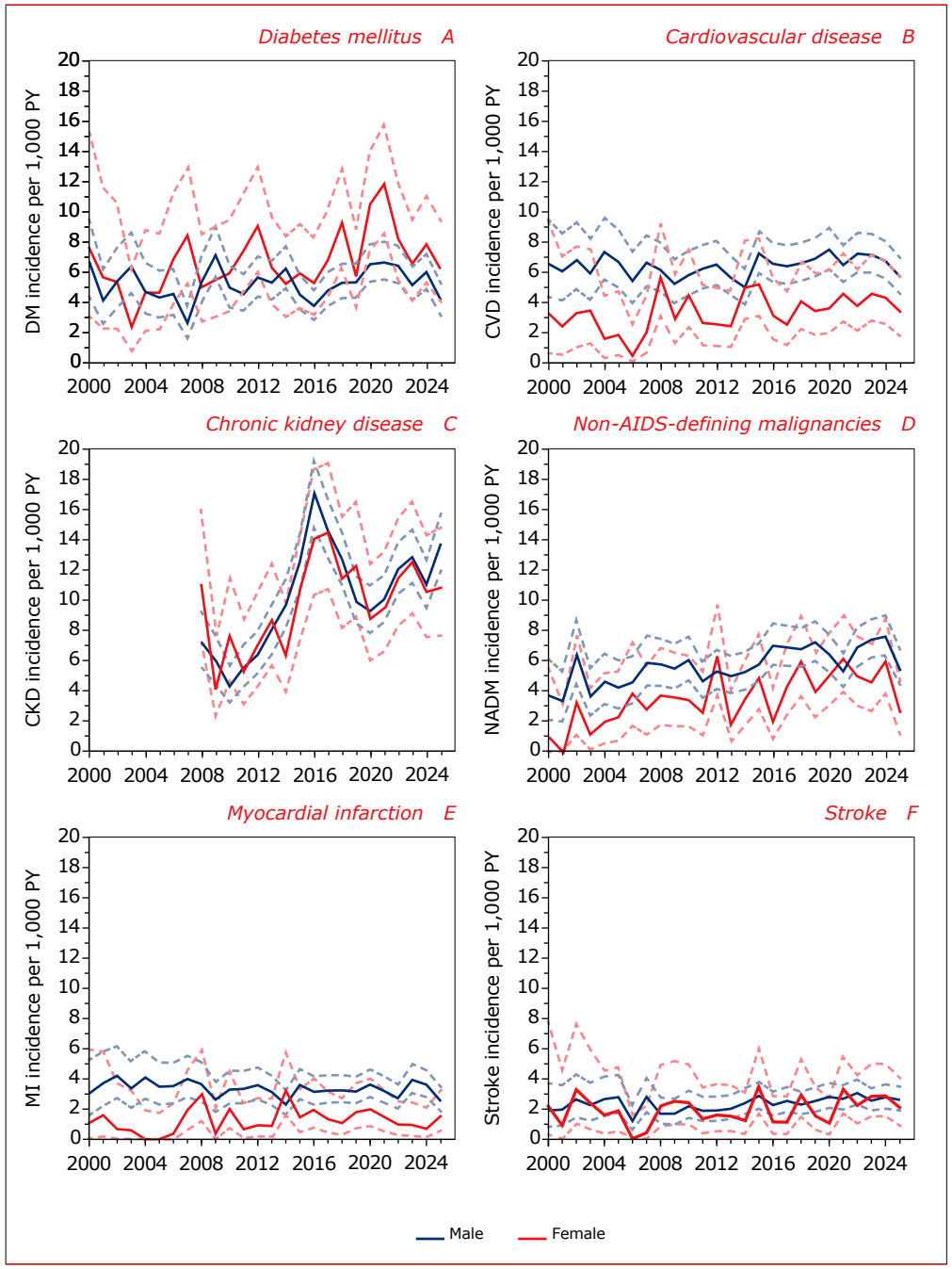
Non-AIDS-defining events

Of the 33,071 adult PWH ever registered with SHM, 32,721 were aged 18 years and over while in follow up in, or after January 2000. For these treated and untreated adults, we report incidence figures and risk factors for:

- diabetes mellitus;
- a composite cardiovascular disease endpoint (and also separately for myocardial infarction and stroke);
- non-AIDS-defining malignancies; and
- Chronic kidney disease (CKD).

We also present the incidence of the first occurrence of diabetes mellitus, cardiovascular disease, or non-AIDS-defining malignancies as a combined non-AIDS disease endpoint (*Figure 6.3A-F*).

Figure 6.3A-F: *Crude incidence rates per 1,000 person years of follow up (solid lines) and 95% confidence intervals (dotted lines) of (A) diabetes mellitus, (B) cardiovascular disease, (C) chronic kidney disease, (D) non-AIDS-defining malignancies, (E) myocardial infarction, (F) stroke, stratified by gender.*



Diabetes mellitus

Of the 32,721 individuals aged 18 years and over, who were in follow up in, or after January 2000, a total of 2,227 (1,704 men and 523 women) were diagnosed with type 2 diabetes from 2000 onwards. The crude incidence of diabetes remained stable over time for men, whereas there was a slight increase in women (*Figure 6.3A*), and in 2025 was 4.1 (95% CI 3.2-5.2) per 1,000 PYFU in men and 6.3 (4.0-9.4) per 1,000 PYFU in women. In men, the age-standardised incidence ratio declined over time and was significantly lower in 2010-2019 and 2020-2025 than in 2000-2009. In women, however, an opposite effect was seen, as the age standardised incidence in significantly increased over the observation period (*Table 6.4*).

Demographic and clinical factors independently associated with an increased risk of new-onset diabetes mellitus were:

- non-Dutch/Western origin;
- older age group;
- a BMI greater than 25 kg/m^2;
- hypertension;
- a latest CD4 cell count below 200 cells/mm^3;
- treatment with NRTI mono or dual treatment prior to the modern combination ART era (in particular zidovudine and didanosine);
- treatment with the integrase inhibitors bictegravir, dolutegravir or raltegravir (but not elvitegravir and cabotegravir) and
- a prior AIDS diagnosis (*Appendix Table 6.5*).

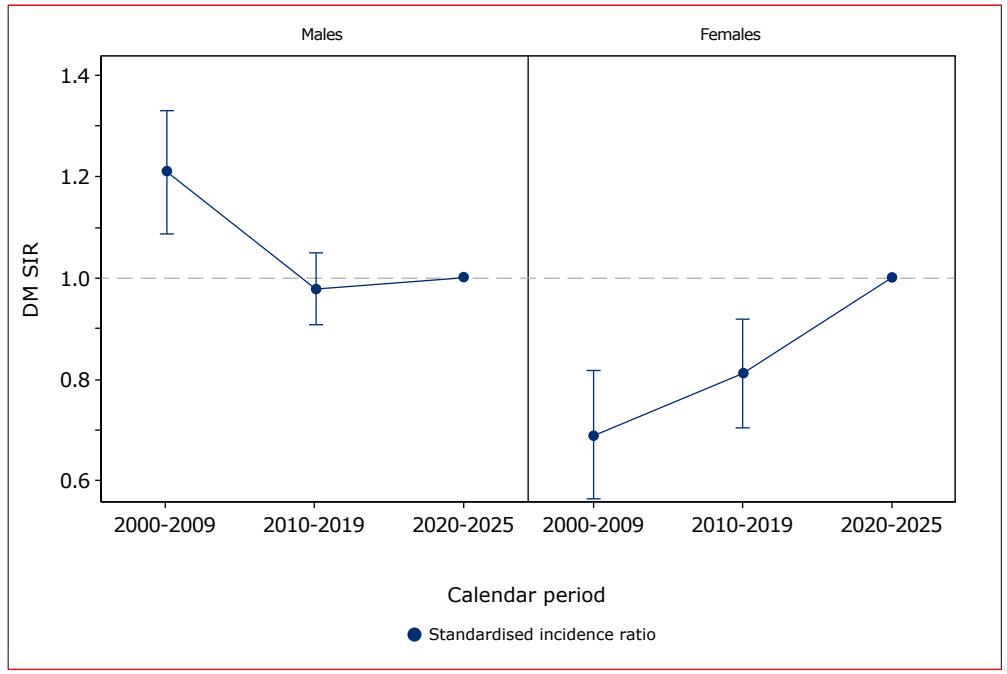
Moreover, the risk of new-onset diabetes in the periods 2000-2009 and 2010-2019 was significantly higher than in the period 2020-2025. Starting ART within 12 months of the last negative HIV test was also associated with a lower risk of new-onset diabetes. Note that multivariate analysis showed that the higher age-adjusted incidence rates of diabetes in women are largely explained by their higher BMI.

We compared the age- and sex-stratified prevalence of diabetes mellitus in the population of people with HIV with that observed in the general Dutch population in 2024, which was the last calendar year for which we have national data at the time of analysis (*Table 6.5 & Figure 6.5*). In men the prevalence of diabetes was significantly lower in nearly all age strata, while in women aged up to 65 year old the observed prevalence of diabetes was higher compared to the reference values in the general population.

Table 6.4: Crude incidence of diabetes mellitus per 1,000 person years of follow up in 2000-2009, 2010-2019 and 2020-2025 and age-standardised incidence ratio (indirect method) with 95% confidence intervals.

Calendar year	Male		Female	
	Incidence/1000PY (95%CI)	Standardized Inc. Ratio (95%CI)	Incidence/1000PY (95%CI)	Standardized Inc. Ratio (95%CI)
2000-2009	5.1 (4.6-5.7)	1.21 (1.09-1.33)	5.7 (4.7-6.8)	0.69 (0.56-0.82)
2010-2019	5.1 (4.7-5.4)	0.98 (0.91-1.05)	6.7 (5.8-7.6)	0.81 (0.70-0.92)
2020-2025	5.9 (5.4-6.4)	1 (reference)	8.4 (7.3-9.7)	1 (reference)

Figure 6.4: Age-standardised incidence ratio (indirect method) with 95% confidence intervals of diabetes mellitus per 1,000 person years of follow up in 2000-2009, 2010-2019 and 2020-2025.



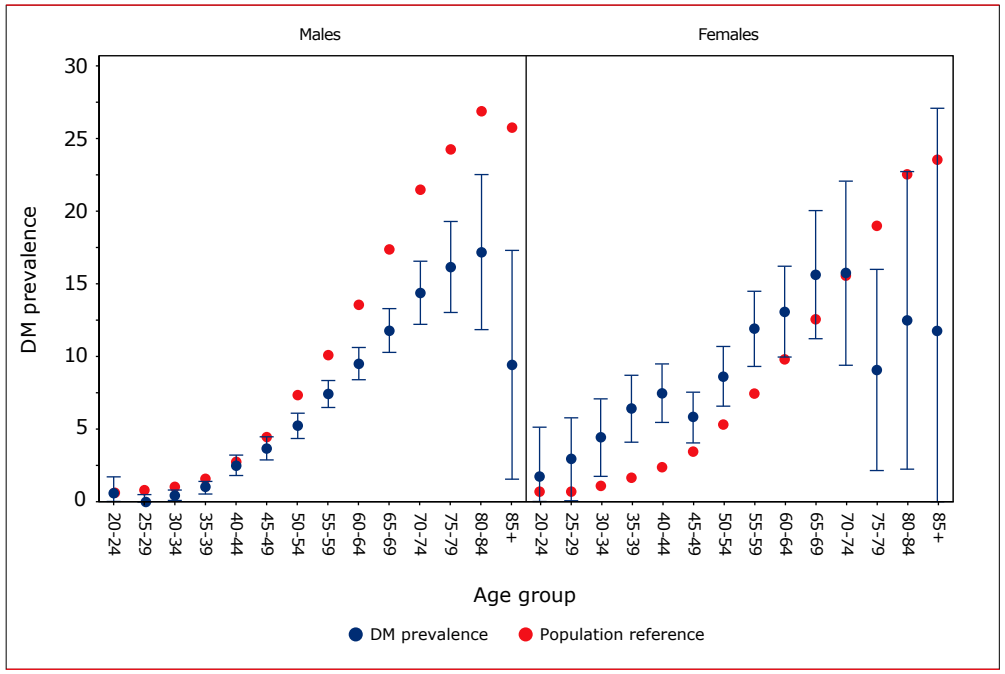
**Standardised according to the observed age distribution between 2020-2025.*

***Legend:** CI = confidence intervals; PY = person years.*

Table 6.5: Prevalence of diabetes mellitus in people with HIV stratified by age and sex in 2024, compared to the prevalence of diabetes mellitus type 2 in the general Dutch population in 2024 (https://www.vzinfo.nl/diabetes-mellitus/leeftijd-en-geslacht, accessed 17-9-2026).

Age group (years)	Males				Females			
	Events (n)	Group size (n)	Prevalence % (95%CI)	General population prevalence (%)	Events (n)	Group size (n)	Prevalence % (95%CI)	General population prevalence (%)
20-24	1	172	0.6 (0.0-1.7)	0.7	1	57	1.8 (0.0-5.2)	0.72
25-29	1	572	0.2 (0.0-0.5)	0.81	4	135	3.0 (0.1-5.8)	0.94
30-34	6	1,335	0.4 (0.1-0.8)	1.19	10	226	4.4 (1.7-7.1)	1.15
35-39	17	1,753	1.0 (0.5-1.4)	1.7	28	436	6.4 (4.1-8.7)	1.68
40-44	47	1,862	2.5 (1.8-3.2)	2.73	48	641	7.5 (5.5-9.5)	2.36
45-49	77	2,082	3.7 (2.9-4.5)	4.42	40	690	5.8 (4.1-7.5)	3.47
50-54	128	2,441	5.2 (4.4-6.1)	7.37	62	718	8.6 (6.6-10.7)	5.31
55-59	219	2,952	7.4 (6.5-8.4)	10.11	71	596	11.9 (9.3-14.5)	7.45
60-64	252	2,645	9.5 (8.4-10.6)	13.56	58	443	13.1 (10.0-16.2)	9.8
65-69	201	1,706	11.8 (10.3-13.3)	17.37	41	262	15.6 (11.2-20.0)	12.58
70-74	143	994	14.4 (12.2-16.6)	21.46	20	127	15.7 (9.4-22.1)	15.56
75-79	86	532	16.2 (13.0-19.3)	24.26	6	66	9.1 (2.2-16.0)	19
80-84	33	192	17.2 (11.9-22.5)	26.89	5	40	12.5 (2.3-22.7)	22.54
85+	5	53	9.4 (1.6-17.3)	25.77	2	17	11.8 (0.0-27.1)	23.53

Figure 6.5: Prevalence of diabetes mellitus in people with HIV stratified by age and sex in 2024, compared to the prevalence of diabetes mellitus type 2 in the general Dutch population in 2024 (https://www.vzinfo.nl/diabetes-mellitus/leeftijd-en-geslacht, accessed 17-9-2026).



Cardiovascular disease

- From January 2000 onwards, 2,321 individuals (2,055 men and 266 women) experienced one or more fatal or non-fatal cardiovascular event. Of these individuals:
- 1,115 had a myocardial infarction;
- 880 had a stroke;
- 173 had a coronary artery bypass graft;
- 875 had a coronary angioplasty or stenting; and
- 25 had a carotid endarterectomy.

The crude incidence over time remained stable and was lower in women than in men (*Figure 6.3B*). The age-standardised incidence ratio in men and women declined over time (*Table 6.6 & Figure 6.6*).

In the analysis of risk factors, those associated with cardiovascular disease were:

- older age group;
- male gender, MSM had lower risk than other men;
- a latest CD4 cell count below 350 cells/mm^3
- a prior AIDS diagnosis; as well as having a longer duration of severe immunodeficiency defined as cumulative number of years with a CD4 count <200 cells/mm^3;
- treatment with NRTI mono or dual treatment prior to the modern combination ART era;
- use of abacavir (either currently or in the last six months);
- current use of dolutegravir, raltegravir or bictegravir (borderline significant) (but not elvitegravir or cabotegravir);
- current and past smoking;
- the presence of diabetes mellitus; and
- the presence of hypertension.

Estimated cardiovascular risk using the D:A:D algorithm was also higher during 2000-2009 and 2010-2019 than during 2020-2025, independent of other variables included in the analysis (*Appendix Table 6.5*). The strong positive association between use of abacavir and CVD was independent of renal function. When eGFR, estimated using the Cockcroft-Gault method (available from 2007 onwards), was included in the model the abacavir effect was only slightly attenuated, decreasing from an incidence risk ratio (IRR) of 1.52 to 1.45, p<0.001.

From January 2000 onwards, 325 men and 35 women experienced a fatal or non-fatal secondary cardiovascular event: 191 had a myocardial infarction, 179 had a stroke (note that 10 persons experienced both a secondary MI and a secondary stroke). The crude incidence per 1,000 PYFU over the whole period between 2000 and 2025 in men and women with a prior cardiovascular event was 25.1 (22.4-28.0) and 21.0 (14.6-29.2), respectively. The crude rate and age-standardised incidence ratio (SIR; indirect method) of secondary myocardial infarction and stroke per 1,000 PYFU decreased significantly over time in men while it increased in women (*Table 6.7 & Figure 6.7*).

We compared the age- and sex-stratified prevalence of coronary artery disease (which includes myocardial infarction, angina pectoris) in the population of people with HIV with that observed in the general Dutch population (*Table 6.8 & Figure 6.8*). In men and women the prevalence of coronary artery disease was fairly equal in all age strata compared to the reference values in the general population.

Table 6.6 & Figure 6.6: *Crude incidence of primary cardiovascular disease per 1,000 person years of follow up in 2000-2009, 2010-2019, and 2020-2025 and age-standardised incidence ratio with 95% confidence intervals.*

Calendar year	Male		Female	
	Incidence/1000PY (95%CI)	Standardized Inc. Ratio (95%CI)	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)
2000-2009	6.2 (5.7-6.8)	1.65 (1.50-1.80)	2.6 (1.9-3.4)	1.42 (1.03-1.81)
2010-2019	6.3 (5.9-6.8)	1.20 (1.12-1.28)	3.5 (2.9-4.2)	1.19 (0.97-1.40)
2020-2025	6.8 (6.3-7.3)	1 (reference)	4.1 (3.3-4.9)	1 (reference)

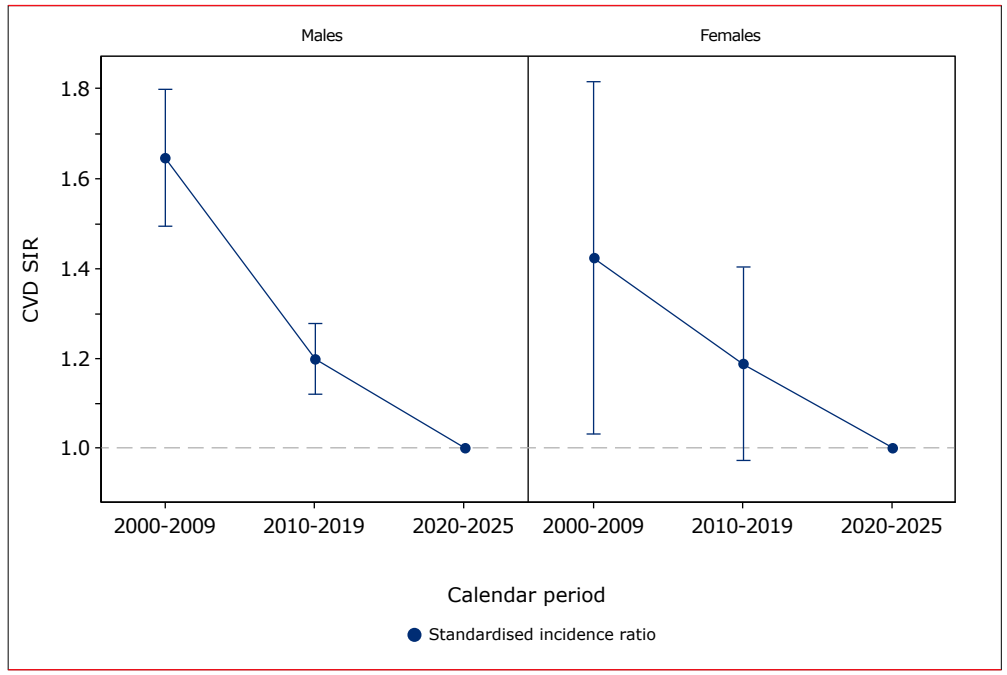
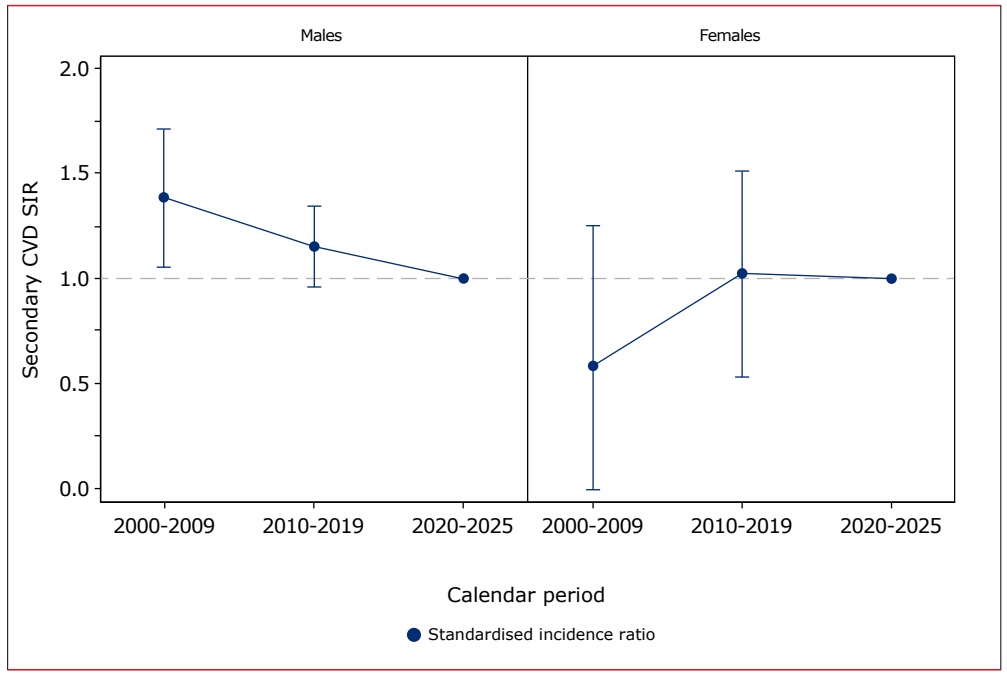


Table 6.7 & Figure 6.7: *Crude incidence of secondary cardiovascular disease per 1,000 person years of follow up in 2000-2009, 2010-2019, and 2020-2025 and age-standardised incidence ratio with 95% confidence intervals.*

Calendar year	Male		Female	
	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)
2000-2009	30.9 (24.0-39.0)	1.38 (1.06-1.71)	14.1 (2.9-41.2)	0.59 (0.00-1.25)
2010-2019	25.7 (21.6-30.3)	1.15 (0.96-1.34)	22.8 (13.3-36.6)	1.02 (0.54-1.51)
2020-2025	22.0 (18.2-26.4)	1 (reference)	21.1 (11.8-34.9)	1 (reference)



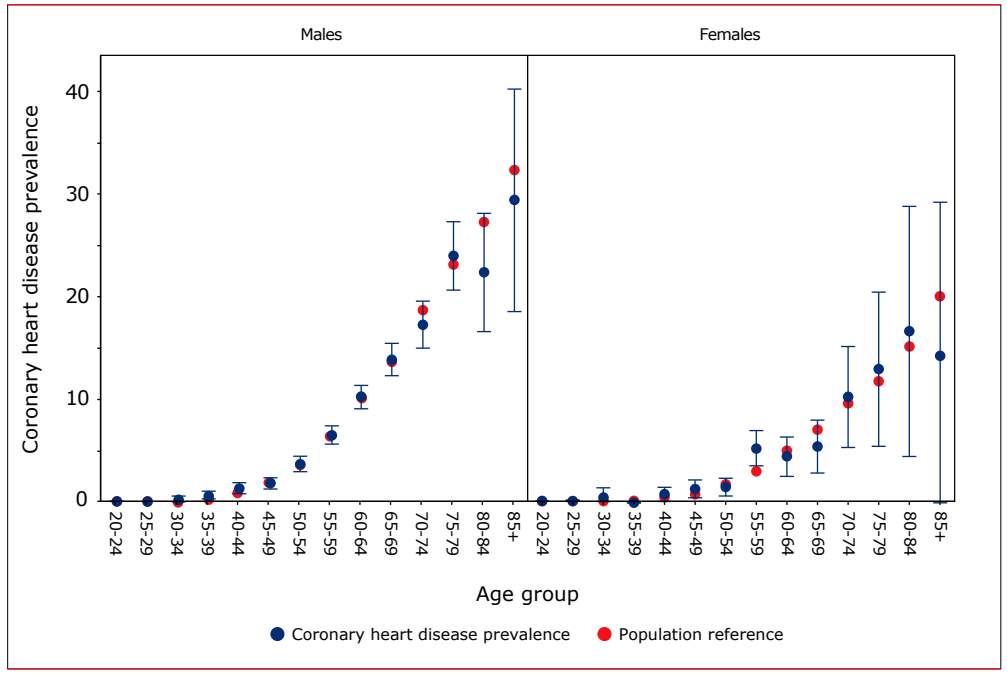
**Standardised according to the observed age distribution in 2020-2025.*

Legend: *CI = confidence intervals; PY = person years.*

Table 6.8 & Figure 6.8 : *Prevalence of coronary artery disease in people with HIV stratified by age and sex in 2025, compared to the prevalence observed in the general Dutch population in 2025 (https://www.staatvenz.nl/kerncijfers/coronaire-hartziekten-aantal-patiënten-bekend-bij-de-huisarts, accessed 17-9-2026).*

Age group (years)	Males				Females			
	Events (n)	Group size (n)	Prevalence % (95%CI)	General population prevalence (%)	Events (n)	Group size (n)	Prevalence % (95%CI)	General population prevalence (%)
20-24	0	150	0.0 (0.0-0.0)	0.03	0	62	0.0 (0.0-0.0)	0.04
25-29	0	583	0.0 (0.0-0.0)	0.05	0	134	0.0 (0.0-0.0)	0.04
30-34	4	1,257	0.3 (0.0-0.6)	0.13	1	213	0.5 (0.0-1.4)	0.07
35-39	12	1,735	0.7 (0.3-1.1)	0.26	0	390	0.0 (0.0-0.0)	0.14
40-44	25	1,805	1.4 (0.8-1.9)	0.79	5	637	0.8 (0.1-1.5)	0.37
45-49	39	2,085	1.9 (1.3-2.5)	1.7	9	673	1.3 (0.5-2.2)	0.85
50-54	86	2,303	3.7 (3.0-4.5)	3.6	11	736	1.5 (0.6-2.4)	1.74
55-59	191	2,907	6.6 (5.7-7.5)	6.45	33	627	5.3 (3.5-7.0)	2.99
60-64	284	2,765	10.3 (9.1-11.4)	10.15	20	449	4.5 (2.5-6.4)	4.92
65-69	257	1,846	13.9 (12.3-15.5)	13.75	16	294	5.4 (2.8-8.0)	7.11
70-74	175	1,011	17.3 (15.0-19.6)	18.64	15	146	10.3 (5.3-15.2)	9.65
75-79	151	629	24.0 (20.7-27.3)	23.26	10	77	13.0 (5.5-20.5)	11.81
80-84	45	201	22.4 (16.6-28.2)	27.31	6	36	16.7 (4.5-28.8)	15.14
85+	20	68	29.4 (18.6-40.2)	32.33	3	21	14.3 (0.0-29.3)	20.04

Legend: *CI = confidence intervals.*



Trends in cardiovascular risk factors

Figures 6.9A and *6.9B* show that the distribution of body mass index (BMI) of both men and women in the HIV-1-positive population has increased over time. In 2025, the proportion of men with available BMI data who were overweight (25-30 kg/m^2) or obese (WHO class I: 30-35 kg/m^2 and WHO class II/III: 35 kg/m^2 or over), was 37.9%, 10.4% and 2.9%, respectively. In women, these proportions were 31.3%, 20.5% and 13.5%, respectively.

Using mixed-effects modelling, we investigated whether the increase in BMI over time could be ascribed to changes in the demographic characteristics and ageing of the population with HIV. This analysis revealed that the increase was at least partially driven by changes over time in population demographic characteristics (age, non-Western region of origin, HIV transmission category) and time since first initiating ART, and that this effect was more marked in men than in women. With regard to specific antiretroviral drugs, the use of bictegravir, dolutegravir, rilpivirine and tenofovir alafenamide were all independently associated with higher body weight.

Figure 6.9A-B: *Distribution of the body mass index (BMI) at the end of each calendar year in (A) men, and (B) women, as a percentage of the total number of men and women with a known BMI in each year. For each individual, the last available weight measurement in each year was selected. The numbers at the top of each bar represent the number of individuals contributing data during that calendar year.*

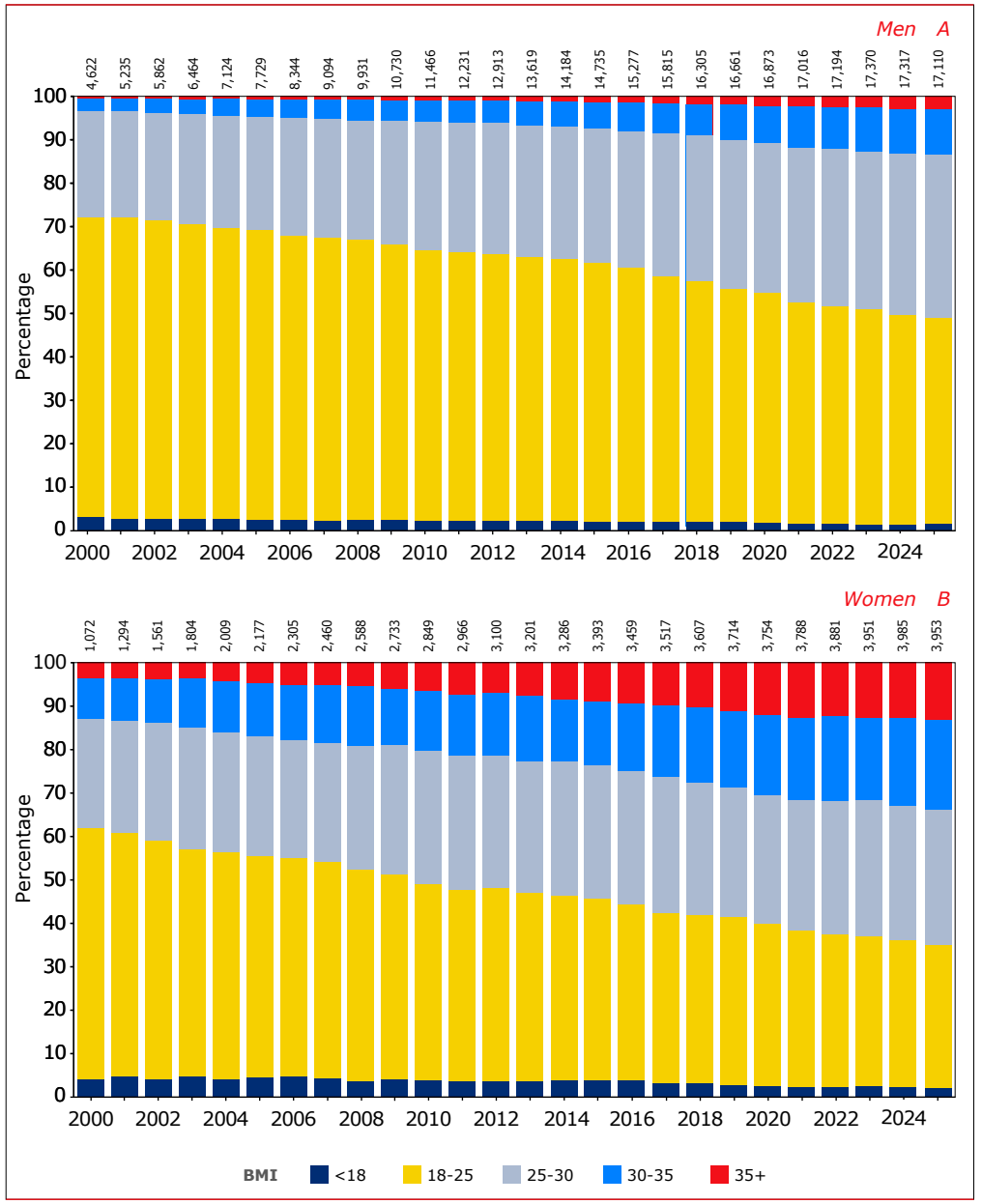


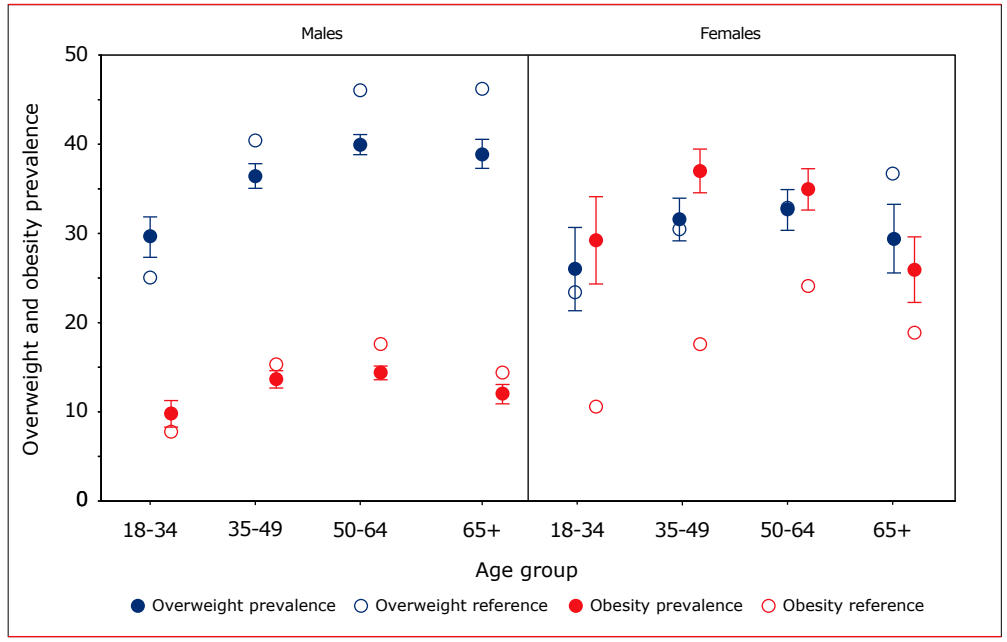
Table 6.9 and *Figure 6.10* shows a comparison with the general Dutch population of the age- and sex-stratified prevalence of overweight and obesity in 2025. Males aged 35 and older were significantly less often overweight or obese than the general Dutch male population, while women in all age strata were more likely to be obese. Whereas in adult men of all age groups, the proportion classified as obese (14.0%) was similar to the proportion found in the general Dutch male population (13.7%), in women of all age groups there was more obesity (34.0%) than in the general Dutch female population (17.7%)[47].

There were substantial differences between those of Dutch origin, Western migrants and non-Western migrants: among males, 12.0% of Dutch men, 14.0% of Western migrants and 16.2% of non-Western migrants were obese. In females, however, those figures were 23.8%, 24.1%, and 40.8%, respectively. Being overweight (a BMI between 25-30) or being obese (a BMI over 30) were both independently associated with an increased risk of diabetes (overweight IRR 2.13, 95%CI 1.90-2.38, p<0.001; obese IRR 5.04, 95%CI 4.44-5.72, p<0.001), as well as with CKD (overweight IRR 1.18, 95%CI 1.09-1.28, p<0.001; obese IRR 1.13, 95%CI 1.01-1.28, p=0.036) (*Appendix Table 6.5*). Overweight and obesity were not associated with an increased risk of CVD and non-AIDS malignancies.

Table 6.9: *Age- and sex-stratified prevalence of overweight and obesity in 2025, compared to the general Dutch population in 2025 (source: https://www.vzinfo.nl/overgewicht/volwassenen, accessed 17-9-2026).*

Age group (years)	Group size (n)	Over-weight (n)	Overweight prevalence % (95%CI)	General population overweight prevalence (%)	Obesity (n)	Obesity prevalence % (95%CI)	General population obesity prevalence (%)
Males							
18-34	1,510	448	29.7 (27.4-32.0)	25.1	149	9.9 (8.4-11.4)	7.8
35-49	4,793	1,749	36.5 (35.1-37.9)	40.5	657	13.7 (12.7-14.7)	15.4
50-64	7,317	2,931	40.1 (38.9-41.2)	46.1	1,055	14.4 (13.6-15.2)	17.7
65+	3,490	1,361	39.0 (37.4-40.6)	46.3	422	12.1 (11.0-13.2)	14.5
Females							
18-34	338	88	26.0 (21.4-30.7)	23.4	99	29.3 (24.4-34.1)	10.6
35-49	1,431	452	31.6 (29.2-34.0)	30.5	530	37.0 (34.5-39.5)	17.6
50-64	1,641	536	32.7 (30.4-34.9)	32.9	574	35.0 (32.7-37.3)	24.1
65+	543	160	29.5 (25.6-33.3)	36.7	141	26.0 (22.3-29.7)	18.9

Figure 6.10: *Distribution of the body mass index (BMI) over the age groups for men, and women, in 2025, compared to the general Dutch population in 2025.*



Legend: *BMI = body mass index.*

Chapter 12 on Quality of Care contains more information on the prevalence and treatment of hypertension; the proportion of treated hypertensive individuals attaining treatment goals; the proportion of individuals with a SCORE2 or SCORE2-OP predicted 10-year risk greater than 10%, without a history of CVD, that received a prescription for statins; the proportion of high-risk individuals receiving statins who attained treatment goals.

Chronic kidney disease

Glomerular filtration rate (GFR) is a marker of renal function and is commonly estimated by one of three formulae, namely the Cockcroft-Gault, the Modification of Diet in Renal Disease (MDRD), or the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations[48]. As all three equations used to estimate GFR (eGFR) are based on serum creatinine, they may be markedly affected by rapid changes in muscle mass, as is seen in some individuals with advanced HIV disease who commence ART. Of these equations, both the Cockcroft-Gault and the CKD-EPI equations have been validated in individuals with HIV[48, 49]. However, because the CKD-EPI equation is the one most often used in clinical practice, we have chosen to report eGFR values as estimated by this equation. The distribution of eGFR categories in ml/min/1.73m^2 (90 or above, normal kidney function; 60-89, mildly reduced; 30-59, moderately reduced; 15-29, severely reduced; and below 15, very severely reduced kidney function) is shown in *Figures 6.11A* and *6.11B* for men and women. The percentage of men with normal kidney function decreased over time from 74.5% in 2007, to 39.0% in 2025, and this pattern was similar in women. Typically, eGFR decreases with increased age, as shown in *Figure 6.12*, and therefore the decrease in the proportion of individuals with normal function over time is likely due, in part, to the increasing age of individuals in care.

CKD incidence and risk factors

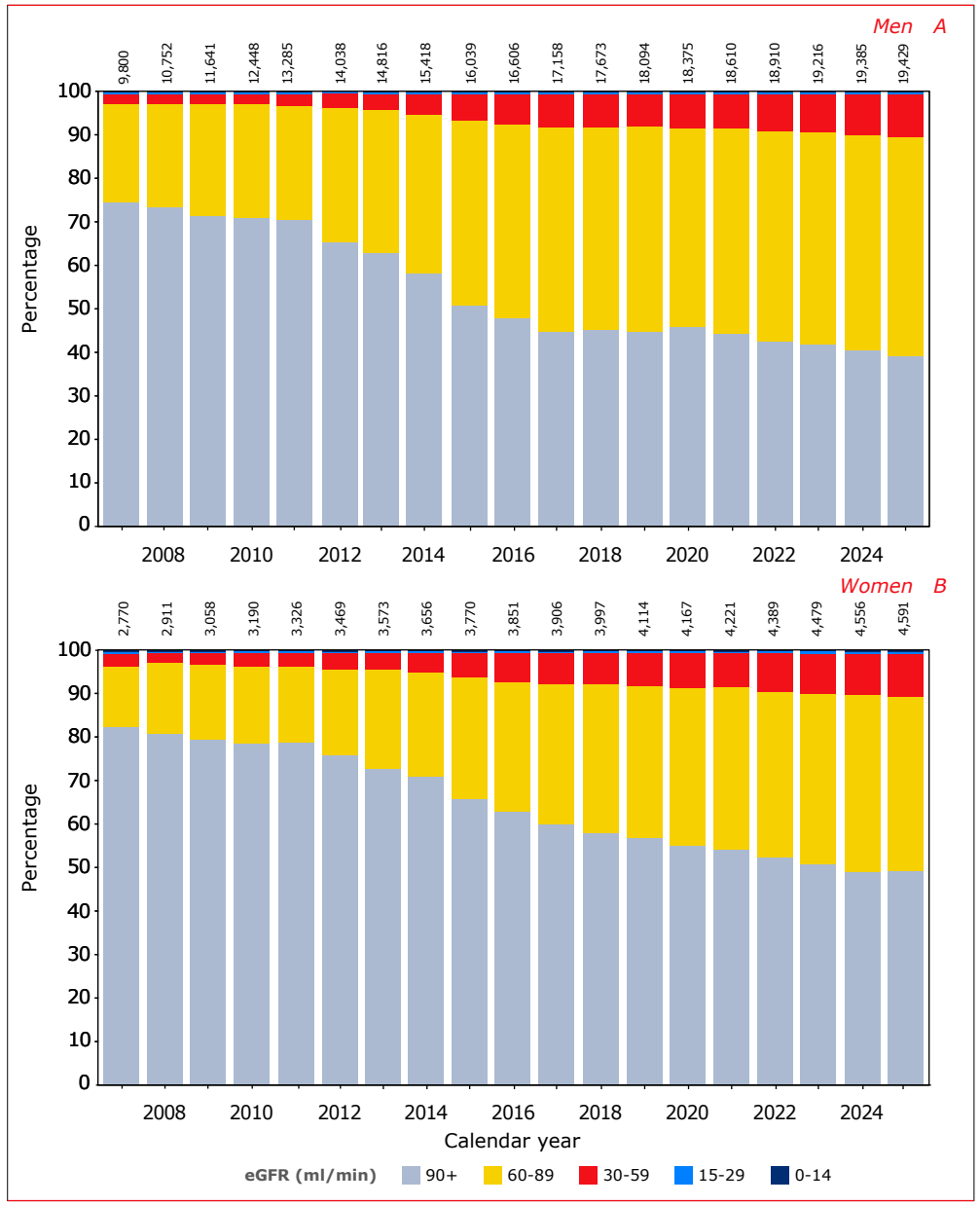
In individuals with an eGFR above 60ml/min/1.73m^2 at the time of inclusion in the analyses, who did not have a previously confirmed CKD, the crude incidence of CKD (defined as eGFR below 60ml/min/1.73m^2 confirmed by a second test at least 26 weeks later) varied over time (*Figure 6.3C*). Routine collection of serum creatinine measurements commenced in 2007. To avoid misclassifying prevalent CKD as incident CKD, we used serum creatinine levels measured in 2007 to distinguish between prevalent (i.e. CKD already present in 2007) versus new-onset incident cases of CKD (i.e. no CKD observed in 2007) from 2008 onwards. In men, the incidence rose from 9.9 cases per 1,000 PYFU in the period 2008-19 to 10.4 in 2020-2025. In women, the incidence rose from 10.4 to 10.8 cases per 1,000 PYFU during the same periods (*Table 6.10*). However, the age-standardised incidence ratio in both men and women was significantly lower in the 2020-2025 period (*Table 6.10*).

Risk factors for CKD included:

- female gender;
- Dutch origin;
- low current CD4 cell count (below 350 cells/mm^3);
- a prior AIDS diagnosis;
- belonging to the HIV transmission risk group of people who inject drugs;
- older age group;
- being underweight or overweight / obese;
- hypertension;
- diabetes mellitus;
- cardiovascular disease;
- treatment with NRTI mono or dual treatment prior to the modern combination ART era; and
- chronic HBV and HCV co-infection (*Appendix Table 6.5*).

When current use of cobicistat, rilpivirine, dolutegravir, and bictegravir were added to the model, the increased risk of CKD over calendar time completely disappeared (even reversed). This strongly suggests that the increase in CKD seen in recent years is largely due to increases in serum creatinine caused by ARV-induced reversible inhibition of two transporters that mediate tubular secretion of creatinine, without affecting the true glomerular filtration rate (namely, organic cation transporter 2 [OCT2], and multidrug and toxin extrusion transporter [MATE1]) and is therefore not a true increase in CKD.

Figure 6.11A–B: *Distribution of categories of estimated glomerular filtration rate (eGFR) at the end of each calendar year in (A) men, and (B) women. For each individual, the last available measurement in each year was selected. The numbers at the top of each bar represent the number of individuals contributing data during that calendar year.*



Legend: *eGFR = estimated glomerular filtration rate; eGFR 90+ ml/min/1.73m^2: normal kidney function; 60–89 ml/min/1.73m^2: mildly reduced; 30–59 ml/min/1.73m^2: moderately reduced; 15–29 ml/min/1.73m^2: severely reduced; 0–15 ml/min/1.73m^2 very severely reduced kidney function.*

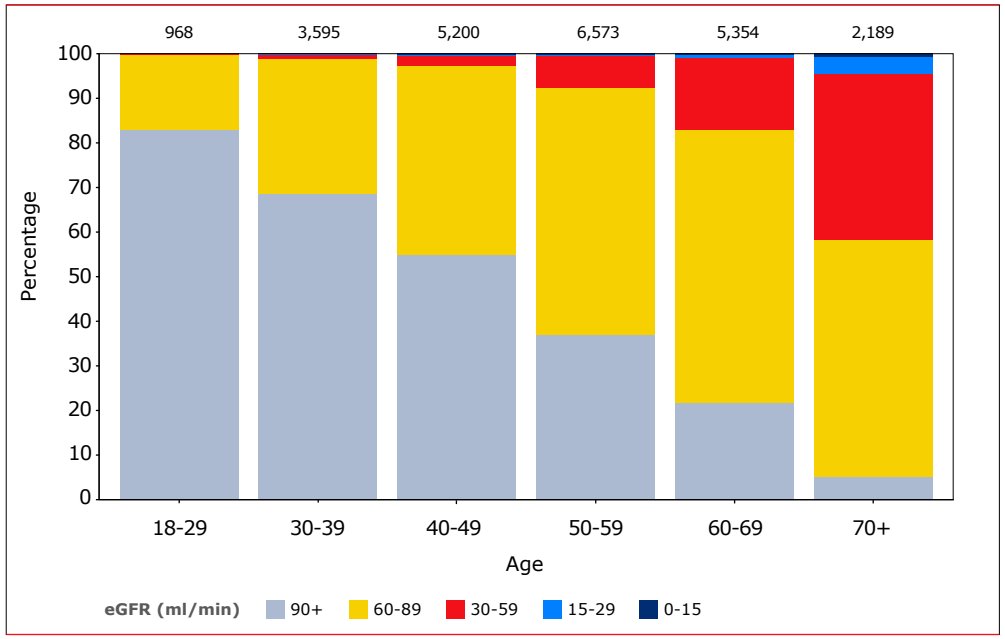
Table 6.10: Crude chronic kidney disease incidence per 1,000 person years of follow up in 2008–2019, and 2020–2025, and age-standardised incidence ratio with 95% confidence intervals.

Calendar year	Male		Female	
	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)
2008–2019	9.9 (9.3–10.5)	1.28 (1.20–1.36)	10.4 (9.0–11.9)	1.38 (1.19–1.57)
2020–2025	10.4 (9.7–11.2)	1 (reference)	10.8 (9.2–12.6)	1 (reference)

**Standardised according to the observed age distribution in 2020–2025.*

***Legend:** CI = confidence interval; PYFU = person years.*

Figure 6.12: Distribution of categories of estimated glomerular filtration rate (eGFR) in 2025 for different age categories. For each individual, the last available measurement in 2025 was selected. The numbers at the top of each bar represent the number of individuals contributing data to that age category.



***Legend:** eGFR = estimated glomerular filtration rate; eGFR 90+ ml/min/1.73m²: normal kidney function; 60–89 ml/min/1.73m²: mildly reduced; 30–59 ml/min/1.73m²: moderately reduced; 15–29 ml/min/1.73m²: severely reduced; 0–15 ml/min/1.73m² very severely reduced kidney function.*

Non-AIDS-defining malignancies

Between 2000 and 2025, 2,874 diagnoses of non-AIDS-defining malignancies (NADM) in 2,626 unique individuals were recorded in SHM's database. An additional 1,128 patients were diagnosed with one or more non-melanoma skin cancers, but these were not included in the present analysis. *Table 6.11* shows the most common types of non-AIDS-defining cancer. *Figure 6.13A* shows the changes in types of non-AIDS-defining cancers over time. The proportion of individuals with intestinal, prostate, and renal cancer has increased over time, likely reflecting the increasing age of the study population. This is further illustrated in *Figure 6.13B*, which shows the distribution of non-AIDS-defining malignancies with increasing age at cancer diagnosis.

Risk factors for non-AIDS-defining malignancies

The crude incidence over time of NADM in men and women is shown in *Figure 6.3D*. The age-standardised incidence in men statistically significantly decreased over time (*Table 6.12* & *Figure 6.14*). This lower age-standardised incidence in men may be due to a reduction over time in risk factors such as smoking, and a higher proportion of individuals living with high CD4 cell counts. The temporal trend for women was similar – the age-standardised incidence decreased (although not significantly) over time.

Demographic and clinical factors independently associated with an increased risk of a first non-AIDS-defining malignancy were (*Appendix Table 6.5*):

- older age group;
- people born in the Netherlands, and migrants from Western countries;
- low body mass index;
- lower current CD4 cell count (CD4 below 350 cells/mm^3);
- prior AIDS;
- chronic HBV co-infection; and
- current or past smoking.

In the period from 1 January 2000 to 31 December 2025, the overall five-year survival rate following the most common non-AIDS-defining malignancies are shown in *Table 6.11* and *Figure 6.15*. *Table 6.11* also shows the distribution and crude 5-year survival rates of the subgroup of NADM diagnosed in the last 10 years of follow-up. For nearly all NADM we observed no clinically significant change in the crude 5-year survival rates (but with slightly improved survival for lung cancer and malignant melanoma).

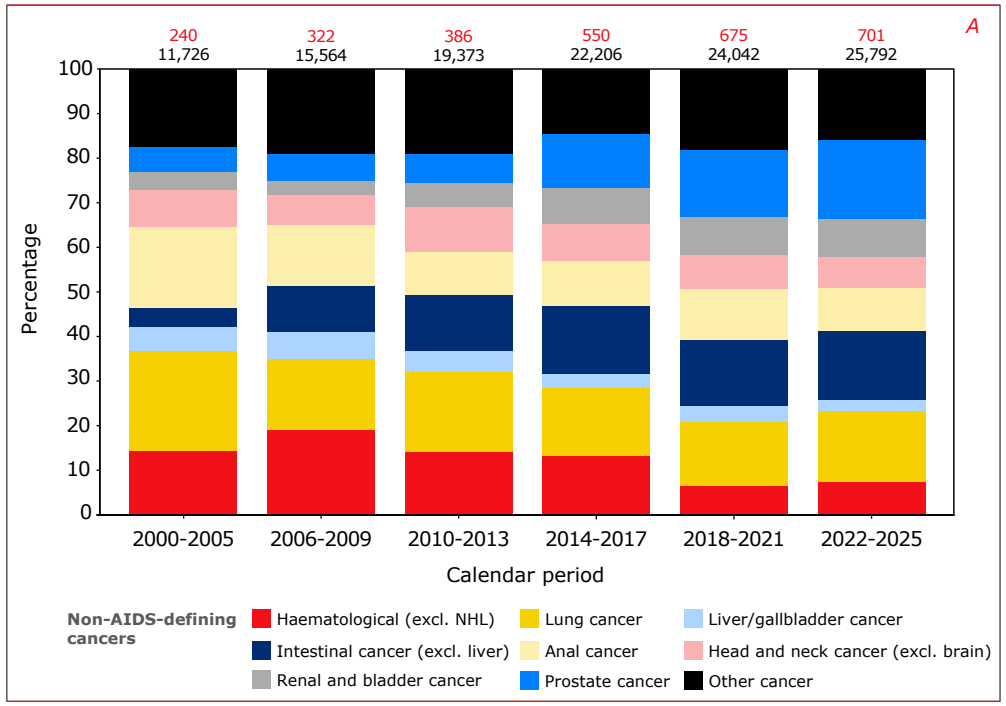
We calculated the age- and sex-stratified incidence of non-AIDS-defining malignancy (including non-melanoma skin cancer) per 1,000 person years of follow up in the 10-year period 2016-2025, and compared with the incidence in the general Dutch population in 2025 (*Table 6.13* & *Figure 6.16*). The incidence of NADM in all age groups (with at least 15 events) in men was significantly higher than the observed cancer incidence in the general Dutch male population. The relatively low cumulative follow-up time and number of events per age group in women limits the statistical power of the analysis. However, the observed incidence in each age group appears to be rather similar to the observed cancer incidence in the general Dutch female population.

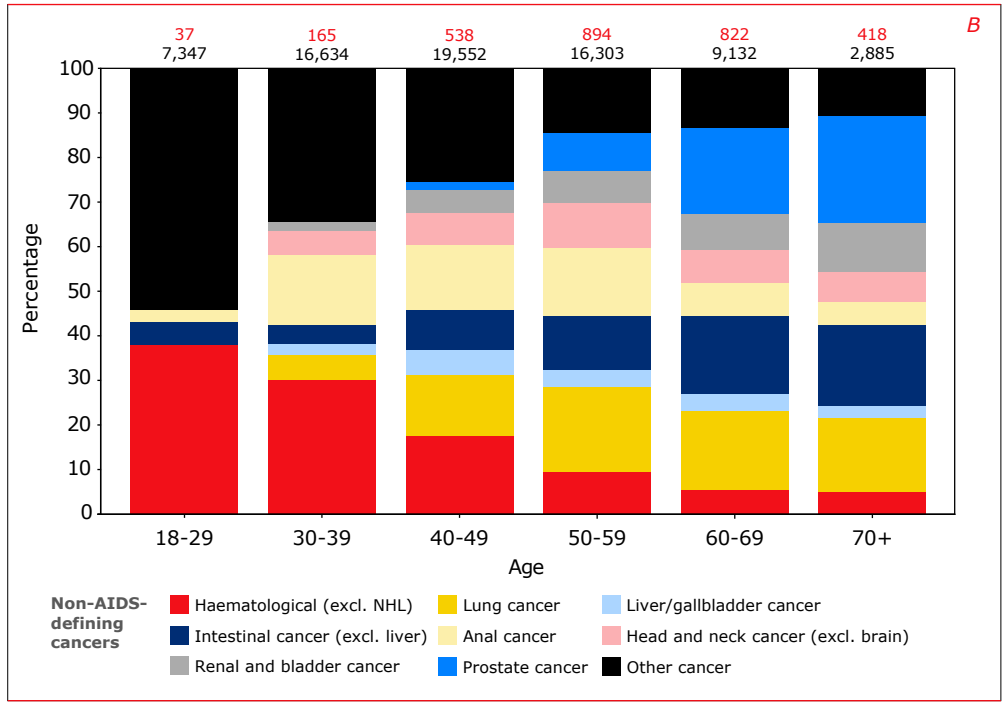
Table 6.11: *Most common non-AIDS-defining malignancies diagnosed in 2000-2025, and a subgroup diagnosed in the last 10 year between 2016-2025, excluding non-melanoma skin cancer and pre-malignant lesions found by cervical and anal screening.*

	2000-2025			2016-2025		
Non-AIDS malignancy	**# of malignancies**	**%**	**Five-year survival (%)**	**# of malignancies**	**%**	**Five-year survival (%)**
Lung cancer	466	16.2	17.2	257	15.3	22.1
Intestinal cancer (excl. liver)	385	13.4	34.3	254	15.1	33.1
Prostate cancer	350	12.2	76.0	263	15.7	74.5
Anal cancer	325	11.3	67.3	171	10.2	70.4
Hematological (excl. NHL)	313	10.9	64.8	133	7.9	61.7
Head and neck cancer (excl. brain)	228	7.9	54.5	128	7.6	52.8
Renal and bladder cancer	205	7.1	62.0	146	8.7	58.7
Other cancers	138	4.8	42.3	68	4.0	38.0
Malignant melanoma	134	4.7	79.8	83	4.9	87.0
Liver/gallbladder cancer	111	3.9	12.9	51	3.0	14.4
Breast cancer	83	2.9	79.2	47	2.8	63.1
Testicular cancer	53	1.8	89.5	26	1.5	91.1
CNS cancer	43	1.5	48.7	36	2.1	37.8
Gynecological cancer (excl. cervical)	40	1.4	71.9	17	1.0	73.3

Legend: *CNS = central nervous system; excl. = excluding; NHL = non-Hodgkin's lymphoma.*

Figure 6.13A-B: *Relative changes in non-AIDS-defining malignancies (A) between 2000 and 2025 and (B) with increasing age, in PWH in the Netherlands. The numbers at the top of each bar represent the number of non-AIDS-defining cancer diagnoses (top number) and the total number of individuals in care during that calendar period (bottom number).*

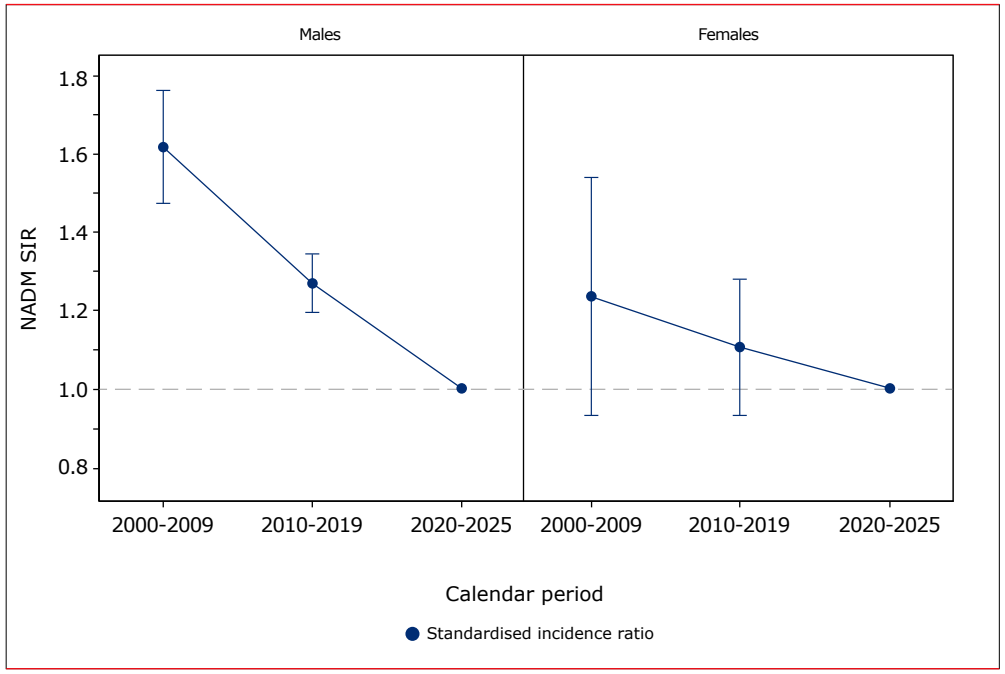




Legend: *excl. NHL = excluding non-Hodgkin's lymphoma.*

Table 6.12 & Figure 6.14: *Crude non-AIDS-defining malignancy incidence per 1,000 person years of follow up in 2000-2009, 2010-2019, and 2020-2025, and age-standardised incidence ratio with 95% confidence intervals.*

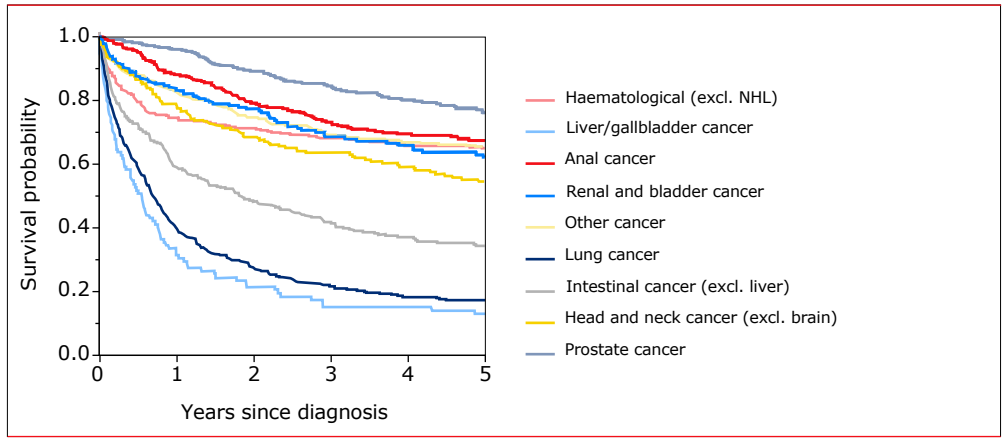
Calendar year	Male		Female	
	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)	Incidence/1,000PY (95%CI)	Standardized Inc. Ratio (95%CI)
2000-2009	6.4 (5.9-7.0)	1.62 (1.47-1.76)	3.1 (2.4-4.0)	1.24 (0.93-1.54)
2010-2019	7.5 (7.1-8.0)	1.27 (1.20-1.34)	4.4 (3.8-5.2)	1.11 (0.93-1.28)
2020-2025	8.1 (7.5-8.6)	1 (reference)	5.5 (4.6-6.5)	1 (reference)



**Standardised according to the observed age distribution in 2020-2025.*

Legend: *CI = confidence intervals; PY = person years.*

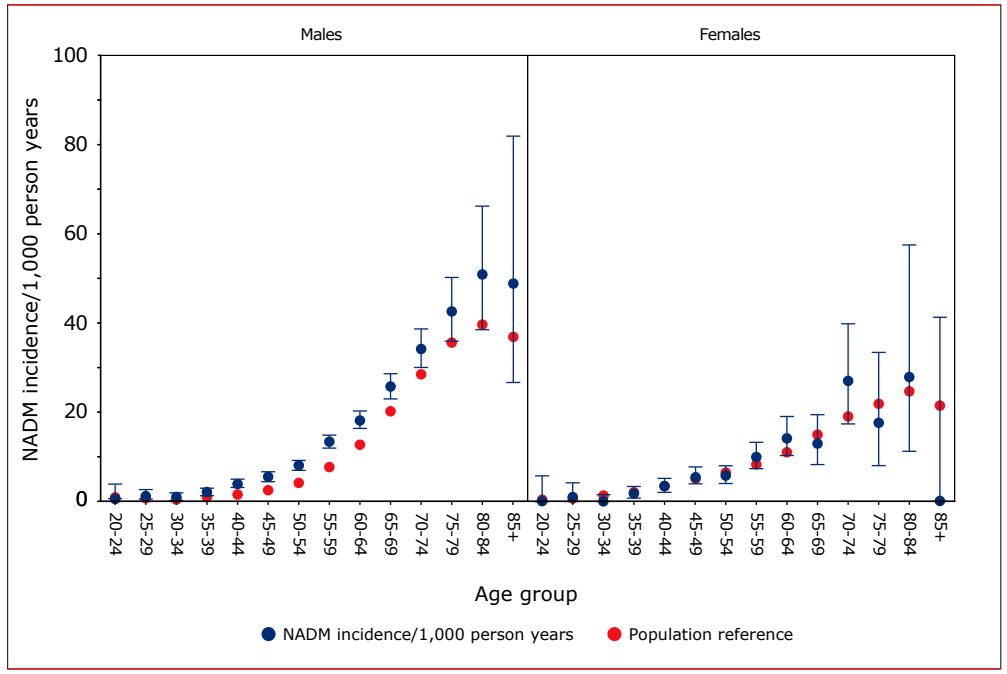
Figure 6.15: *Estimated five-year survival following the diagnosis of the most common non-AIDS-defining malignancies diagnosed between 1 January 2000 and 31 December 2025.*



Legend: *KM = Kaplan-Meier; excl. NHL = excluding non-Hodgkin's lymphoma.*

Table 6.13 & Figure 6.16: Age- and sex-stratified incidence of non-AIDS-defining malignancy (including non-melanoma skin cancer) per 1,000 person years of follow up in 2016-2025, compared to the incidence in the general Dutch population in 2025 (https://www.vzinfo.nl/kanker/leeftijd-en-geslacht, accessed 18-9-2026).

Age categories	Males				Females			
	Person-years of follow-up	Number of NADM	Incidence/ 1,000PY (95%CI)	Incidence general population	Person-years of follow-up	Number of NADM	Incidence/ 1,000PY (95%CI)	Incidence general population
20-24	1,861	2	1.1 (0.1-3.9)	0.37	643	0	0.0 (0.0-5.7)	0.36
25-29	6,705	9	1.3 (0.6-2.5)	0.6	1,334	1	0.7 (0.0-4.2)	0.7
30-34	12,472	14	1.1 (0.6-1.9)	0.87	2,807	0	0.0 (0.0-1.3)	1.38
35-39	15,515	33	2.1 (1.5-3.0)	1.15	4,744	8	1.7 (0.7-3.3)	2.24
40-44	18,202	73	4.0 (3.1-5.0)	1.58	6,021	20	3.3 (2.0-5.1)	3.37
45-49	22,098	121	5.5 (4.5-6.5)	2.5	6,553	36	5.5 (3.8-7.6)	5.06
50-54	27,067	217	8.0 (7.0-9.2)	4.33	6,119	35	5.7 (4.0-8.0)	6.54
55-59	26,901	360	13.4 (12.0-14.8)	7.87	4,724	47	9.9 (7.3-13.2)	8.34
60-64	19,975	364	18.2 (16.4-20.2)	12.71	3,112	44	14.1 (10.3-19.0)	10.98
65-69	12,493	321	25.7 (23.0-28.7)	20.25	1,768	23	13.0 (8.2-19.5)	14.85
70-74	7,237	247	34.1 (30.0-38.7)	28.49	927	25	27.0 (17.5-39.8)	19.08
75-79	3,379	144	42.6 (35.9-50.2)	35.63	512	9	17.6 (8.0-33.4)	21.9
80-84	1,100	56	50.9 (38.5-66.1)	39.64	251	7	27.9 (11.2-57.5)	24.7
85+	287	14	48.8 (26.7-81.9)	36.81	89	0	0.0 (0.0-41.3)	21.45



Multimorbidity

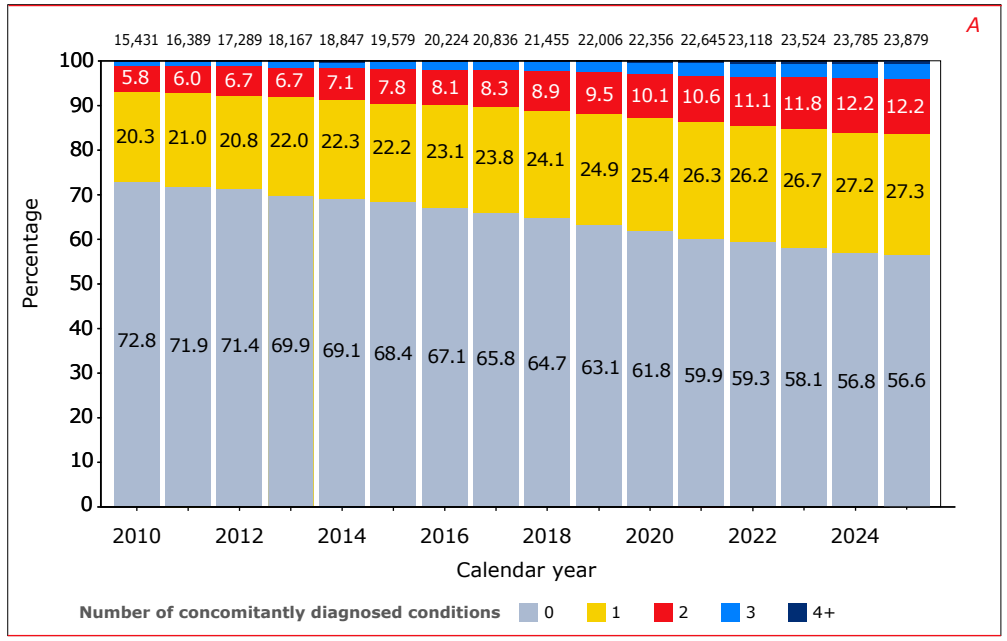
We investigated changes over time in the prevalence of non-AIDS multimorbidity. HIV infections and AIDS diagnoses did not contribute to the multimorbidity count. The following comorbidities and conditions were taken into account:

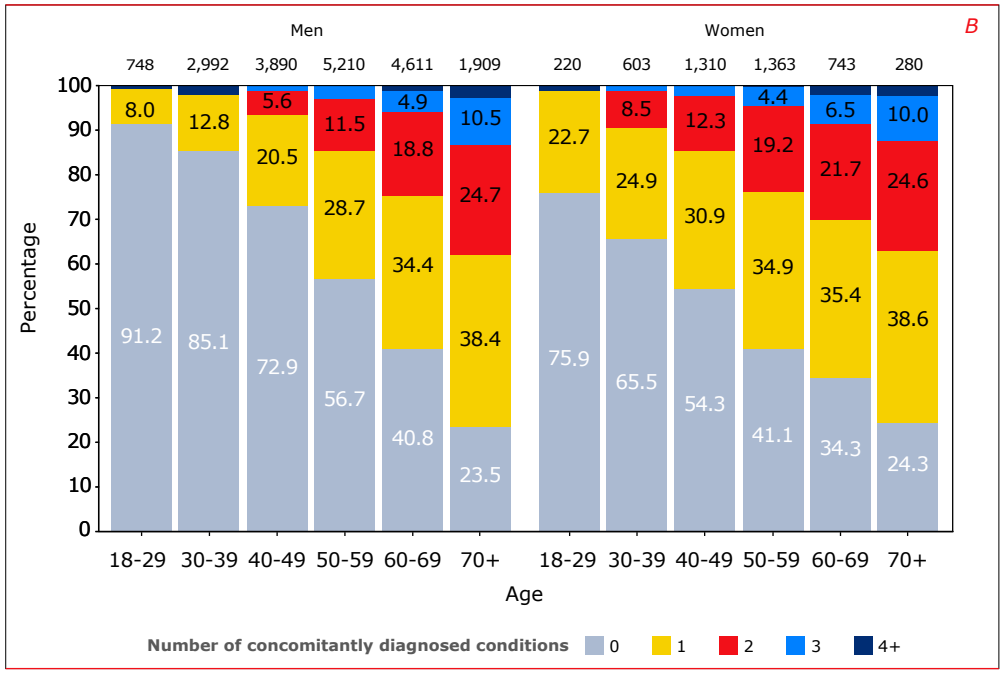
1. **Cardiovascular disease** (either myocardial infarction, coronary artery bypass grafting, coronary angioplasty or stenting, and carotid endarterectomy)
2. **Stroke**
3. **Non-AIDS-defining malignancies**, excluding non-melanoma skin cancers and pre-malignant lesions found at cervical/anal screening
4. **Chronic kidney disease** (eGFR below 30 ml/min/1.73 m^2)
5. **Diabetes mellitus** (according to D:A:D diagnostic criteria)
6. **Hypertension**, defined as the use of antihypertensive drugs and/or measured grade 2 (or higher) hypertension with systolic pressure at or above 160 mmHg and/or diastolic pressure at or above 100 mmHg
7. **Obesity** (BMI over 30).

Note that more stringent definitions of CKD and hypertension have been applied here than in the analyses presented earlier in this chapter; this is to avoid overdiagnosis of CKD in people using antiretroviral drugs that inhibit tubular secretion of creatinine, and hypertension in those with borderline hypertension. Recurrences and non-primary CVD, stroke, and non-AIDS-defining malignancy events were not considered. Finally, CKD, hypertension, and obesity could be reversible.

Figure 6.17A shows the prevalence of each individual comorbidity over calendar time. *Figure 6.17B* shows the distribution of the number of concomitantly-diagnosed conditions in various age categories of the adult male and female population in 2025. The number of concomitant conditions was slightly higher in women than in men for all age categories. After adjusting for the variables listed in *Appendix Table 6.2*, multimorbidity was independently associated with increased risk of mortality (RR 2.01 (1.94-2.07), p<0.001, per additional comorbidity diagnosed).

Figure 6.17A-B: *(A) Prevalence of non-AIDS multimorbidity in the adult population over calendar time. (B) Prevalence of non-AIDS multimorbidity by gender in the adult population in 2025. The numbers at the top of each bar represent the number of individuals contributing data to that age category. The numbers in the stacked bars represent percentages, with all stacked bars adding up to 100% per age category.*





Polypharmacy

Polypharmacy, commonly defined as the concomitant use of five or more medications, is associated with adverse health outcomes, prescription errors, lower adherence and an increased risk of clinically relevant pharmacological interactions and adverse drug reactions, especially in the elderly. At the end of each calendar year, we count the number of registered comedications for each individual in active follow up. Antiretroviral drugs are excluded from this count. We further excluded the ATC categories "Vitamins (A11)" and "Mineral supplements (A12)" for the count. We counted individual ATC codes (Anatomical Therapeutic Chemical classification system[a]) of the comedications. Note that coformulated combinations, such as cotrimoxazole, have a single ATC code and therefore increase the comedication count by one.

In 2025, 25.1% of adults in active follow up had no recorded comedication use, 25.3% used one comedication, 14.6% used two comedications, 10.4% used three comedications, and 6.8% used four comedications. A further 18.0% used five or more non-antiretroviral comedications in addition to their ART regimen, which qualifies as polypharmacy.

a https://www.whocc.no/atc_ddd_index/

The prevalence of polypharmacy among adults has increased over time (*Figure 6.18*): in 2000, just 3.4% of adults used five or more non-antiretroviral comedications in addition to their ART regimen. The main drivers for this increase are the rising age of the population and the growth in the number of chronic comorbidities. Older people (*Figure 6.19*) used more comedications, primarily because they have been diagnosed with a higher number of comorbidities. There were some differences between men and women, with women using slightly more comedications than men, while the most pronounced differences were to be found in the youngest age groups. Finally, in adults receiving ART in the period 2007-2025, polypharmacy was also associated with an increased risk of death (RR 2.35 (2.15-2.56), p<0.001) independent of demographic and HIV-related parameters, chronic HBV and HCV co-infections, smoking status, and number of comorbidities (i.e. multimorbidity). All comedications used by at least 250 adults with HIV in care in 2025 are listed in *Table 6.14*. A notable difference with what we reported last year is that in 2025 lipid lowering agents were used by 7,400 individuals compared to 6,209 individuals in 2024 and 5,155 individuals in 2023, a substantial increase caused by the guideline change for primary CVD prophylaxis based on the findings of the REPRIEVE study[9].

Table 6.14: *Use of comedications in 2025.*

Comedication use in 2025	N	%
ATC group		
Lipid modifying agents	7,400	11.2
Vitamins	6,707	10.1
Drugs for acid related disorders	4,466	6.8
Agents acting on the renin-angiotensin system	4,255	6.4
Psycholeptics drugs (antipsychotics, anxiolytics, hypnotics, sedatives)	3,700	5.6
Antithrombotic agents	3,494	5.3
Drugs for obstructive airway diseases	3,324	5.0
Drugs used in diabetes	3,293	5.0
Psychoanaleptics (antidepressants, psychostimulants)	2,759	4.2
Urological drugs	2,139	3.2
Calcium channel blockers	2,131	3.2
Beta blocking agents	1,929	2.9
Mineral supplements	1,753	2.7
Antibacterial drugs	1,553	2.3
Diuretic drugs	1,459	2.2
Antianemic drugs	1,420	2.1
Analgesic drugs	1,368	2.1
Sex hormones and modulators of the genital system	1,310	2.0
Topical dermatological corticosteroids	1,272	1.9
Corticosteroids systemic	1,186	1.8
Cardiac therapy	957	1.4
Nasal preparations	831	1.3
Antiviral drugs	801	1.2
Antidiarrheals, intestinal anti-inflammatory/anti-infective agents	552	0.8
Antiepileptic drugs	541	0.8
Antimycotic drugs	525	0.8
Drugs affecting bone structure and mineralization	488	0.7
Immunosuppressants drugs	465	0.7
Thyroid therapy	413	0.6
Ophthalmological drugs	405	0.6
Anti-inflammatory and antirheumatic drugs	273	0.4
Antineoplastic drugs	262	0.4
Other nervous system drugs	260	0.4

Figure 6.18: Number of comedications used over calendar time. The numbers at the top of each bar represent the number of individuals contributing data to that period. The numbers in the stacked bars represent percentages, with all stacked bars adding up to 100% per period.

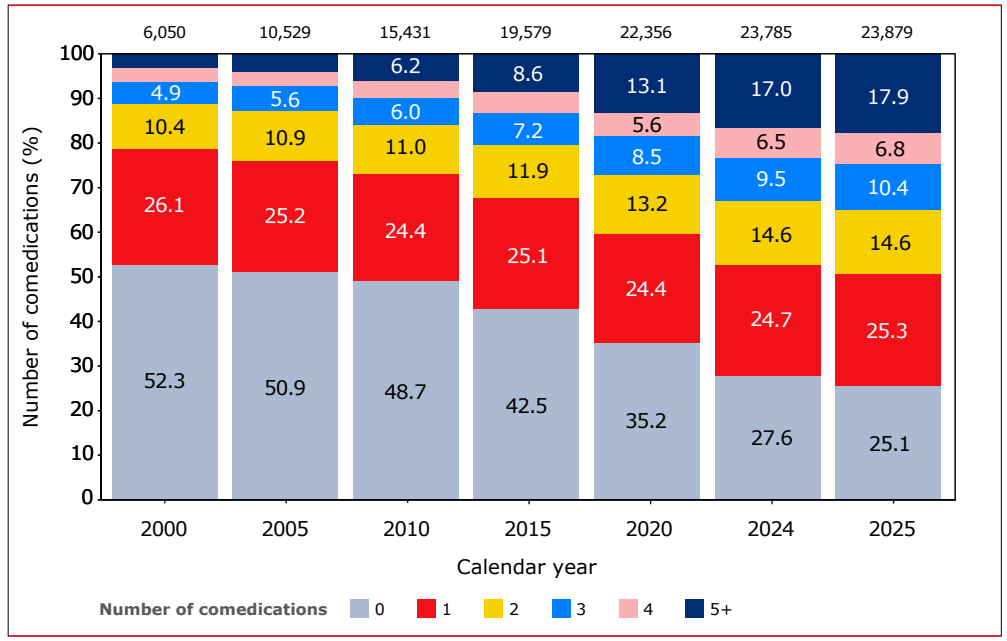
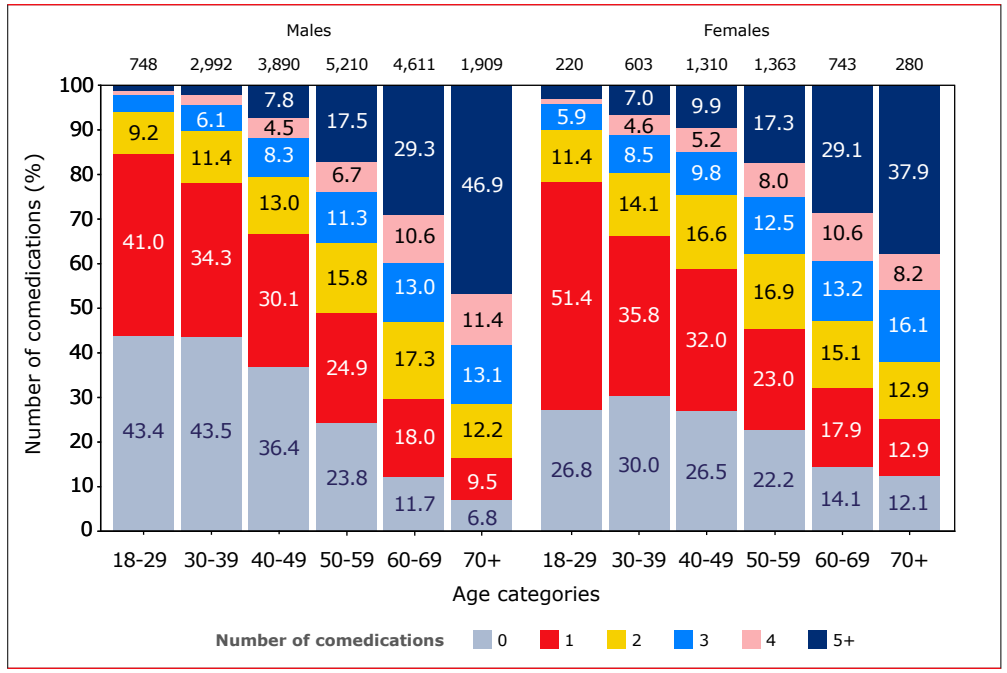


Figure 6.19: Number of comedications used by age group and gender in 2025. The numbers at the top of each bar represent the number of individuals contributing data to that age/gender category. The numbers in the stacked bars represent percentages, with all stacked bars adding up to 100% per age category.



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Appendix: supplementary tables

Appendix Table 6.1: *Absolute number of causes of death among PWH during the periods 1996–2025.*

Cause of death	1996–2001		2002–2004		2005–2007		2008–2010		2011–2013		2014–2016		2017–2019		2020–2022		2023–2025	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
AIDS (subtotal)	258	54.0	148	36.9	157	37.7	132	29.9	110	24.4	79	15.4	63	12.1	52	8.0	71	9.2
Infection	83	17.4	70	17.5	102	24.5	88	19.9	79	17.5	32	6.3	16	3.1	13	2.0	30	3.9
Malignancy	73	15.3	34	8.5	46	11.1	37	8.4	27	6.0	27	5.3	35	6.7	29	4.5	32	4.2
Unclassifiable	102	21.3	44	11.0	9	2.2	7	1.6	4	0.9	20	3.9	12	2.3	10	1.5	9	1.2
Non-AIDS malignancies	40	8.4	60	15.0	66	15.9	88	19.9	109	24.2	127	24.8	183	35.2	194	30.0	212	27.5
CVD (subtotal)	31	6.5	45	11.2	45	10.8	49	11.1	50	11.1	77	15.0	59	11.3	95	14.7	81	10.5
MI	15	3.1	13	3.2	16	3.8	13	2.9	18	4.0	20	3.9	16	3.1	34	5.3	17	2.2
Stroke	4	0.8	8	2.0	6	1.4	8	1.8	8	1.8	11	2.1	8	1.5	18	2.8	18	2.3
Other CVD	12	2.5	24	6.0	23	5.5	28	6.3	24	5.3	46	9.0	35	6.7	43	6.6	46	6.0
Non-AIDS infection	25	5.2	37	9.2	14	3.4	18	4.1	14	3.1	19	3.7	21	4.0	59	9.1	33	4.3
Liver disease	20	4.2	14	3.5	28	6.7	34	7.7	26	5.8	22	4.3	16	3.1	10	1.5	9	1.2
Lung disease	9	1.9	8	2.0	11	2.6	14	3.2	17	3.8	30	5.9	36	6.9	27	4.2	39	5.1
Non-natural death (subtotal)	30	6.3	31	7.7	41	9.9	46	10.4	46	10.2	61	11.9	34	6.5	43	6.6	40	5.2
Accident / violence	8	1.7	8	2.0	9	2.2	15	3.4	9	2.0	13	2.5	7	1.3	11	1.7	19	2.5
Suicide	14	2.9	19	4.7	32	7.7	31	7.0	35	7.8	47	9.2	27	5.2	32	4.9	20	2.6
Euthanasia	8	1.7	4	1.0	.	.	.	.	2	0.4	1	0.2	.	.	.	.	1	0.1
Alcohol, substance abuse, psychiatric disease	14	2.9	8	2.0	15	3.6	20	4.5	17	3.8	16	3.1	24	4.6	33	5.1	24	3.1
Other causes	24	5.0	14	3.5	13	3.1	12	2.7	19	4.2	28	5.5	33	6.3	55	8.5	89	11.6
Unknown	27	5.6	36	9.0	26	6.3	29	6.6	43	9.5	52	10.2	51	9.8	60	9.3	62	8.1
Sudden death	.	.	.	.	.	.	.	.	.	.	1	0.2	.	.	19	2.9	110	14.3
Total	**478**	**100**	**401**	**100**	**416**	**100**	**442**	**100**	**451**	**100**	**512**	**100**	**520**	**100**	**647**	**100**	**770**	**100**

Legend: *CVD = cardiovascular disease.*

Appendix Table 6.2: *Adjusted risk factors for death and AIDS among PWH.*

			Death			AIDS
Risk factors	**RR (95%CI)**	**p-value**	**Overall p-value**	**RR (95%CI)**	**p-value**	**Overall p-value**
Region of birth						
Native Dutch	1 (reference)		0.006	1 (reference)		0.015
Western migrants	0.95 (0.84-1.07)	0.370		1.30 (1.11-1.51)	<.001	
non-Western migrants	0.87 (0.79-0.96)	0.005		1.06 (0.94-1.19)	0.363	
Unknown origin	1.78 (1.03-3.08)	0.038		1.12 (0.58-2.18)	0.733	
HIV-1 transmission route						
MSM	1 (reference)		<.001	1 (reference)		0.140
Other men	1.19 (1.08-1.30)	<.001		0.98 (0.86-1.11)	0.749	
Women	0.89 (0.78-1.00)	0.051		0.92 (0.80-1.06)	0.261	
Transgender	0.83 (0.48-1.43)	0.497		1.33 (0.83-2.12)	0.238	
IDU	1.46 (1.24-1.72)	<.001		0.73 (0.58-0.93)	0.011	
Blood contact	0.89 (0.69-1.16)	0.404		0.81 (0.58-1.14)	0.234	
Pediatric transmission	1.41 (0.70-2.84)	0.339		0.84 (0.45-1.56)	0.580	
Age*						
18-29	0.86 (0.62-1.17)	0.333	<.001	1.04 (0.85-1.27)	0.681	<.001
30-39	1 (reference)			1 (reference)		
40-49	1.59 (1.38-1.83)	<.001		1.03 (0.91-1.16)	0.648	
50-59	2.77 (2.41-3.18)	<.001		1.21 (1.06-1.39)	0.004	
60-69	4.96 (4.29-5.73)	<.001		1.41 (1.20-1.65)	<.001	
70+	11.97 (10.27-13.94)	<.001		1.86 (1.48-2.36)	<.001	
CD4 cell count**						
0-50	7.70 (6.52-9.09)	<.001	<.001	6.41 (5.27-7.79)	<.001	<.001
050-199	3.62 (3.22-4.07)	<.001		2.73 (2.36-3.17)	<.001	
200-349	1.80 (1.61-2.01)	<.001		1.61 (1.40-1.86)	<.001	
350-499	1.32 (1.18-1.46)	<.001		1.17 (1.02-1.36)	0.030	
500-749	1 (reference)			1 (reference)		
750+	0.85 (0.77-0.95)	0.004		1.10 (0.94-1.28)	0.244	
Per year longer on ART with HIV RNA>1,000 cp/mL	1.06 (1.05-1.08)	<.001	<.001	1.05 (1.02-1.07)	<.001	<.001
Treatment status						
Treatment-experienced at start ART	0.93 (0.86-1.02)	0.135		0.68 (0.61-0.77)	<.001	
Treatment-naive at start	1 (reference)			1 (reference)		
Prior AIDS event	1.59 (1.47-1.71)	<.001				
Hepatitis B virus positive	1.26 (1.12-1.42)	<.001		0.94 (0.79-1.11)	0.441	
Hepatitis C virus positive	1.54 (1.36-1.74)	<.001		1.14 (0.96-1.35)	0.134	
Body mass index *						
0-18	3.31 (2.96-3.70)	<.001	<.001			
18-25	1 (reference)					
25-30	0.67 (0.61-0.73)	<.001				
30+	0.81 (0.71-0.93)	0.002				
Smoking status						
Current smoker	1.26 (1.13-1.39)	<.001	<.001	0.74 (0.67-0.83)	<.001	<.001
Never smoker	1 (reference)			1 (reference)		
Past smoker	1.89 (1.72-2.08)	<.001		0.91 (0.80-1.03)	0.154	
Early ART***	0.75 (0.58-0.97)	0.027		1.15 (0.91-1.46)	0.255	

**Time-updated.*

***Time-updated and lagged by three months.*

****ART started within 12 months of the last HIV-negative test.*

Legend: *ART = combination antiretroviral therapy; IDU = people who inject drugs; MSM = men who have sex with men; CI = confidence interval; RR = risk ratio.*

Appendix Table 6.3: *Lost to care (no recorded follow up after 31 December 2024) by region of origin and time-updated CD4 cell count.*

	Total population			Native Dutch			Western migrants			non-Western migrants		
Last CD4 count	**N**	**PY**	**Incidence/ 1,000PY (95%CI)**	**N**	**PY**	**Incidence/ 1,000PY (95%CI)**	**N**	**PY**	**Incidence/ 1,000PY (95%CI)**	**N**	**PY**	**Incidence/ 1,000PY (95%CI)**
0-50	82	3,359	24.4 (19.4-30.3)	6	1,792	3.3 (1.2-7.3)	17	342	49.7 (29.0-79.6)	59	1,225	48.2 (36.7-62.1)
050-199	298	13,162	22.6 (20.1-25.4)	40	7,191	5.6 (4.0-7.6)	73	1,578	46.3 (36.3-58.2)	185	4,393	42.1 (36.3-48.6)
200-349	541	29,402	18.4 (16.9-20.0)	86	16,971	5.1 (4.1-6.3)	131	2,763	47.4 (39.6-56.3)	324	9,668	33.5 (30.0-37.4)
350-499	780	56,972	13.7 (12.7-14.7)	147	33,405	4.4 (3.7-5.2)	205	5,908	34.7 (30.1-39.8)	428	17,659	24.2 (22.0-26.6)
500-749	1,220	137,970	8.8 (8.4-9.4)	296	81,006	3.7 (3.2-4.1)	350	14,152	24.7 (22.2-27.5)	574	42,812	13.4 (12.3-14.6)
750+	1,115	195,613	5.7 (5.4-6.0)	301	113,737	2.6 (2.4-3.0)	395	23,402	16.9 (15.3-18.6)	419	58,475	7.2 (6.5-7.9)

Legend: *n = number; PY = person years of follow up; CI = confidence interval.*

Appendix Table 6.4: *Absolute number of first AIDS events among PWH during the periods 1996–1999, 2000–2004, 2005–2009, 2010–2014, 2015–2019, and 2020–2025.*

CDC event	1996–1999	2000–2004	2005–2009	2010–2014	2015–2019	2020–2025	Total	
	N	N	N	N	N	N	N	%
AIDS Dementia Complex – HIV Encefalopathy	32	40	57	40	24	21	214	2.80
Aspergillosis, invasive extrapulmonary/disseminated	.	.	1	.	.	1	2	0.03
Aspergillosis, invasive pulmonary	.	.	2	.	7	6	15	0.20
Bacterial pneumonia, recurring	40	53	76	70	108	105	452	5.92
CMV colitis/proctitis	1	.	1	1	5	4	12	0.16
CMV disease, unspecified	21	33	29	34	7	.	124	1.62
CMV gastroenteritis	.	.	.	.	.	1	1	0.01
CMV meningo-encefalitis	.	.	.	.	1	.	1	0.01
CMV oesophagitis	.	.	.	.	.	3	3	0.04
CMV pneumonitis	.	.	.	1	12	22	35	0.46
CMV radiculomyelitis	.	1	.	.	.	.	1	0.01
CMV retinitis	25	19	16	13	12	4	89	1.16
Candidiasis lung/bronchial/trachea	4	13	9	7	5	4	42	0.55
Candidiasis oesophagitis	217	216	270	227	169	154	1,253	16.40
Cervical cancer	2	6	5	7	6	2	28	0.37
Coccidioimycosis, extrapulmonary/disseminated	.	.	1	.	.	.	1	0.01
Cryptococcosis, extrapulmonary/disseminated	18	29	39	12	15	2	115	1.51
Cryptosporidiosis	17	15	9	14	5	5	65	0.85
Cystoisosporiasis	1	11	5	1	.	.	18	0.24
HIV wasting	42	45	75	78	70	40	350	4.58
HSV chronic ulcer	1	.	4	4	24	31	64	0.84
HSV oesophagitis	.	.	.	.	.	1	1	0.01
HSV pneumonitis	.	.	1	.	.	1	2	0.03
Herpes simplex virus	26	33	57	44	15	.	175	2.29
Histoplasmosis, extrapulmonary/disseminated	5	13	12	8	2	1	41	0.54
Kaposi sarcoma	144	138	198	162	100	68	810	10.60
Leishmaniasis visceral	.	1	3	2	1	.	7	0.09
Microsporidiosis	11	1	2	2	.	1	17	0.22
Mycobacterium avium/kansasii, extrapulmonary/disseminated	21	22	23	14	9	4	93	1.22
Mycobacterium avium/kansasii, pulmonary	3	2	4	1	8	5	23	0.30
Mycobacterium other/unspecified, extrapulmonary/disseminated	17	13	7	11	7	5	60	0.79
Mycobacterium other/unspecified, pulmonary	2	2	7	11	4	7	33	0.43
Non-Hodgkin lymphoma (NHL)	53	74	98	94	93	59	471	6.16
Penicilliosis	.	.	1	.	.	.	1	0.01
Pneumocystis jirovecii extrapulmonary	.	1	3	1	1	1	7	0.09
Pneumocystis jirovecii pulmonary	264	297	309	294	215	168	1,547	20.25
Primairy CBS lymphoma	6	6	9	7	5	1	34	0.44
Progressive multifocal leucoencefalopathy	14	19	37	26	10	9	115	1.51
Salmonella sepsis, recurring	2	.	.	1	.	.	3	0.04
Toxoplasmosis cerebral	55	94	62	55	33	19	318	4.16
Tuberculosis, extrapulmonary/disseminated	56	113	91	61	43	34	398	5.21
Tuberculosis, pulmonary	80	168	135	99	72	46	600	7.85
Total	**1,180**	**1,478**	**1,658**	**1,402**	**1,088**	**835**	**7,641**	**100.00**

Legend: *CDC = Centers for Disease Control and Prevention; CMV = cytomegalovirus; MAI = mycobacterium avium intracellulare complex.*

Appendix Table 6.5: *Adjusted risk factors for non-AIDS-defining morbidity.*

	Non-AIDS-defining disease			Cardiovascular disease			Non-AIDS-defining malignancy			Diabetes mellitus			CKD		
	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value
Region of birth															
Native Dutch	1 (reference)	.	<.001	1 (reference)	.	0.195	1 (reference)	.	<.001	1 (reference)	.	<.001	1 (reference)	.	<.001
Western migrants	0.94 (0.85-1.03)	0.188	.	0.98 (0.85-1.14)	0.804	.	0.97 (0.83-1.13)	0.678	.	0.95 (0.80-1.12)	0.517	.	0.95 (0.83-1.08)	0.427	.
non-Western migrants	1.14 (1.06-1.23)	<.001	.	0.88 (0.78-0.99)	0.033	.	0.79 (0.70-0.90)	<.001	.	1.80 (1.61-2.00)	<.001	.	0.70 (0.63-0.77)	<.001	.
Unknown origin	0.63 (0.33-1.21)	0.168	.	1.08 (0.49-2.42)	0.844	.	0.18 (0.02-1.26)	0.083	.	0.60 (0.19-1.87)	0.380	.	1.34 (0.76-2.36)	0.317	.
HIV-1 transmission route															
MSM	1 (reference)	.	<.001	1 (reference)	.	<.001	1 (reference)	.	0.034	1 (reference)	.	<.001	1 (reference)	.	<.001
Other men	1.19 (1.11-1.28)	<.001	.	1.19 (1.06-1.33)	0.003	.	1.04 (0.92-1.18)	0.492	.	1.33 (1.19-1.50)	<.001	.	1.10 (1.00-1.22)	0.057	.
Women	0.93 (0.86-1.02)	0.127	.	0.74 (0.63-0.86)	<.001	.	0.98 (0.84-1.13)	0.765	.	0.99 (0.87-1.13)	0.912	.	1.53 (1.37-1.71)	<.001	.
Transgender	0.88 (0.63-1.24)	0.458	.	1.39 (0.86-2.24)	0.185	.	0.33 (0.12-0.89)	0.028	.	0.93 (0.58-1.51)	0.780	.	1.01 (0.60-1.68)	0.976	.
IDU	1.20 (1.01-1.42)	0.043	.	0.99 (0.76-1.31)	0.969	.	1.27 (0.98-1.65)	0.070	.	1.38 (1.03-1.86)	0.033	.	1.73 (1.36-2.20)	<.001	.
Blood contact	1.13 (0.92-1.38)	0.255	.	1.07 (0.78-1.48)	0.662	.	1.32 (0.97-1.80)	0.080	.	1.28 (0.95-1.72)	0.106	.	1.32 (1.01-1.73)	0.041	.
Pediatric transmission	0.71 (0.29-1.74)	0.457	.	0.00 (0.00-99.99)	0.998	.	1.16 (0.28-4.88)	0.840	.	0.63 (0.20-2.00)	0.430	.	2.78 (0.83-9.33)	0.098	.
Age *															
18-29	0.61 (0.47-0.80)	<.001	<.001	0.51 (0.28-0.93)	0.028	<.001	0.65 (0.39-1.09)	0.101	<.001	0.66 (0.46-0.93)	0.019	<.001	0.26 (0.12-0.59)	0.001	<.001
30-39	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.
40-49	2.05 (1.83-2.30)	<.001	.	2.87 (2.29-3.60)	<.001	.	2.45 (1.95-3.07)	<.001	.	1.54 (1.31-1.81)	<.001	.	2.58 (2.02-3.30)	<.001	.
50-59	3.74 (3.33-4.19)	<.001	.	5.84 (4.68-7.30)	<.001	.	4.58 (3.67-5.72)	<.001	.	2.44 (2.07-2.88)	<.001	.	7.46 (5.91-9.43)	<.001	.
60-69	6.30 (5.58-7.12)	<.001	.	9.37 (7.43-11.81)	<.001	.	9.95 (7.93-12.49)	<.001	.	3.56 (2.97-4.27)	<.001	.	18.80 (14.87-23.78)	<.001	.
70+	9.88 (8.57-11.39)	<.001	.	15.77 (12.26-20.29)	<.001	.	17.19 (13.45-21.98)	<.001	.	3.79 (2.99-4.80)	<.001	.	34.89 (27.26-44.64)	<.001	.
CD4 cell count **															
0-50	3.36 (2.72-4.15)	<.001	<.001	2.66 (1.83-3.87)	<.001	<.001	2.39 (1.58-3.64)	<.001	<.001	4.72 (3.50-6.37)	<.001	<.001	2.58 (1.75-3.82)	<.001	<.001
050-199	1.77 (1.55-2.02)	<.001	.	1.62 (1.31-2.00)	<.001	.	1.96 (1.58-2.44)	<.001	.	1.73 (1.39-2.15)	<.001	.	1.90 (1.57-2.30)	<.001	.
200-349	1.23 (1.11-1.35)	<.001	.	1.23 (1.06-1.44)	0.007	.	1.37 (1.18-1.59)	<.001	.	1.17 (0.99-1.37)	0.062	.	1.18 (1.04-1.35)	0.011	.
350-499	1.07 (0.99-1.16)	0.096	.	1.12 (0.99-1.28)	0.083	.	1.09 (0.96-1.24)	0.168	.	1.07 (0.93-1.22)	0.357	.	1.08 (0.98-1.20)	0.131	.
500-749	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.
750+	1.15 (1.08-1.24)	<.001	.	1.22 (1.09-1.36)	<.001	.	1.00 (0.89-1.12)	0.978	.	1.26 (1.12-1.41)	<.001	.	0.92 (0.84-1.01)	0.076	.
Per year longer with CD4<200 cells/mm^3	1.00 (0.99-1.02)	0.645	.	1.03 (1.00-1.05)	0.020	.	0.99 (0.96-1.02)	0.419	.	1.00 (0.97-1.03)	0.880	.	0.98 (0.96-1.01)	0.165	.
Prior AIDS event	1.22 (1.14-1.29)	<.001	.	1.10 (1.00-1.21)	0.057	.	1.15 (1.05-1.27)	0.004	.	1.32 (1.20-1.45)	<.001	.	1.14 (1.05-1.23)	0.002	.
Per year longer on cART while HIV RNA>1000 cp/mL	1.01 (0.99-1.03)	0.196	.	1.01 (0.98-1.03)	0.629	.	1.00 (0.97-1.02)	0.760	.	0.99 (0.97-1.02)	0.517	.	0.97 (0.94-0.99)	0.005	.
Treatment status															
Not (yet) started cART	1.34 (1.19-1.51)	<.001	<.001	1.15 (0.94-1.42)	0.180	0.086	1.38 (1.13-1.69)	0.002	<.001	1.65 (1.37-1.99)	<.001	<.001	0.32 (0.22-0.45)	<.001	<.001
Treatment-experienced at start cART	1.28 (1.18-1.38)	<.001	.	1.13 (0.99-1.28)	0.065	.	1.16 (1.02-1.32)	0.023	.	1.26 (1.10-1.46)	0.001	.	1.07 (0.96-1.20)	0.227	.
Treatment-naive at start	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.
Per year longer on cART	1.01 (1.00-1.01)	0.016	.	1.00 (0.99-1.01)	0.814	.	1.01 (1.00-1.02)	0.053	.	1.00 (0.99-1.01)	0.650	.	0.99 (0.98-1.00)	0.010	.

	Non-AIDS-defining disease			Cardiovascular disease			Non-AIDS-defining malignancy			Diabetes mellitus			CKD		
	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value	IRR (95%CI)	p-value	Overall p-value
Early cART within 12 months after last HIV-negat	0.83 (0.70-0.97)	0.024		0.99 (0.78-1.25)	0.922	.	0.79 (0.61-1.04)	0.096	.	0.59 (0.43-0.82)	0.002	.	1.01 (0.84-1.20)	0.947	.
Body mass index*															
0-18	1.48 (1.25-1.75)	<.001	<.001	1.26 (0.97-1.65)	0.085	0.034	1.91 (1.54-2.38)	<.001	<.001	1.34 (0.95-1.87)	0.094	<.001	1.27 (0.99-1.64)	0.060	<.001
18-25	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.
25-30	1.19 (1.11-1.27)	<.001	.	1.00 (0.91-1.11)	0.990	.	0.84 (0.76-0.93)	0.001	.	2.13 (1.90-2.38)	<.001	.	1.18 (1.09-1.28)	<.001	.
30+	1.87 (1.72-2.04)	<.001	.	1.05 (0.90-1.22)	0.549	.	0.83 (0.70-0.98)	0.027	.	5.04 (4.44-5.72)	<.001	.	1.13 (1.01-1.28)	0.036	.
Hepatitis B virus positive	1.18 (1.06-1.31)	0.002	.	0.97 (0.82-1.16)	0.775	.	1.51 (1.29-1.76)	<.001	.	1.11 (0.93-1.32)	0.240	.	1.29 (1.12-1.49)	<.001	.
Hepatitis C virus positive	1.04 (0.93-1.15)	0.509	.	1.02 (0.86-1.20)	0.850	.	1.05 (0.89-1.24)	0.582	.	1.04 (0.87-1.25)	0.672	.	1.09 (0.96-1.25)	0.191	.
Hypertension	1.12 (1.06-1.18)	<.001	.	1.18 (1.08-1.29)	<.001	.	0.93 (0.85-1.02)	0.130	.	1.18 (1.08-1.29)	<.001	.	1.06 (0.99-1.14)	0.103	.
Smoking status															
Current smoker	1.40 (1.30-1.50)	<.001	<.001	1.84 (1.65-2.06)	<.001	<.001	1.53 (1.36-1.72)	<.001	<.001	1.07 (0.96-1.20)	0.236	<.001	0.80 (0.73-0.88)	<.001	<.001
Never smoker	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.
Past smoker	1.36 (1.27-1.47)	<.001	.	1.48 (1.32-1.66)	<.001	.	1.63 (1.46-1.83)	<.001	.	1.22 (1.09-1.37)	<.001	.	0.99 (0.91-1.08)	0.893	.
Calendar year period															
2000-2009	1.19 (1.08-1.31)	<.001	<.001	1.50 (1.26-1.78)	<.001	<.001	1.03 (0.87-1.22)	0.733	<.001	1.45 (1.21-1.73)	<.001	<.001	2.09 (1.73-2.51)	<.001	<.001
2010-2019	1.17 (1.09-1.25)	<.001	.	1.21 (1.07-1.36)	0.002	.	1.20 (1.08-1.34)	<.001	.	1.19 (1.05-1.34)	0.007	.	1.77 (1.63-1.94)	<.001	.
2020-2025	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.	1 (reference)	.	.
Recent use of ABC ***		.	.	1.52 (1.37-1.69)	<.001	.		.	.		.	.		.	.
Per year longer on LOP/r		.	.	1.00 (0.99-1.01)	0.798	.		.	.		.	.		.	.
Per year longer on IDV		.	.	1.00 (0.99-1.01)	0.897	.		.	.		.	.		.	.
Prior diabetes		.	.	1.95 (1.70-2.24)	<.001	.		.	.		.	.	1.29 (1.14-1.46)	<.001	.
Current use of bictegravir		.	.	1.43 (1.18-1.72)	<.001	.		.	.	1.70 (1.42-2.03)	<.001	.	2.59 (2.28-2.95)	<.001	.
Current use of dolutegravir		.	.	1.25 (1.10-1.42)	<.001	.		.	.	1.56 (1.39-1.77)	<.001	.	2.80 (2.58-3.04)	<.001	.
Current use of elvitegravir		.	.	1.06 (0.88-1.27)	0.546	.		.	.	1.11 (0.92-1.33)	0.277	.		.	.
Current use of raltegravir		.	.	1.67 (1.41-1.99)	<.001	.		.	.	2.29 (1.92-2.72)	<.001	.		.	.
Current use of cabotegravir		.	.	1.04 (0.56-1.95)	0.893	.		.	.	0.98 (0.52-1.84)	0.953	.	0.44 (0.21-0.94)	0.035	.
Per year longer on ZDV		.	.		.	.		.	.	1.02 (1.01-1.03)	0.003	.		.	.
Per year longer on d4T		.	.		.	.		.	.	1.03 (1.00-1.05)	0.051	.		.	.
Per year longer on ddI		.	.		.	.		.	.	1.04 (1.02-1.06)	<.001	.		.	.
Per year longer on TAF		.	.		.	.		.	.		.	.	1.00 (0.99-1.00)	0.315	.
Per year longer on TDF		.	.		.	.		.	.		.	.	1.01 (1.00-1.01)	0.067	.
Prior cardiovascular event		.	.		.	.		.	.		.	.	1.62 (1.45-1.82)	<.001	.
Current use of cobicistat		.	.		.	.		.	.		.	.	1.35 (1.21-1.49)	<.001	.
Current use of rilpivirine		.	.		.	.		.	.		.	.	1.29 (1.11-1.49)	<.001	.

**Time-updated.*

***Time-updated and lagged by three months.*

****Current use or recently used in the past six months.*

***Legend:** CKD = chronic kidney disease; IDU = injecting drug use; ART = combination antiretroviral therapy; LOP/r = lopinavir/ritonavir; IDV = indinavir; ABC = abacavir; ZDV = zidovudine; d4T = stavudine; ddI = didanosine; BMI: <18 kg/m² = underweight; 18-25 kg/m² = normal; 25-30 kg/m² = overweight;>30 kg/m² = severely overweight.*

Appendix Table 6.6: *Specific CDC-B and CDC-C (AIDS) events occurring in individuals on ART with undetectable viral load between 2000 and 2025.*

				CD4 category									
		All events		0-50		050-199		200-349		350-499		500-749		750+	
	CDC event	n	%	n	%	n	%	n	%	n	%	n	%	n	%
CDC-B events	Bacillary Angiomatosis	1	0.0%	0	0.0%	1	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Candidiasis oropharyngeal	1,109	27.5%	136	30.1%	294	33.8%	214	28.0%	170	24.1%	173	22.3%	122	26.3%
	Candidiasis vulvovaginal, recurring/persistent	57	1.4%	2	0.4%	5	0.6%	12	1.6%	13	1.8%	20	2.6%	5	1.1%
	Cardiomyopathy, HIV-associated	37	0.9%	2	0.4%	6	0.7%	4	0.5%	5	0.7%	11	1.4%	9	1.9%
	Cardiomyopathy, HIV-related	6	0.1%	0	0.0%	2	0.2%	1	0.1%	0	0.0%	1	0.1%	2	0.4%
	Diarrea, HIV-related >=30 days	66	1.6%	2	0.4%	9	1.0%	12	1.6%	19	2.7%	16	2.1%	8	1.7%
	Fever e.c.i. HIV-related	6	0.1%	0	0.0%	1	0.1%	2	0.3%	0	0.0%	1	0.1%	2	0.4%
	HIV-associeerd nephropathy (HIVAN)	27	0.7%	5	1.1%	4	0.5%	4	0.5%	6	0.9%	5	0.6%	3	0.6%
	Herpes zoster, multidermatomal	45	1.1%	4	0.9%	3	0.3%	8	1.0%	10	1.4%	11	1.4%	9	1.9%
	Herpes zoster, recurrent/multidermatomal	209	5.2%	10	2.2%	38	4.4%	45	5.9%	41	5.8%	47	6.1%	28	6.0%
	Herpes zoster, unidermatomaal recurring	60	1.5%	4	0.9%	9	1.0%	4	0.5%	9	1.3%	21	2.7%	13	2.8%
	Listeriosis	1	0.0%	0	0.0%	0	0.0%	1	0.1%	0	0.0%	0	0.0%	0	0.0%
	Myelopathy, HIV-related	10	0.2%	0	0.0%	4	0.5%	2	0.3%	0	0.0%	2	0.3%	2	0.4%
	Neuropathy, HIV-associated	145	3.6%	0	0.0%	12	1.4%	19	2.5%	38	5.4%	44	5.7%	32	6.9%
	Neuropathy, HIV-related	134	3.3%	2	0.4%	9	1.0%	19	2.5%	33	4.7%	44	5.7%	27	5.8%
	Nocardiosis	2	0.0%	1	0.2%	0	0.0%	0	0.0%	1	0.1%	0	0.0%	0	0.0%
	Oral Hairy Leukoplakia (OHL)	59	1.5%	2	0.4%	16	1.8%	14	1.8%	8	1.1%	11	1.4%	8	1.7%
	Pelvic inflammatory disease (PID)	13	0.3%	0	0.0%	0	0.0%	5	0.7%	0	0.0%	5	0.6%	3	0.6%
	Trombocytopenia, HIV-associated	44	1.1%	8	1.8%	4	0.5%	12	1.6%	5	0.7%	13	1.7%	2	0.4%
	Trombocytopenia, HIV-related	144	3.6%	8	1.8%	27	3.1%	29	3.8%	32	4.5%	35	4.5%	13	2.8%
	Weight loss >10% HIV-related/unknown cause	37	0.9%	5	1.1%	5	0.6%	6	0.8%	8	1.1%	5	0.6%	8	1.7%
Subtotal		**2212**	**54.9%**	**191**	**42.3%**	**449**	**51.6%**	**413**	**54.1%**	**398**	**56.5%**	**465**	**60.0%**	**296**	**63.8%**
CDC-C events	AIDS Dementie Complex - HIV Encefalopathy	48	1.2%	7	1.5%	8	0.9%	8	1.0%	11	1.6%	10	1.3%	4	0.9%
	Aspergillosis, invasive extrapulmonary/ disseminated	2	0.0%	0	0.0%	1	0.1%	0	0.0%	0	0.0%	1	0.1%	0	0.0%
	Aspergillosis, invasive pulmonary	20	0.5%	3	0.7%	5	0.6%	3	0.4%	0	0.0%	5	0.6%	4	0.9%
	Bacterial pneumonia, recurring	376	9.3%	13	2.9%	75	8.6%	84	11.0%	94	13.3%	74	9.5%	36	7.8%
	CMV colitis/proctitis	2	0.0%	1	0.2%	1	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	CMV disease, unspecified	19	0.5%	4	0.9%	4	0.5%	3	0.4%	5	0.7%	1	0.1%	2	0.4%
	CMV meningo-encefalitis	2	0.0%	1	0.2%	0	0.0%	1	0.1%	0	0.0%	0	0.0%	0	0.0%
	CMV oesophagitis	2	0.0%	1	0.2%	0	0.0%	0	0.0%	1	0.1%	0	0.0%	0	0.0%
	CMV pneumonitis	2	0.0%	1	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.2%
	CMV retinitis	27	0.7%	9	2.0%	11	1.3%	2	0.3%	4	0.6%	1	0.1%	0	0.0%
	Candidiasis lung/bronchial/trachea	12	0.3%	2	0.4%	1	0.1%	6	0.8%	1	0.1%	2	0.3%	0	0.0%

		All events		0–50		CD4 category: 050–199		200–349		350–499		500–749		750+	
	CDC event	n	%	n	%	n	%	n	%	n	%	n	%	n	%
	Candidiasis oesophagitis	332	8.2%	52	11.5%	79	9.1%	70	9.2%	44	6.2%	57	7.4%	30	6.5%
	Cervical cancer	13	0.3%	0	0.0%	3	0.3%	3	0.4%	2	0.3%	4	0.5%	1	0.2%
	Coccidioimycosis, extrapulmonary/disseminated	1	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.1%	0	0.0%
	Cryptococcosis, extrapulmonary/disseminated	18	0.4%	10	2.2%	5	0.6%	2	0.3%	0	0.0%	1	0.1%	0	0.0%
	Cryptosporidiosis	12	0.3%	3	0.7%	1	0.1%	1	0.1%	4	0.6%	2	0.3%	1	0.2%
	Cystoisosporiasis	2	0.0%	0	0.0%	1	0.1%	1	0.1%	0	0.0%	0	0.0%	0	0.0%
	HIV wasting	30	0.7%	13	2.9%	13	1.5%	1	0.1%	2	0.3%	1	0.1%	0	0.0%
	HSV chronic ulcer	50	1.2%	3	0.7%	8	0.9%	2	0.3%	7	1.0%	17	2.2%	13	2.8%
	HSV oesophagitis	3	0.1%	0	0.0%	1	0.1%	0	0.0%	1	0.1%	0	0.0%	1	0.2%
	HSV pneumonitis	2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	0.4%
	Herpes simplex virus	66	1.6%	10	2.2%	8	0.9%	14	1.8%	19	2.7%	10	1.3%	5	1.1%
	Histoplasmosis, extrapulmonary/disseminated	3	0.1%	2	0.4%	0	0.0%	0	0.0%	0	0.0%	1	0.1%	0	0.0%
	Kaposi sarcoma	159	3.9%	11	2.4%	24	2.8%	36	4.7%	28	4.0%	38	4.9%	22	4.7%
	Leishmaniasis visceral	5	0.1%	1	0.2%	3	0.3%	1	0.1%	0	0.0%	0	0.0%	0	0.0%
	Microsporidiosis	6	0.1%	2	0.4%	3	0.3%	0	0.0%	0	0.0%	0	0.0%	1	0.2%
	Mycobacterium avium/kansasii, extrapulmonary/disseminated	34	0.8%	12	2.7%	12	1.4%	4	0.5%	4	0.6%	1	0.1%	1	0.2%
	Mycobacterium avium/kansasii, pulmonary	8	0.2%	1	0.2%	3	0.3%	1	0.1%	0	0.0%	1	0.1%	2	0.4%
	Mycobacterium other/unspecified, extrapulmonary/disseminated	14	0.3%	6	1.3%	4	0.5%	3	0.4%	1	0.1%	0	0.0%	0	0.0%
	Mycobacterium other/unspecified, pulmonary	7	0.2%	1	0.2%	2	0.2%	0	0.0%	2	0.3%	1	0.1%	1	0.2%
	Non-Hodgkin lymphoma (NHL)	219	5.4%	13	2.9%	51	5.9%	48	6.3%	45	6.4%	41	5.3%	21	4.5%
	Pneumocystis jirovecii extrapulmonary	1	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.2%
	Pneumocystis jirovecii pulmonary	104	2.6%	40	8.8%	36	4.1%	13	1.7%	8	1.1%	6	0.8%	1	0.2%
	Primary CBS lymphoma	10	0.2%	1	0.2%	4	0.5%	4	0.5%	0	0.0%	1	0.1%	0	0.0%
	Progressive multifocal leukoencephalopathy	24	0.6%	9	2.0%	8	0.9%	4	0.5%	2	0.3%	1	0.1%	0	0.0%
	Toxoplasmosis cerebral	33	0.8%	14	3.1%	12	1.4%	6	0.8%	0	0.0%	1	0.1%	0	0.0%
	Tuberculosis, extrapulmonary/disseminated	65	1.6%	9	2.0%	15	1.7%	11	1.4%	7	1.0%	11	1.4%	12	2.6%
	Tuberculosis, pulmonary	85	2.1%	6	1.3%	19	2.2%	19	2.5%	15	2.1%	20	2.6%	6	1.3%
Subtotal		**1,818**	**45.1%**	**261**	**57.7%**	**421**	**48.4%**	**351**	**45.9%**	**307**	**43.5%**	**310**	**40.0%**	**168**	**36.2%**
Total		**4,030**	**100.0%**	**452**	**100.0%**	**870**	**100.0%**	**764**	**100.0%**	**705**	**100.0%**	**775**	**100.0%**	**464**	**100.0%**

Legend: *CDC = Centers for Disease Control and Prevention; CNS = Central Nervous System; MAI = mycobacterium avium intracellulare complex.*

7. HIV and sexually transmitted infections

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Key findings

Chlamydia and gonorrhoea

- Between 2010 and 2024, 95,262 *Chlamydia trachomatis* (CT) assays and 93,345 *Neisseria gonorrhoea* (GO) assays were performed within Dutch HIV treatment centres in 11,046 and 11,317 individuals, respectively.
- Between 2010 and 2024, the number of tests performed annually per 1000 participants in care increased from 270 to 448 for CT and from 259 to 448 for GO, while the proportion of participants undergoing testing remained unchanged. This pattern was driven by an increase in sampling at multiple anatomical sites per testing episode, primarily in men who have sex with men (MSM).
- The proportion of participants with CT detected at any anatomical site per testing episodes was 12.3% and was highest in MSM (13.1%) and transgender women (13.8%). CT detection rates decreased by 1.5% per year in MSM; no significant temporal changes were observed in other transmission groups.
- The proportion of participants with GO detected at any anatomical site per testing episode was 13.1% and was highest in MSM (14.3%) and transgender women (9.9%). GO detection rates increased by 1.0% per year in MSM; no significant temporal changes were observed in other transmission groups.
- For both CT and GO, test positivity rates were highest in anorectal specimens, at 12.8% and 12%, respectively.

Syphilis

- Between 2010 and 2024, 93.7% of individuals with newly diagnosed HIV in the Netherlands were tested for syphilis at entry to HIV care. Rates of syphilis testing at entry to HIV care were similar in all HIV transmission groups.
- Between 2010 and 2024, syphilis seroprevalence at care entry increased from 22.4% to 32.3%. The increase in seroprevalence at HIV care entry was observed in MSM, men who have sex with women (MSW) and transgender women but not in cisgender women who have sex with men (WSM).

Doxycycline pre- and post-exposure prophylaxis (doxyPEP)

- Data collection on doxyPEP use began in January 2025. Of 16,319 charts reviewed to date, 156 (1.0%) had documented use of doxyPEP, 165 (1.0%) were documented to have not used doxyPEP and data was missing in 98%.
- Of the 156 participants in which doxyPEP use was recorded, 152 (97.4%) were MSM. Most participants reported obtaining doxyPEP from their HIV provider (75.6%), either exclusively or via additional formal and informal sources.

Introduction

People with HIV are at increased risk of sexually transmitted infections (STIs)[1-5]. In the Netherlands, most STIs – including those occurring in people with HIV – are diagnosed and treated at the general practitioner's (GP) office or at public Sexual Health Centres (SHCs). STI screening and testing is also performed within the 23 national HIV treatment centres. In this setting, screening for syphilis is recommended in all participants entering HIV care[6]. Gonorrhoea (GO) and chlamydia (CT) screening within the HIV treatment centres is performed at the provider's discretion and no standard screening protocol exists. Testing for CT, GO, and syphilis in symptomatic participants may be performed as indicated.

National STI surveillance statistics are based on diagnoses made at SHCs, GPs and through the pregnancy screening program. In people with HIV, national estimates may thus exclude cases diagnosed at one of the HIV treatment centres.

In this new chapter of the HIV Monitoring Report, we present data on the testing and diagnosis of CT, GO and syphilis among ATHENA participants. Preliminary data on doxycycline post-exposure prophylaxis (doxyPEP) for STI prevention is also presented. This chapter focuses on bacterial STIs. Viral hepatitis is discussed in Chapter 9 of this report. Information on syphilis during pregnancy and congenital syphilis among pregnant people with HIV can be found in the RIVM Sexually Transmitted infections in the Netherlands annual report[1].

Methods

We used data from ATHENA participants who were registered in the Netherlands, were 15 years of age or older at HIV diagnosis, had at least one HIV care visit between January 1, 2010, and December 31, 2024, and belonged to the principle HIV transmission group in the cohort: cis-gender men who have sex with men and men who have sex with men and women (MSM), cis-gender men who have sex with women (WSM), cis-gender women who have sex with men (WSM) and transgender women (TGW).

Demographic, clinical, and laboratory data were extracted from the ATHENA database. Data on sexual behaviour was limited; information on condom use, serosorting, and number of sexual partners was not available. Collection of doxyPEP use data began in January 2025. These data are extracted manually from clinical charts and are collected both retrospectively and prospectively.

Collection of CT, GO, and syphilis test results began in 2010. We included only laboratory assays performed within the 23 HIV treatment centers. Laboratory data from 20 HIV treatment centres is linked to the ATHENA database via direct electronic exchange, while data from the remaining three centres is extracted manually. Laboratory results for tests performed within the HIV treatment centres are therefore near-complete in the ATHENA database.

Notable shifts in national STI screening guidelines in the Netherlands occurred during the observation period, with a general trend towards less CT and GO screening in asymptomatic individuals[7]. In the first section of this chapter, we report test positivity rates for CT and GO within the national HIV treatment centres. These data should be interpreted with caution. Information on the indication for testing and clinical symptomatology was not available. If screening of asymptomatic participants decreased during the observation period, test positivity may rise as result, despite stable incidence, and vice versa.

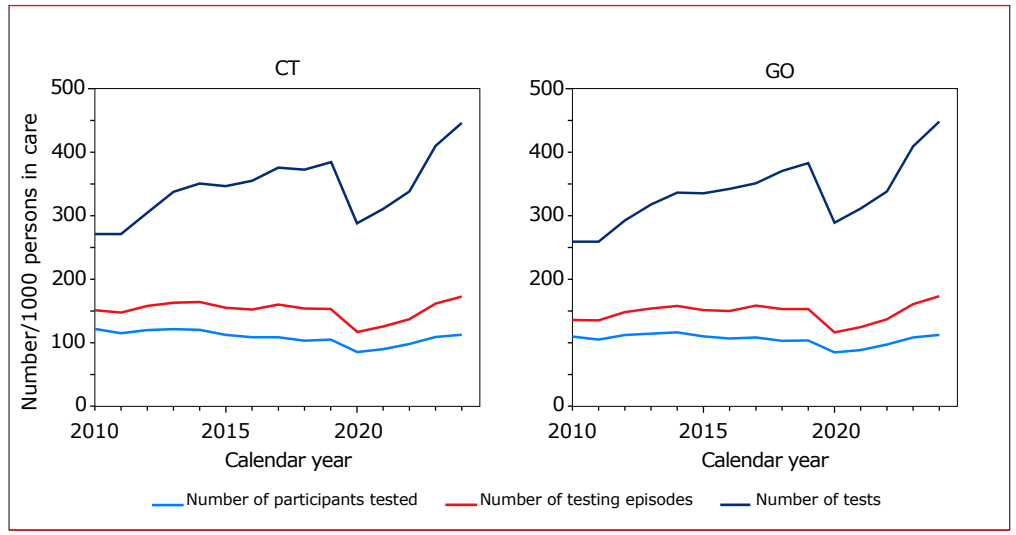
Chlamydia and gonorrhoea

Testing frequency

We determined the total number of CT and GO assays performed during the observation period, the number of infections detected per testing episode, the proportion of testing episodes with three site screening, and test positivity rates by anatomical site sampled. For each organism, the testing episode was defined as sampling at any anatomical location within a period of ≤ 21 days for each participant. Three site testing was defined as sampling from urogenital, anorectal and pharyngeal sites during a testing episode, per organism.

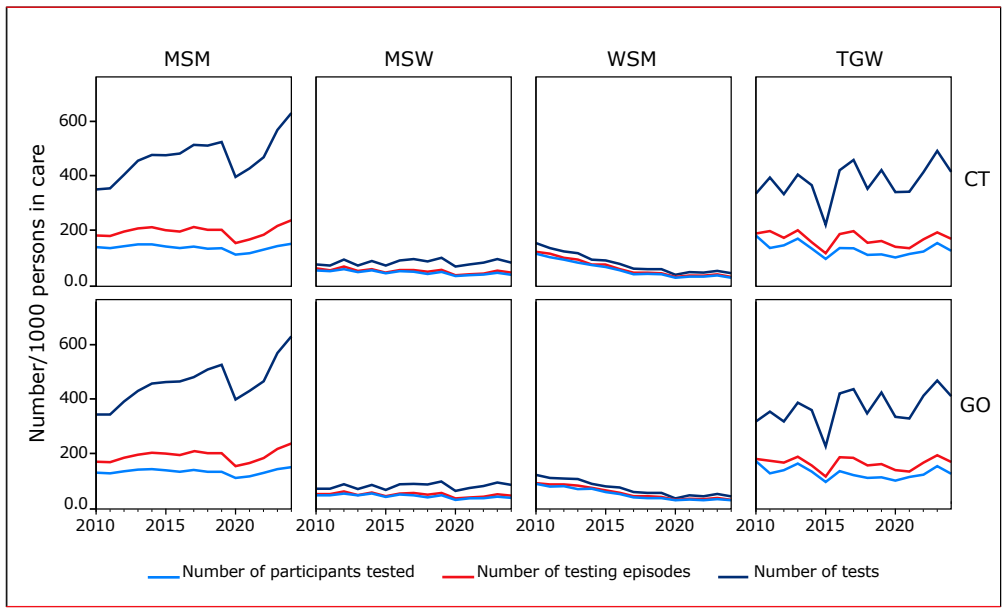
Between 2010 and 2024, 95,262 CT and 93,345 GO specimens were obtained in 11,317 and 11,046 individuals, respectively. Ninety-two percent of CT and GO tests were performed in MSM. Overall, the number of CT and GO tests per 1000 participants in care annually increased from 270 and 259, respectively in 2010, to 446 and 448, respectively in 2024. A marked decline was observed during the COVID-19 pandemic. The number of testing episodes per 1000 participants in care increased slightly over the observation period while the proportion of participants tested annually remained unchanged (*Figure 7.1A*).

Figure 7.1A: *CT and GO testing frequencies per 1000 participants in HIV care annually, 2010–2024.*



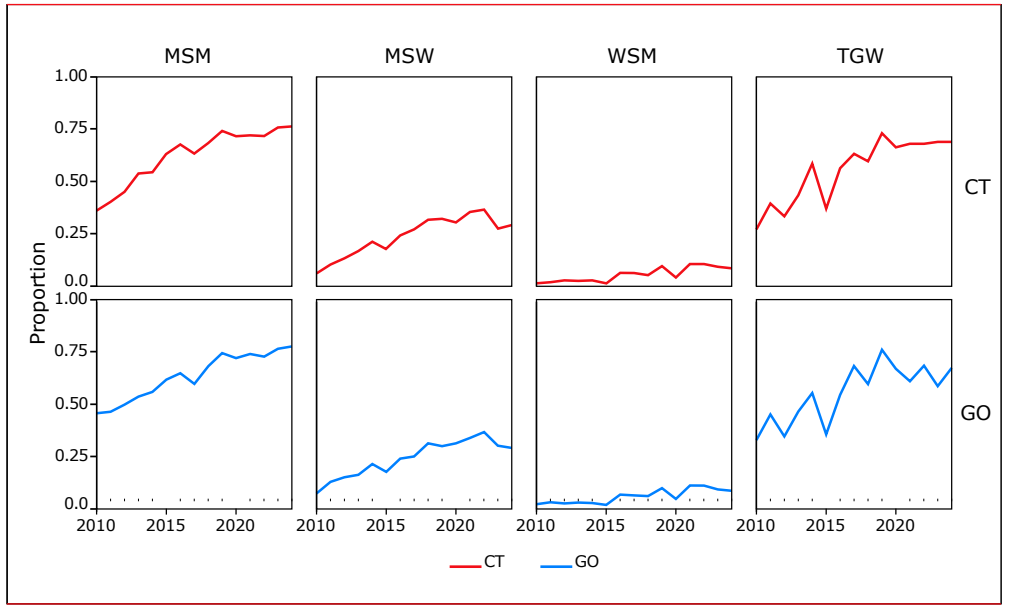
The number of CT and GO tests per 1000 participants per year increased in MSM and TGW, remained stable in MSW, and decreased in WSM (*Figure 7.1B*).

Figure 7.1B: *CT and GO testing frequencies per 1000 participants in HIV care annually, by HIV transmission group, 2010–2024.*



The most frequent anatomical site tested was genitourinary (n=71,275, 37.8%), followed by anorectal (n=58,544, 31.0%), and pharyngeal (n=54,492, 28.9%). Over time, the proportion of participants undergoing three site testing increased, from 30% to 72.6% for CT and from 37.5% to 73.6% for GO, with marked differences by transmission group (Figure 7.2). By 2024, three site testing occurred in more than 75% of testing episodes in MSM, for both CT and GO.

Figure 7.2: *Proportion of testing episodes with three-site testing performed, by transmission group, 2010–2024.*



Disease burden

A total of 41,355 CT and 40,346 GO testing episodes occurred, of which 86.9% and 87.5% were in MSM, respectively. The overall detection rate per testing episode for CT was 12.3% and for GO 13.1%. Detection rates per testing episode were notably lower in WSM compared to other transmission groups (*Table 1*).

Table 7.1: CT and GO detection rates per testing episode, by transmission group (%, (n/N)).

	MSM	MSW	WSM	TGW
CT	13.1% (4724/35935)	8.7% (162/1859)	4.4% (131/2983)	13.8% (80/578)
GO	14.3% (5033/35299)	7.0% (126/1797)	1.6% (42/2682)	9.9% (56/568)

Figures 7.3A and 7.3B show trends in CT and GO detection per testing episode over time, overall and by transmission group, respectively. Overall, CT detection did not change significantly over time while GO detection increased. CT detection rates decreased by 1.5% per year in MSM ($p < 0.0001$); no significant temporal changes were observed in other transmission groups. GO detection increased by 1.0% per year in MSM ($p = 0.01$); no significant temporal changes were observed in other transmission groups.

Figure 7.3A: CT and GO detection rate per testing episode, 2010–2024.

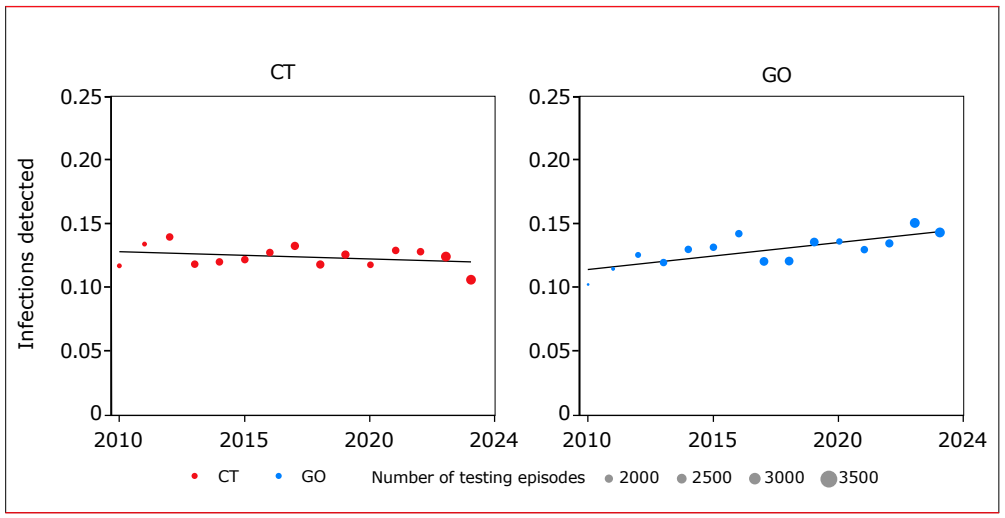
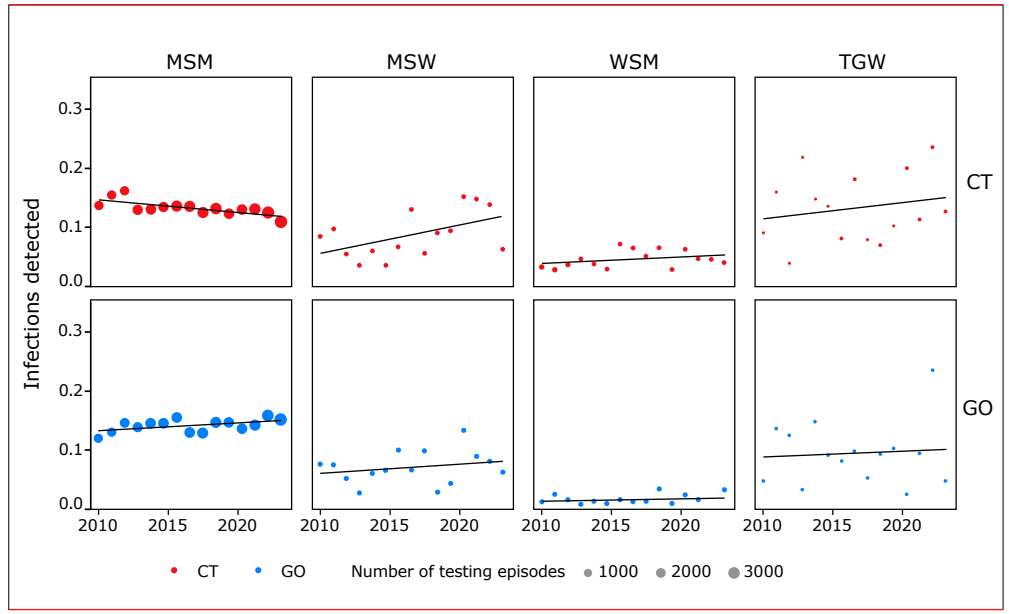


Figure 7.3B: CT and GO detection rate per testing episode, 2010–2024.



Test positivity rates by anatomical site

Between 2010 and 2024, CT was detected in 5,588 specimens performed in 2,959 participants and GO was detected in 6,780 specimens performed in 2,673 participants. For both CT and GO, test positivity rates were highest in anorectal specimens (12.8% and 12.0%) respectively. Tables 7.2A and 7.2B show test positivity rates for CT and GO, respectively, by transmission group and anatomical site.

Table 7.2A: Test positivity rates for Chlamydia trachomatis (CT), by transmission group and anatomical site, 2010–2024.

Transmission group	Genitourinary	Anorectal	Pharyngeal	Vaginocervical
MSM	3.7% (1226/32895)	12.8% (3654/28466)	1.2% (299/25749)	9.1% (2/22)*
MSW	5.2% (90/1738)	12.1% (76/630)	1.5% (10/681)	NA
WSM	4.2% (42/999)	5.2% (11/212)	0.3% (1/292)	4.2% (93/2229)
TGW	2.1% (10/482)	14.9% (66/443)	1.7% (7/403)	4.8% (1/21)

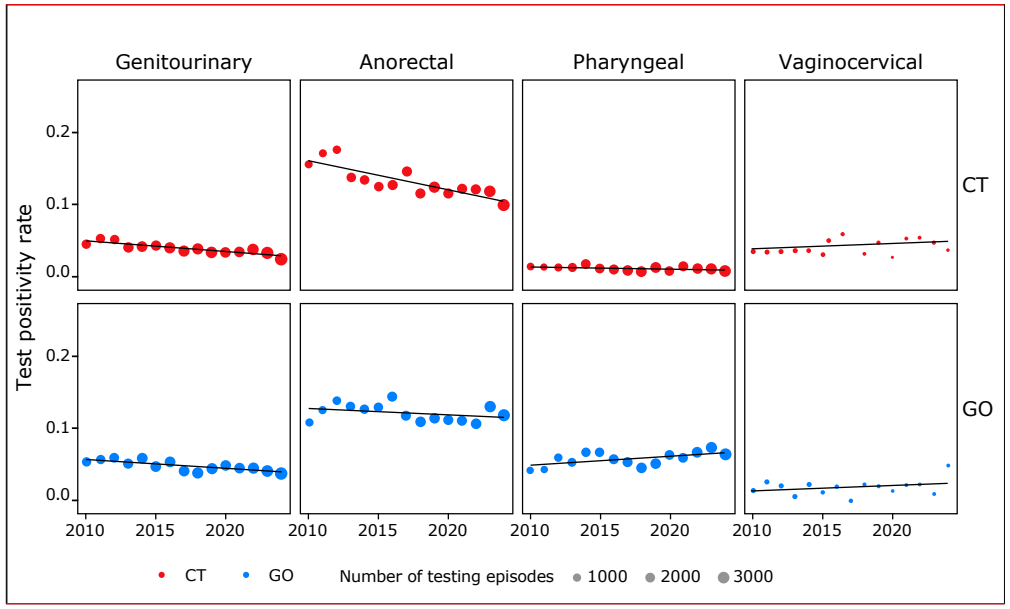
Table 7.2B: Test positivity rates for Neisseria gonorrhoea (GO), by transmission group and anatomical site, 2010–2024.

Transmission group	Genitourinary	Anorectal	Pharyngeal	Vaginocervical
MSM	4.8% (1553/32061)	12.2% (3375/27572)	6.1% (1587/25979)	4.8% (1/21)*
MSW	3.9% (66/1680)	10.1% (60/596)	2.8% (19/685)	NA
WSM	1.1% (10/945)	1% (2/200)	0.7% (2/305)	1.7% (34/1982)
TGW	2.5% (12/475)	8.2% (35/425)	5.8% (23/398)	4.8% (1/21)

**A small number of participants categorized as MSM had vaginocervical CT/GO specimens reported.*

Figures 7.4 shows changes in CT and GO test positivity over time by transmission group and anatomical site.

Figure 7.4: CT and GO test positivity rates, by anatomical site, 2010–2024.



Lymphogranuloma venereum (LGV)

LGV testing is recommended in MSM and transgender women with rectal chlamydia. We determined the proportion of LGV positive assays in this group. We considered LGV tests performed within 21 days following positive anorectal CT testing to be related to the same infectious episode.

Out of 3,720 episodes of anorectal CT among MSM and transgender women, LGV testing was performed in 2,390 (64.2%). LGV serovars were detected during 656 episodes, namely in 17.6% (656/3,720) of all anorectal CT episodes and in 27.5% (656/2,390) of those with LGV testing. No statistically significant temporal change in LGV test positivity was noted during the observation period.

The test positivity rate for LGV observed in our cohort is significantly higher than reported by the sexual health centres (1) but consistent with other reports[8]. These discrepancies are likely due differing indications for CT and LGV testing in differing contexts.

Syphilis

Syphilis testing at entry to HIV care

In the Netherlands, syphilis screening is generally performed using treponemal assays (e.g. TPCLIA, TPPA). Reactive samples are subsequently tested using non-treponemal assays (RPR and VDRL) for disease staging and/or treatment monitoring. Screening for syphilis is recommended in all individuals at entry to HIV care. We determined the proportion of participants entering care in whom syphilis screening was performed.

We included participants who were diagnosed with HIV in the Netherlands between 2010 and 2024 (n = 10,278). We considered syphilis tests performed within 60 days before or after the first HIV care visit (testing window) to represent syphilis testing at entry to care.

Between 2010 and 2024, a total of 20,281 syphilis assays in 9,641 participants were performed within the 60-day testing window; 15,526 (76.7%) were treponemal assays and 4,755 (23.3%) were non-treponemal assays. In many participants, multiple tests were performed within the testing window.

Overall, 93.8% of people entering HIV care were tested for syphilis at care entry. Testing coverage was high throughout the observation period and increased over time. In 2010, 88.0% of people entering care had treponemal testing and 92.0% had any syphilis testing performed at entry to care; in 2024, those proportions were 92.6% and 95.6%, respectively. Rates of syphilis testing at entry to HIV care were similar in all HIV transmission group.

Syphilis seroprevalence at entry to HIV care

Syphilis serology was reactive in 2,718 (28.2%) participants. Seroreactivity at entry to care was highest among transgender women (48.0%, 85/177), followed by MSM (34.6%, 2,324/6,708), MSW (16.4%, 225/1,369) and was lowest among and WSM (6.1%, 84/1,387). *Table 7.3* shows baseline syphilis seroprevalence by demographic characteristics.

Table 7.3: *Syphilis seroprevalence at HIV care entry among participants newly diagnosed with HIV in the Netherlands, by demographic characteristic, 2010–2024 (n = 9,641)*

	Reactive n/N (%)
Transmission group	
MSM	2324/6708 (34.6%)
WSM	84/1387 (6.1%)
MSW	225/1369 (16.4%)
TGW	85/177 (48.0%)
Age at HIV diagnosis (years)	
15–24	202/996 (20.3%)
25–34	812/2843 (28.6%)
35–44	698/2476 (28.2%)
45–54	598/1980 (30.2%)
55+	408/1346 (30.3%)
Birth region	
Netherlands	1627/5837 (27.9%)
Latin America and Caribbean	441/1175 (37.5%)
Sub-Saharan Africa	90/873 (10.3%)
Central and Eastern Europe	225/627 (35.9%)
W Europe, N America, Australia	141/447 (31.5%)
South and East Asia	109/408 (26.7%)
N Africa and Middle East	63/213 (29.6%)
Unknown	22/61 (36.1%)

Overall, syphilis seroprevalence at entry to HIV care increased from 24.5% in 2010 to 33.0% in 2024 ($p < 0.0001$) (*Figure 7.5A*). Seroprevalence at care entry increased in MSM, MSW, and transgender women but not in WSM (*Figure 7.5B*). Syphilis seroprevalence increased most rapidly over time in participants under 35 years of age (*Figure 7.5C*).

Figure 7.5A: *Proportion of newly diagnosed participants entering HIV care in the Netherlands with reactive syphilis serology, by calendar year, 2010–2024.*

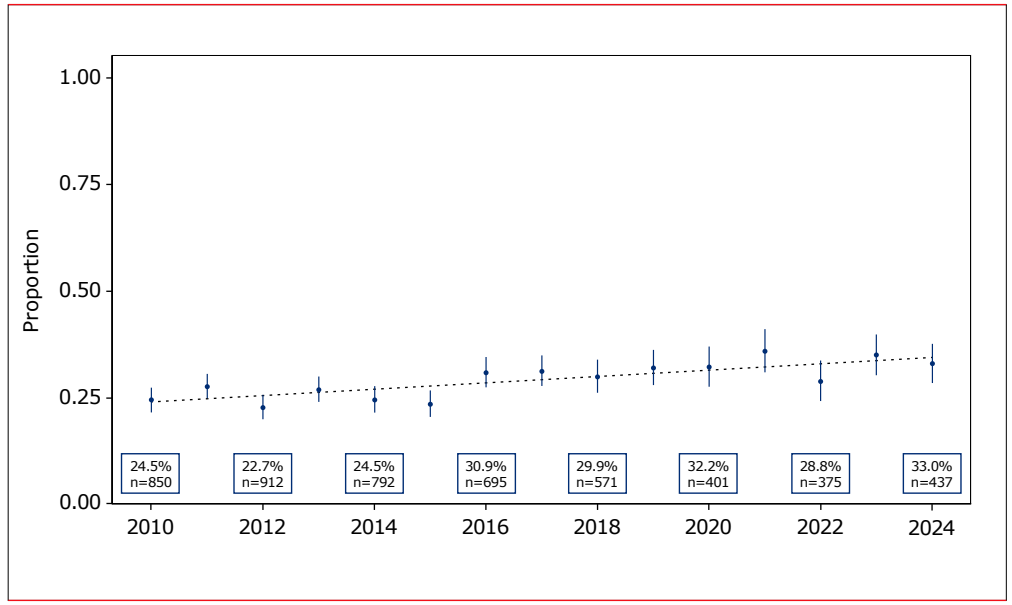


Figure 7.5B: *Proportion of newly diagnosed participants entering HIV care in the Netherlands with reactive syphilis serology, by calendar year and HIV transmission group, 2010-2024.*

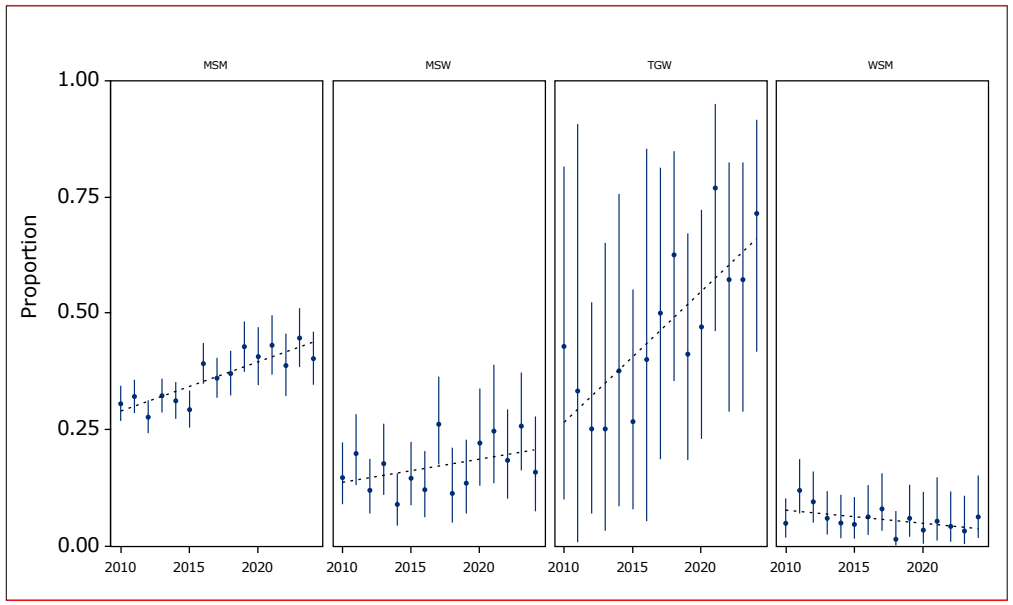
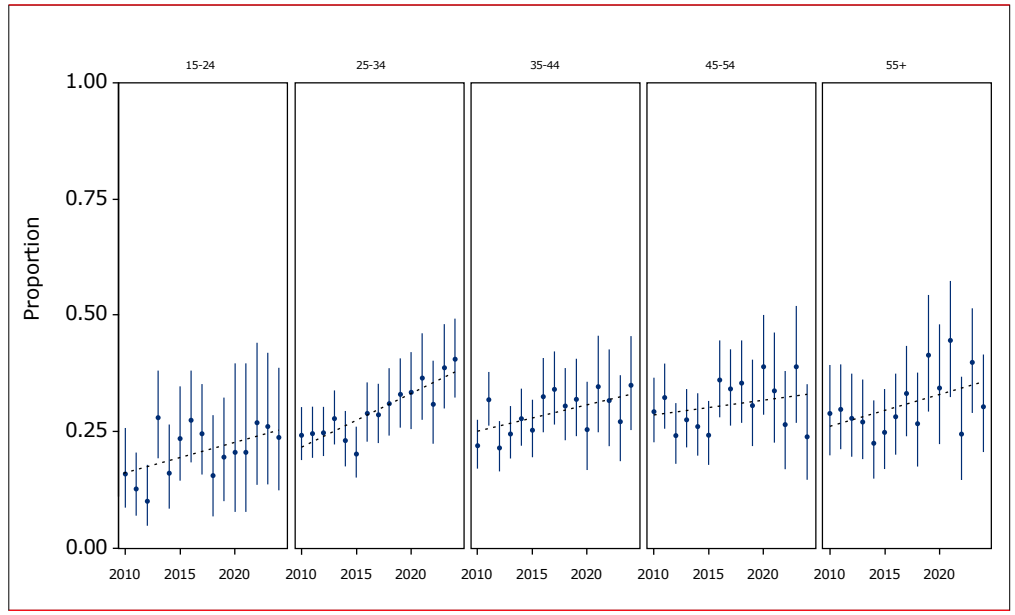


Figure 7.5C: *Proportion of newly diagnosed participants entering HIV care in the Netherlands with reactive syphilis serology, by calendar year and age group, 2010-2024*



Circles represent mean observed syphilis seroprevalence; vertical bars represent 95% binomial confidence intervals; the dashed line represents unadjusted linear regression for the time trend for each level of each covariate.

Doxycycline for STI prevention

Since January 2025, medical records of ATHENA participants have been reviewed for information on doxyPEP use. In this section, we present preliminary descriptive statistics on doxyPEP use among adult participants who had at least one HIV care visit between January 2020 and December 2025. We defined formal doxyPEP use as prescribed by a medical provider, either in the Netherlands or abroad. All other means of obtaining doxyPEP were considered informal.

Of 26,280 participants in care over the past five years, records of 16,319 (62.1%) were reviewed for doxyPEP use. Data on doxyPEP use were not reported in 15,998 (98.0%); 165 (1.0%) participants were documented to have not used doxyPEP and 156 (1.0%) to have ever used doxyPEP.

Among the 156 participants reporting doxyPEP use, 152 (97.4%) were men who have sex with men (MSM), 77 (49.4%) were born in the Netherlands, and 106 (67.9%) received care in the Amsterdam region (*Table 7.4*). Mean age at doxyPEP initiation was 47.0 years (range, 26.6–74.5). The earliest recorded use was in December 2022. DoxyPEP was obtained exclusively from formal sources in 122 (78.2%) participants, exclusively from informal sources in 14 (9.0%), and from a combination of formal and informal sources in 7 (4.5%); in the remaining 13 (8.3%) medication source was unknown.

Most participants obtained doxyPEP from their HIV care provider (n=118, 75.6%; 108 exclusively from the HIV provider and 10 from additional sources), followed by unknown source (n=13, 8.3%) and general practitioner or other medical provider (n=11, 7.1%). Informal sources included friends or partners, purchase online, and purchase abroad. DoxyPEP was used on demand by 107 participants (68.6%) and daily by 9 (5.8%); in the remaining 40 participants, the dosing schedule was unknown or included both on demand or daily use (n=2). Of the 11 participants reporting ever using daily doxyPEP, 4 reported obtaining doxyPEP via formal means, with the remaining recorded as either informal or unknown.

Table 7.4: Characteristics of ATHENA participants reporting doxyPEP use (n = 156).

Age at first doxyPEP use	
Mean (range)	47.0 (26.6 – 74.5)
Transmission group	
MSM	152 (97.4%)
Other	4 (2.5%)
Birth region	
Netherlands	77 (49.4%)
W Europe, N America, Australia	28 (17.9%)
Latin America and Caribbean	24 (15.4%)
Central and Eastern Europe	13 (8.3%)
N Africa and Middle East	7 (4.5%)
Other	7 (4.5%)
Care region	
Noord-Holland and Flevoland	106 (67.9%)
Other	23 (14.7%)
Zuidelijk Zuid-Holland	17 (10.9%)
Utrecht	10 (6.4%)
Medication source, type	
Formal	122 (78.2%)
Informal	14 (9.0%)
Unknown	13 (8.3%)
Formal and informal	7 (4.5%)
Medication source, detailed	
HIV provider (+/- other source)	118 (75.6%)
Unknown	13 (8.3%)
GP or other medical provider	11 (7.1%)
Purchased on internet	5 (3.2%)
Purchased, other/not specified	5 (3.2%)
Partner/friend	4 (2.6%)
Schedule	
On demand	107 (68.6%)
Unknown/either	40 (25.7%)
Daily	9 (5.8%)

DoxyPEP, doxycycline post-exposure prophylaxis; MSM, men who have sex with men; GP, general practitioner.

Conclusions

We report data from bacterial STI testing performed within the 23 Dutch national HIV treatment centers over the past 25 years.

Testing frequency was high. Nearly 95% participants with newly diagnosed HIV in the Netherlands underwent syphilis screening at care entry. The number of CT and GO tests and increased over time as did the number of tests per 1000 participants in care, while the number of testing episodes and number of participants tested per year remained largely unchanged. This pattern was driven by increased testing at multiple anatomical sites per testing episodes, particularly in MSM. MSM and TGW had the highest burden of STIs, consistent with national data[1].

Preliminary data on doxyPEP use among people with HIV shows both formal and informal utilization, with most participants obtaining doxyPEP from their HIV care provider.

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8. Viral hepatitis

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Key findings

Hepatitis C (2016–2025)

- Of individuals with HIV in care between 2016 and 2025, 99% was at least once screened for hepatitis C (HCV).
- Of the 27,459 individuals who were ever screened for HCV, 897 were diagnosed with a primary HCV infection and 145 individuals with a reinfection between 2016-2025.
- The majority of recent HCV infections occurred in MSM (n=229/254 [90%])
- In 2025, 58 individuals were diagnosed with HCV, including 12 primary chronic infections, 13 recent infections, and 12 re-infections. Twenty- three individuals with an HCV diagnosis in 2025 (36%) originated from European countries, other than the Netherlands.
- The prevalence of individuals with detectable HCV RNA decreased from 1.5% in 2016 to 0.3% in 2025.
- The incidence of primary infection decreased from 6.63 per 1,000 persons years in 2016 to 1.62 per 1,000 person years in 2025.
- The incidence of HCV reinfection among MSM decreased from 35 reinfections per 1,000 PY in 2016 to 9 per 1,000 PY in 2025.
- 97% of individuals in care had received treatment for HCV and 98% were successfully treated and achieved treatment-induced clearance of HCV.
- Probable or definite severe liver disease was documented in 26.1% of participants with a history of HCV; cirrhosis was documented in 5.6%. Death due to liver disease occurred in less than 1% of participants with a history of HCV.

Hepatitis B

- Screening for hepatitis B (HBV) has improved over time. By 2025, 99.0% of participants in care had at least one HBV serological assay performed and 83.5% had interpretable serological profiles available.
- A total of 1,329 participants had a history of chronic HBV, of whom 348 (26.2%) had evidence of surface antigen clearance. In 2025, 89.0% of participants with chronic HBV were treated with a tenofovir prodrug and cytidine analogue.
- Probable or definite severe liver disease was documented in 17.8% of participants with a history of chronic HBV; cirrhosis was documented in 7.8%. Death due to liver disease occurred in less than 1% of participants with a history of chronic HBV.
- Among 5,136 MSM who entered HIV care between 2016 and 2025 and had no evidence of active HBV at care entry, 44.6% had HBV vaccination or vaccine-acquired immunity, 16.5% had infection-acquired immunity, and 37.2% had no evidence of HBV immunity at care entry. Between 2015 and 2026, the proportion of participants with evidence of HBV vaccination or vaccine-acquired immunity at entry to care increased from 36.3% to 47.0%.

Hepatitis A

- Screening for hepatitis A (HAV) has improved over time. The proportion of participants with serological testing for HAV increased from 51.7% in 2016 to 84.9% in 2025.
- The last outbreak of acute HAV occurred in 2017, with an annual total of 54 cases. Since 2020, 5 or less acute HAV cases have been observed annually.
- Among 5,262 MSM who entered HIV care between 2015 and 2026, 45.8% had received at least one dose of HAV vaccine or were immune by history or serology. The proportion of participants without evidence of HAV vaccination or immunity at entry to care decreased from 69.8% in 2016 to 48.7% in 2025.

Introduction

People with HIV are vulnerable to infection with viral hepatitis, due to shared routes of transmission including but not limited to sexual practices and substance use[1,2]. In this chapter, we describe the epidemiology of chronic and acute viral hepatitis in people with HIV in the Netherlands. We focus primarily on hepatitis C [HCV] and hepatitis B [HBV] (including hepatitis delta virus), the most common causes of chronic viral hepatitis in the Netherlands. We provide brief overviews of acute hepatitis due to Hepatitis A and E viruses. In our analysis, we included individuals registered in the SHM database who had at least one HIV care visit between 2016 and 2025, at time of database closure in May 2026.

Hepatitis C virus (HCV)

Box 8A: Definitions of hepatitis C infection.

Primary HCV infection
First documented HCV infection.

Chronic HCV infection
Individuals who remain HCV RNA-positive for longer than six months after their first known positive HCV RNA test result.

Recent HCV infection[3,4]

1. Case definition of recent HCV according to preferred criteria[3]:
   Positive anti-HCV IgG with a documented negative anti-HCV IgG within the past 12 months,
   or:
   detectable HCV RNA in the presence with either a documented negative HCV RNA test, or a negative anti-HCV IgG within the past 12 months.

2. Case definition of acute HCV according to alternative criteria[3]: Detectable HCV RNA in association with a rise in alanine aminotransferase (ALT) (above 200 IU/l) with a documented normal ALT within the past 12 months.

Spontaneously cleared HCV infection
Individuals with a documented positive test result for HCV antibody or RNA, a subsequent negative HCV RNA test result, and without a history of medical treatment. Spontaneous clearance was distinguished as either 'definitive' (i.e. two consecutive negative HCV-RNA test results after a positive HCV antibody or RNA test result), or 'possible' (one negative HCV-RNA test result following an earlier positive HCV antibody or RNA test result).

SVR12
Sustained virological response, defined as a negative HCV RNA test result 12 weeks after treatment discontinuation in individuals treated for prior documented recent or chronic HCV infection.

Hepatitis C reinfection
Detectable HCV RNA after an earlier achieved SVR, or after spontaneous HCV clearance, or documentation of a new infection with a different genotype.

Severe (chronic) liver disease
Presumptive, based on clinically documented evidence of:

- bleeding from gastric or oesophageal varices, hepatic encephalopathy or hepatorenal syndrome, and/or
- chronic liver disease based on radiographically documented or endoscopically documented evidence of the presence of portal hypertension in terms of oesophageal varices, ascites, splenomegaly, and reversal of portal blood flow and/or cirrhosis.

Definitive if there is:

- a liver transplantation, *or*
- presumptive evidence, combined with a pathology, histology, or transient elastography report documenting severe liver fibrosis or cirrhosis (Metavir score F3-F4 or transient elastography stiffness ≥8kPa).

HCV screening over time between 2016 and 2025

In the Netherlands the national guidelines for the treatment and monitoring of HIV recommend HCV screening during the first clinical visit after HIV diagnosis, and additional annual HCV screening for MSM who report behaviour associated with increased risk of acquiring HCV[5].

Of the 27,818[a] individuals who were in care between 2016 and 2025:

- 99% were screened at least once for HCV with anti-HCV or HCV RNA.

a The total number of people screened for HBV differs from the total number screened for HCV, as not all those screened for HBV are also screened for HCV.

Follow-up screening

Individuals with a negative first HCV test

Among individuals who ever had a negative first HCV test and who remained in care for at least one year:

- 82% had a second HCV test at some point during follow up;
- Repeat screening was highest among MSM (90%);
- And lowest for individuals who acquired HIV through heterosexual contact (67%).

As most HCV infections are observed among MSM[6], the following analysis on testing frequency is reported for MSM only.
The median cumulative number of repeated HCV tests among HCV negative MSM was 4 tests (IQR: 2-9).
Overall, the percentage of HCV seronegative MSM with HCV testing in a calendar year:

- Varied between 34% in 2016 and 48% in 2019;
- 36% of the MSM in care were tested for HCV in 2025.

When testing was stratified by age, the highest percentage of testing was seen among MSM under 30 years of age, and testing decreased with increasing age (*Figure 8.1*). From the diagnosis data we known that the median age at diagnosis of recent HCV was 46 years (IQR 39-53) (*Table 8.1A*), while in the age range 40-50 years, 39% had at least one test in 2025.

Individuals with a history of HCV infection

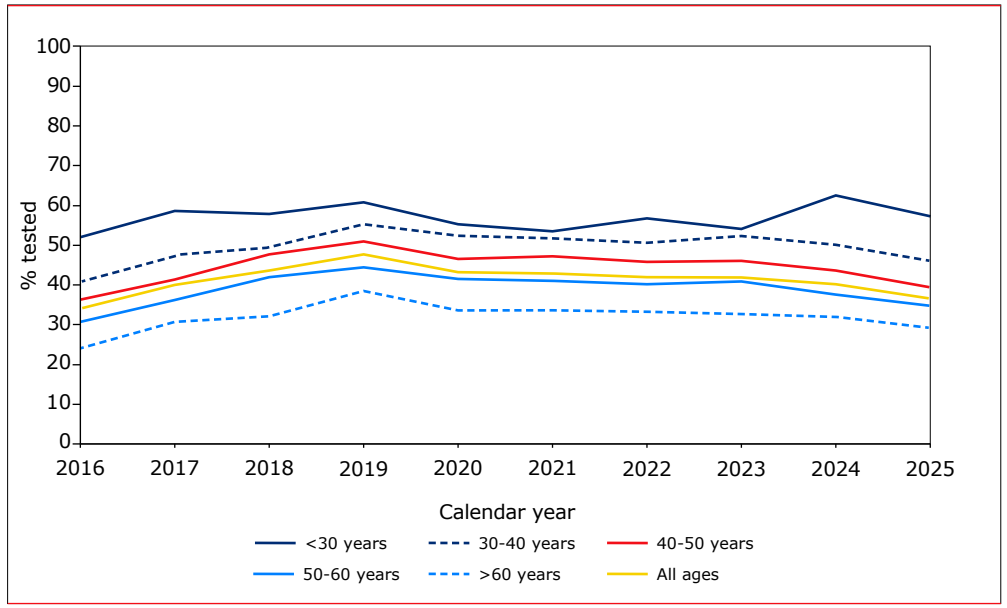
Screening with HCV RNA among those at risk of HCV reinfection is an important factor in identifying HCV reinfection. As most HCV reinfections are observed among MSM[6], the following analysis on testing frequency is reported for MSM only.
Among MSM with HIV at risk of reinfection after treatment-induced or spontaneous clearance of HCV, the percentage of MSM with repeated HCV RNA testing declined from 65% in 2016 to 35% in 2025. The median cumulative number of repeated HCV RNA tests among MSM with a history of HCV was 10 (IQR: 5-16).

Targeted screening, based on the presence of incident transaminase elevations

National guidelines advice additional annual HCV screening for MSM who report behaviour associated with increased risk of acquiring HCV[5]. The above-described HCV RNA follow up testing data may include MSM who are not considered at risk of HCV reinfection anymore by their treating physician. However, we cannot exclude these individuals as data on HCV-related risk-taking behaviour are not available to SHM.

Also of note is that repeated HCV screening among MSM at risk of HCV reinfection might be guided by a policy of targeted screening, based on the presence of incident transaminase elevations as an indicator of liver inflammation. This might be reflected by the observed higher proportion of repeat HCV screening among MSM with elevated transaminase levels (defined as an increase of at least 50% compared to the last measured ALT value). In those at risk of HCV reinfection and incident transaminase elevations, the overall percentage of men with an HCV test following elevated transaminase level varied between 57% and 76% in 2016-2025.

Figure 8.1: *The percentage of men who have sex with men (MSM) without HCV and susceptible to primary HCV infection with an HCV test in a calendar year, stratified by age.*



Number of diagnoses of primary HCV infection and reinfection between 2016–2025

As of 31 December 2025, 27,818 people with HIV (aged 15 years or older at the time of their HIV diagnosis) had been in care between 2016 and 2025 and were registered by Stichting hiv monitoring (*Figure 8.2*). Of those individuals, 27,459 (99%) were screened for HCV co-infection: 2,600 (10%) ever had a positive result with an HCV antibody test and/or HCV RNA test. Of whom 897 (35%) had a first diagnosis of HCV between 2016 and 2025. When focusing on the diagnoses between 2016 and 2025, HCV RNA data were not documented in 31 of the 897 individuals (3%), of whom:

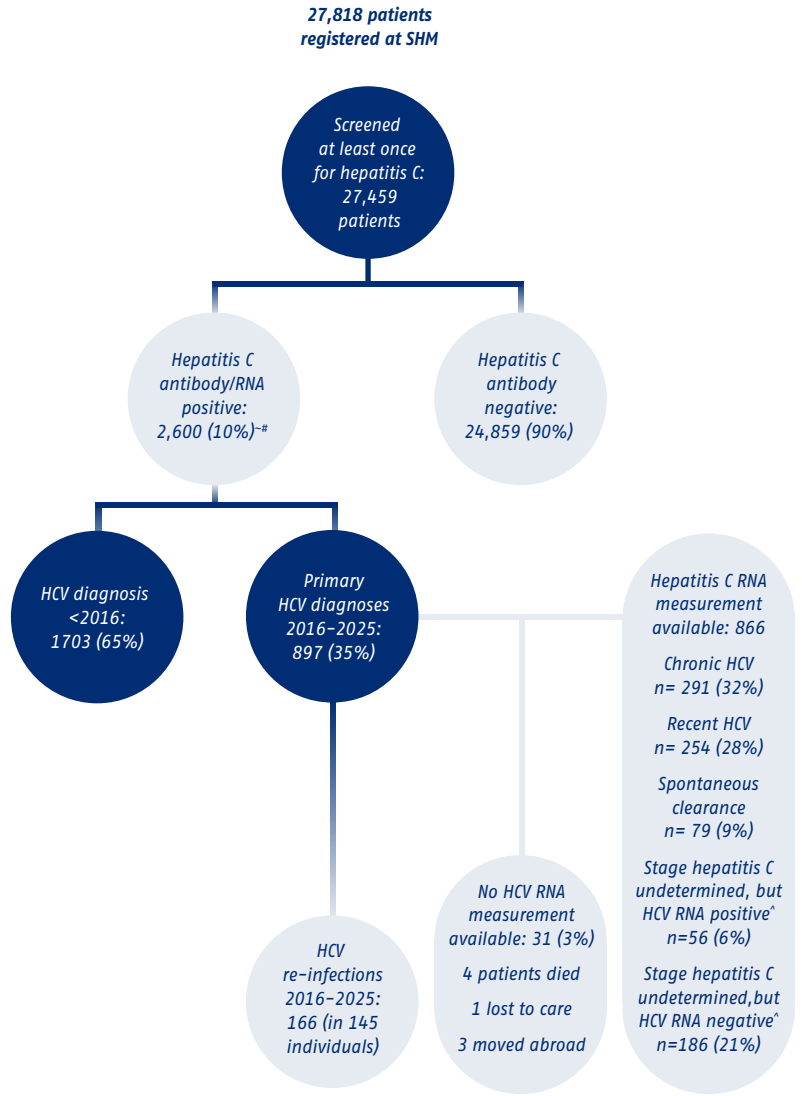
- 4 had died;
- 1 had been lost to care;
- 3 had moved abroad; and
- 23 do not have a known reason for an undocumented HCV RNA outcome.

In total, 897 individuals were diagnosed with HCV infection from 2016 to 2025, and had documented HCV RNA data:

- 291 (32%) were classified as having a chronic HCV infection at the time of their diagnosis;
- 254 (28%) were diagnosed with a recent HCV infection;
- 79 (9%) had evidence of spontaneous clearance of HCV;
- 56 individuals had one positive HCV RNA test result, and no follow-up results, rendering it impossible to determine the stage of their HCV infection at the time of diagnosis (37 individuals are no longer in care and another 9 newly entered care in 2025).
- 186 (21%) had a positive HCV antibody test result accompanied with a negative HCV RNA test.
  - 143/186 (77%) individuals originated from outside the Netherlands, mainly from eastern and central Europe (n=102).
  - 14/186 (8%) newly entered care in 2025 and all but five individuals originated from outside the Netherlands.

Between 2016 and 2025, 166 HCV reinfections occurred in 145 individuals (*Figure 8.2*).

Figure 8.2: Flowchart of individuals with HIV in care and diagnosed with hepatitis C virus (HCV) between 2016–2025.



~ including patients who are HCV RNA positive, but with no known HCV antibody data
 # including documented seroconversion
^ excluded from further analyses

Demographic characteristics of individuals with a primary HCV diagnosis between 2016 and 2025

In total, 545/866 individuals could be definitively classified as having either chronic (n=291), or recent (n=254) HCV infection at the time of their primary HCV diagnosis. Most of these were male (84% and 99%, respectively).

Most individuals with chronic HCV were not born in the Netherlands (*Table 8.1A*), 34% of the individuals diagnosed with chronic HCV between 2016 and 2025 originated from Eastern Europe and 12% from Central Europe. Eighteen percent (51/291) of the individuals with chronic HCV reported (former) injecting drug use. Another 19% reported heterosexual contact as the most likely mode of HIV transmission. However, the mode of transmission for HCV is mostly unknown and may differ from the reported HIV transmission mode.

Among the individuals with a recent HCV infection, 69% was born in the Netherlands and 90% were MSM.

Table 8.1A: *Demographic characteristics of individuals with HIV and diagnosed with a chronic or recent HCV infection between 2016–2025.*

HCV status		Chronic HCV	Recent HCV
Total N (%)		291	254
Age at HCV diagnosis	Median (IQR)	41.9 (35.1 to 49.1)	46.4 (39.0 to 53.2)
Gender at birth	men	243 (83.5)	252 (99.2)
	women	48 (16.5)	2 (0.8)
Region	Netherlands	82 (28.2)	174 (68.5)
	Caribbean/South America	26 (8.9)	25 (9.8)
	Sub-Saharan Africa	11 (3.8)	1 (0.4)
	Western Europe	21 (7.2)	18 (7.1)
	Other	4 (1.4)	10 (3.9)
	Central Europe	36 (12.4)	9 (3.5)
	Southeast Asia	13 (4.5)	10 (3.9)
	Eastern Europe	98 (33.7)	7 (2.8)
HIV transmission route	Men who have sex with men	147 (50.5)	229 (90.2)
	Heterosexual	54 (18.6)	12 (4.7)
	Other	39 (13.4)	11 (4.3)
	People who use/used injecting drugs	51 (17.5)	2 (0.8)
ART	ART	287 (98.6)	254 (100.0)

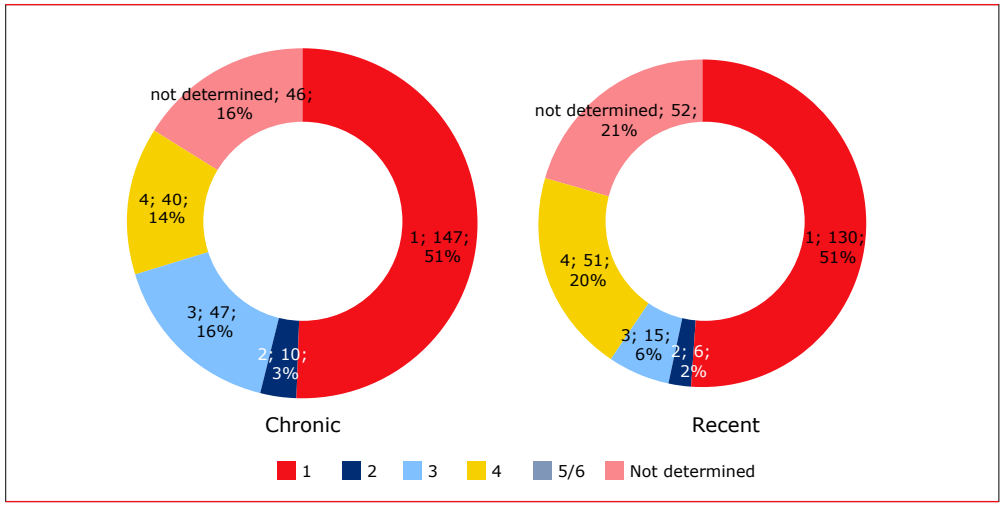
Legend: *n = total for each category; (%) = percentage of the total for each column; HCV = hepatitis C virus; ART = combination antiretroviral therapy.*

The HCV genotype was determined and documented in the clinical records of 447 of the 545 (82%) individuals with chronic or recent HCV. *Figure 8.3* shows the genotype distribution.

Table 8.1B: *Number of HCV diagnoses between 2016–2025.*

Year of diagnosis	Primary HCV infection				HCV reinfection	Total
	Chronic HCV	Recent HCV	Spontaneous clearance of HCV	HCV status, undetermined		
2016	43	53	7	5	25	133
2017	26	47	8	10	32	123
2018	38	28	7	3	31	107
2019	22	40	6	7	18	93
2020	17	21	6	0	8	52
2021	22	15	6	1	14	58
2022	52	8	15	8	3	86
2023	35	17	9	7	12	80
2024	24	12	7	2	11	56
2025	12	13	8	13	12	58
Total	291	254	79	56	166	846

Figure 8.3: *Frequency of HCV genotypes among individuals with a primary HCV diagnosis between 2016–2025, stratified by chronic and recent HCV.*



Changes over time

Number of diagnoses of primary HCV and reinfection

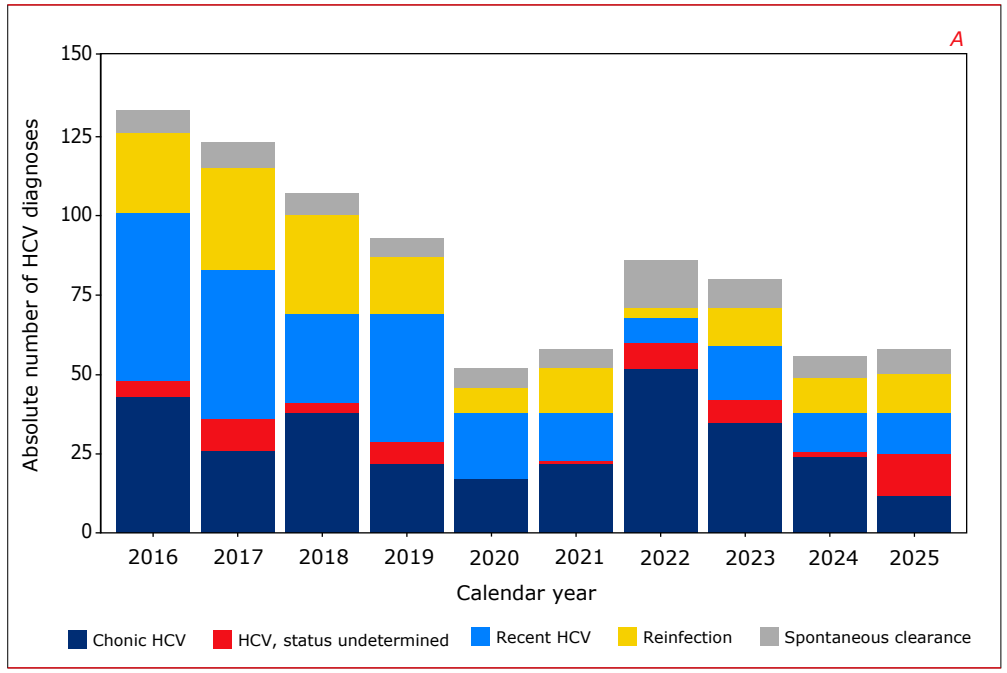
Between 2016 and 2025, 846 HCV diagnoses with detectable HCV RNA occurred (680 primary infections and 166 reinfections). The annual number of primary HCV diagnoses (ie with detectable HCV RNA) and HCV reinfection decreased from 133 cases in 2016 to 86 and 80 in 2022 and 2023, respectively. The decreasing trend continued through 2025, reaching 58 cases, including 12 reinfections (*Table 8.1B*, *Figure 8.4A*).

Of the HCV diagnoses with detectable HCV RNA between 2016 and 2025, 382 (45%) originated from the Netherlands, 19% from Eastern Europe, 8% from Western Europe and 9% from Central Europe. However, the number of individuals born in the Netherlands decreased and in 2025, 36% of the individuals originated from other European countries than the Netherlands (*Figure 8.4B*). Most reported countries in this region were Ukraine (7, 12%) and Poland (5, 9%). Many individuals with an HCV diagnosis were MSM (*Figure 8.4C*).

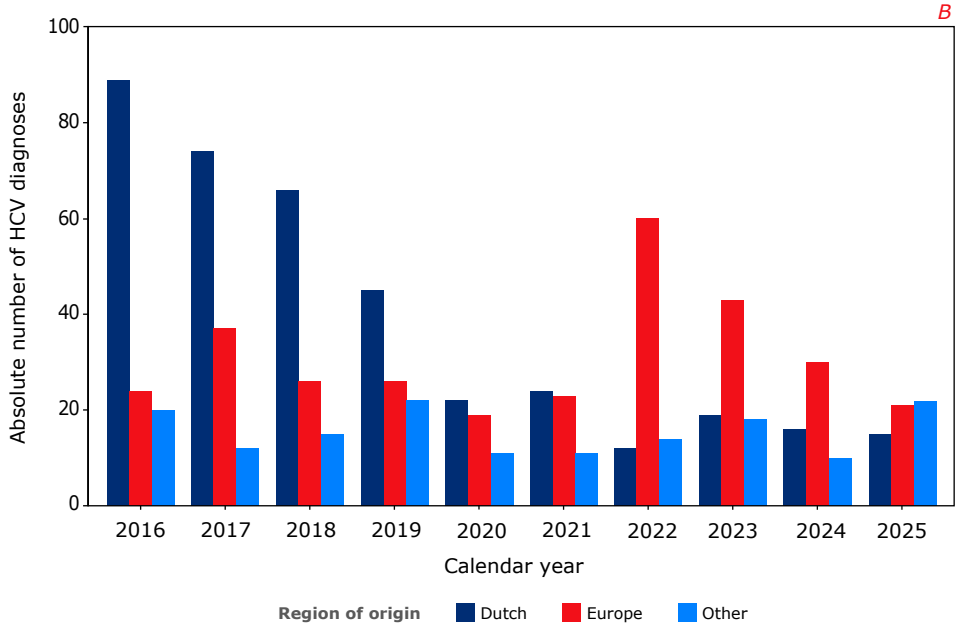
Prevalence of detectable HCV RNA

Figure 8.4D shows the percentage of individuals with detectable HCV RNA over time. Individuals contributed follow-up time to the analysis if they were screened for HCV and in care between 2016 and 2025. HCV RNA positivity was based on the last available HCV RNA test result before the end of that calendar year. The overall percentage of individuals with detectable HCV RNA decreased from 1.5% in 2016 to 0.3% in 2025. In MSM, the highest percentage of HCV RNA positivity was 1.0% in 2016; by 2022, the percentage of positive HCV RNA in this group had decreased to 0.2% and stabilizes around the 0.2% in the most recent years.

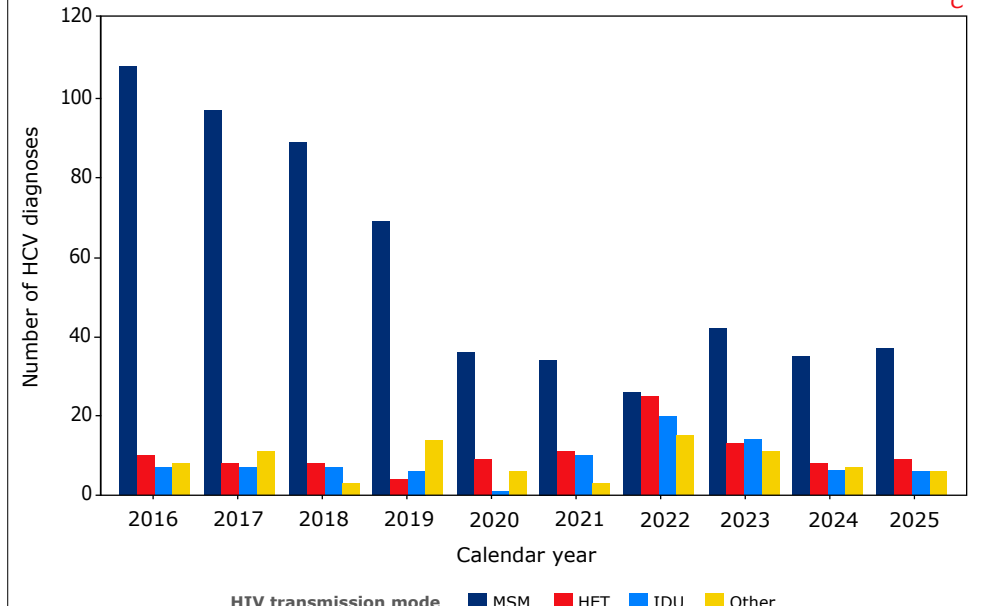
Figure 8.4: *A) Absolute number of diagnoses of hepatitis C virus (HCV) co-infection with detectable HCV RNA, B) number of HCV diagnoses of HCV with detectable HCV RNA, stratified by region of origin, C) Percentage of HCV diagnoses with detectable HCV RNA stratified by HIV transmission group, and D) detectable HCV RNA, per calendar year*



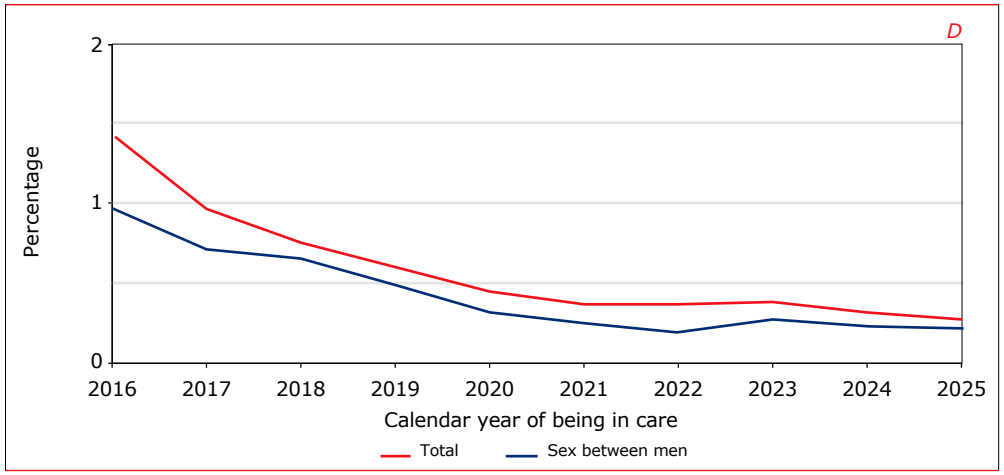
B


Absolute number of HCV diagnoses
100
80
60
40
20
0
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Calendar year
Region of origin
Dutch
Europe
Other

C


Number of HCV diagnoses
120
100
80
60
40
20
0
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Calendar year
HIV transmission mode
MSM
HET
IDU
Other

D


Percentage
2
1
0
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Calendar year of being in care
Total
Sex between men

Incidence of new HCV infections

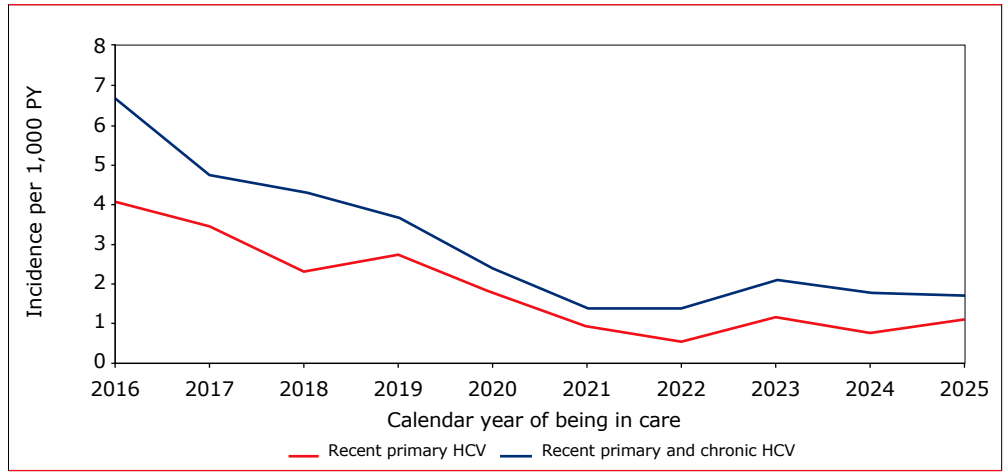
The incidence of primary infection is calculated for individuals with a first documented HCV infection, based on the date of their first positive HCV antibody or HCV RNA test result. The definition of recent HCV infection is consistent with the one given in the European AIDS Treatment Network's (NEAT) preferred criteria[7]. We have expanded this definition to include alternative criteria[3,4]. This alternative definition is based on (i) detectable HCV RNA associated with an acute rise in alanine aminotransferase (ALT) greater than five times the upper limit of normal (above 200 U/l), and (ii) a documented normal ALT within the past 12 months, together with (iii) no change in antiretroviral regimen in the last six months.

There were important differences in the incidence of primary recent HCV infection in terms of HIV transmission category. Between 2016 and 2025, most recent HCV infections occurred in MSM (n=229/254 [90%]). In contrast to the high prevalence of HCV in PWID or former PWID, the overall incidence of recent HCV in this group was low, occurring in only two PWID or former PWID. This is probably due to the high background prevalence of HCV infection in former PWID, the fact that injecting drug use has become very uncommon in the Netherlands, and the effective harm-reduction programmes implemented in addictive care centres in the Netherlands. Twelve cases occurred among individuals who had acquired HIV heterosexually (*Table 8.1A*).

Figure 8.5 shows both the incidence of recent primary HCV infection and all primary HCV diagnoses among MSM over time. Between 2016 and 2025, the overall rate of primary HCV infection was 2.59 per 1,000 person years (PY) (95% confidence interval [CI]2.37-2.82). The incidence of primary infection decreased from 6.63 per 1,000 PY (95% CI 5.23-8.27) in 2016 to 1.62 per 1,000 PY (95% CI 0.97-2.53) in 2025.

When looking at those with recent HCV, the overall rate of recent HCV infection, including cases with a rise in ALT levels, among MSM was 1.78 per 1,000 PY (95% CI 1.56-2.03). The incidence of recent HCV infection decreased from 4.00 cases per 1,000 PY (95%CI 2.93-5.31) in 2016 to 1.02 cases per 1,000 PY (95%CI 0.52-1.78) in 2025.

Figure 8.5: *Incidence of recent primary hepatitis C infection (blue line) and all primary recent and chronic HCV diagnoses (red line) among men who have sex with men per calendar year.*



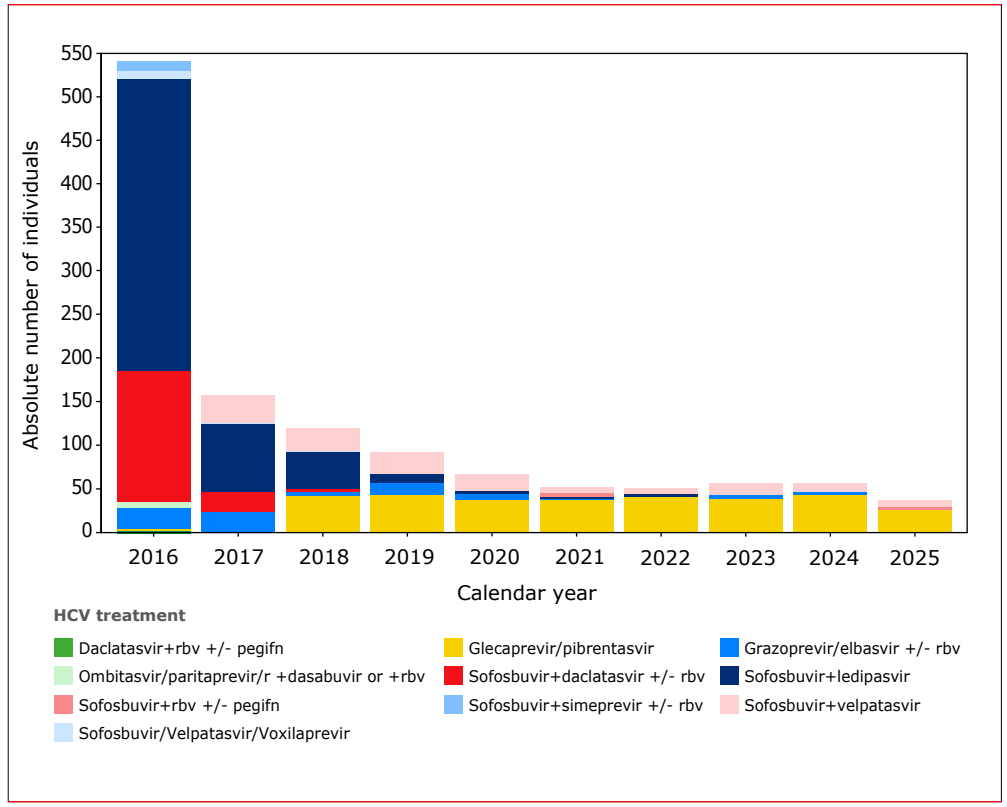
Legend: *HCV = hepatitis C virus.*

HCV treatment

The primary aim of HCV treatment is to achieve a sustained virological response (SVR)[8]. Since 2012, the introduction of the first generation of direct acting agents (DAA) improved the HCV treatment efficacy[9,10] and efficacy was further improved with the introduction of all-oral DAAs from 2014 onwards. Initially, with government restrictions, only for a defined group of individuals with severe liver fibrosis and cirrhosis. And by the end 2015, it was made available for all individuals with chronic HCV, regardless of fibrosis state. An overview of DAA-containing HCV treatment combinations currently available in the Netherlands can be found at https://hcvrichtsnoer.nl/.

Of the individuals ever diagnosed with primary chronic, recent HCV, or a reinfection, 1,091 received HCV treatment between 2016 and 2025; with in total 1220 treatment episodes with all-oral direct-acting antiviral treatment (DAAs), including those who received HCV treatment more than once (people who were unsuccessfully treated and those who reacquired HCV after prior successful treatment).

Figure 8.6: Number of individuals with HIV/HCV starting hepatitis C treatment per calendar year.



Legend: HCV=hepatitis C virus; RBV=ribavirin; PEG-IFN=pegylated interferon.

Treatment with DAAs

Figure 8.6 shows the annual number of individuals initiating HCV treatment. Between 2016 and 2025, a total of 1,091 individuals were documented as having started a DAA regimen; 108 of these received more than one episode of DAA treatment, resulting in 1,220 treatment episodes overall. The most frequent indications for repeated DAA treatment were reinfection following DAA treatment-induced clearance (n=74), and patient preference (n=12), and treatment related toxicity (n=8). Of the total 1,220 DAA treatment episodes, 540 were in 2016. The number of treatment episodes subsequently decreased to 36 in 2025 (*Figure 8.6*).

The most frequently used DAA regimens were:

1. sofosbuvir plus ledipasvir +/- RBV (n=476);
2. pibrentasvir/glecaprevir (n=306), most commonly used since 2020;
3. sofosbuvir plus daclatasvir +/- RBV (n=175);
4. sofosbuvir plus velpatasvir (n=140).

Treatment outcomes

1,205 out of 1,220 DAA treatment episodes had been completed at least 12 weeks prior to the database lock. In 1,194 treatment episodes follow up HCV RNA data was available, and in 11 there was no data after treatment completion:

- In 1,171 of the 1,194 treatment episodes (98%), SVR12 was achieved.
- No SVR was achieved in 23 treatment episodes among 23 individuals.

- For the remaining 11 treatment episodes, no follow-up data on SVR were available: three people died after being treated and 6 cases had a last clinical visit shortly after treatment discontinuation. For the remaining two cases there were no reported HCV RNA tests available.

SVR rates were lower in individuals with severe liver disease (99% vs 96%). In terms of HIV transmission risk groups, SVR rates were 99% among MSM, 97% among PWID or former PWID, and 96% among individuals who acquired HIV through heterosexual contact.

Among the 23 individuals who did not achieve SVR:

- 19 were successfully retreated with another DAA regimen;
- 4 were not retreated:
  - one individual died;
  - one moved abroad;
  - and for the remaining individuals, the reason for not being retreated is unknown.

- In total, 6 mutations among 4 individuals were identified among the individuals who did not achieve SVR.
  - 4 mutations in the NS5A region (30R, 93.S, T58P, T99S)
  - 2 mutations in the NS3 region (S122T, I/V1701, Q80K)

HCV reinfection

Reinfection with HCV following successful treatment or spontaneous clearance has been reported mainly in MSM with HIV[19]. High reinfection rates have been observed in MSM in the Netherlands, Germany[20] and the United Kingdom[21,22].

To identify possible HCV reinfections among individuals with a prior HCV infection, we selected those who had initially achieved SVR after receiving any type of HCV treatment, as well as individuals with spontaneous clearance of HCV.

Between 2016 and 2025, 2,124 individuals met the above criteria (1805 after SVR, 319 after spontaneous clearance). Among these, 166 reinfections were documented in 145 individuals. The median time from SVR or spontaneous clearance to HCV reinfection was 1.6 years (IQR 0.6-3.0). There was an increase in the time to reinfection from less than one year in 2016 to 4 years in 2025.

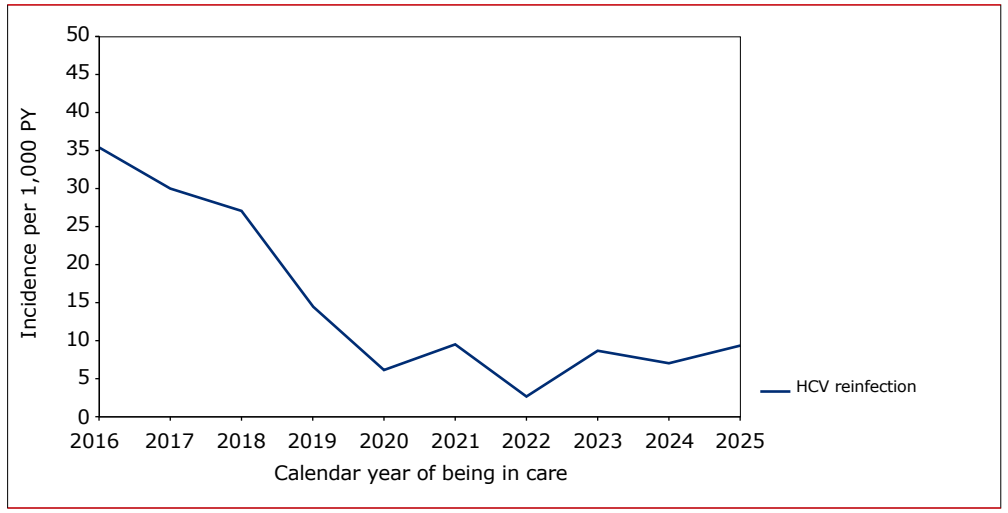
Most reinfections occurred in MSM (148 out of 166, 89%). And six reinfections were observed in PWID or former PWID (4%). Among the remaining 12 reinfections, documented HIV transmission routes were heterosexual contact (n=5) and other or unknown (n=7).

Of the 166 reinfections, 9 (5%) cleared spontaneously and 132 (80%) were subsequently retreated. The median time from reinfection to retreatment was 4 months (IQR 2-8).

We calculated the incidence of reinfection for the period 2016 and 2025. Follow-up time was calculated from the date of SVR, the date of spontaneous clearance, or from 1 January 2016, until the earliest date of HCV reinfection, death, or last known contact. In the total population, the incidence of HCV reinfection was 11 reinfections per 1,000 PY (95% CI 9-13), and for MSM it was 14 reinfections per 1,000 PY (95% CI 12-16).

Because most reinfections occurred among MSM, trends in HCV reinfection incidence are presented for MSM only (*Figure 8.7*). Among MSM, the incidence decreased from 35 reinfections per 1,000 PY in 2016 to 14 per 1,000 PY in 2019 and then declined to 7 reinfections per 1,000 PY in 2024, and 9 per 1,000 PY in 2025.

Figure 8.7: *Incidence of hepatitis C reinfection after earlier treatment-induced and spontaneous clearance among men who have sex with men, per calendar year.*



Legend: *HCV = hepatitis C virus; PY = person year.*

Continuum of care for those with diagnosed HCV

Figure 8.8 presents the HCV continuum of care among individuals known to be in HIV care as of 31 December 2025 and who had an HCV diagnosis between 2016 and 2025 or an uncleared HCV infection diagnosed before 2016. Individuals were categorised according to their last documented HCV infection episode. In total 1,496 individuals were linked to HIV care with an active HCV infection between 2016 and 2025, 1,011 individuals had primary HCV infection, and 123 individuals had an HCV reinfection.

Of the 1,496 individuals linked to HIV care:

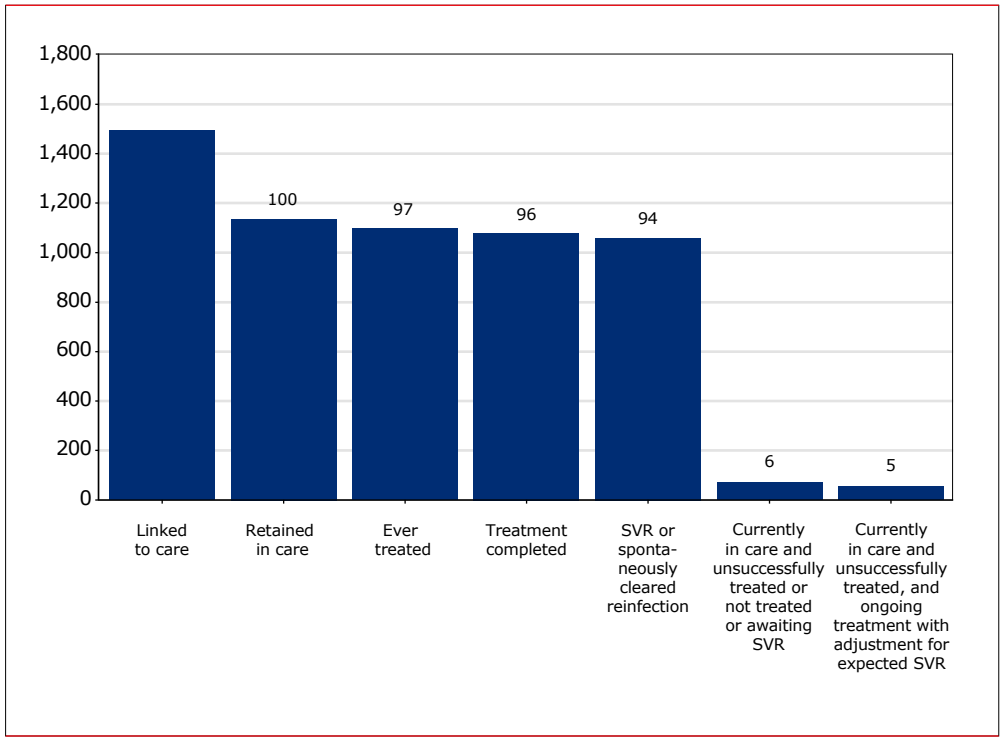
- 1,134 (76%) were retained in care;
- 362 individuals were no longer in care (157 had died; 108 had moved abroad; and 97 were lost to care). Among the 213 individuals who were lost to care or who moved abroad:
  - 151 had a negative HCV RNA test result before they left care; and
  - for 73 individuals the last HCV RNA measurement was detectable
- 1,097 (97%) of those still alive and in care had received treatment for HCV
- 1,083 (96%) of those still alive, in care, had completed HCV treatment and had available data to assess treatment response (SVR12).

Overall, 1,061(98%) of the 1,083 people in care in 2025 who completed treatment achieved SVR, including those who were successfully retreated after prior treatment failure. An additional 3 individuals with HCV reinfection had a negative last HCV RNA result without documentation of HCV treatment, suggesting spontaneous clearance of HCV. This yields a total of 1,064 individuals with either treatment-induced or spontaneous clearance of their most recent HCV episode.

The remaining 70 (6%) of 1,134 individuals known to be alive and in care on 31 December 2025, were still in need of HCV treatment (n=56) or awaiting confirmation of SVR after treatment (n=14). Of these, 34 (3%) individuals had never received HCV treatment, eight were born in the Netherlands, and 17 were born in central or eastern Europe. Thirty-three individuals were receiving ART. The proportion of individuals who remained untreated for HCV was higher among PWID (7%), those who acquired HIV through heterosexual contact (9%), and those with an unknown HIV transmission mode (3%), compared with MSM (1%).

For 14/70 individuals SVR could not yet be determined: all had been treated with novel DAA combinations. We therefore extrapolated the observed DAA SVR rate and assumed that 98% of the 14 individuals will achieve SVR. Under this assumption, an estimated 56 (70-14=56) remain in need of HCV treatment or have experienced unsuccessful treatment.

Figure 8.8: Hepatitis C continuum of care including individuals in care with an active HCV infection between 2016 and 2025. (Percentages of those who retained in care are reported at the top of each bar).



Legend: SVR=sustained virological response.

Liver-related morbidity and mortality in individuals with HCV

Additional data from liver biopsy pathology reports, transient elastography, radiology reports, or a combination of those sources, were available for:

- 1,726 of the 2,049 individuals in care between 2016 and 2025 and ever diagnosed chronic or recent HCV;
- 451/1,726 (26%) individuals had evidence of severe chronic liver disease (presumptive and definitive categories combined);
- definitive severe chronic liver disease was documented for 102 (6%) individuals with HCV co-infection.

Data on hepatocellular carcinoma (HCC) showed that between 2016 and 2025:

- 9 (0.4%) cases of hepatocellular carcinoma (HCC) were reported among 2,049 individuals with HCV and without other viral hepatitis (i.e. HBV or HDV).
- 3 of the 9 individuals with HCC were born in the Netherlands.
- No cases of HCC were reported among DAA treated individuals without cirrhosis or fibrosis.

Between 2016 and 2025, among the 2,049 individuals with HCV:

- 230 (11%) deaths from any cause occurred;
- 20 (1%) deaths were liver related.
  - 17 individuals who died of a liver-related cause were treated for HCV (13 with DAAs and 4 with older regimens).
  - 19/20 individuals were known to have liver cirrhosis.

Hepatitis B virus

Hepatitis B is a vaccine-preventable disease caused by the hepatitis B virus (HBV). HBV may be sexually or parenterally transmitted and causes both acute and chronic hepatitis. The following sections describe HBV epidemiology among 27,818 ATHENA cohort participants who had at least one HIV care visit between 2016 and 2025.

We used three serological markers of HBV infection to determine an individual's HBV clinical state: hepatitis B surface antigen (HBsAg), anti-hepatitis B surface antibodies (anti-HBs), and anti-hepatitis B core antibodies (anti-HBc). For each participant, we determined the HBV serological profile by combining assay results across time. When all three assays were available or when HBsAg was positive, we designated the serological profile as "interpretable" (see *Box 9B*). Otherwise, the profile was considered incomplete.

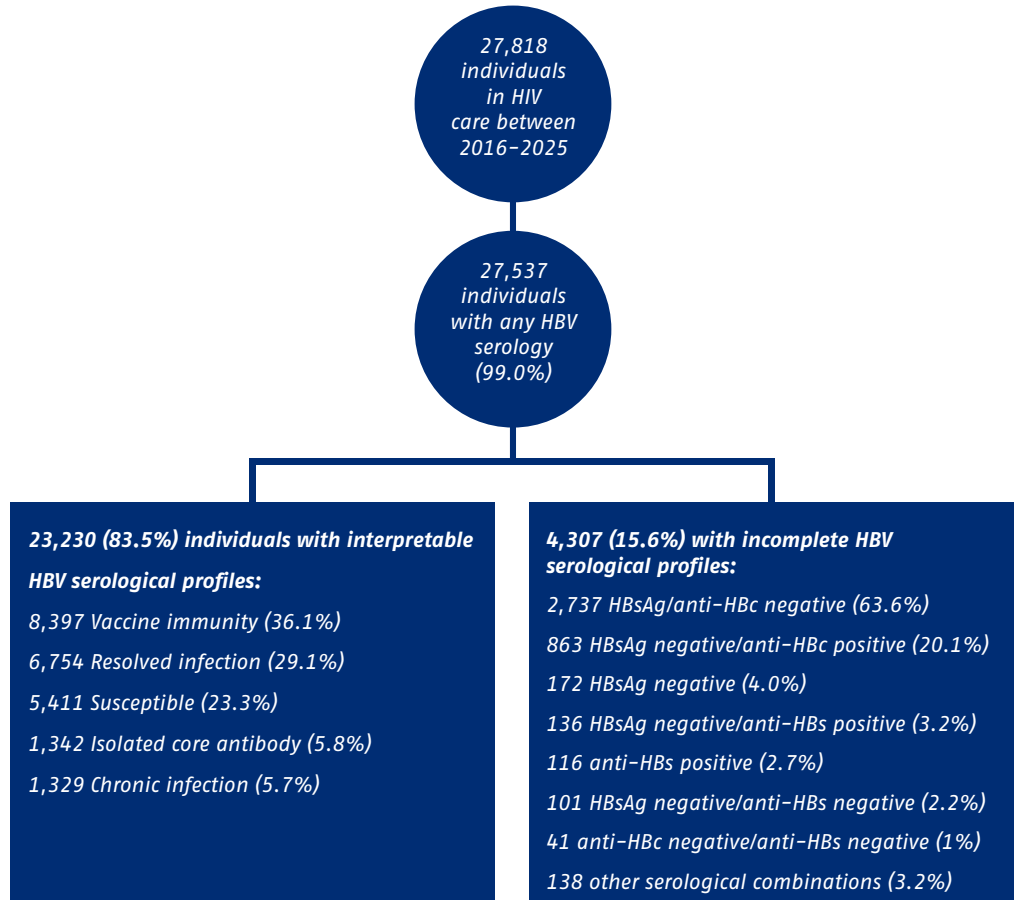
***Box 8B:** Interpretation of HBV serological profiles*

HBV Clinical state	HBsAg	Anti-HBs	Anti-HBc
Chronic infection	Positive >= 6 months	Negative or missing	Any value or missing
Resolved infection	Negative	Positive	Positive
Vaccine-derived immunity	Negative	Positive	Negative
Susceptible, never infected	Negative	Negative	Negative
Isolated core antibody positive	Negative	Negative	Positive

HBV serological profiles

Of 27,818 participants in care, 27,537 (99.0%) had any of the three key HBV serological markers performed at any time and 23,233 (83.5%) had interpretable serological profiles. The serological profiles of the 27,537 participants who underwent HBV testing is show in *Figure 8.9*.

***Figure 8.9:** HBV serological profiles among participants in care, 2016–2025 (n = 27,357).*



Of 23,233 participants with interpretable serological profiles, 8,397 (36.1%) had a profile consistent with vaccine acquired immunity, 6,754 (29.0%) with resolved infection, 1,342 (5.8%) had isolated anti-HBc, and 5,411 (23.3%) remained HBV susceptible by serology.

HBsAg testing was performed in 27,242 participants; of these, 1,370 (5.0%) were ever positive. To distinguish between participants with acute versus chronic HBV, we reviewed the duration of HBsAg positivity. We considered HBV infection to be acute if the following two conditions were present: 1) documented negative HBsAg followed by surface antigenemia; 2) documented clearance of HBsAg within 180 days of first detection. HBsAg antigen clearance was defined as at least two negative HBsAg assays, or a single negative HBsAg with a positive anti-HBs. Individuals with surface antigenemia lasting 180 days or more, or in whom the duration could not be ascertained, were categorized as having chronic HBV.

Forty-one participants met our criteria for acute HBV. The remaining 1,329 had evidence of HBsAg antigenemia lasting >=180 days or of unknown duration and are discussed in greater detail in the section on chronic HBV.

The demographic characteristics of people with interpretable HBV profiles are shown in *Table 8.2.*

Table 8.2: *Demographic characteristics of participants with interpretable HBV profiles (n=23,230)*

	Chronic (N=1329)	Immunized (N=8397)	Resolved (N=6754)	Susceptible (N=5411)	Isolated core (N=1342)
Gender					
Male	1138 (85.6%)	7331 (87.3%)	5810 (86.0%)	3882 (71.7%)	987 (73.5%)
Female	191 (14.4%)	1066 (12.7%)	944 (14.0%)	1529 (28.3%)	355 (26.5%)
Transmission group					
MSM	781 (58.8%)	6097 (72.6%)	4637 (68.7%)	2359 (43.6%)	542 (40.4%)
Heterosexual	384 (28.9%)	1641 (19.5%)	1457 (21.6%)	2405 (44.4%)	527 (39.3%)
Unknown	81 (6.1%)	303 (3.6%)	277 (4.1%)	373 (6.9%)	111 (8.3%)
Sexual transmission NOS	33 (2.5%)	209 (2.5%)	137 (2.0%)	127 (2.3%)	25 (1.9%)
PWID	34 (2.6%)	52 (0.6%)	152 (2.3%)	53 (1.0%)	113 (8.4%)
Other	16 (1.2%)	95 (1.1%)	94 (1.4%)	94 (1.7%)	24 (1.8%)
Birth region					
Netherlands	584 (43.9%)	4499 (53.6%)	3488 (51.6%)	2890 (53.4%)	453 (33.8%)
Latin America and Caribbean	177 (13.3%)	1309 (15.6%)	926 (13.7%)	782 (14.5%)	138 (10.3%)
Sub-Saharan Africa	296 (22.3%)	501 (6.0%)	1010 (15.0%)	612 (11.3%)	444 (33.1%)
W Europe, N America, Australia	73 (5.5%)	785 (9.3%)	492 (7.3%)	263 (4.9%)	87 (6.5%)
Central and Eastern Europe	91 (6.8%)	649 (7.7%)	356 (5.3%)	477 (8.8%)	123 (9.2%)
South and East Asia	82 (6.2%)	369 (4.4%)	362 (5.4%)	179 (3.3%)	63 (4.7%)
N Africa and Middle East	21 (1.6%)	237 (2.8%)	96 (1.4%)	174 (3.2%)	29 (2.2%)
Unknown	5 (0.4%)	48 (0.6%)	24 (0.4%)	34 (0.6%)	5 (0.4%)
Died					
No	1182 (88.9%)	8021 (95.5%)	6065 (89.8%)	4979 (92.0%)	1212 (90.3%)
Yes	147 (11.1%)	376 (4.5%)	689 (10.2%)	432 (8.0%)	130 (9.7%)

MSM, men who have sex with men; NOS, not otherwise specified; PWID, people who inject drugs; W, Western; N, North.

Chronic HBV

A total of 1,329 participants had a history of chronic HBV. Of these 348 (26.1%) had sustained loss of HBsAg during the observation period, while 981 (73.8%) remained antigenemic (877) or had a single negative HBsAg assay with no further follow up (104). Two hundred and sixteen participants (15.5%) lost HBsAg and seroconverted to anti-HBs positive. HBV viral DNA measurements were available in 1097 (82.5%) participants with a history of chronic HBV, of which 915 (83.4%) were undetectable (≤ 20 copies/ml or below the threshold of detection for assays using a higher cutoff).

Table 8.3 summarizes the clinical characteristics of participants with a history of chronic HBV, by serological status at last observation. Probable or definite severe liver disease was documented in 233 (17.8%) of participants with a history of chronic HBV, of whom 103 (7.8%) had documented cirrhosis and 15 had hepatocellular carcinoma (for the definition of severe disease see Box 8.1). One hundred and forty-seven deaths occurred among participants with a history of chronic HBV, of which 11 (7.5%) were attributable to liver-related causes. As a proportion of the 1,329 participants with a history of chronic HBV, less than 0.8% died of liver-related causes.

Table 8.3: *Laboratory and clinical characteristics of participants with a history of chronic HBV (n = 1,329).*

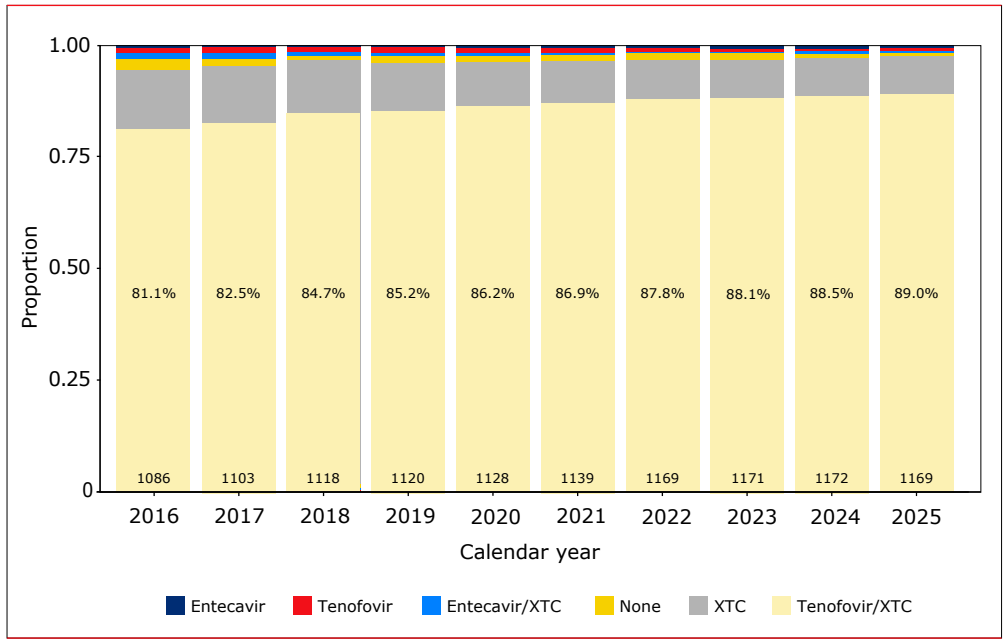
	HBsAg+ (n=981)	HBsAg-/anti-HBs+ (n=216)	HBsAg-/anti-HBs- (n=132)	Total (n=1,329)
HBV DNA below level of detection				
Missing	106	89	37	232
Yes	722 (82.5%)	112 (88.2%)	81 (85.3%)	915 (83.4%)
No	153 (17.5%)	15 (11.8%)	14 (14.7%)	182 (16.6%)
Cirrhosis				
No	902 (91.9%)	206 (95.4%)	118 (89.4%)	1226 (92.2%)
Yes	79 (8.1%)	10 (4.6%)	14 (10.6%)	103 (7.8%)
Severe liver disease				
None/not documented	788 (80.3%)	195 (90.3%)	110 (83.3%)	1093 (82.2%)
Probable	144 (14.7%)	14 (6.5%)	12 (9.1%)	170 (12.8%)
Confirmed	49 (5.0%)	7 (3.2%)	10 (7.6%)	66 (5.0%)
Hepatocellular carcinoma				
No	967 (98.6%)	215 (99.5%)	132 (100.0%)	1314 (98.9%)
Yes	14 (1.4%)	1 (0.5%)	0 (0.0%)	15 (1.1%)
Death from any cause				
No	870 (88.7%)	188 (87.0%)	124 (93.9%)	1182 (88.9%)
Yes	111 (11.3%)	28 (13.0%)	8 (6.1%)	147 (11.1%)

Treatment of chronic hepatitis B

The goal of HBV treatment is to reduce viral replication and prevent hepatic inflammation and liver disease progression[11]. Suppression of HBV DNA has been shown to reduce the risk of HCC and overall mortality in individuals with HIV/HBV coinfection[12, 13]. Antiretroviral agents with activity against HBV include the cytidine analogues lamivudine and emtricitabine, and tenofovir prodrugs.

HBV treatment data was available in 1,325 of 1,329 individuals ever diagnosed with chronic HBV. *Figure 8.10* shows changes in prescribed HBV treatment regimens over the past decade. For each calendar year, we included participants with ongoing surface antigenemia, defined as the presence of HBsAg in the most recent available serology or no evidence of HBsAg clearance (i.e. a single negative assay at last check with no evidence of anti-HBs). In 2016, 81.1% received a regimen containing tenofovir and a cytidine analogue while 13.3% were treated with a suboptimal regimen containing a cytidine analogue only. In 2025, 89.0%% were treated with tenofovir and a cytidine analogue while 8.5% were treated with a cytidine analogue only.

Figure 8.10: *Evolution of HBV treatment strategies among participants with HBsAg positive serology (n = 1,323).*



Numbers below bars represent the number of participants with surface antigenemia XTC, 3TC/TFC.

Coinfection with other hepatitis viruses

People with chronic hepatitis B may be coinfected with other hepatitis viruses, including hepatitis C, D, and E[14].

HCV, HDV and HEV testing was performed in 1,324 (99.6%), 892 (67.1%), and 168 (12.6%) participants with chronic HBV, respectively. One hundred and twelve participants (8.4%) had a history of HBV-HCV coinfection. Fifty-four participants (4.1%) had evidence of HBV-HDV coinfection by either positive antibody or RNA; of these, 22 had evidence of HDV viremia. Nine participants had a history of HBV-HCV-HDV triple infection. Sixteen participants with chronic hepatitis B had evidence of past HEV infection but none had evidence of chronic HBV-HEV coinfection.

HBV vaccination

Dutch guidelines recommend HBV immunization in MSM[15]. We estimated the proportion of MSM entering HIV care with evidence of HBV immunity acquired through vaccination or prior infection. For each participant, we reviewed data available at care entry using the baseline questionnaire, pre-entry vaccine records, and laboratory results obtained before or within 30 days of the first visit. We excluded participants with evidence of chronic or acute HBV at care entry from the analysis.

Participants were considered to have infection-acquired immunity if they had evidence of anti-HBc and anti-HBs antibodies. Participants who had isolated core positivity with no additional serological, immunization, or baseline questionnaire data were considered non-immune.

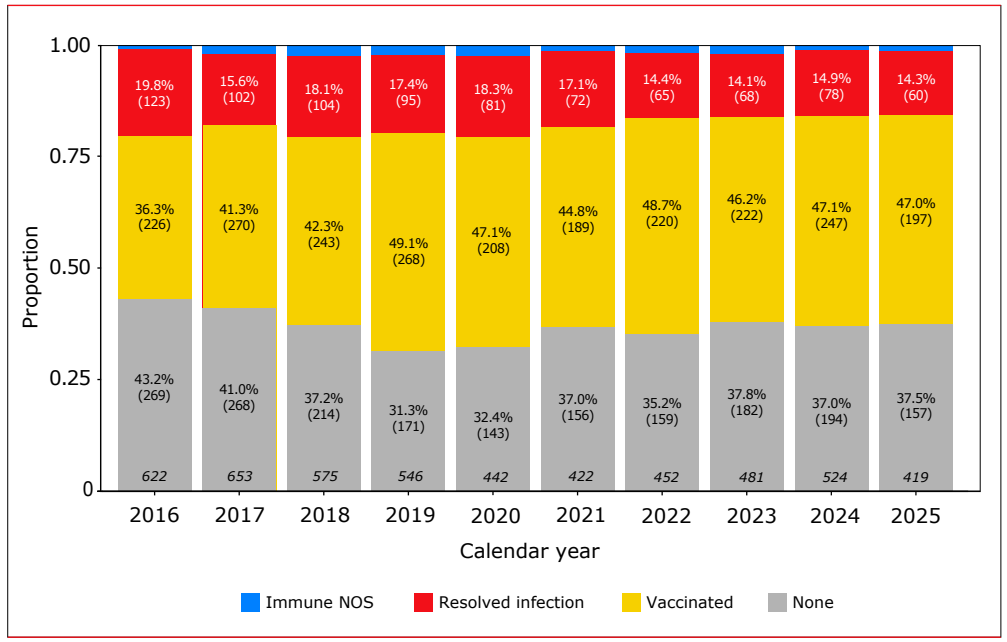
Participants were considered to have been vaccinated or have vaccine-acquired immunity if they received 3 or more doses of a hepatitis B-containing vaccine, were recorded to have been vaccinated on the baseline questionnaire, or had a serological profile consistent with HBV vaccination (anti-HBc negative and anti-HBs positive). Participants with evidence of immunity by serology and HBV vaccination were considered vaccinated. Participants with no vaccine or laboratory data but a recorded history of immunity to HBV on the baseline questionnaire, were assigned to an "immune, not otherwise specified category".

For the subset of participants without evidence of HBV vaccination or immunity at care entry, we calculated the proportion with HBV immunity among those who remained in care through 2025.

A total of 5262 MSM entered care between 2016 and 2025, of whom 126 (0.04%) had evidence of acute or chronic HBV at care entry, leaving 5,136 participants in the analysis. Of these, 2,290 (44.6%) had evidence of vaccination or vaccine-acquired immunity, 848 (16.5%) had evidence of prior infection or infection-acquired immunity, and in 1,913 (37.2%) there was no evidence of vaccination, vaccine-acquired, or infection-acquired immunity. Between 2016 and 2025, the proportion of participants with evidence of HBV vaccination or vaccine-acquired immunity at care entry increased from 36.3% to 47.0% ($p < 0.001$) (*Figure 8.11*).

Among the 1913 participants with no evidence of HBV vaccination, vaccine-acquired, or infection-acquired immunity at care entry, 1,652 (86.4%) remained in care in 2025; of these, 726 (44.1.7%) had been fully vaccinated or had evidence of vaccine-acquired immunity by serology, an additional 237 (14.4%) were partially vaccinated (≤ 2 doses) and 16 (1.0%) had evidence of infection-acquired immunity; the remaining 669 (40.6%) had no record of vaccination, vaccine-acquired or infection-acquired immunity at end observation.

Figure 8.11: *Hepatitis B immunity status in MSM entering HIV care, 2016–2025 (n = 5,136).*



Numbers in italics at bottom of bars represent the number of MSM entering care included in the analysis.

Hepatitis A virus

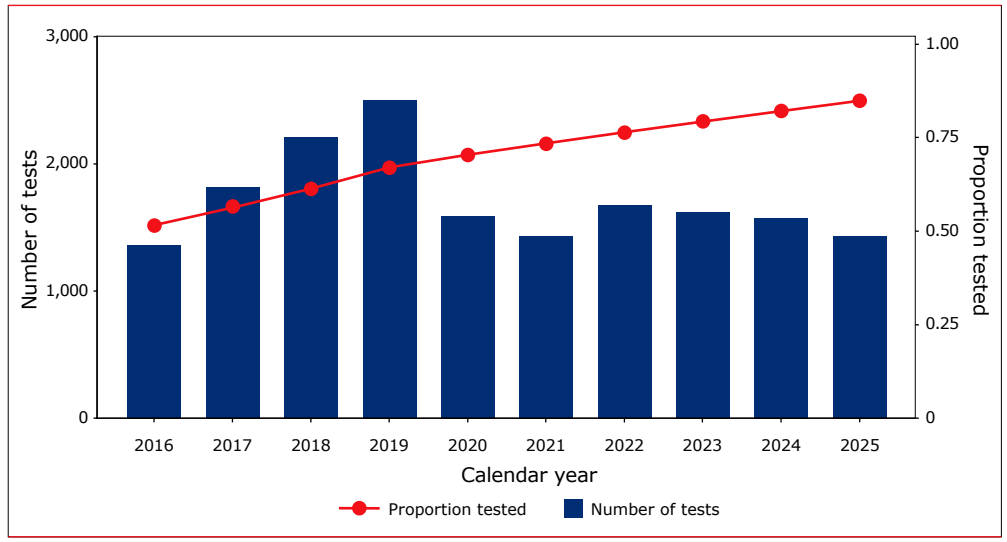
Hepatitis A is a vaccine-preventable infection caused by the hepatitis A virus (HAV). HAV is transmitted via the fecal-oral route, including anal-oral sexual contact. HAV causes acute hepatitis but does not lead to chronic infection.

A diagnosis of acute HAV is made on the basis of serology and clinical features compatible with acute viral hepatitis. Serological assays include anti-HAV IgM and liver enzymes. Anti-HAV IgG seropositivity confers lifelong immunity to HAV but does not distinguish between vaccine-induced and infection-acquired immunity.

HAV testing

Of 27,818 individuals with at least one HIV care visit over the past decade, 20,242 (72.8%) were ever tested for hepatitis A. By 2025, 84.9% of participants in care had at least one serological assay for hepatitis A performed. The number of annual tests and the cumulative proportion of participants tested for hepatitis A is shown in *Figure 8.12*.

Figure 8.12:



Of the 20,242 participants with available HAV serology, 13,330 (65.9%) had evidence of immunity to HAV. HAV seropositivity was highest in people born in sub-Saharan Africa (91.3%), followed by those born in North Africa and the Middle East (79.1%); 53.9% of people born in the Netherlands were seropositive. HAV seropositivity rate was 66.6% in cis-gender women, compared to 58.8% in cis-gender men. MSM had lower mean seropositivity than other HIV transmission groups, 57.9% versus 63.5%, respectively.

Acute HAV

A diagnosis of acute HAV was determined on the basis of available clinical and serological data. Acute HAV was defined as either 1) a diagnosis of laboratory-confirmed and/or symptomatic acute HAV documented in the medical record; or 2) positive anti-HAV IgM serology with ALT ≥ 3 times the upper limit of normal (ULN) within 3 months of IgM detection.

Between 2016 and 2025, a total of 109 cases of acute HAV were identified. The median number of acute HAV cases annually was 5. In 2016-2017, an outbreak of hepatitis A among sexually active MSM was identified across Europe[16]. In 2017, 55 cases of acute HAV were documented in the ATHENA cohort. Since 2020, the annual number of acute HAV cases has remained under 5. One hundred and six (97.2%) of all acute HAV cases occurred in men, of whom 96 (88.1%) were MSM (Figure 8.13). The majority of cases occurred in people born in the Netherlands (n = 51, 46.8%) (*Figure 8.14*).

Figure 8.13: *Number of acute HAV cases, by transmission group, 2016–2025 (n = 109).*

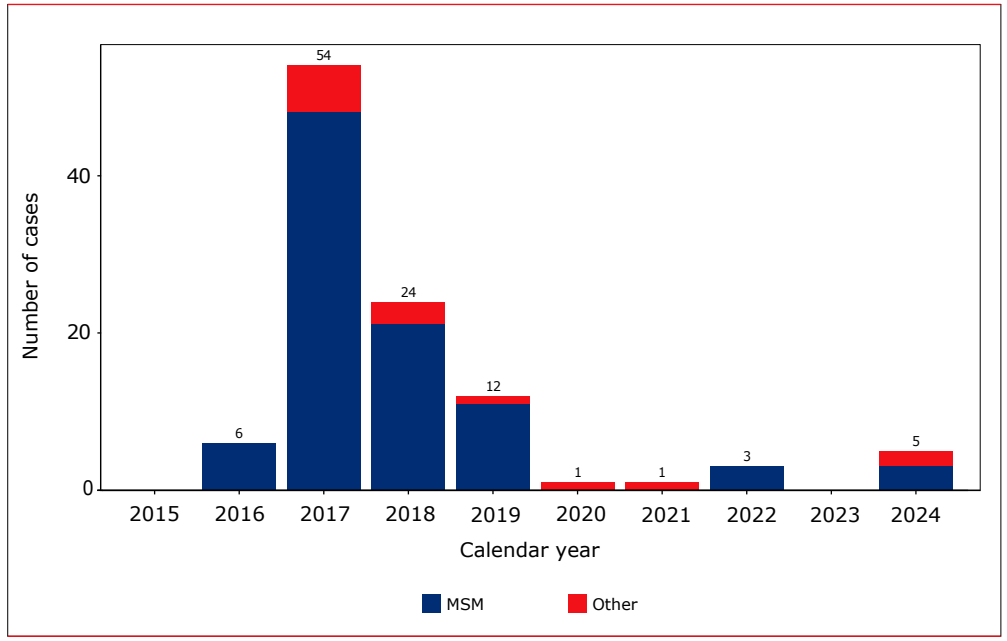
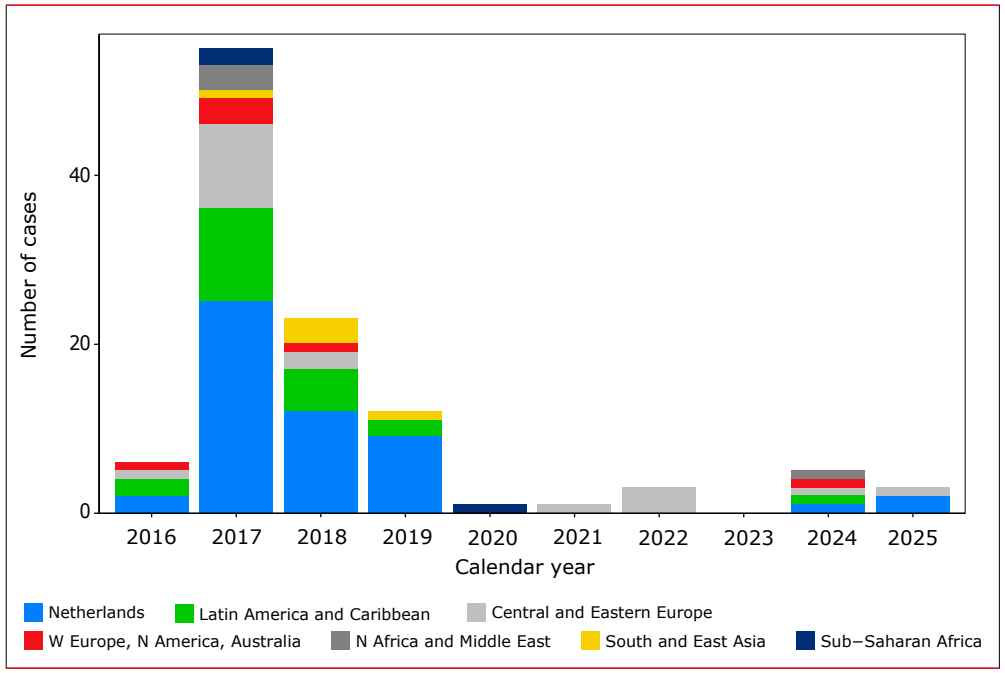


Figure 8.14: Number of acute HAV cases, by birth region, 2016–2025 (n = 109).



HAV immunity

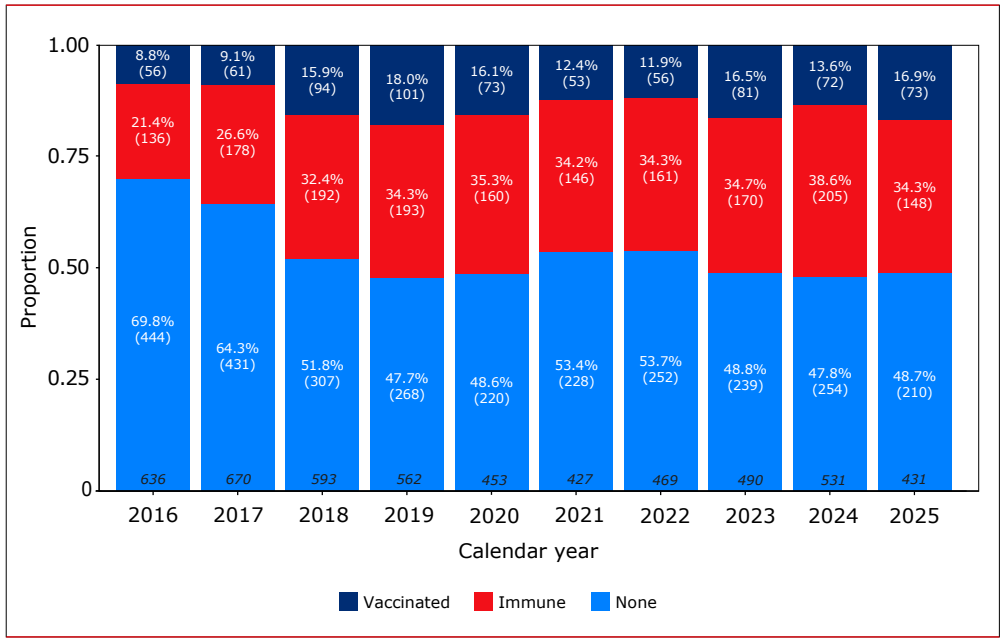
Dutch guidelines recommend HAV immunization in MSM[5]. We estimated HAV vaccination coverage and immune status among 5,262 MSM entering HIV care between 2016 and 2025. For each participant, we reviewed data available at care entry from vaccine administration records, the baseline questionnaire and laboratory assays performed before or within 30 days of the first visit. Participants were considered vaccinated if they had at least one dose of HAV vaccine administration record or were reported to have been vaccinated in the baseline questionnaire. Participants were considered immune if they had evidence of anti-HAV IgG or were reported to be immune in the baseline questionnaire. Participants with evidence of both HAV vaccination and serological immunity were considered vaccinated.

In the subset of participants without evidence of vaccination or serological immunity to HAV at care entry, we calculated the proportion who were vaccinated or immune at end observation among those who remained in care through 2025.

Figure 8.15 shows HAV vaccination and immunity status among 5,262 MSM entering HIV care between 2016 and 2025. Of these, 2,409 (45.8%) had evidence of immunity to HAV either by vaccination or serology, while 2,853 (54.2%) had no evidence of HAV vaccination or immunity at care entry. The proportion of participants without evidence of HAV vaccination or immunity at entry to care decreased from 69.8% in 2016 to 48.7% in 2025 ($p < 0.001$).

Among the 2,853 participants with no evidence of HAV vaccination or immunity at care entry, 2,459 (86.2%) remained in care in 2025; of these, 510 (20.7%) had been vaccinated, 475 (19.3%) were immune by serology, and 17 developed acute HAV, while the remaining 1,457 (59.3%) had no record of vaccination or serological immunity at end observation.

Figure 8.15: Hepatitis A vaccination and immunity status in MSM entering HIV care, 2016-2025 (n = 5,262).



Hepatitis E virus

Hepatitis E virus (HEV) is increasingly recognized as a cause of acute viral hepatitis[17]. Like HAV, HEV is transmitted via the oral-fecal route. Unlike HAV, acute HEV may lead to chronic infection. There is currently no anti-HEV vaccine available in the Netherlands.

Testing for acute and chronic HEV relies on a combination of HEV IgM, IgG and RNA measurements in a clinically compatible setting. Testing for resolved infection is determined by detection of IgG anti-HEV antibodies.

Of the 27,818 people in HIV care between 2016 and 2025, 2,370 (8.5%) were ever tested for HEV, 346 (14.6%) of whom had any evidence of acute or past HEV. Of participants with any evidence of HEV infection, 305 (88.2%) were cis-gender men; 215 (62.1%) were MSM. Ninety-five participants had evidence of acute HEV, 52 of whom had positive IgM only and 38 of whom had detectable HEV RNA only (>=200 copies per ml), while 5 had evidence of both positive IgM and viremia. Two participants had evidence of chronic HEV, with RNA detected for greater than 6 months.

Conclusions

Over the past decade, we note significant improvements in screening, treatment, and prevention of viral hepatitis in the SHM cohort.

Between 2016 and 2025, 897 individuals were diagnosed with primary HCV infection (including 254 recent infections), and 145 individuals were diagnosed with in total 166 reinfections. Recent HCV infection and reinfections occurred more often among MSM, 90% of the recent infections and 89% of the reinfections were among MSM. By the end of 2025, 99% of individuals had been screened for HCV. Between 2016 and 2025, the number of individuals with an HCV diagnosis, including reinfections, has decreased from 133 to 58. The proportion of individuals with a HCV diagnosis and born in the Netherlands also decreased and in 2025, more than one third of those with an HCV diagnosis originated from other European countries than the Netherlands. Of the individuals in care between 2016 and 2025, 97% had received treatment for HCV and 98% were successfully treated (including retreatment after earlier treatment failure) and achieved treatment-induced clearance of HCV. Effective treatment with DAAs has reduced the proportion of individuals with positive HCV RNA to 0.2%. HCV reinfection continues to occur, but rates have declined.

Screening for HBV improved over time, with nearly 100% of participants having at least one HBV serological assay available by 2025. Of 1329 participants with a history of chronic HBV, 877 (66.0%) did not have evidence of surface antigen clearance at last observation. Ninety percent of individuals with a history of chronic HBV receive an antiretroviral regimen containing a tenofovir prodrug, the optimal agent for treating HIV/HBV coinfection[18].

Evidence of severe liver disease was documented in 26% of individuals with a history of HCV and 18% of participants with a history of chronic HBV. Rates of hepatocellular carcinoma and liver-related deaths in participants with viral hepatitis and severe liver disease are low.

Vaccination against HBV and HAV in MSM remains incomplete. Among MSM entering care between 2016 and 2025, 23% of vaccine-eligible individuals had no evidence of HBV vaccination or vaccine-induced immunity by the end of observation while 48% had no documented HAV vaccination or immunity.

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9. Children with HIV

Colette Smit, Tom Wolfs, Annemarie van Rossum

***Box 9.1:** Chapter definitions.*

Children with HIV	A child diagnosed with HIV before the age of 15[1,2], whose first visit to a Dutch HIV treatment centre was before the age of 18 years.
Vertically-acquired HIV	Transmission during pregnancy, delivery, or breastfeeding
Non-vertically-acquired HIV	Included sexual transmission or exposure to contaminated blood or blood products.
Viral suppression	reported at thresholds of <200 and <50 copies/ml

***Box 9.2:** Cohort outline.*

Between 1998 and 2025, 511 individuals were diagnosed with HIV before age 15 and registered in the SHM database; 415 entered care in the Netherlands before age 18 and form the paediatric cohort described here. By 2025, 322 of these individuals (78% of the 415) were still in care.
Children in care in 2025 comprise:

- 129 individuals aged <18 years
- 193 individuals aged ≥18 years

Background

Antiretroviral therapy (ART) has markedly reduced morbidity and mortality in children with HIV worldwide[3-7]. Evidence demonstrating the benefits of early ART initiation led to a 2015 revision of the World Health Organization (WHO) guidelines on when to start ART; recommending ART for everyone with HIV (including children), regardless of CD4 cell count[8-12].

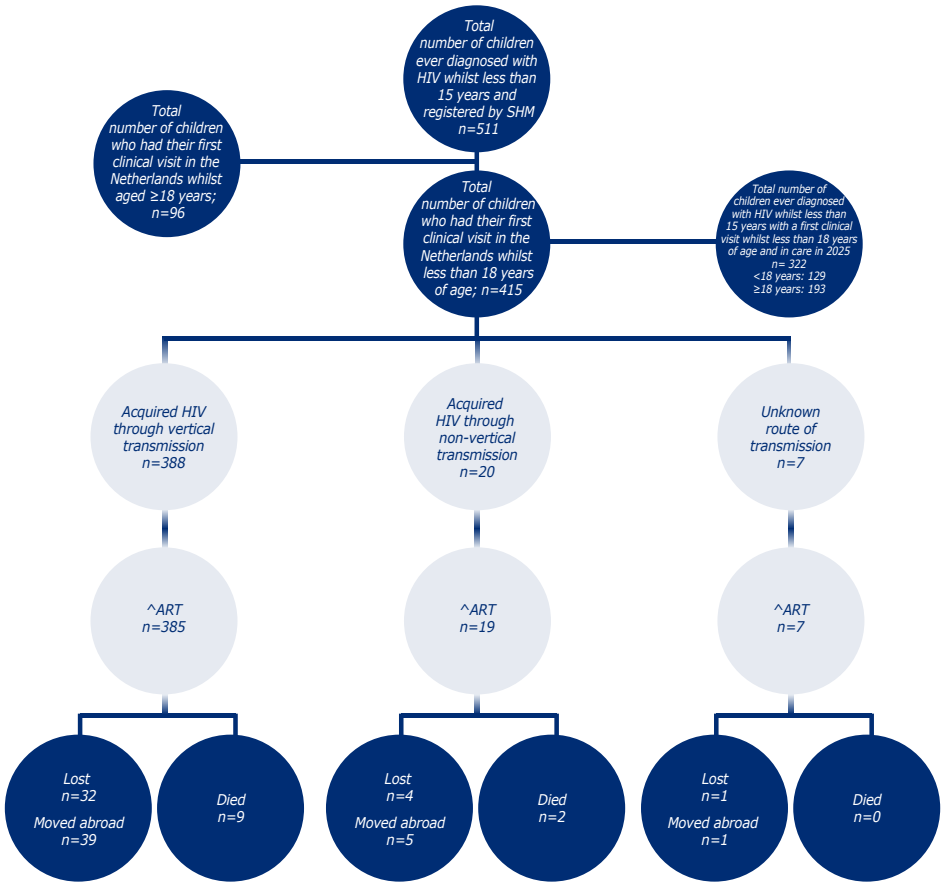
In the Netherlands children with HIV generally receive health care at one of four paediatric HIV treatment centres and transition to adult HIV care around the age of 18. Children diagnosed at older ages through non-vertical transmission more often enter care directly at adult HIV treatment centres. Those aged over 15 years when diagnosed are described as part of the adult population in *Chapter 1*.

This chapter summarises demographics, clinical characteristics, treatment and treatment outcomes between 2016-2025 for children diagnosed with HIV before the age of 15, and ever in care at a Dutch paediatric and/or adult HIV treatment centre before age 18 (*Box 9.2*). The age limit of 15 years aligns with the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) definitions of children [1, 2] .

Ever registered

As of December 2025, 511 individuals diagnosed with HIV before age 15 were registered in the SHM database (*Figure 9.1*). Of these, 415 children entered care in the Netherlands before age 18: the remaining 96 entered care after age 18, most of whom (85%) were born outside the Netherlands and 15% were born in the Netherlands. Those who were born in the Netherlands were diagnosed with HIV before 1996 and were already age 18 or older before the registration started. Among the 511 registered individuals, 415 met the inclusion criteria for description in this chapter.

Figure 9.1: *Overview of total population children with HIV registered in SHM database as of 31 December 2025.*



Legend: *^ of the total number of children who acquired HIV through a vertical, non-vertical or an unknown route of transmission. Legend: ART = antiretroviral therapy.*

Most children (97%) first attended paediatric care; only 12 first presented to an adult HIV treatment centre (median age of 17.1 years (IQR 16.3-17.5). Sub Saharan Africa was the most frequent region of origin (57%), followed by the Netherlands (27%) and other regions (16%). Detailed characteristics by transmission route are shown in *Table 9.1*.

Table 9.1: *Demographic and HIV-related characteristics of 415 children with HIV ever registered by SHM who were diagnosed before 15 years of age and entered care in the Netherlands below the age of 18.*

Characteristics	Total	Vertical transmission	Non-vertical transmission	Route of transmission unknown
Total N (%)	415	388 (93.5)	20 (4.8)	7 (1.7)
HIV treatment centre				
Paediatric care	403 (97.1)	380 (97.9)	16 (80.0)	7 (100.0)
Adult care	12 (2.9)	8 (2.1)	4 (20.0)	
Gender				
Female	211 (50.8)	197 (50.8)	12 (60.0)	2 (28.6)
Male	204 (49.2)	191 (49.2)	8 (40.0)	5 (71.4)
Child region of origin				
Sub-Saharan Africa	237 (57.1)	214 (55.2)	16 (80.0)	7 (100.0)
Netherlands	113 (27.2)	111 (28.6)	2 (10.0)	
Other/unknown	65 (15.7)	63 (16.2)	2 (10.0)	
Mother region of origin				
Sub-Saharan Africa	201 (48.4)	188 (48.5)	8 (40.0)	5 (71.4)
Other/unknown	179 (43.1)	167 (43.0)	10 (50.0)	2 (28.6)
Netherlands	35 (8.4)	33 (8.5)	2 (10.0)	
Adopted	155 (37.3)	153 (39.4)		2 (28.6)
Age at HIV diagnosis				
Median (IQR)	1.2 (0.2 to 4.2)	1.0 (0.2 to 3.5)	11.5 (7.4 to 14.3)	10.9 (10.2 to 11.7)
ART-treated	411 (99.0)	385 (99.2)	19 (95.0)	7 (100.0)
Therapy-naïve at ART initiation	360 (86.7)	337 (86.9)	16 (80.0)	7 (100.0)
CD4 at ART initiation				
Median (IQR)	540.0 (275.0 to 1152.0)	555.0 (279.8 to 1217.5)	323.5 (176.5 to 472.0)	475.0 (320.0 to 570.0)
CD4 Z-score at ART initiation				
Median (IQR)	-0.9 (-1.3 to -0.5)	-0.9 (-1.3 to -0.5)	-0.8 (-1.2 to -0.5)	-0.4 (-0.6 to -0.3)
VL (log copies/ml) at ART initiation				
Median (IQR)	5.1 (4.4 to 5.8)	5.2 (4.5 to 5.8)	4.3 (4.0 to 5.5)	4.9 (4.7 to 5.0)

Legend: **Data are number (%) of children or median (interquartile range). ART = antiretroviral therapy; VL = viral load.*

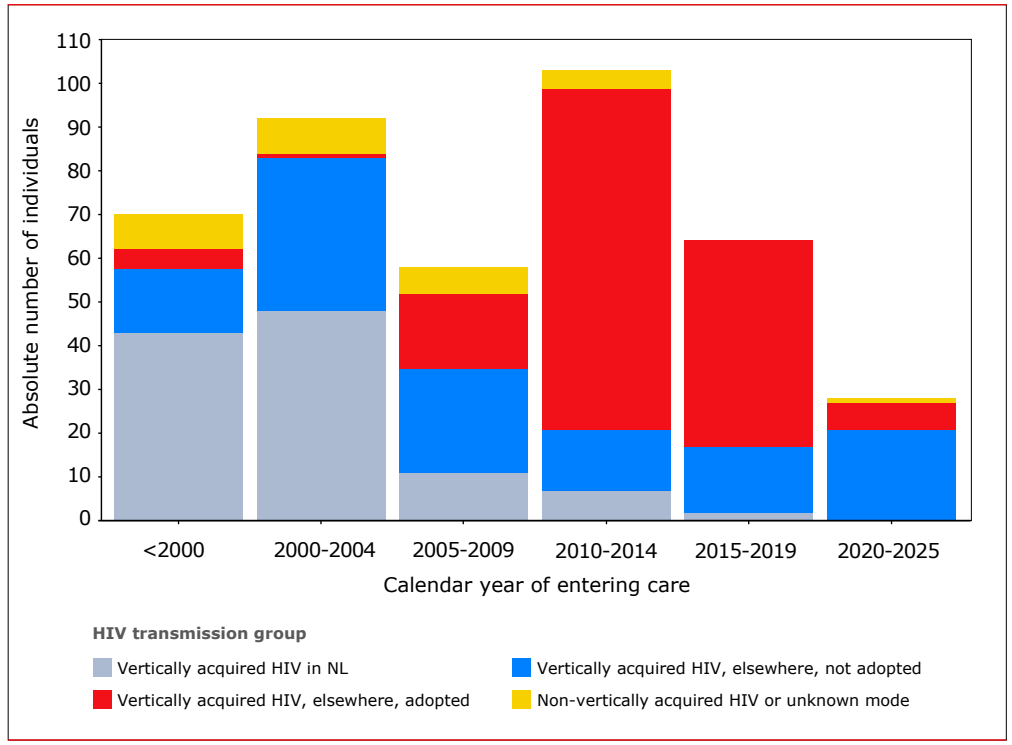
Mode of transmission

Vertical transmission

- Vertical transmission was the predominant mode of transmission, accounting for 94% of the children (n=388).
- Median age at first reported HIV-positive test result (including self-reported tests performed in the country of origin), was 1.0 years (interquartile range [IQR] 0.2-3.5 years).
- Nearly all children received care in a paediatric HIV treatment centre in the Netherlands.
- ART initiation was documented for 99% of the children.
- Just over half of the children were born in sub-Saharan Africa (55%), and 29% were born in the Netherlands.

Vertical transmission within the Netherlands has declined substantially following the introduction of the national standardized antenatal HIV screening in 2004[13, 14]. Vertical transmission in the Netherlands declined sharply from 2005 onwards and has become rare in the recent years (*Figure 9.2*), reflecting effective antenatal screening and treatment of pregnant women living with HIV.

*Figure 9.2: Number of children with HIV by year **of entering care** in the Netherlands, stratified by mode of HIV transmission and adoption status.*



Note: The numbers of children with non-vertically-acquired HIV or unknown mode of HIV transmission entering care were too small for stratification by mode of acquisition.

Non-vertical transmission

- Non-vertical transmission was rare: 20 children (5%) acquired HIV through heterosexual transmission or exposure to contaminated blood and blood products or medical procedures.
- Median age at diagnosis was 11.5 years (IQR 7.4-14.3). Among those with heterosexual transmission, median age at diagnosis was 14.7 years (IQR 13.8-14.9).
- Most of these children (95%) started ART.
- 80% were born in Sub-Saharan Africa.
- And 20% received care in an adult HIV treatment centre.

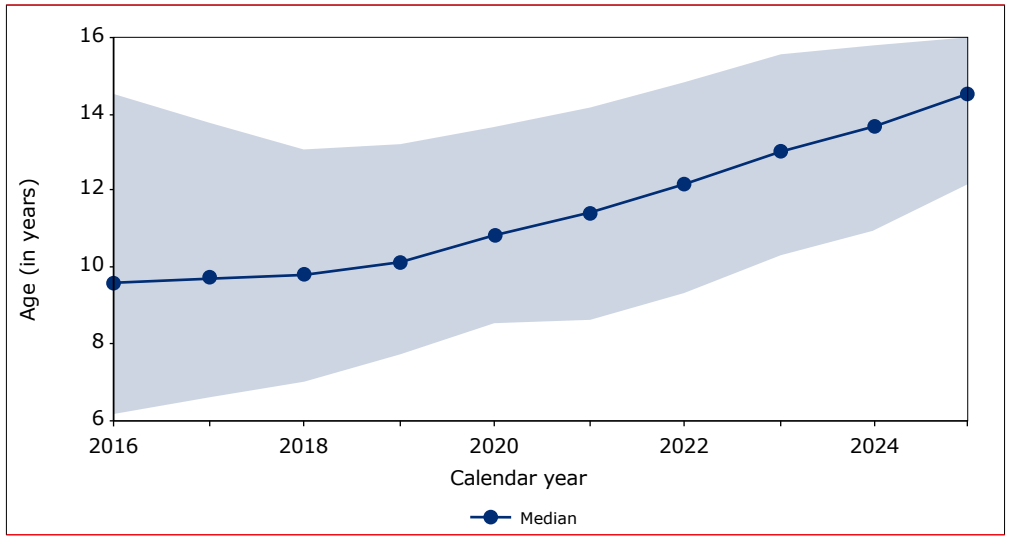
Unknown route of HIV transmission

- For 7 children with HIV, the route of transmission remains unknown (*Table 9.1*).
- Their median age at diagnosis was 10.9 years (IQR 10.2-11.7).
- All children had started ART.

Age distribution

Figure 9.3 shows the age distribution of children receiving HIV care in the last 10 years (2016-2025). The median age of children in HIV care in the Netherlands has increased steadily over the past decade, from 9.6 (IQR:6.1-14.5) years in 2016 to 14.6 (IQR:12.2-16.1) years in 2025. This increasing median age is a result of more children reaching the age of 18 years and, at the same time, fewer children are newly entering care (*Figure 9.2*).

Figure 9.3: *Time-dependent age distribution of children with HIV in care over time.*



Low mortality rates

Mortality in this cohort has been low. No child registered with SHM died before age 18 between 2016 and 2025. Since the start of registration, two deaths before age 18 have been recorded, both due to AIDS before 2010. However, between 2016 and 2025, 7 young adults diagnosed with HIV in childhood died at a median age of 26.8 years (IQR 24.9–29.8); 5 deaths were AIDS-related and two were due to non-AIDS related underlying cause of death, according to the Coding of Death format[15].

Antiretroviral treatment

Of the 415 children who entered care before age 18, 411 (99%) started ART. The majority (87%) were ART-naïve at initiation; 12% had prior exposure to mono- or dual therapy. Four children never received ART; all have left care, with last contact dates between 1998 and 2010.

For analyses of prescribed ART regimens and outcomes, children who initiated ART from 2016 onwards were included, irrespective of prior therapy. In this period, 54 children started ART (n=41 between 2016–2019:n=13 between 2020–2025).

Initial antiretroviral regimen

Among 54 children with documented ART initiation between 2016 and 2025:

- 52% started a protease inhibitor (PI).
- 24% started a non-nucleoside reverse transcriptase inhibitor (NNRTI).
- 24% started an integrase strand transfer inhibitor (INSTI) .
- INSTI-containing first regimens increased from 20% between 2016-2020 to 38% in the last 5 years, while PI containing first regimens decreased from 59% between 2016-2020 to 31% in the last 5 years.

Over half of these children (59%) were already on ART before entering care in the Netherlands; focusing on initial regimens started in the Netherlands (n=22):

- 45% started with a INSTI-containing regimen,
- 41% with an PI-containing regimen,
- 14% with an NNRTI-containing regimen.
- Since 2019, only INSTI-containing regimens were started in the Netherlands.

Ritonavir-boosted lopinavir was the most commonly used PI. Following the introduction of dolutegravir in 2014, INSTI-containing first-line regimens became more frequent: dolutegravir was used in 22% of children initiating ART in 2016–2025.

Discontinuation of the initial ART regimen

Of the 54 children initiating ART between 2016 and 2025, 49 (90%) discontinued their initial regimen. Median time on the first-line regimen was 16 months (IQR 1–39). Excluding weight-related dose adjustments, the main reasons for change were simplification (35%) and toxicity (10%).

Virological response

Virological response was assessed using viral load thresholds of 50 copies/ml and 200 copies/ml. Initial response was evaluated for the first two years after ART initiation between 2016–2025, and long-term response by time-updated age among children on ART for ≥24 months (*Figure 9.4*).

Initial response to ART

Data from 37 children initiating ART between 2016 and 2025 with available viral load measurements in the first 24 months were analysed. Children were grouped by age at ART initiation:

1. 0–2 years (n=18)
2. 2–18 years (n=19)

Viral suppression was assessed at 24-week intervals, using measurements closest to each time point (±8 weeks).

- Children aged 0–2 years at ART initiation
  - Suppression <50 copies/ml: 50% at 24 weeks, 92% at 2 years
- Children aged 2–18 years at ART initiation
  - Suppression <50 copies/ml: 69% at 24 weeks, 94% at 2 years.

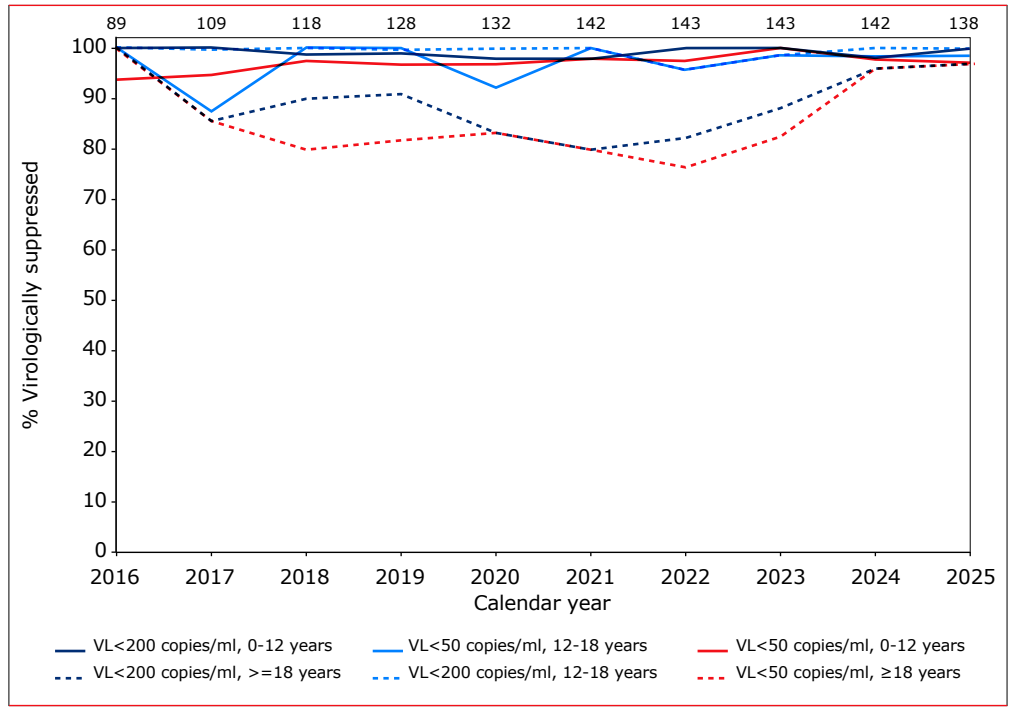
Long-term virological response

For children on ART for more than 24 months, the latest viral load measurement per calendar year was used to calculate annual suppression rates. Time-updated age was categorised as:

1. <12 years
2. 12–18 years
3. ≥18 years

Viral suppression rates remained high during childhood and adolescence but declined after age 18 (*Figure 9.4*). Given the small numbers in each calendar year, estimates for the oldest age group are more susceptible to variability.

Figure 9.4: Viral suppression following antiretroviral therapy (ART) initiation: Time-dependent and age-dependent viral suppression rates for children in care between 2016 and 2025 with at least two years with ART. Viral suppression is defined as any viral load measurement below 50 copies/ml, except for time points in the past where tests were used with quantification limits above 50 copies/ml. The numbers above the lines represent the total number of individuals with an viral load measurement.



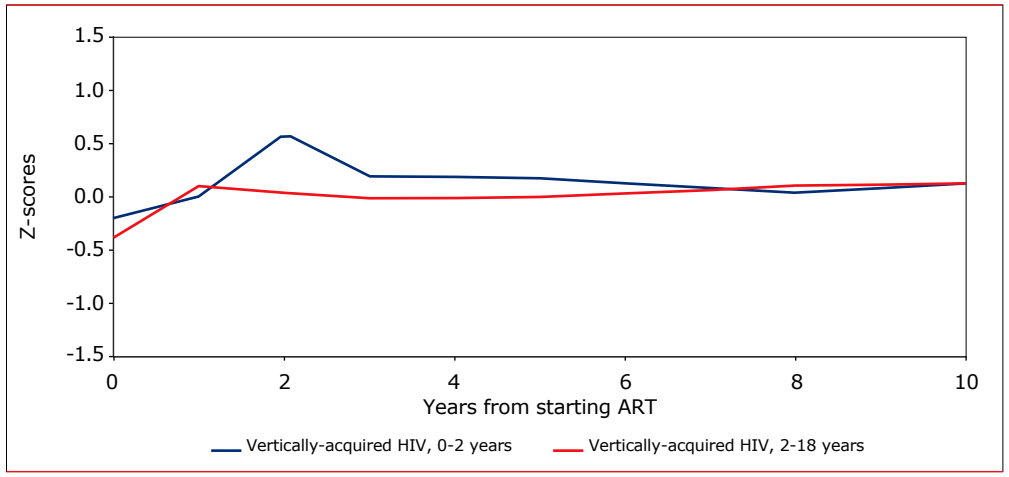
Legend: VL = viral load.

Immunological response

Clinical benefit of ART is closely linked to CD4 cell recovery[16]. Because normal CD4 counts vary strongly with age, CD4 trajectories were analysed using age-standardised Z-scores based on reference values from HIV-negative children[17,18]. A Z-score of zero represents the age-appropriate median. A CD4 Z-score of minus 1 indicates that a child's CD4 cell count is 1 standard deviation below the age-specific median of the HIV-negative population.

Figure 9.5 shows CD4 Z-score changes among children with vertically acquired HIV who initiated ART between 2016 and 2025, stratified by age at ART initiation (0–2 years vs 2–18 years). In both age groups, CD4 Z-scores increased during the first year after initiation. In the second year, the increase was less pronounced in children who started ART at ages 2–18 years.

Figure 9.5: *Changes in Z-scores for CD4 cell counts among children with HIV, stratified by age at initiation of antiretroviral therapy (ART), who initiated ART between 2016 and 2025.*



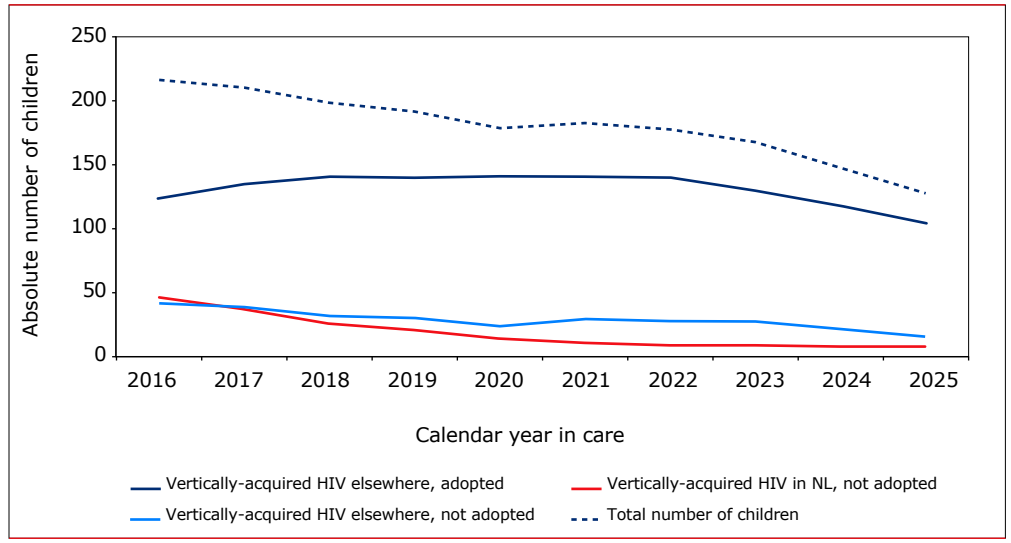
Blue: *age at ART initiation 0–2 years;* ***Red:*** *age at ART initiation 2–18 years;*
Legend: *ART = antiretroviral therapy.*

Currently in clinical care (as of 31 December 2025)

Of the 415 children ever registered who entered care before age 18, 322 (78%) were still in care in 2025, and 93 (22%) were no longer in care. Among the 93 no longer in care: 11 had died, 45 had moved abroad, 37 were lost to care.

Of the 322 individuals still in care, 129 were younger than 18 years (*Figure 9.1*). The number of children under 18 was 218 in 2016 and declined to 149 in 2024 and 129 in 2025, primarily because more children reached adulthood and fewer new cases entered paediatric care (*Figure 9.6*).

Figure 9.6: *Number of children aged <18 years known to be in care at the end of each calendar year shown by mode of HIV transmission and adoption status. Note: Children with non-vertically-acquired HIV are not reported as a separate category due to their small numbers, but they are included in the total number of children in care.*



Currently in care and under 18 years of age

- 129 were <18 years, of whom 74 were <15 years
- Median age: 14.6 years (IQR 12.2-16.1)

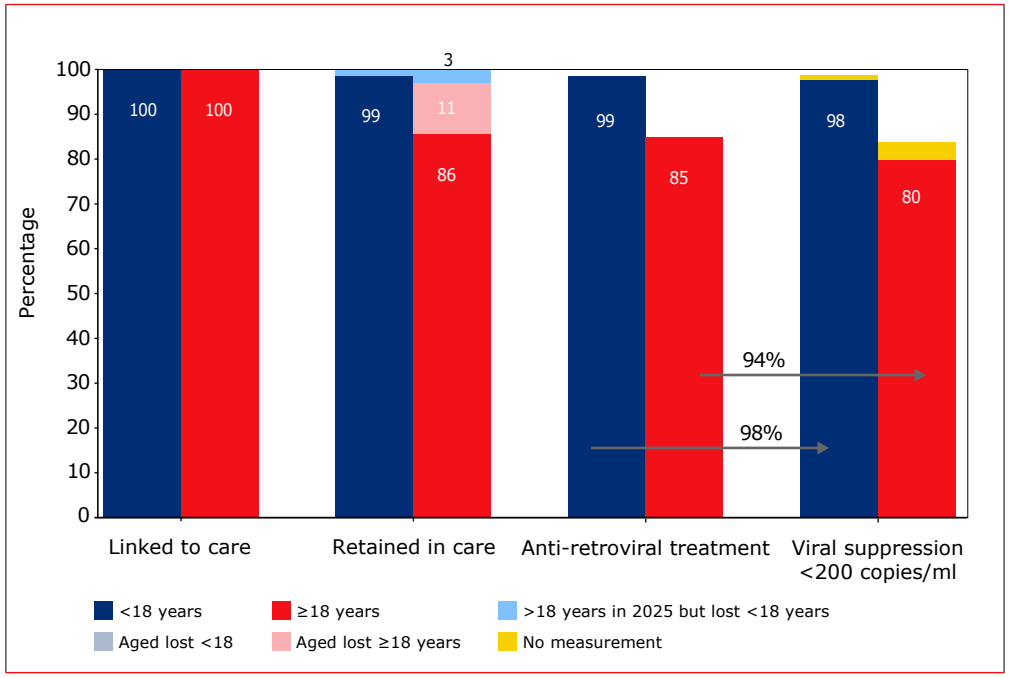
Currently in clinical care and 18 years or older

- 193 were ≥18 years at the end of 2025
- Median age: 26.6 years (IQR 21.9-31.2)

Continuum of care

A continuum of care was constructed for all children ever registered by SHM who were still alive in 2025 and not reported to have moved abroad. Individuals were stratified by current age (<18 vs ≥18 years), and steps included linkage to care, retention, ART use, and viral suppression <200 copies/ml (*Figure 9.7*).

Figure 9.7: *Continuum of care by age, as of 31 December 2025. The numbers in and above the bars indicate the proportion of individuals.*



Continuum of care: current age under 18 years

- 130 children were linked to care
- 129 (99%) were retained in care; one was lost to care
- All children in care were on ART at their last clinical visit in 2025
- 127 (98%) of all children had a most recent HIV RNA measurement <200 c/ml

Continuum of care: current age 18 years or older

- 224 individuals were linked to care
- 193 (86%) were retained in care; 31 were lost to care (21 born outside the Netherlands). Six were lost before age 18, and 25 after age 18
- 191 (85%) were on ART at their last clinical visit in 2025
- 179 (80%) of all individuals had a most recent HIV RNA measurement <200 c/ml (94% among those on ART)

Ten of the 31 young adults lost to care had their last clinical contact at a paediatric centre and may have been lost during transition to adult care or awaiting registration at an adult centre.

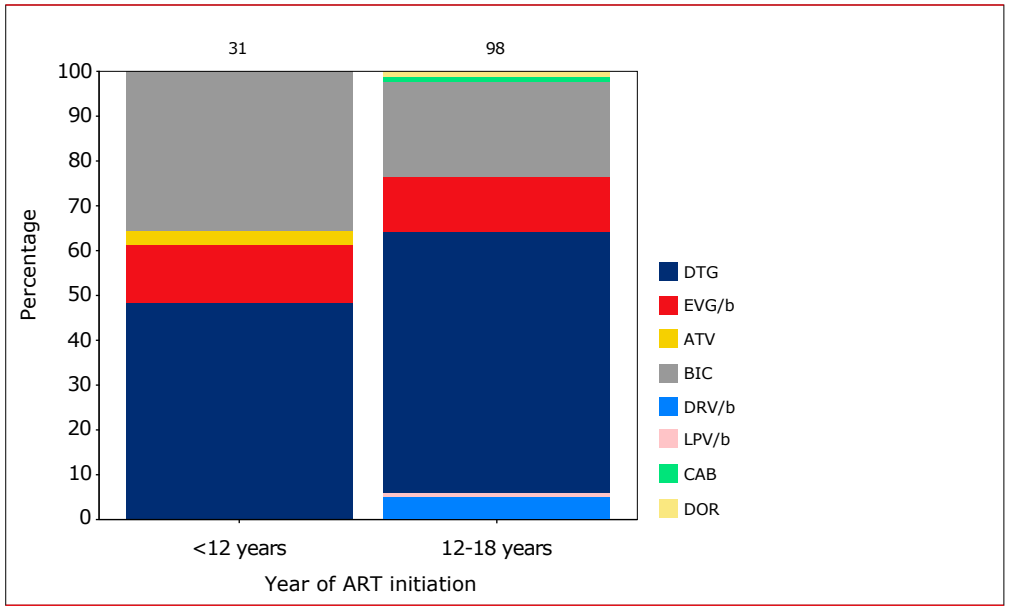
In care and on ART in 2025

Of the 129 children in care and <18 years in 2025, all were on ART at their last visit. The current regimen composition by age was:

- Children <12 years
  - All except one child used INSTI-based regimens
  - Dolutegravir (48%) and bictegravir (35%) were the most common third agents
- Children 12–18 years
  - 93% used INSTI-based regimens
  - 6% were on PI-based regimens

Among INSTI-based regimens, dolutegravir was most common (58%), followed by bictegravir (21%) and elvitegravir (12%).

*,**Figure 9.8:** Third-drug additions to the nucleoside reverse transcriptase backbone used as part of the current regimen, stratified by current age. Numbers above the bars represent the total number of individuals initiating ART in that particular calendar year period.*



***Legend:** DRV/b = cobicistat/ritonavir-boosted darunavir; LPV/b = ritonavir-boosted lopinavir; DTG = dolutegravir; EVG/b = cobicistat-boosted elvitegravir; ATV = atazanavir; BIC = bictegravir.*

SPECIAL POPULATIONS

Adopted children

Among the 415 children ever registered who entered care before age 18, 155 (37%) were adopted by Dutch parents. The number of adopted children among newly registered cases increased from less than five before 2000 to 78 children in 2010–2014, 47 children in 2015–2019, and declined to 6 children in 2020–2025 (*Figure 9.2*). Median age at entry into care for adopted children was 2.7 years (IQR 1.5–4.7).

- 72% (112/155) were already on ART before entering care in the Netherlands
- 11% (17/155) had received mono- or dual therapy prior to ART
- All adopted children received ART during care in the Netherlands

As of 31 December 2025, 142 adopted children were alive and in care; 105 were <18 years (median age 15.3 years, IQR 13.0–18.1)(*Figure 9.6*). Thirteen adopted children were no longer in care, because they were lost to follow-up, moved abroad, or died after the age of 18 years. All adopted children still in care in 2025 were on ART, and all but one had HIV RNA <200 copies/mL; 98% had HIV RNA <50 copies/mL.

Transfer to adult care

By 31 December 2025, 218 of the 415 children had reached the age of 18 years or older and transferred from paediatric to adult care. Their follow-up status is summarised in *Figure 9.9*:

- 178 (82%) remained in care in 2025
- 7 (3%) moved abroad
- 8 (4%) were deregistered at paediatric centres but not yet registered at adult centres (possibly administrative delay or loss during transition)
- 18 (8%) were lost to care
- 7 (3%) had died

Median age at last paediatric visit was 18.1 years (IQR 17.7–18.7). The median interval between the last paediatric visit and first visit in an adult HIV treatment center was 4 months (IQR 3–6), and median time in adult care until last documented visit was 8 years (IQR 5–12).

At the last paediatric visit:

- 26 adolescents (12%) had HIV RNA >200 copies/mL (median 4135 copies/mL, IQR 1115–47072)
- 41 adolescents (19%) had HIV RNA >50 copies/mL

However, the proportion with detectable HIV RNA decreased over calendar time: among those transferring in or after 2015, detectable HIV RNA was less frequent than in those transferring earlier (from 20% to 6% for >200 copies/mL, and from 31% to 10% for >50 copies/mL; *Figure 9.10A*).

During the last paediatric visit, 91% of adolescents were on ART, 2% had never started ART, and 7% had discontinued ART. Before 2015, adolescents were more often not on ART at transition compared with transitions in or after 2015 (19% vs 2%; *Figure 9.10B*).

ART regimen shifted over time:

- Adolescents transferring before 2015 were most commonly on NNRTI-based (30%) or PI-based regimens (33%).
- Among those transferring in or after 2015, 61% used INSTI-based regimens, 18% NNRTI-based, and 21% PI-based regimens.
- Of the 218 adolescents who transferred, 87 had a treatment change within 2 years after transfer, 10 of whom were not using treatment at the time of transfer. The most common change was a switch to an INSTI-based regimen (32%).

Of the 178 adolescents who transferred and remained in care by 2025, 168 (94%) were on ART; 72% used INSTI-based regimens. In 2025, 92% had HIV RNA <200 copies/mL and 90% had HIV RNA <50 copies/ml.

Figure 9.9: *Follow up status, as of 31 December 2025, of children who transferred to adult care.*

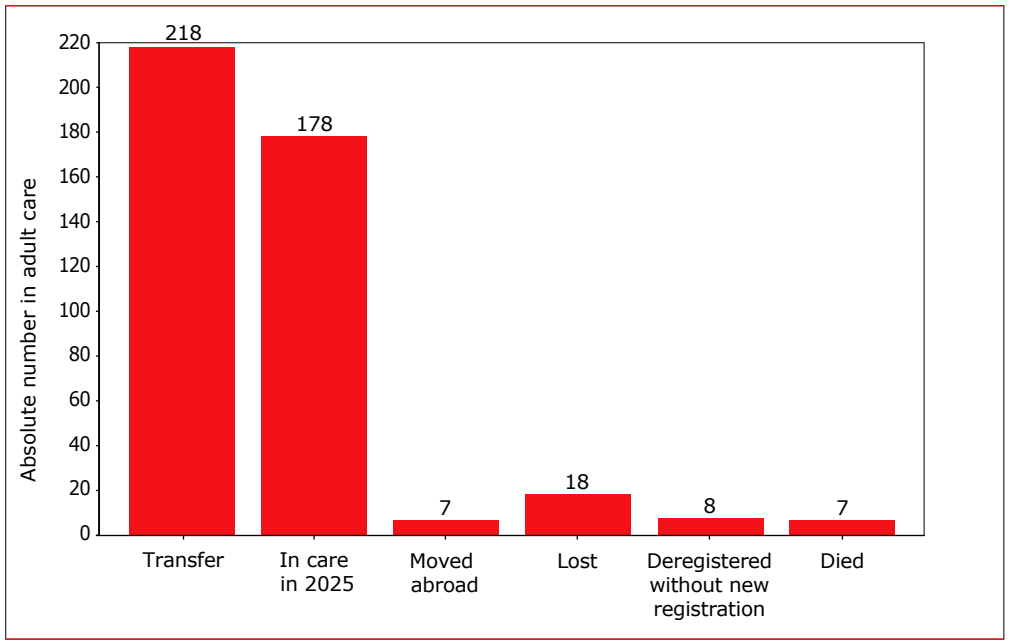
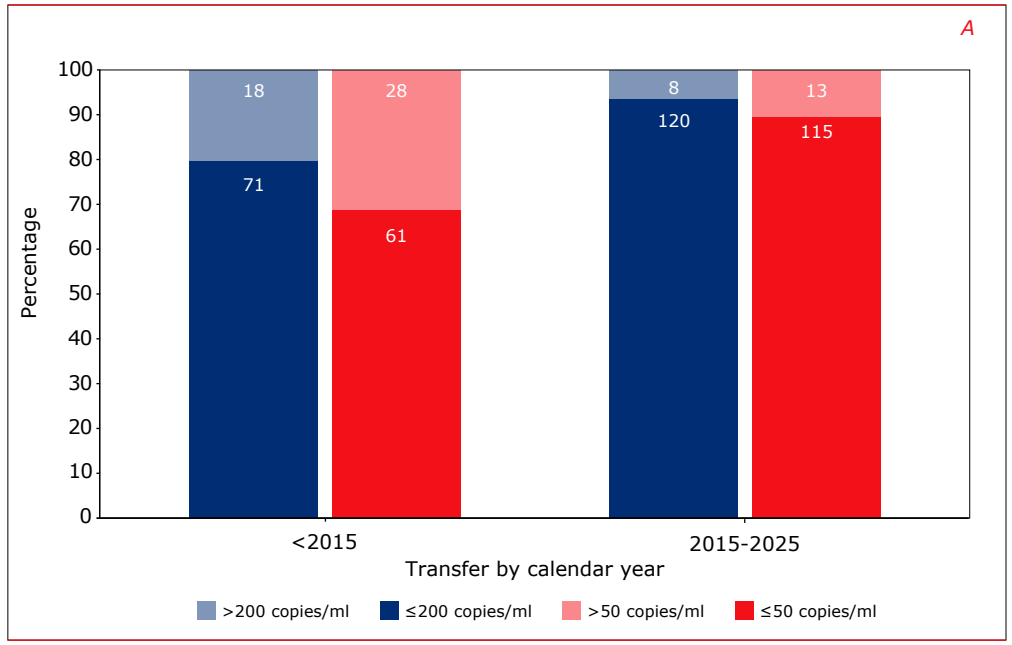
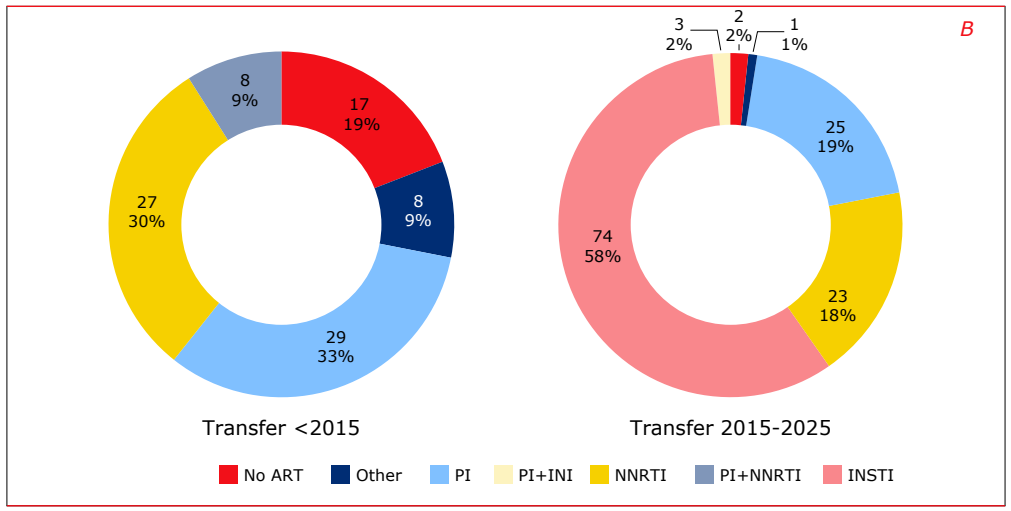


Figure 9.10: *HIV RNA (A) and ART regimens (B) at last visit in paediatric care of children who transferred to adult care, stratified by calendar year of transfer.*





Summary

Of the 415 children ever registered by SHM who entered care before age 18, 78% remained in care in 2025. Clinical outcomes have been favourable: no deaths occurred among children under 18 years over the past decade. Nearly all children (99%) received ART. The use of INSTI-containing regimens increased over time, and have largely replaced PI- and NNRTI-based regimens.
The number of children in paediatric care is declining due to effective prevention of mother-to-child transmission and a reduction in the number of adopted children, combined with an increasing proportion of this cohort reaching adulthood and transitioning to adult care. This transition is associated with lower rates of viral suppression and reduced retention in care compared with paediatric follow-up, indicating that adolescents and young adults require special attention.

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10. Pregnancies in women with HIV

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Introduction

Worldwide, vertical transmission is the most common mode of HIV acquisition in children aged 0–15 years. Without intervention, the risk of vertical transmission ranges from 15% to 45%[1-3]. Combination antiretroviral therapy (ART) during pregnancy has reduced the risk to less than 1%[4,5].

Treatment recommendations have evolved over time: since 2015, ART is recommended for all individuals with HIV, regardless of CD4 cell count[6]. Consequently, most women with HIV are already on ART at conception and are advised to continue therapy throughout pregnancy and postpartum. Timely knowledge of a woman's HIV status is essential to initiate ART and minimize the risk of vertical transmission. In the Netherlands, pregnant women are offered opt-out HIV antibody testing in the first trimester[7], and newborns perinatally exposed to HIV receive post-exposure prophylaxis (PEP) as soon as possible after birth[39].

This chapter describes women who were pregnant during the years 2016 to 2025, a population treated according to the current treatment guidelines. The follow-up and therapy outcomes of all pregnant women in care during the period 1996 to 2018 were described in detail in the 2019 *SHM Monitoring report*[8].

Demographics

Maternal characteristics

Geographical region of origin

Between 2016 and 2025, 735 women with HIV with at least one registered pregnancy received care in the Netherlands (*Table 10.1A*).
These women were born in:

- the Netherlands: 188 (26%)
- sub-Saharan Africa: 327 (45%)
- the Caribbean/Latin America region: 100 (14%)
- and other regions: 120 (16%), including 64 women from Central or Eastern Europe, and 26 women from South and Southeast-East Asia.

Diagnosis

Most women (n=626, 85%) were aware of their HIV diagnosis before becoming pregnant; this proportion did not differ between women of Dutch and non-Dutch origin. The remaining 109 women were diagnosed during pregnancy, mostly through the national pregnancy screening programme. The proportion of women newly diagnosed during pregnancy varied between 7% and 13% per year over 2016-2025. These 109 women were born in:

- the Netherlands: 24/188 (13%)
- sub-Saharan Africa: 52/327 (16%)
- the Caribbean/Latin America region: 15/100 (15%)
- and other regions: 18/120 (15%)

Among newly diagnosed women, the median time from conception to diagnosis was 13 weeks (IQR: 11-18):

- 56% were diagnosed in the first trimester,
- 36% in the second,
- and 8% in the third.

Fifty-seven of these 109 women reported a previous negative HIV test, the remaining 52 did not report ever having tested for HIV before. The SHM database does not record whether these earlier tests were part of the national pregnancy screening.

For newly diagnosed pregnant women, the median time from blood sampling to first contact with an HIV treatment centre was 8 days (5-17), and from first visit to ART initiation 8 days (IQR 1-15). The timing of diagnosis by the obstetric caregiver and referral to an HIV treatment centre is not recorded.

Clinical characteristics

The median CD4 cell count at the first measurement after conception was 570 cells/mm^3 (IQR 380-770); 7% of the women had a CD4 cell count below 200 cells/ mm^3. Women who were newly diagnosed (and starting ART) during pregnancy had a lower median CD4 cell count(330 cells/mm^3, IQR 212-459). Because haemodilution lowers CD4 cell counts during pregnancy[9], CD4 cell percentages may be a more reliable parameter; these were also lower among the group of women newly diagnosed during pregnancy (*Table 10.1A*).

Mode of HIV acquisition

The self-reported mode of HIV acquisition among the 735 women was (*Table 10.1A*):

- Heterosexual contact: 641 (87%)
- Vertical transmission: 45 (6%)
- Other: 49 (7%), including exposure to contaminated blood or medical procedures (n=18), injecting druguse (n=4), and unknown mode (n=27).

Population no longer in care

In total 69 (9%) women were no longer in care in the Netherlands

- 27 (4%) were known to have moved abroad; one woman moved during pregnancy
- 33 were lost to follow-up (4%) and
- 9 (1%) women were documented to have died during follow up.

All but two women were lost to follow-up after their pregnancy ended; with a median of 31 months (IQR: 8-59) between delivery and last clinical visit; and 31 women had at least one clinical visit after pregnancy.

Of the women who were lost to follow-up:

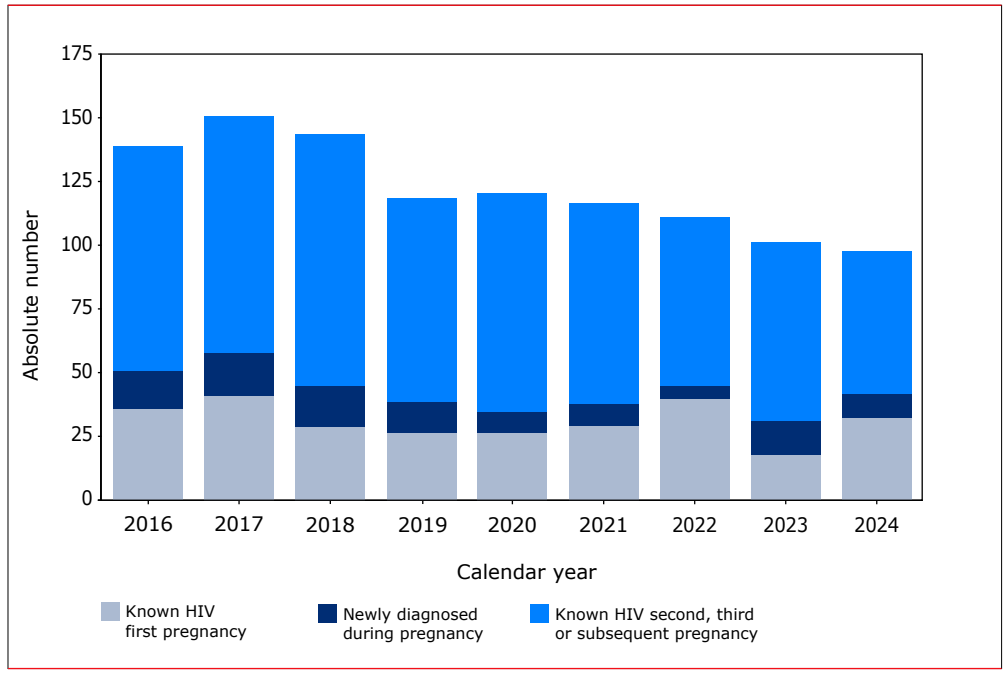
- 13 women started ART during their pregnancy, 10 were newly diagnosed with HIV;
- all but three women had a documented ART regimen at their last clinical visit.
- five women had detectable HIV RNA (660-177710 copies/ml) during the last clinical visit.
- of the 33 pregnancies among these women, 26 resulted in a live-birth, seven pregnancies ended before 24 weeks.
- vertical transmission was not reported in any of these pregnancies.

Nine women died during follow up, all after their pregnancy at a median age of 40 years (IQR: 39-46). Three had delivered a child and in the other women the pregnancy was terminated by induced abortion or miscarriage. Two women died of aids-related causes, the cause of death was a non-aids-related in six women and in one woman the cause was unknown.

Number of pregnancies in women with HIV over time

Between 2016 and 2025, 1,142 pregnancies were reported among 735 women. The annual number of pregnancies declined from 151 in 2017 to 98 in 2024 (*Figure 10.1*). The number of women newly diagnosed during pregnancy varied between 17 in 2017 and five in 2022, corresponding 5-13% of all pregnancies among women living with HIV per year. Each year, approximately 80 women with a previous pregnancy, became pregnant again (*Figure 10.1*).

Figure 10.1: *Absolute number of first and subsequent pregnancies per year, stratified by whether HIV status was already known before pregnancy, or newly diagnosed during pregnancy.*



Note: *there is backlog in data collection of pregnancy related data for pregnancies starting in the most recent year in the SHM database (2025). Therefore, the most recent calendar year is not shown in the figure.*

Pregnancy-related characteristics

The 735 women accounted for 1,142 registered pregnancies:

- 22% of women had one registered pregnancy,
- 27% two,
- 52% three or more (*Table 10.1B*).

Table 10.1A: *Maternal characteristics: of pregnant women with HIV registered and monitored by stichting hiv monitoring between 2016-2025.*

	Total	Nether-lands	Sub-Saharan Africa	Caribbean/ South America	Other	p
Total number of women N (%)	735	188 (25.6)	327 (44.5)	100 (13.6)	120 (16.3)	
HIV diagnosis before pregnancy	626 (85.2)	164 (87.2)	275 (84.1)	85 (85.0)	102 (85.0)	0.817
Newly diagnosed during pregnancy	109 (14.8)	24 (12.8)	52 (15.9)	15 (15.0)	18 (15.0)	
Age at start of first pregnancy following HIV diagnosis						
Median (IQR)	33.2 (29.1 to 36.9)	32.2 (28.0 to 35.8)	33.3 (29.2 to 36.9)	34.3 (29.7 to 37.6)	34.3 (29.8 to 38.4)	0.004
HIV transmission route						
Heterosexual contact	641 (87.2)	165 (87.8)	297 (90.8)	95 (95.0)	84 (70.0)	<0.001
Other~	49 (6.7)	9 (4.8)	8 (2.4)	1 (1.0)	31 (25.8)	
Vertical transmission	45 (6.1)	14 (7.4)	22 (6.7)	4 (4.0)	5 (4.2)	
First CD4 count in pregnancy						
Median (IQR)	570.0 (380.0 to 770.0)	650.0 (500.0 to 830.0)	501.5 (330.0 to 727.0)	588.0 (350.0 to 790.0)	550.0 (418.5 to 833.5)	<0.001
CD4 percentage						
Median (IQR)	32.6 (23.6 to 40.0)	37.6 (27.6 to 42.8)	29.2 (20.6 to 37.9)	29.8 (24.8 to 37.8)	32.6 (26.3 to 41.1	0.002
First CD4 count when newly diagnosed during pregnancy						
Median (IQR)	330.0 (211.5 to 459.0)	352.5 (298.2 to 530.0)	270.0 (182.0 to 443.2)	320.0 (200.0 to 470.0)	360.0 (290.0 to 423.0)	0.304
CD4 percentage when newly diagnoses during pregnancy						
Median (IQR)	22.5 (16.1 to 25.8)	25.6 (23.3 to 31.4)	20.9 (12.5 to 23.0)	17.3 (13.9 to 29.2)	23.5 (18.6 to 24.6)	0.078

~ Mode of HIV transmission was exposure to contaminated blood or medical procedures (n=18), injecting drug use (n=4), or unknown (n=27).

Table 10.1B: Pregnancy-related characteristics of pregnant women with HIV registered and monitored by stichting hiv monitoring between 2016-2025.

	Total	Nether-lands	Sub-Saharan Africa	Caribbean/ South America	Other	p
Total number of pregnancies N (%)	1142	297 (26.0)	521 (45.6)	149 (13.0)	175 (15.3)	
Total number of pregnancies ever after 2016						
3	589 (51.6)	136 (45.8)	300 (57.6)	78 (52.3)	75 (42.9)	<0.001
2	305 (26.7)	100 (33.7)	109 (20.9)	43 (28.9)	53 (30.3)	
1	248 (21.7)	61 (20.5)	112 (21.5)	28 (18.8)	47 (26.9)	
Pregnancy outcome						
Delivery after at least 24 weeks	749 (65.6)	199 (67.0)	337 (64.7)	92 (61.7)	121 (69.1)	0.643
Miscarriage or stillbirth,	246 (21.5)	57 (19.2)	120 (23.0)	32 (21.5)	37 (21.1)	
Induced abortion,	144 (12.6)	40 (13.5)	62 (11.9)	25 (16.8)	17 (9.7)	
Unknown	3 (0.3) [a]					
Mode of delivery						
Vaginal	510 (44.7)	153 (51.5)	213 (40.9)	58 (38.9)	86 (49.1)	0.045
Caesarean, secondary	115 (10.1)	27 (9.1)	57 (10.9)	13 (8.7)	18 (10.3)	
Caesarean, elective	117 (10.2)	18 (6.1)	61 (11.7)	21 (14.1)	17 (9.7)	
Pregnancy duration was	394 (34.5)	98 (33.0)	185 (35.5)	57 (38.3)	54 (30.9)	
<24 weeks						
Unknown	6 (0.5) [a]					
Pregnancy duration						
≥37 weeks	659 (57.7)	167 (56.2)	305 (58.5)	79 (53.0)	108 (61.7)	0.140
34-36 weeks	60 (5.3)	21 (7.1)	18 (3.5)	11 (7.4)	10 (5.7)	
28-33 weeks	22 (1.9) [a]					
26-27 weeks	3 (0.3) [a]					
24-25 weeks	4 (0.4) [a]					
<24 weeks	394 (34.5)	98 (33.0)	185 (35.5)	57 (38.3)	54 (30.9)	
Birth weight (grams)						
Median (IQR)	3120.0 (2768.8 to 3481.2)	3135.0 (2692.5 to 3422.5)	3130.0 (2805.0 to 3517.0)	3036.5 (2737.5 to 3475.0)	3075.0 (2820.0 to 3495.0)	0.489
Perinatal death	5 (0.4) [a]					

[a] *Counts <5 are not reported separately for the regions of origin.*

Table 10.1C: ART initiation among pregnant women with HIV registered and monitored by stichting hiv monitoring between 2016-2025.

	Total	Nether-lands	Sub-Saharan Africa	Caribbean/ South America	Other	p
Total number of births N (%)	749	199 (26.6)	337 (45.0)	92 (12.3)	121 (16.2)	
Antiretroviral therapy started						
Before pregnancy	630 (84.1)	174 (87.4)	276 (81.9)	77 (83.7)	103 (85.1)	0.394
During pregnancy	119 (15.9)	25 (12.6)	61 (18.1)	15 (16.3)	18 (14.9)	
Latest available plasma HIV RNA level prior to delivery						
<50 copies/ml	723 (96.5)	195 (98.0)	322 (95.6)	88 (95.7)	118 (97.5)	0.617
50-500 copies/ml	17 (2.3) [a]					
>500 copies/ml	5 (0.7) [a]					
no HIV RNA	4 (0.5) [a]					
Time between delivery and latest HIV RNA measurement (weeks)						
Median (IQR)	2.4 (0.9 to 4.1)	2.4 (1.0 to 4.4)	2.3 (0.9 to 3.9)	2.4 (1.0 to 4.1)	2.6 (0.9 to 4.3)	0.859

[a] *Counts <5 are not reported separately for the regions of origin.*

Pregnancy outcome

Of the 1,142 pregnancies, 749 (66%) resulted in a birth after ≥24 weeks (including 14 twin pregnancies), 246 (22%) pregnancies ended in miscarriage, 144 (13%) in induced abortion, and three (<1%) had an unknown outcome (*Table 10.1B*).

Pregnancy duration, preterm birth and perinatal death

Of the 749 births (Table 10.1B):

- 659 (88%) occurred at or after 37 weeks,
- 89 (12%) were preterm (defined as a pregnancy duration of 24-37 weeks, these included 50 spontaneous deliveries (including vacuum assisted deliveries) and 38 deliveries by caesarean section (15 elective, 21 secondary, 2 unknown).
- Out of the 89 preterm births: 60 births (5%) had a pregnancy duration of 34-36 weeks, 22 (2%) 28-33 weeks, 3 (<0.5%) 26-27 weeks and 4 (<0.5%) 24-25 weeks (*Table 10.1B*).
- one live birth had an unknown pregnancy duration.

The prevalence of preterm birth is higher than in the general population (7%)[29]. Perinatal death, including antepartum death, occurred in five (<1%) births and congenital disorders were registered for 21 infants.

Mode of delivery

Vaginal delivery is recommended for women with HIV who achieve viral suppression during pregnancy [10,11]. In the presence of detectable HIV RNA levels at, or near delivery, elective Caesarean section is recommended to minimise the risk of vertical transmission: the European AIDS Clinical Society (EACS) guidelines recommend elective Caesarean section when HIV RNA concentration is above 50 copies/ml in weeks 34-36 of pregnancy[12], whereas Dutch guidelines allow vaginal delivery with HIV RNA below 500 copies/ml and declining viral loads[13], with intravenous zidovudine given during labour.

Overall, 68% (n=510) of newborns were delivered vaginally; 77% of women of Dutch origin compared with 63% of women of SSA origin, and 63% of women of Latin America or Caribbean origin. Sixteen percent of newborns were delivered by elective (n=117) and 15% (n=115) by secondary Caesarean section (*Table 10.1B*).
The indication for a secondary caesarean section was not documented for all deliveries. Where documented, reasons were fetal distress (n=43) and failure to progress in labour (n=44).

Antiretroviral therapy and response in pregnant women

Therapy uptake

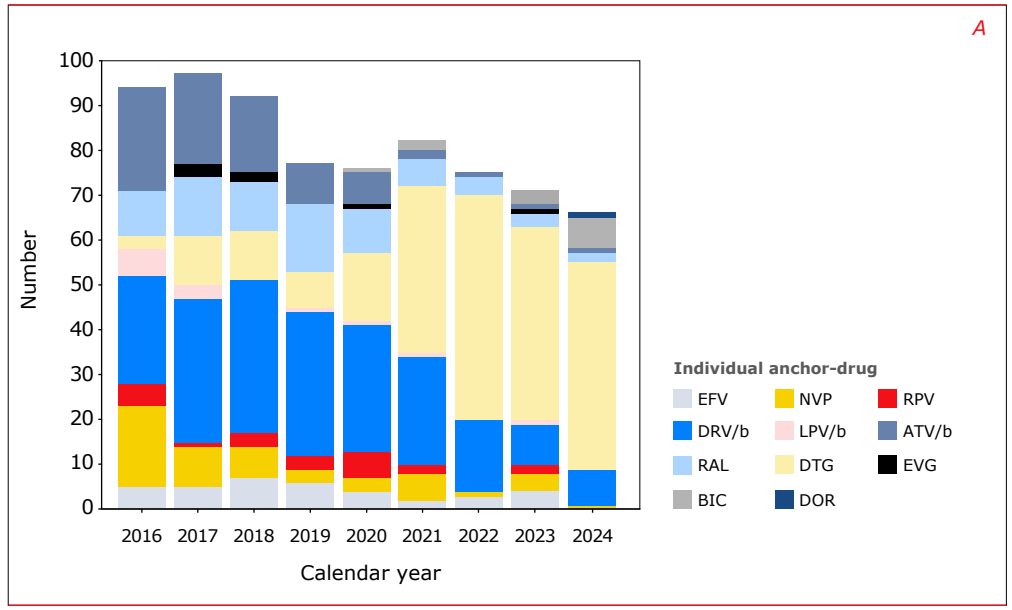
During the 749 pregnancies lasting at least 24 weeks, all women received ART during the pregnancy:

- in 630 (84%) pregnancies, ART was initiated before pregnancy
- and in 119 (16%) pregnancies during pregnancy, including 20 women diagnosed before pregnancy (*Table 10.1C*). One woman discontinued treatment before delivery.

Figure 10.2A shows the most commonly used third-drug additions to the nucleoside analogue reverse transcriptase inhibitor (NRTI) backbone between 2016 and 2024.

- Integrase inhibitors (INSTI) use increased from 4% in 2016 to 74% in 2024.
- NNRTI use decreased from 30% in 2016 to 4% in 2024
- PI use decreased from 57% to 15% (*Figure 10.2C*).
- In 21 pregnancies a two-drug regimen was used, which were mainly INSTI-based combinations.

Figure 10.2A: *The most commonly used third-drug additions to the nucleoside analogue reverse transcriptase inhibitor (NRTI) backbone used as part of ART regimens during pregnancies in 2016-2024 with a minimum duration of 24 weeks.*



Note: *there is backlog in data collection of pregnancy related data for pregnancies starting in the most recent year. Therefore, the most recent calendar year is not shown in the figure.*

Figure 10.2B: *The nucleoside reverse transcriptase (NRTI) backbone used as part of ART regimens during pregnancies in 2016–2024 with an minimum duration of 24 weeks.* ***Note:*** *there is backlog in data collection of pregnancy related data for pregnancies starting in the most recent year in the SHM database (2025). Therefore, the most recent calendar year is not shown in the figure.*

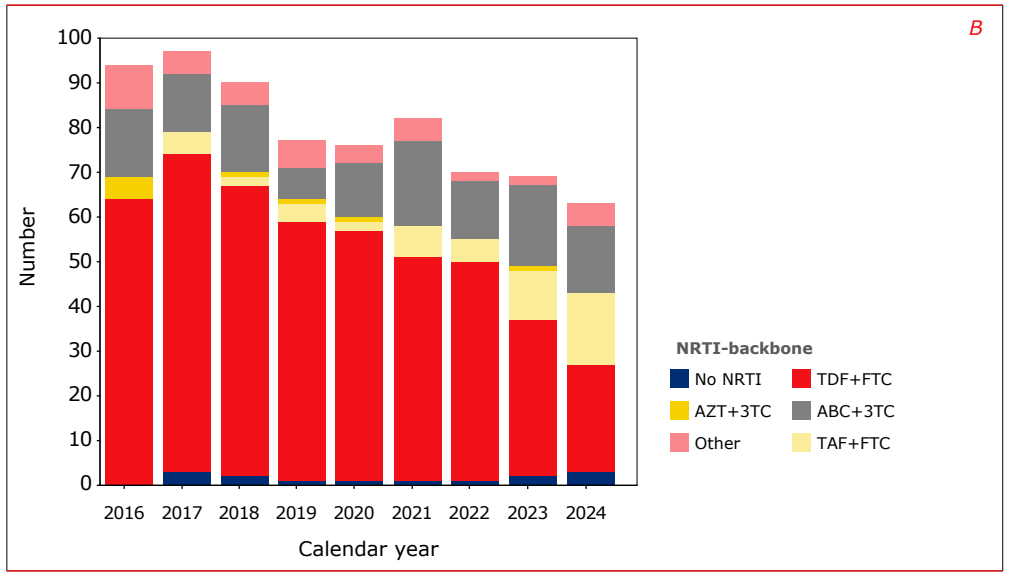
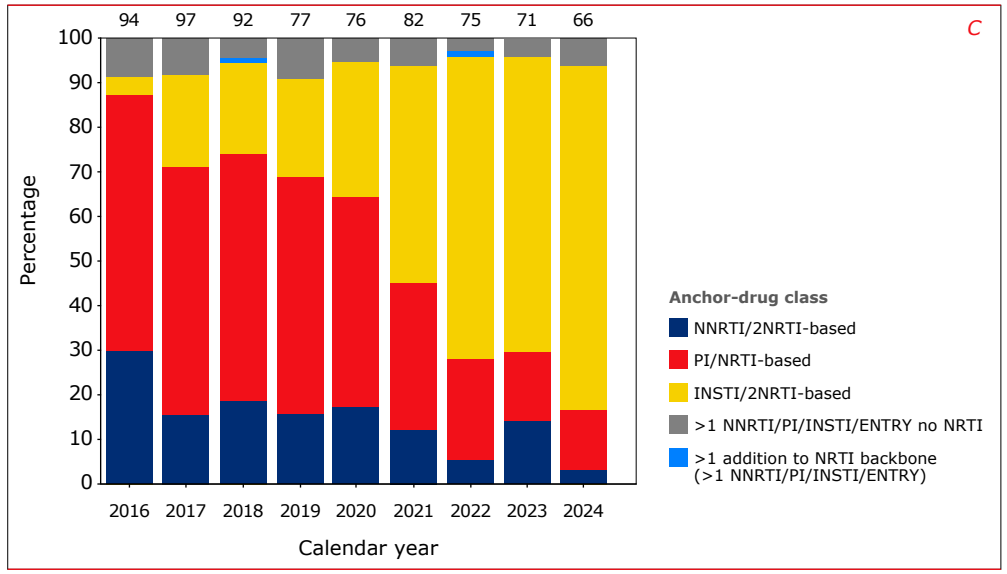


Figure 10.2C: *Antiretroviral class use stratified by calendar year period regimens during pregnancies in 2016–2024, with aminimum duration of 24 weeks.* ***Note:*** *there is backlog in data collection of pregnancy related data for pregnancies starting in the most recent year in the SHM database (2025). Therefore, the most recent calendar year is not shown in the figure.*



Legend: *ENTRY = entry inhibitor; INSTI = integrase inhibitor; NRTI = nucleoside reverse transcriptase inhibitor; NNRTI = non-NRTI; PI = protease inhibitor; 3TC = lamivudine; /b = boosted (cobicistat or ritonavir); ABC = abacavir; ATV = atazanavir; AZT = zidovudine; DRV = darunavir; DTG = dolutegravir; BIC = bictegravir; EFV = efavirenz; EVG = elvitegravir; FTC = emtricitabine; IDV = indinavir; LPV = lopinavir; NFV = nelfinavir; NVP = nevirapine; RAL = raltegravir; RPV = rilpivirine; SQV = saquinavir; TDF = tenofovirdisoproxil fumarate; TAF = tenofovir alafenamide; NRTI = nucleoside analogue reverse transcriptase inhibitor.*

Figure 10.2B provides an overview of the components of the NRTI backbone used during pregnancy between 2016 and 2024. The most commonly prescribed backbones were:

- Tenofovir disoproxil fumarate and emtricitabine (TDF+FTC) (63%).
- Abacavir and lamivudine (ABC+3TC) (17%).
- Tenofovir alafenamide and emtricitabine (TAF+FTC) (7%).

A switch in ART regimen was reported during 370 pregnancies. The most commonly documented reason was pregnancy-related (n=170). In 27% of pregnancy-related switches, a cobicistat-boosted regimen was replaced. Other common pregnancy-related switches included a switch to dolutegravir or from an integrase-containing regimen to a protease inhibitor (darunavir or atazanavir) and switches within the class of integrase inhibitors, particularly from elvitegravir to raltegravir or dolutegravir.

Because cobicistat levels are reduced during the second and third trimesters, with reductions in darunavir and elvitegravir levels when boosted with cobicistat, regimens containing cobicistat were no longer recommended during pregnancy from 2018 onwards[15]. In the Netherlands, cobicistat was used in six pregnancies between 2018 and 2025, all with HIV RNA below 50 copies/ml at the time of delivery.

Therapy response

Figure 10.3 shows the latest available plasma HIV RNA level prior to delivery, in 73% of deliveries this measurement was taken within 4 weeks prior to delivery. HIV RNA levels were categorised as below 50 copies/ml, 50-500 copies/ml, and above 500 copies/ml***a***.

- Overall 97% of the mothers had an HIV RNA below 50 copies/ml, and 3% had an HIV RNA level above 50 copies/ml.
- The proportion of women with an HIV RNA below 50 copies/ml at the time of delivery was above 95% in all years.

In total, 22 women had HIV RNA levels above 50 copies/ml (50-500 copies/ml: n=17, >500 copies/ml: n=5, median RNA=128 copies/ml; minimum=53, maximum=15500) prior to delivery (*Table 10.2*).

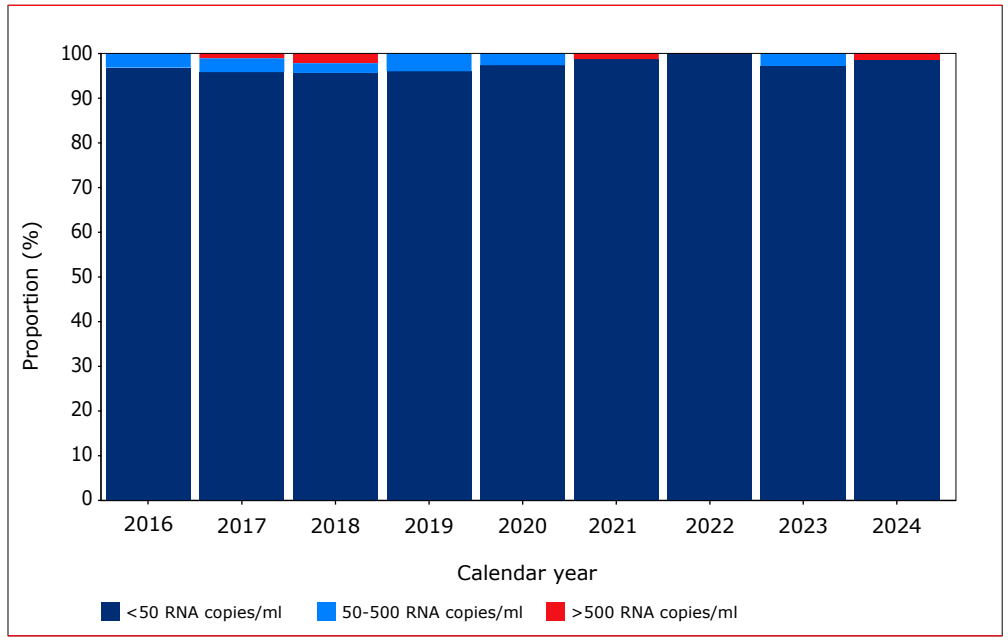
a Dutch guidelines allow a vaginal delivery with HIV RNA below 500 copies/ml and declining viral loads13 or with a undetectable HIV RNA <50 or <20 copies/ml, depending on the used assay.

Table 10.2: *Overview of characteristics of 22 women with a detectable HIV RNA level prior to delivery.*

Women with detectable HIV RNA	22 (3%)	
Age (median, IQR)	32 (27–36)	
Newly diagnosed during pregnancy	7 (32)	4 women were diagnosed after the first trimester.
ART initiated during pregnancy	7 (32)	
ARV at time of detectable HIV RNA*		
INSTI-containing	12 (55)	
NNRTI-containing	2 (9)	
PI-containing	6 (27%)	
unknown	2 (9)	
Mode of delivery		RNA (minimum; maximum)
Caesarean section	15 (68)	53, 15500 copies/ml
Vaginal	4 (18)	73, 1003 copies/ml
Unknown	3 (14)	
Zidovudine during delivery		
Yes	16 (73)	
No	4 (18)	
Unknown	2 (9)	
Evaluation of drug resistance	16	5 women had evidence of low-level resistance or greater (i.e. low, intermediate, high) before or during pregnancy. Of these: • 3 women had high level resistance to at least one NNRTI, • 1 woman had low level resistance to at least one NRTI, • 1 woman had high level multiclass resistance to at least one NRTI, NNRTI and INSTI.

**None of the women used a two-drug regimen at time of detectable HIV RNA.*

Figure 10.3: Distribution of women using ART with their latest HIV RNA levels prior to delivery: <50 copies/ml, 50-500 copies/ml, or >500 copies/ml for pregnancies with a minimum duration of 24 weeks.



Note: there is backlog in data collection of pregnancy related data for pregnancies starting in the most recent year in the SHM database (2025). Therefore, the most recent calendar year is not shown in the figure.

Vertical transmission rate in the Netherlands

Between 2016 and 2025, 749 births were registered among mothers known to be living with HIV before conception or diagnosed during pregnancy. All received ART during their pregnancy and in 97% of pregnancies HIV RNA was below 50 copies/ml. Vertical transmission has become extremely rare in the Netherlands, which is in line with low reported vertical transmission rates in other western European countries[16,17,18,19]. To avoid inadvertent identification of individuals in the case of rare events (defined as fewer than five), the vertical transmission rate is not reported.

Postpartum follow up

Postpartum follow-up was defined as the first 12 months after delivery and considered all pregnancies with a minimum duration of 24 weeks. Therapy, virological suppression, and breastfeeding rates during the postpartum follow-up are described below.

Therapy

Of the 749 pregnancies, 65 were excluded from this analysis: 40 because of insufficient follow-up between delivery and database closure; and 25 because the women were no longer in care (6 had moved abroad and 19 were reported as lost to care during the postpartum period).

For the remaining 684 pregnancies in 528 women, ART was initiated before conception or during pregnancy in 80% and 20% of cases, respectively. The majority of women used an integrase inhibitor-containing regimen during the postpartum period (53%). The use of integrase inhibitor increased from 24% in 2016, to 57% in 2020 and 79% in 2025.

In 41 (6%) of these 684 pregnancies, ART was discontinued postpartum:
The most common documented reasons were:

- patient decision (n=27)
- documented reason was end of pregnancy (n=8)
- In 3 cases the documented reason was experienced ART toxicity

In two cases the documented reason was elite controller or long-term non- progressor[b].

In 17 out of the 41 cases, treatment was restarted after a median of 5.3 weeks (IQR 2.9-9.3). In the remaining 24 cases, ART was not restarted postpartum, however 14 women did start again after the postpartum period had ended. Ten women did not have a documented restart of ART at the time of database closure.

b Elite controller or long-term non-progressor refers to an individual with HIV who is able to control HIV without ART and maintain a CD4 cell count in normal range.

Virological outcome

Detectable viremia postpartum was defined as at least one HIV RNA measurement above 50 copies/ml during the postpartum period. On the basis of this definition:

- Detectable HIV RNA >50 copies/ml was observed in 88 (13%) of the 684 pregnancies analysed. When considering >200 copies/ml as a detection margin, 8% of the pregnancies had a detectable HIV RNA.

For the 643/684 (94%) women with documented continued use of ART postpartum:

- 68 (11%) had at least one episode of an HIV RNA level above 50 copies/ml (median HIV RNA=217 copies/ml, minimum=51 and maximum=85900 copies/ml)
- 35 (5%) had a HIV RNA level above 200 copies/ml,
- 29 had more than one episode of an HIV RNA level above 50 copies/ml during the postpartum period.
- 13 of the 68 women with an HIV RNA above 50 copies/ml were newly diagnosed with HIV during the pregnancy.
- 55/68 women were diagnosed and treated before conception, of whom 54% (n=37) had earlier episodes of detectable HIV RNA levels more than 6 months after the start of initial ART.

In the 41/684 (6%) women who discontinued the use of ART postpartum:

- One woman did not have HIV RNA measurements;
- 20 (49%) had at least one episode of an HIV RNA level above 50 copies/ml (median HIV RNA=18,400 copies/ml, minimum 617 and maximum 450000 copies/ml).
- in 20 pregnancies women remained virally suppressed during the postpartum period:
  - 12 women eventually restarted ART;
  - 1 woman who became virally unsuppressed after the postpartum period;
  - 5 women with 7 pregnancies continued to report high CD4 cell counts and HIV RNA levels <50 copies/ml in the absence of ART.

Breastfeeding

In the Netherlands, pregnant women with sustained virological suppression are informed about the possibility of breastfeeding. The final decision about the baby feeding is a result of a shared decision by the patient and health care professional. Breastfeeding in such cases is recommended for a maximum of six months.

Data about the baby feeding were available for 607 of the 684 pregnancies, and breastfeeding was reported in 68 pregnancies (the duration of breastfeeding was not documented). The proportion of deliveries with reported breastfeeding varied between 2% in 2016 to 21% in 2023. It is noteworthy that all women had documented use of ART and that all except 2 women had HIV RNA levels below 50 copies/ml and all women had HIV RNA levels below 200 copies/ml during the first 6 months of the postpartum period. The median number of HIV RNA measurements during the first 6 months after delivery among the 68 pregnancies with reported breastfeeding was 2 HIV RNA measurements (IQR 1-4 measurements). No cases of vertical transmission were documented.

Summary and conclusions

Between 2016 and 2025, all pregnant women with HIV in the Netherlands received ART and vertical transmission became very rare, in line with rates in other western European countries[16,17,18,19].

A small proportion of women had detectable HIV RNA levels near the time of delivery, this occurred more often in women newly diagnosed during pregnancy and women with a history of detectable HIV RNA levels. This underscores the importance of timely diagnosis, multidisciplinary care, and close monitoring especially in women newly diagnosed and those with a history of virological failure.

Although 85% of women were aware of their HIV status before conception, 15% were newly diagnosed during pregnancy, mostly through the first trimester national pregnancy screening (PSIE)[21]. Some diagnoses occurred in the second or third trimester, this may be a result of late booking of the first antenatal clinical visit, which may delay ART initiation. Between 2016 and 2024, timely screening within PSIE was achieved between 74% and 83% of the general population[22] and PSIE reports a decline in timely screening since the introduction of the non-invasive prenatal testing (NIPT) [21 20]. This test was allowed after 11 weeks of pregnancy and may have result in taking a single blood sample to test for HIV, HBV and syphilis as well as the NIPT test, at the same time. Due to technical improvements, the NIPT is offered from 10 weeks of pregnancy onwards as from April 2023 as part of the national pre- and neonatal screening programme[20].

Preterm birth (12% versus 7%) and Caesarean sections (31%-19%) were more common than in the general population[29]. Other studies have also reported a high prevalence of caesarean sections in women with undetectable HIV RNA levels[30 31], and higher rates of premature delivery[40]. As invasive perinatal procedures, such as foetal blood sampling or placement of a foetal scalp electrode, are contraindicated in women with HIV [13], the threshold for performing a Caesarean section is generally lower; however, it is not clear whether this contributed to the higher number of Caesarean sections observed. The aetiology of preterm delivery is complex and multifactorial. Premature delivery has been linked to ART use in earlier reports, especially in the first 12 weeks of pregnancy[32,33,34], but it is unclear whether ART use or other demographic or socio-economic factors, can explain the high proportion of preterm births[35]. Associations between various antiretrovirals and adverse pregnancy outcomes such as low birthweight remain conflicting[36].

Postpartum treatment adherence requires close attention: 11% of women who continued ART after delivery had at least one episode of viraemia, consistent with earlier reports of deteriorating adherences during the postpartum period[23,24,25,26,27,28]. Women who start ART during pregnancy require a high degree of support; both to achieve viral suppression at delivery and to maintain postpartum adherence, especially if they wish to breastfeed. Women who decide to breastfeed should be closely monitored clinically and virologically, along with their infants as described in the national HIV exposure follow-up protocol for newborns [37,38 39].

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11. Quality of care

Colette Smit, Anders Boyd, Kees Brinkman, Suzanne Geerlings, Jan den Hollander, Luc Gelinck, Judith Branger, Anna Roukens, Marc van der Valk, Dorine de Vries

Introduction

One of the missions of SHM is to contribute to the quality of HIV care in the Netherlands. Via the collection of pseudonymised data from individuals in outpatient care at the 23 dedicated treatment centres, SHM can provide a nationwide overview of the outcome of care for individuals. This unique overview allows SHM to facilitate assessment of the quality of HIV care in the Netherlands.

The Dutch Association of HIV-Treating Physicians (Nederlandse Vereniging van HIV Behandelaren, NVHB) has issued a variety of indicators to reflect the quality of health care provided to individuals with HIV. Given the broad range of indicators, SHM, along with members of the Quality Commission from the NVHB, has decided to focus on only one set of key indicators that will be described in this year's report.

As individuals with HIV have increased their lifespans with the use of effective antiretroviral therapy, age-related comorbidities have increased in prevalence[1]. One of the more concerning comorbidities is cardiovascular disease[2]. As in the reports from the last two years, we focus our indicators on primary and secondary prevention of cardiovascular disease. We evaluate center-specific completeness of information for the following indicators: smoking, lipid profile, and blood pressure measurement.

The SCORE-2 for individuals aged 40-69 years old and the SCORE2-OP for individuals 70 years old or older are often used in clinical care to understand the 10-year risk of developing a cardiovascular disease event for those who have not yet had such an event[3, 4]. We provide information on whether the SCORE2 or SCORE2-OP were able to be calculated for these age groups. Based on data from the REPRIEVE study[5], guidelines from the European AIDS Clinical Society and the Netherlands recommend statin prescription for individuals with HIV who have a high 10-year risk of cardiovascular disease event, that is ≥2.5% for those aged below 50 years, ≥5% for those aged between 50 and 69 years and ≥7.5% for those aged above 70 years[6, 7]. In addition to these recommendations, the updated guidelines from the European society of cardiology (ESC) and the European Atherosclerosis Society (EAS) recommend statin prescription for individuals aged ≥40 years with HIV[8]. For individuals with a high 10-year risk of a cardiovascular disease event (based on current Dutch and international recommendations), we report the percentage who received a prescription for statins (including those who ever used a statin and those with refused statin use) and those with an LDL cholesterol at or below the recommended limits (i.e., target LDL cholesterol)[9].

Finally, we report the percentage of individuals with high blood pressure who received a prescription for antihypertensive medication and, conversely, the percentage of individuals who received an antihypertensive medication and had a blood pressure at or below the recommended limits in Dutch guidelines (i.e., target blood pressure)[9]. The full list of indicators, their definitions and in which populations these indicators were analyzed are provided in *Box 11.1*.

This analysis relates to all individuals who were diagnosed with HIV and who are currently in care at one of the 23 HIV treatment centres in the Netherlands. To facilitate presentation, we have decided to provide mostly figures describing changes over the last 5 years and comparison of indicators between individual centres and the national average. Indicators are reported for the 23 HIV treatment centres individually. Each HIV treatment centre is referenced by a number, which is used consistently across all figures in this chapter. These centre numbers do not correspond with those used in the map with centre overview at page 5 of this report.

Each HIV treatment centre receives its own unblinded data. The NVHB Quality Committee has access to all data and reviews the results during the audits. Where necessary, data may be unblinded to facilitate discussions with the respective centres and to support quality improvement initiatives.
In collaboration with V&VN VCH, the NVHB organizes annual audits with four different HIV treatment centres, during which three auditors discuss aspects of quality of care and the results of the indicator report generated by SHM. These audits also provide an opportunity to discuss challenges in care delivery and share best practices. HIV treatment centres are re-audited every five years. The data presented in this chapter are also available online to HIV treatment centres and are included in the audits. In addition, these data can serve as a valuable benchmark for centres to identify potential areas for improvement. The findings presented in this chapter are discussed annually at the NVHB members' meeting.

Box 11.1: Definitions of specific indicators and focus populations.

Specific indicator	Definition	Focus population
Information on smoking		
	The percentages of individuals who ever gave information on their smoking status. The percentage of individuals who gave information on their smoking status during the calendar year.	40 years old or older
Information needed for cardiovascular disease screening		
Total, HDL or LDL cholesterol	The percentage of individuals who had a total, HDL or LDL cholesterol measurement during the calendar year[1].	40 years old or older
Blood pressure	The percentage of individuals who had at least one blood pressure measurement during the calendar year.	
All cardiovascular parameters	The percentage of individuals who had total, HDL and LDL cholesterol and blood pressure measurement during the calendar year and during the last 5 calendar years.	
Information on cardiovascular event risk		
SCORE2(-OP)	The percentage of individuals who had enough information to have their SCORE2(-OP) cardiovascular risk assessment during the calendar year.	40-69 years old (SCORE2) or 70 year old or older (SCORE2-OP), without a history of CVD.
Statin use		
	The percentage of individuals who received a prescription for statins during the calendar year. The percentage of individuals who received a prescription for statins, including individuals with past and refused statin use in 2025.	40 years old or older with SCORE2 or SCORE2-OP predicted 10-year high risk differentiated by age and without a history of CVD[2].
Target LDL cholesterol		
	The percentage of individuals who had an LDL cholesterol level ≤2.6 mmol/L during the calendar year.	40 years old or older with SCORE2 or SCORE2-OP predicted 10-year high risk, differentiated by age.
Antihypertensive medication use		
	The percentage of individuals who received a prescription for antihypertensive mediation during the calendar year.	• All individuals with high blood pressure[3] • And stratified by hypertension grades[4]
Target blood pressure		
	The percentage of individuals who had a systolic blood pressure <130 mmHg and diastolic blood pressure <80 mmHg (for those 18-64 years old), or a systolic blood pressure <140 mmHg and diastolic blood pressure <80 mmHg (for those 65 years old or older).	All individuals on antihypertensive medication.

Abbreviations: *HDL = high-density lipoprotein; LDL = low-density lipoprotein.*

1 Calendar year is defined as running from 1 January to 31 December.

2 Defined as : ≥2.5% when aged <50; ≥5% aged 50-69 years; ≥7.5% when aged≥70 years and without a history of CVD, details on these scores can be found in the following website: https://u-prevent.com and also references[3, 4, 6, 7].

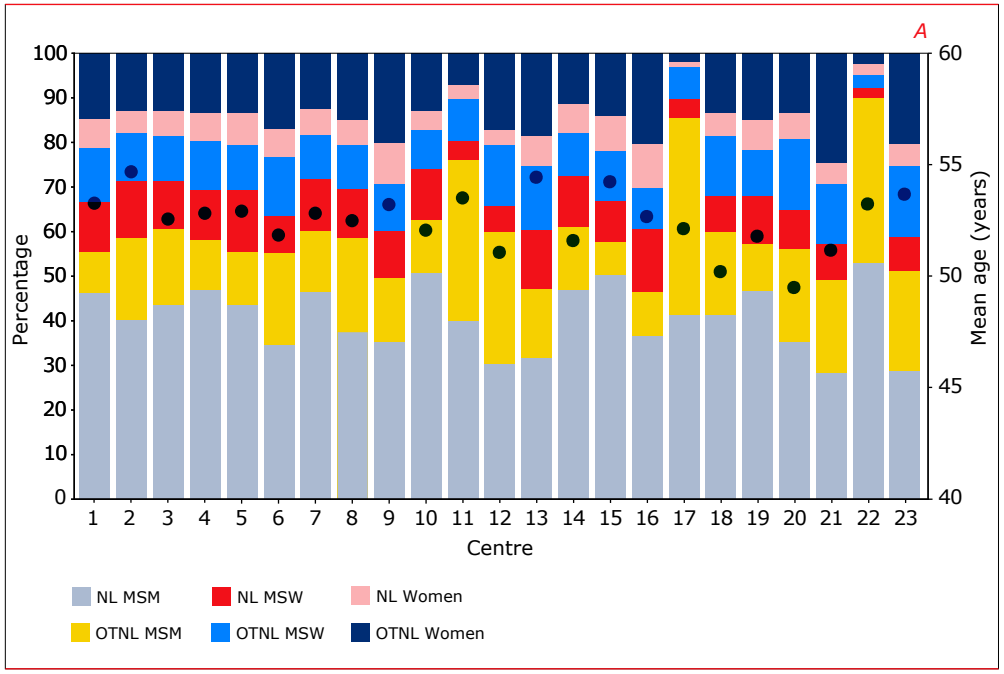
3 Defined as a diastolic blood pressure ≥90 mmHg and systolic blood pressure ≥140 mmHg[7].

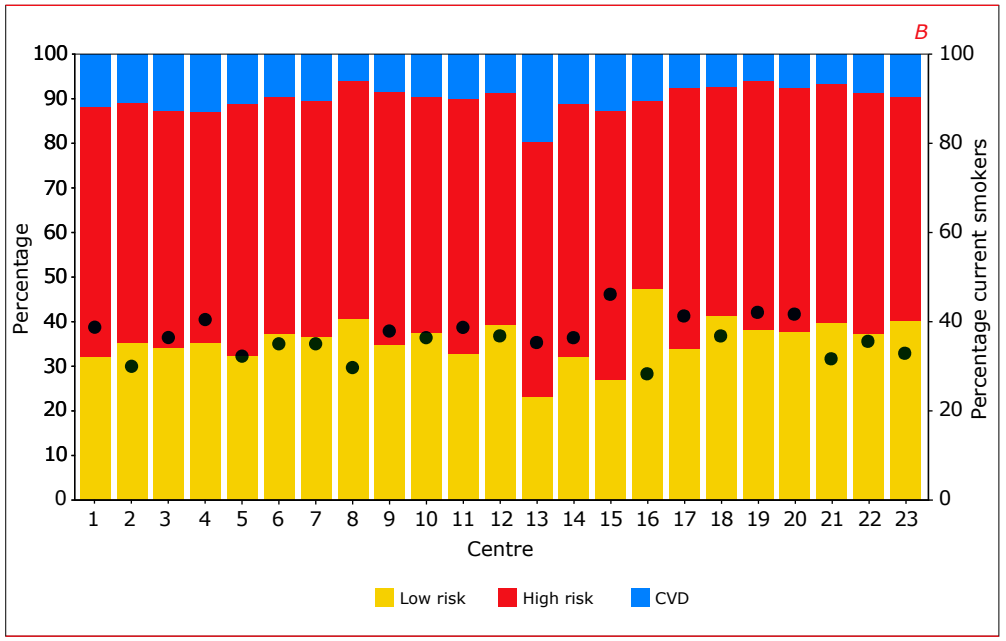
4 Defined as hypertension Grade 1 BP 140-159/90-99 mmHg; Grade 2 Hypertension BP 160-179/100-109 mmHg; Grade 3 Hypertension BP > 180/110 mmHg[7].

Centre overview

To provide an understanding of the patient 'mix' across centres, the distribution of geographical origin/mode of HIV acquisition/gender groups and age have been provided for each centre (*Figure 11.1A*). The distribution of individuals with low and high predicted 10-year risk of cardiovascular disease, according to the current recommendations, for those who have not had a cardiovascular disease event, and the percent with cardiovascular disease are also provided for each treatment centre (*Figure 11.1B*). Predicted 10-year cardiovascular risk was assessed with SCORE2 (i.e., 40-69 year old) or SCORE2-OP (i.e., 70 year old or older). These are presented alongside the percentage of individuals who are currently smoking.

Figure 11.1: *Description of the patient 'mix' for individuals in care (A), and the distribution of cardiovascular disease risk according to the current recommendations and smoking status (B) in 2025 in the Netherlands.*





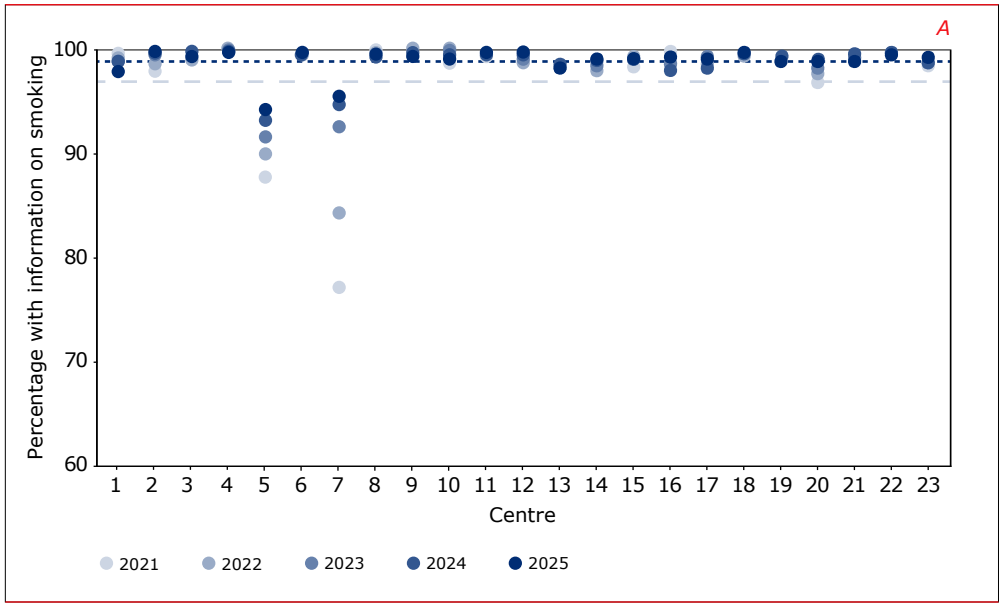
Note: *In A, the bars in this chart show the percentage of individuals per centre according to geographical origin/mode of transmission/gender group. In A, black dots represent the mean age of individuals in care at each centre. In B, black dots represent the percent of current smokers of individuals in care at each centre. This panel distinguishes those who already have cardiovascular disease (CVD) and those who are low or high risk according to the predicted 10-year cardiovascular risk were assessed with SCORE2 (i.e., 40-69 year old) or SCORE2-OP (i.e., 70 year old or older).*

Legend: *CVD=cardiovascular disease; MSM = men who have sex with men; MSW = men who exclusively have sex with women; OTNL = other than Dutch.*

Evolution of indicators over time

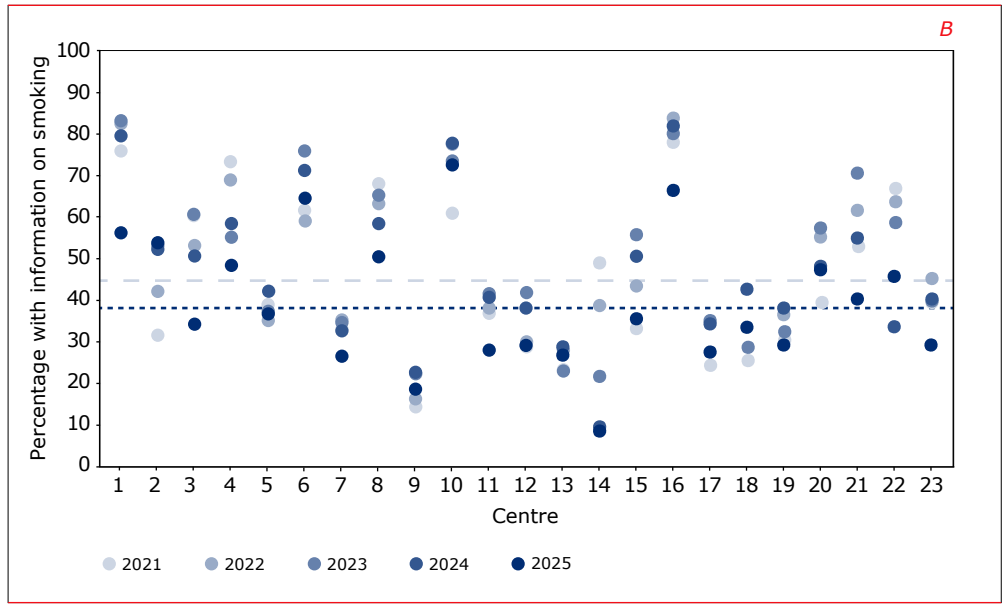
To provide an understanding of how indicators have evolved, each indicator in *Box 11.1* has been reported for its corresponding focus population on an annual basis between 2021 and 2025. For example, the indicator 'information on smoking' has been provided for individuals who were 40 years old or older and were in care in 2021, 2022, 2023, 2024, and 2025.

Figure 11.2A: *Information on smoking; in other words, individuals who ever had information on their smoking status during each year between 2021 and 2025.*



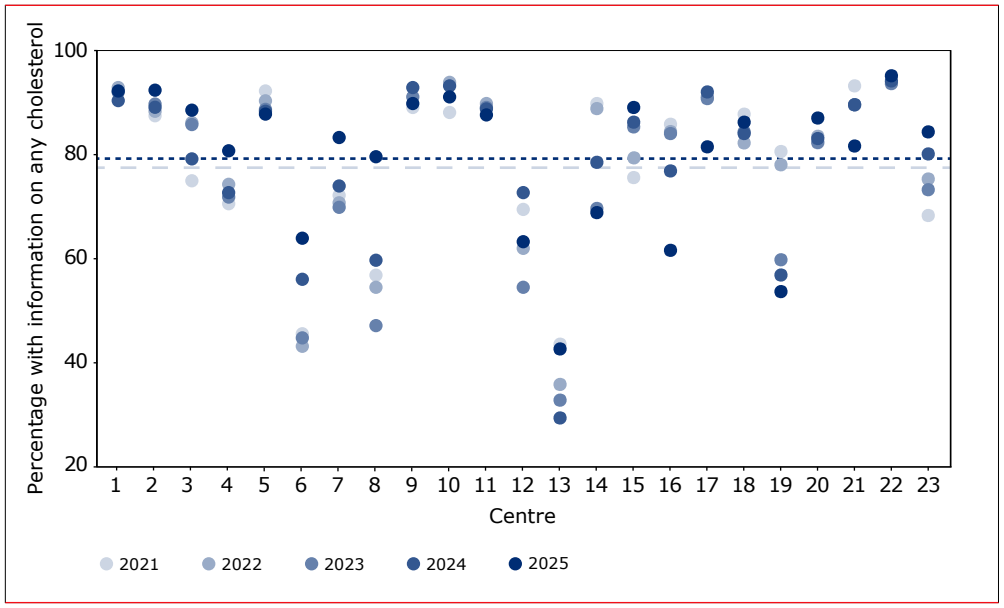
Legend: *Data are provided for individuals 40 years old or older. Data points from multiple years can overlap with one another. The dashed lines represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

Figure 11.2B: *Information on smoking; in other words, individuals who had information on their current smoking status during each year between 2021 and 2025.*



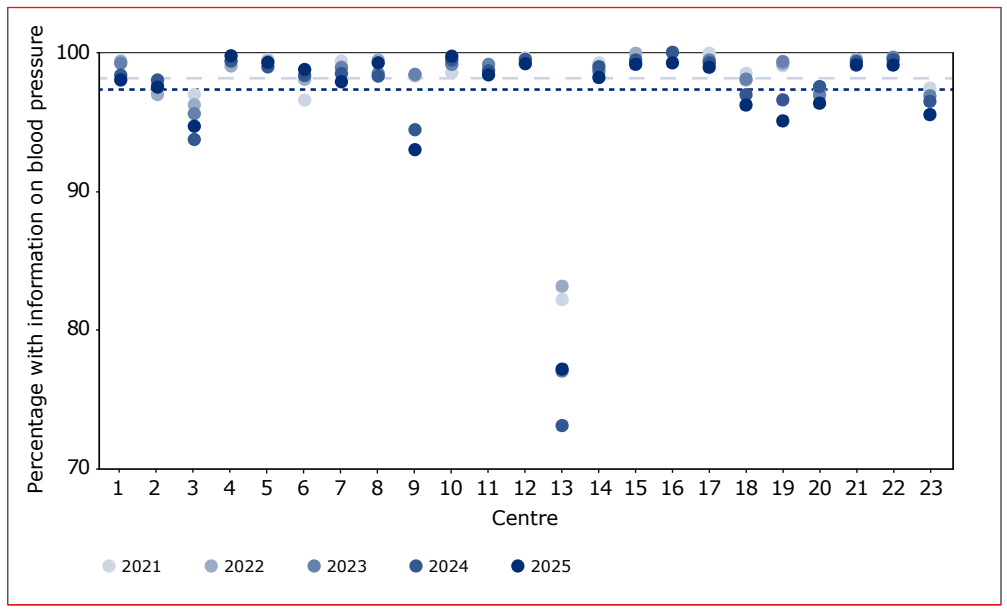
Legend: *Data are provided for individuals 40 years old or older. Data points from multiple years can overlap with one another. The dashed lines represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

Figure 11.3: *Information on total cholesterol; in other words, individuals who had a total, LDL or HDL cholesterol measurement during each year between 2021 and 2025.*



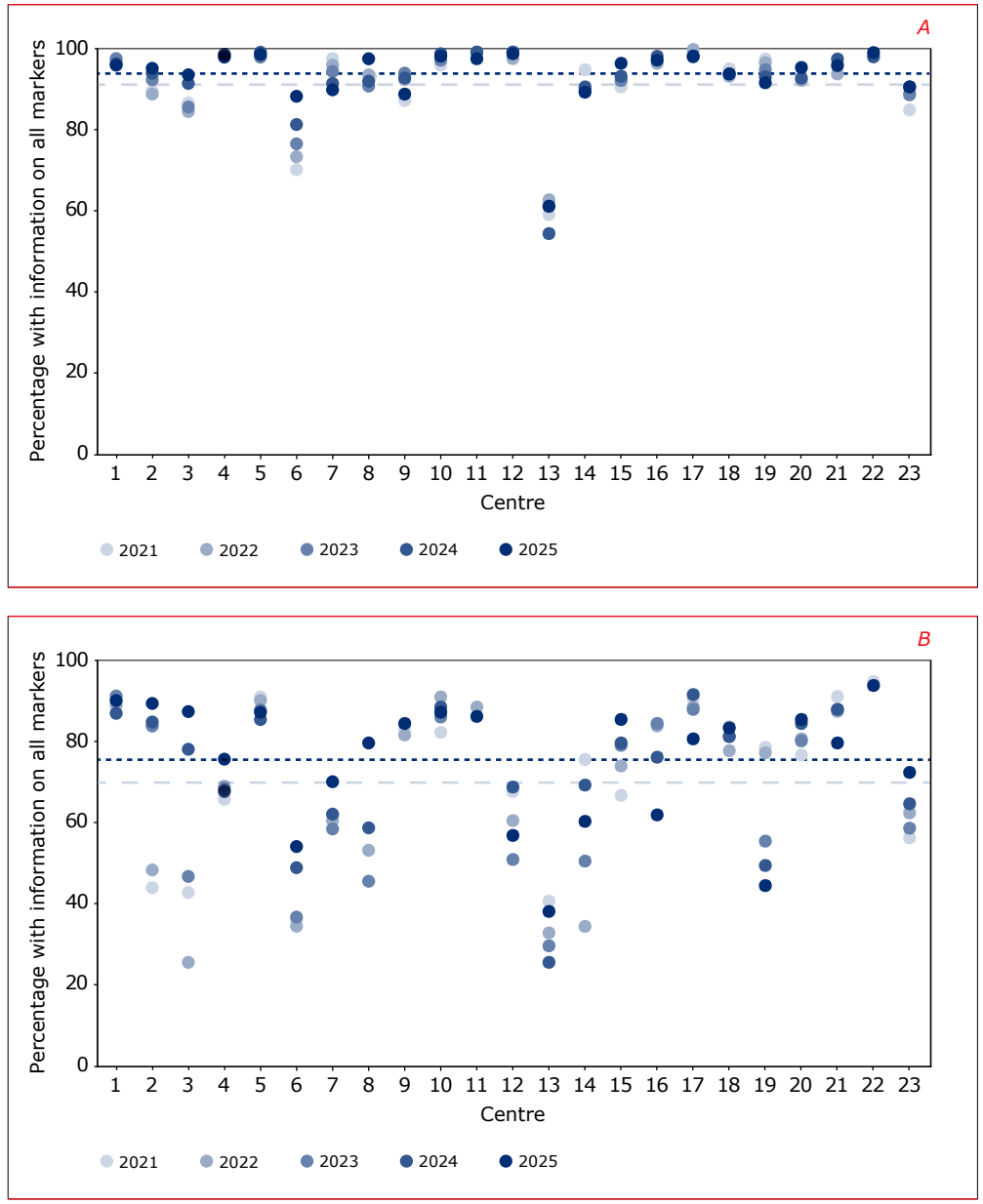
Legend: *Data are provided for individuals 40 years old or older. Data points from multiple years can overlap with one another. The dashed lines represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

Figure 11.4: *Information on blood pressure; in other words, individuals who had a blood pressure measurement during each year between 2021 and 2025.*



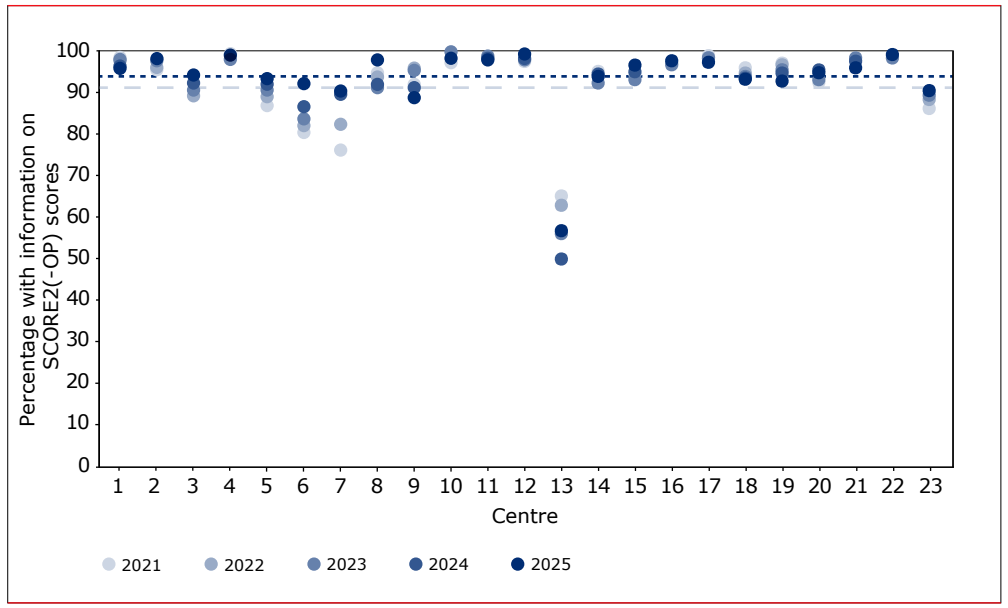
Legend: *Data are provided for individuals 40 years old or older. Data points from multiple years can overlap with one another. The dashed lines represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

Figure 11.5: *Information on all cardiovascular parameters; in other words, individuals who had total, HDL, LDL cholesterol and blood pressure measurement during (A) during the last 5 years and (B) each year between 2021 and 2025.*



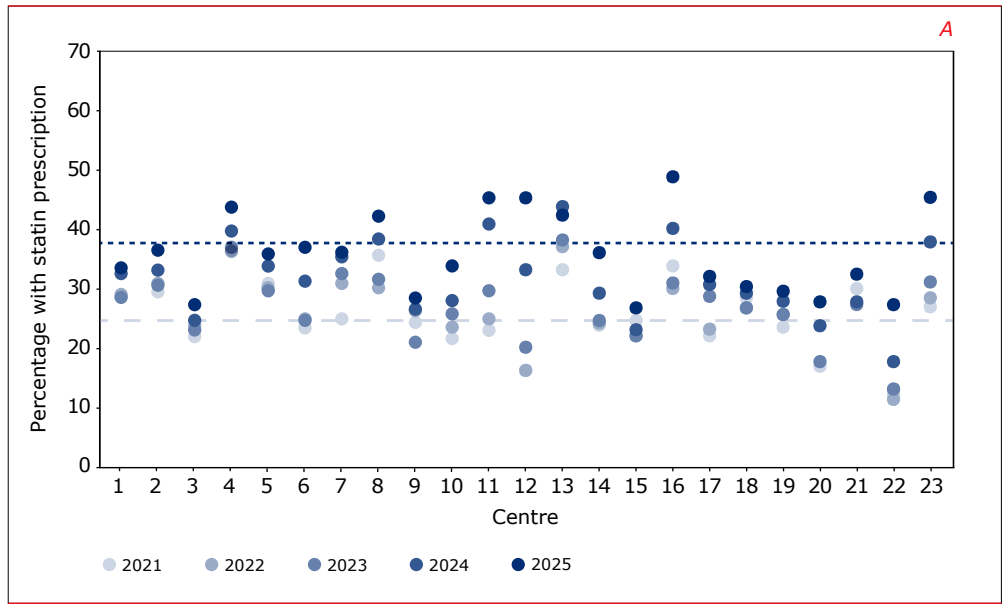
Legend: *Data are provided for individuals 40 years old or older. Data points from multiple years can overlap with one another. The dashed lines represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

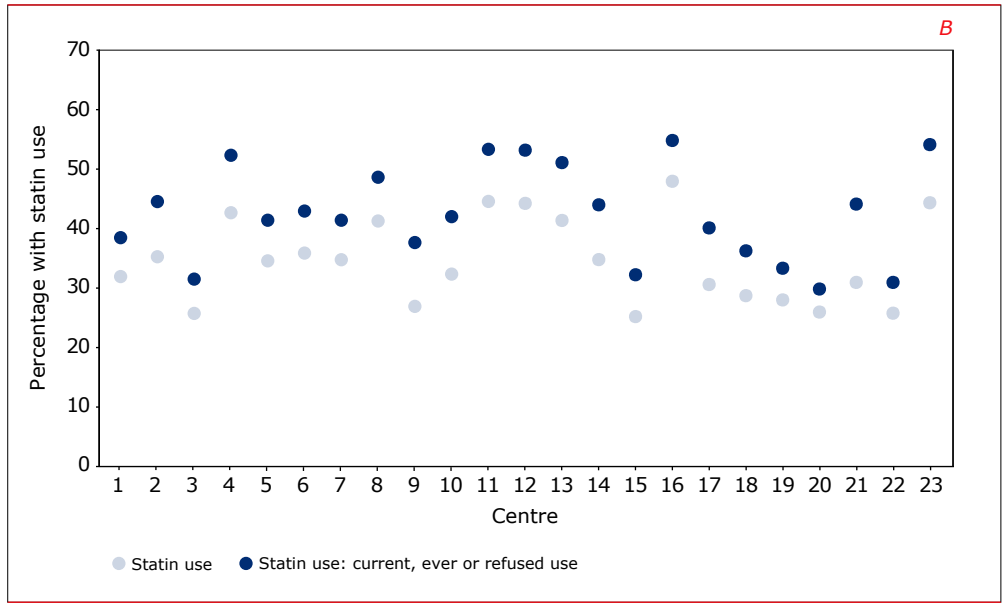
Figure 11.6: *Information on cardiovascular event risk during the last 5 years between 2021 and 2025.*



Legend: *The indicator represents individuals who had enough information to have their cardiovascular disease assessed by the SCORE2 (40–69 year old) or SCORE2-OP (70 year old or older). If data for calculating SCORE2-(OP) were missing, we replaced (i.e., imputed) the missing value with the value from the last observation with data. We only used data within a maximum of five years, except for smoking. The dashed lines represent the national averages for 2021 and 2025. Data points from multiple years can overlap with one another. Centre numbers correspond to those used in Figure 11.1.*

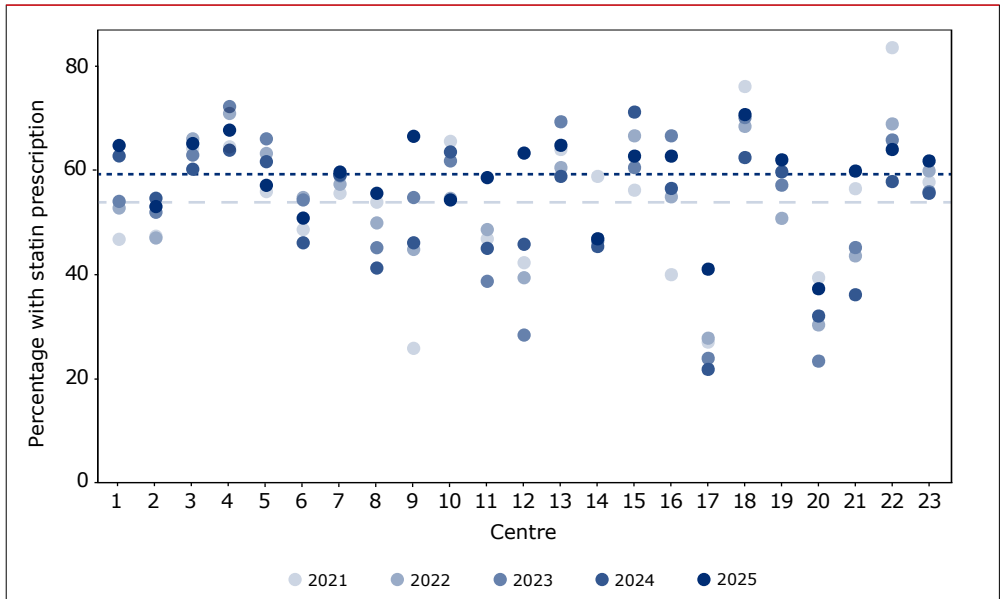
Figure 11.7: *Statin use, in other words, statin use among individuals with a high predicted 10-year cardiovascular event risk score using SCORE2(-OP): (A) Individuals using statins during each year between 2021 and 2025, (B) individuals in care in 2025 who received a statin prescription, stratified by current statin use, refused statin use, and past statin use (i.e., used statins at some point before 2025 but no longer using them).*





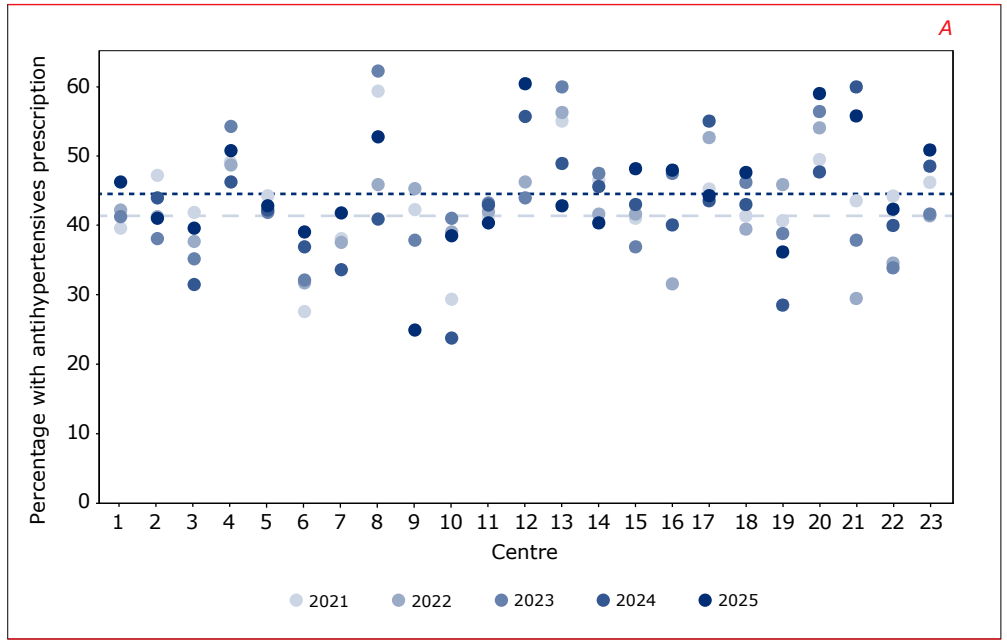
Legend: *Data are provided for those whose predicted 10-year cardiovascular risk were assessed with SCORE2 (i.e., 40-69 year old) or SCORE2-OP (i.e., 70 year old or older). If data for calculating SCORE2-(OP) were missing, we replaced (i.e., imputed) the missing value with the value from the last observation with data. We only used data within a maximum of five years, except for smoking.Data points from multiple years can overlap with one another. The dashed lines in A represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

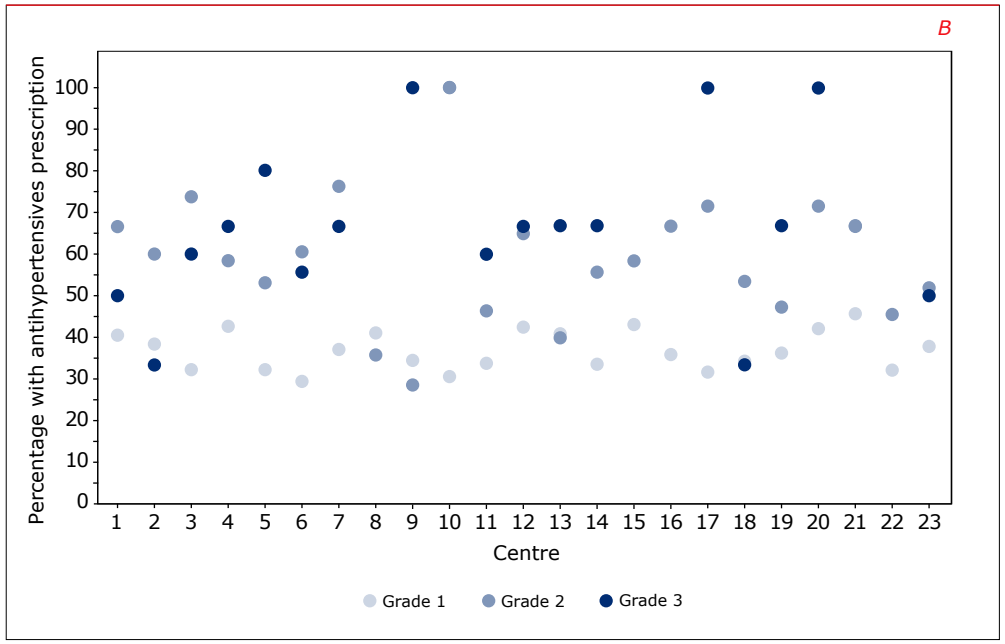
Figure 11.8: *Target LDL cholesterol; in other words, individuals with a high predicted 10-year cardiovascular event risk score using SCORE2(-OP), with a prescription for statins , and had an LDL cholesterol level ≤2.6 mmol/mL during each year between 2021 and 2025.*



Legend: *Data are provided for those whose 10-year cardiovascular risk were assessed with SCORE2 (i.e., 40-69 year old) or SCORE2-OP (i.e., 70 year old or older). If data for calculating SCORE2-(OP) were missing, we replaced (i.e., imputed) the missing value with the value from the last observation with data. We only used data within a maximum of five years, except for smoking. Data points from multiple years can overlap with one another. The dashed lines represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

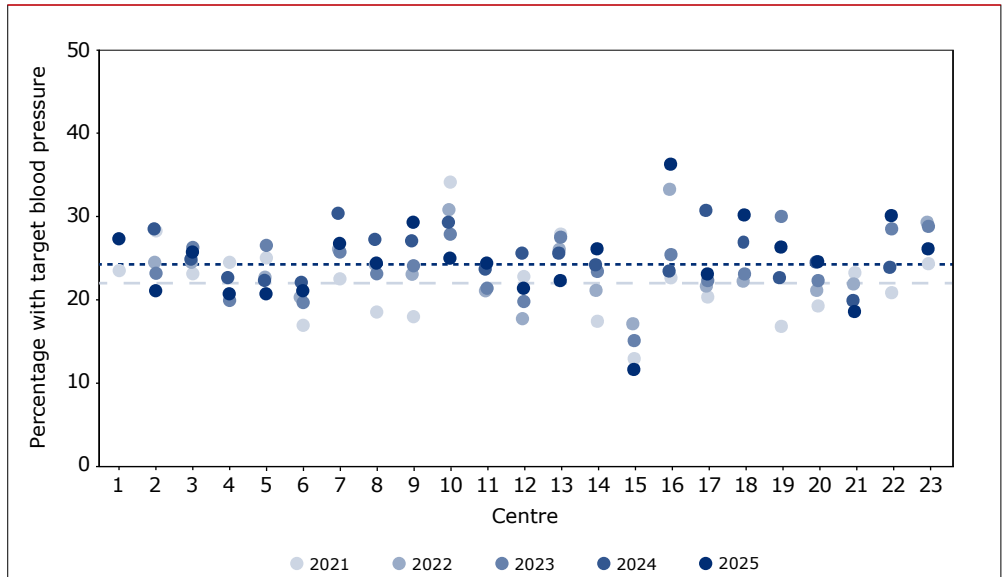
Figure 11.9: *Antihypertensive medication use; in other words, individuals who had high blood pressure and received a prescription for antihypertensive medication during each year between 2021 and 2025. A) high blood pressure defined as a diastolic blood pressure ≥90 mmHg and systolic blood pressure ≥140 mmHg and B) by different grades of hypertension for the year 2025.*





Legend: *(A) Data are provided for those who had high blood pressure, defined as ever having a diastolic blood pressure ≥90 mmHg. (B) Data provided for those with hypertension, defined as grade 1 blood pressure (i.e., 140–159/90–99 mmHg); grade 2 blood pressure (i.e., 160–179/100–109 mmHg); grade 3 blood pressure (i.e., >180/110 mmHg). Data points from multiple years can overlap with one another. The dashed lines in A represent the national averages for 2021 and 2025. Centre numbers correspond to those used in Figure 11.1.*

Figure 11.10: *Target blood pressure; in other words, individuals who were receiving antihypertensive medication and had a blood pressure below age-specific thresholds during each year between 2021 and 2025.*



Legend: *Age-specific thresholds refer to the following: systolic blood pressure <130 mmHg and diastolic blood pressure <80 mmHg (for those 18–64 years old), or a systolic blood pressure <140 mmHg and diastolic blood pressure <80 mmHg (for those 65 years old or older). Data are provided for those on antihypertensive medication. The dashed lines represent the national averages for 2021 and 2025. Data points from multiple years can overlap with one another. Centre numbers correspond to those used in Figure 11.1.*

Key findings and conclusions

The most important findings of this comparison of cardiovascular disease indicators between HIV treatment centres in the Netherlands are as follows:

- In 2025, the national average for data availability in that year was 38% for smoking (45% in 2021), 97% for blood pressure (98% in 2021), and 81% for total-, HDL- or LDL-cholesterol (77% in 2021). Compared with 2021, yearly updated information on smoking decreased, while it remained high for blood pressure and improved somewhat for total-, HDL-, or LDL-cholesterol. However, there was substantial variation in the percentage of individuals with information on total, HDL- or LDL- cholesterol across centres.
- In 2025, the national average for having all the information to predict 10-year risk of a cardiovascular event was 94%, and slightly increased from 91% in 2021
- The national average of receiving statins among individuals with a high predicted 10-year risk of a cardiovascular disease event according to SCORE2(-OP), increased from 23% in 2021 to 37% in 2025. Even when current statin use was combined with past or refused statin use, only 45% of individuals with a high predicted 10-year CVD risk had ever been prescribed statins in 2025. There was substantial variation between centres in the percentage who received a statin prescription. Although most centres showed an increase over the past five years in the percentage of individuals with a high risk receiving statins.
- Among those with a high predicted 10-year risk of a cardiovascular disease event, as determined by the SCORE2(-OP), there was some variation between centres in the percentage with target LDL cholesterol when individuals had a prescription for statins. The national average in 2025 was 59%.
- Overall, 45% of the individuals with high blood pressure in 2025 received an antihypertensive prescription. There was also slight between-centre variation in the percentage of individuals with high blood pressure who received an antihypertensive prescription and some centres have shown decreases in this percentage over the past 5 years. However, antihypertensive prescription increased as the grade of hypertension increased. Overall, 24% of the individuals taking antihypertensive medication had achieved a target blood pressure. There was slight between-centre variation in the percentage of individuals with target blood pressure.

Nevertheless, these conclusions must be considered in light of the data collection methods used by SHM. Much of the data are obtained through electronic medical records, which might contain incomplete information on items, such as smoking status and antihypertensive medication. Furthermore, primary prevention of cardiovascular disease for specific centres is commonly provided by general practitioners or peripheral healthcare centres. There remains a possibility that in some cases information may not have been captured in the data collection. Certain data related to cardiovascular disease may be missing simply because these data are not measured at the HIV treatment centre. We were unable to include individuals lacking the information needed to predict the 10-year risk of a cardiovascular event when analysing the indicators for statin and antihypertensive medication use. Finally, we do not have specific reasons why people are not taking antihypertensive medications, which could be unrelated to the care given at the HIV treatment centre. For statin prescription, SHM recently started collecting information on statin refusal.

Care related to cardiovascular disease does have variation across centres. Nevertheless, there is room for improvement. Certain centres should therefore strive to increase the percentage of individuals with information on cholesterol measurements and risk assessment of cardiovascular disease events. Less than half of the individuals with a predicted high 10-year risk of a cardiovascular event used statins. This analysis provides insight into the provision of cardiovascular diseases care at the different treatment centres.

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12. The Amsterdam Cohort Studies (ACS) on HIV infection: annual report 2025

Carien Blomaard, Neeltje Kootstra, Lia van der Hoek, Vita Jongen and Janneke Heijne

Introduction

The Amsterdam Cohort Studies (ACS) on HIV infection and AIDS started shortly after the first cases of AIDS were diagnosed in the Netherlands. Since October 1984, men who have sex with men (MSM) have been enrolled in a prospective cohort study. A second cohort involving people who use/inject drugs (PWUD/PWID) was initiated in 1985 and discontinued in 2016[1-5].

In 2024, the cohort celebrated the milestone of 40 years of follow-up. From the outset, research in the ACS has taken a multidisciplinary approach, integrating epidemiology, social science, virology, immunology, and clinical medicine in one study team. This unique collaboration has been highly productive, significantly contributing to the knowledge and understanding of many different aspects of HIV-1 infection, as well as other infections [e.g., viral hepatitis B and C (HBV and HCV) and human papillomavirus (HPV)]. This expertise, in turn, has contributed directly to advances in prevention, diagnosis, and management of these infections.

Collaborating institutes and funding

Within the ACS, the following institutes collaborated in 2025 to bring together data and biological sample collections, and to conduct research:

- **Public Health Service of Amsterdam** (*Gemeentelijke Gezondheidsdienst Amsterdam, GGD Amsterdam*): Department of Infectious Diseases
- **Amsterdam University Medical Centers, location Academic Medical Center (AMC)** (Amsterdam UMC): Department of Medical Microbiology and Infection prevention, Laboratory of Experimental Virology (LEV), Experimental Immunology, Laboratory for Viral Immune Pathogenesis, and Internal Medicine (Department of Infectious Disease)
- **Stichting hiv monitoring** (SHM)

In addition, there are numerous collaborations between the ACS and other research groups, both within and outside the Netherlands. The ACS is financially supported by the Centre for Infectious Disease Control Netherlands of the National Institute for Public Health and the Environment *(Rijksinstituut voor Volksgezondheid en Milieu - Centrum voor Infectieziektenbestrijding, RIVM-CIb)*.

Ethics statement

The ACS has been conducted in accordance with the ethical principles set out in the Helsinki declaration. Participation in the ACS is voluntary and written informed consent is obtained from each participant. The most recent version for the study protocol for the MSM cohort was approved by the Amsterdam UMC medical ethics committee in 2022.

The Amsterdam Cohort Studies (ACS)

The cohort of men who have sex with men (MSM)

In 1984 and 1985, men who had had sexual contact with at least one other man in the preceding six months were enrolled, independent of their HIV status. In the first 6 months of the recruitment period, 750 MSM, of which one-third with HIV, were enrolled. Over a 40-year follow-up, minor changes in the inclusion criteria for ACS were introduced, mainly concerning HIV status and age. From 1985 to 1988, men without HIV of all age groups were eligible to participate if they lived in, or around, Amsterdam and had had at least two male sexual partners in the preceding six months. Between 1988 and 1998, MSM with HIV were also enrolled because of the cohort involvement in HIV treatment trials. From 1995 to 2004, only men aged 30 years or younger, with at least one male sexual partner in the previous six months, could be included in the study. Since 2005, men without HIV of all age groups have been eligible to participate in the ACS if they live in, or are closely connected to the city of Amsterdam and had at least one male sexual partner in the preceding six months. In line with the advice issued by the International Scientific Advisory Committee in 2013, the cohort continues to strive to recruit young MSM (aged 30 years or younger). From 2022 onwards, we aimed to actively follow 825 MSM (750 without HIV and 75 with HIV). Currently, eligible for enrolment are individuals of at least 16 years old, who were assigned male sex at birth and who have not undergone gender reassignment surgery, live in the Amsterdam area or are involved in MSM-related activities in Amsterdam, and who have had sex with at least one man in the preceding six months.

Men who seroconverted for HIV within the ACS remained in the cohort until 1999, when follow-up of a selection of MSM with HIV was transferred to the MC Jan van Goyen. In 2003, the 'HIV Research in Positive Individuals' (Hiv Onderzoek onder Positieven, HOP) protocol was initiated. Individuals with a recent HIV infection when entering the study at the GGD Amsterdam, and those who seroconverted for HIV during follow-up within the cohort, continue to return for study visits at the GGD Amsterdam or at an HIV treatment centre.

All (sexual) behavioural data are collected by questionnaires, coordinated by the GGD Amsterdam, and clinical data (for PWH) are provided by SHM. Every six months, participants complete a standardised questionnaire designed to obtain data regarding: medical history, (sexual) behaviour and substance use, uptake of prevention measures (including PrEP, doxyPEP, and condom use), underlying psychosocial determinants, health care use, signs of depression and other psychological disorders, and demographics.

As of 31 December 2025, 3,048 MSM have been included in the ACS since its initiation in 1984. These MSM contributed a total of 71,635 cohort visits at the GGD Amsterdam. Of these 3,048 MSM, 609 were living with HIV at entry into the study and 269 seroconverted for HIV during follow-up.

On 31 December 2025, 670 HIV-negative participants and 39 participants with HIV were in follow-up (meaning that they had at least one study visit in 2024 or 2025). Of these, 643 HIV-negative participants and 37 participants with HIV had at least one visit in 2025. 24 were newly enrolled in the cohort in 2025, all MSM without HIV with a median age of 34 years at enrolment. Two MSM seroconverted in 2025.

In this chapter, we report on the MSM actively participating in the ACS in 2025:
- The median age was 48 years at their last cohort visit in 2025;
- The majority were born in the Netherlands (84%) and a resident of Amsterdam (80%);
- 81% of the MSM had a college/university degree.

ACS biobank

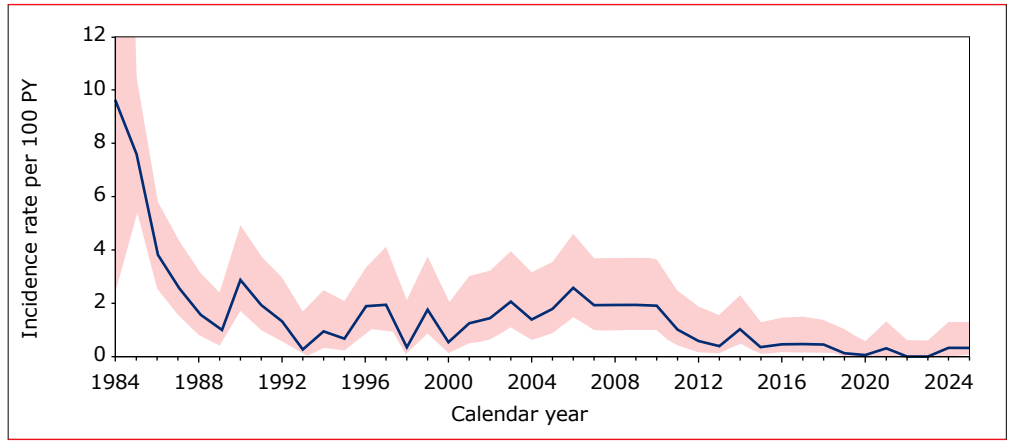
The ACS biobank, at the Amsterdam UMC, location AMC, stores all samples (plasma/serum, peripheral blood mononuclear cells) taken in the context of the ACS study. In addition to samples taken at routine ACS study visits, the biobank also contains samples collected for sub-studies and affiliated studies embedded in the ACS. Over the past 40 years, more than 350,000 samples have been stored for ongoing and future research.

ACS in 2025: HIV and STI among MSM

HIV incidence

The observed HIV incidence rate among MSM participating in the ACS has declined over time (*Figure 12.1*). Between 1985 and 1993 HIV incidence declined significantly, then stabilized between 1993 and 1996, before rising again in the period 1996 to 2009. Since 2009, the HIV incidence decreased again. Two participants seroconverted in 2025.

Figure 12.1: *HIV incidence per calendar year in the Amsterdam Cohort Studies (ACS) among men who have sex with men (MSM), 1984–2025.*



PrEP use

373/643 (58%) participants without HIV reported PrEP use in 2025. Of these, 177 (47.5%) obtained PrEP through the national PrEP program at the Centre of Sexual Health, 163 (43.7%) through their GP, 16 (4.3%) through an Internal Medicine specialist or another physician and 17 (4.6%) obtained their pills through informal routes (e.g. cross-border clinics, sexual or social networks, self-prescribed or online offered pills).

STI screening

Since October 2008, all MSM participating in the ACS are routinely screened for bacterial STIs during their cohort visits (in addition to HIV testing). This is in accordance with the standard care offered by the Centre of Sexual Health Amsterdam. Chlamydia testing was part of standard care until December 2024; since January 2025, chlamydia is tested only in the presence of symptoms. Chlamydia and gonorrhea were tested with nucleic acid amplification techniques using urine samples and pharyngeal and rectal swabs. Syphilis was screened for by *Treponema pallidum haemagglutination* assay.

In 2025, STI data were available from the Centre of Sexual Health Amsterdam for 668 MSM (with 1,561 visits including extra STI visits) participating in the ACS. Of these, 119 (17.8%) were diagnosed with at least one positive bacterial STI test (93 (13.9%) gonorrhea, 29 (4.3%) chlamydia and 19 (2.8%) syphilis). For MSM with and without HIV, 11 out of 36 (30.6%) and 108 out of 632 (17.1%) MSM were diagnosed with at least one positive bacterial STI test, respectively.

Until August 2024, participants using PrEP were screened for STIs 3-monthly, whereas other participants were screened 6-monthly, according to national PrEP guidelines. Following the revised national PrEP guidelines, STI screening is now offered 6-monthly to both PrEP users and those not using PrEP. Trends of any bacterial STI incidence among MSM without HIV, and stratified by PrEP use and no PrEP use, between 2009 and 2025 are shown in *Figure 12.2* and *12.3*. The annual incidence rate of any bacterial STI for MSM without HIV increased over time (*Figure 12.2*). MSM who used PrEP in the preceding 6 months were diagnosed with STIs more often than MSM who did not (*Figure 12.3*).

Figure 12.2: *Any bacterial STI incidence per calendar year in the Amsterdam Cohort Studies (ACS) among men who have sex with men (MSM) without HIV with at least two study visits, 2009–2025.*

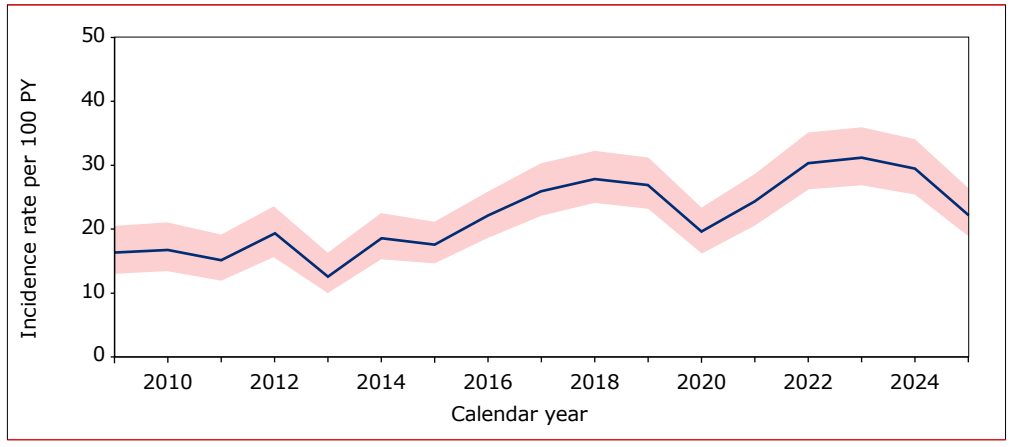
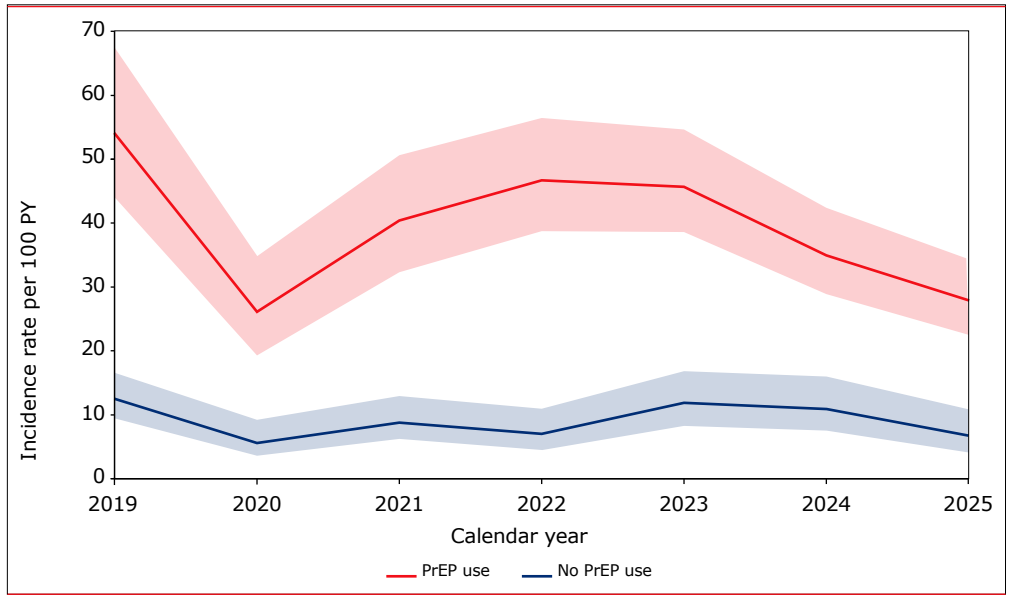


Figure 12.3: *Any bacterial STI incidence per calendar year in the Amsterdam Cohort Studies (ACS) stratified by PrEP use in the preceding 6 months, among men who have sex with men (MSM) without HIV with at least two study visits, 2019–2025.*



ACS 2025 research highlights

Barriers and missed opportunities in PrEP uptake, use and care among men who have sex with men with recent HIV infection

Some men who have sex with men entering HIV care indicated having PrEP experience prior to diagnosis. Semi-structured in-depth interviews on PrEP among MSM diagnosed with HIV from 2019 onwards with previous PrEP experience were conducted to identify barriers and missed opportunities in PrEP uptake, care and use[6]. Of the 11 included MSM, most reported significant PrEP-uptake delay because of the limited NPP capacity and high threshold of accessing PrEP from GPs (e.g. stigma, lack of sexual health expertise). Additional uptake or use barriers included anticipated/experienced side-effects, burden of daily pill-taking or event-driven regimen complexity, the latter leading to PrEP discontinuation. Missed opportunities in counseling on adherence and safer sex alternatives after discontinuation were reported. Most interviewees considered informal PrEP unsuitable. We conclude that HIV diagnoses at or shortly after PrEP initiation emphasize the importance of ensuring rapid and timely PrEP access. Uptake barriers at GPs, stigma related to sexuality, lack of expertise, and missed care opportunities need to be addressed. Early detection of PrEP protocol/user-mismatch and counseling on safer sex alternatives after discontinuation are pivotal for sustainable HIV prevention.

Incidence of hepatitis C virus infection and associated determinants among men who have sex with men without HIV in Amsterdam, the Netherlands, between 2012 and 2021

This study was conducted to assess the prevalence, incidence, and determinants of hepatitis C virus (HCV) infection among men who have sex with men without HIV in Amsterdam[7]. Data of 926 participants from the Amsterdam Cohort Studies (2012–2021) were used, including repeated serological testing and behavioral questionnaires. The results showed a very low prevalence of past/current HCV infection at baseline (0.2%) and an incidence rate of 0.05 per 100 person-years, with only three incident infections observed between 2014 and 2018. Incident infections were associated with receptive condomless anal sex, a higher number of sexual partners, recent or ever injecting drug use, and engaging in fisting. Phylogenetic analysis revealed that one HCV-RNA sequence was closely related to HCV sequences from MSM with HIV. Thus, while HCV infection is uncommon among MSM without HIV, the risk of infection seems to increase among those with specific behaviors.

Uncovering Metabolic Control of HIV Latency

A major challenge in curing HIV is understanding how the virus remains dormant within long-lived cellular reservoirs. We developed an innovative flow cytometry–fluorescent in situ hybridization (flow-FISH) assay that directly detects HIV-infected cells ex vivo without requiring viral reactivation[8]. Using this approach, we distinguished cells expressing abortive versus elongated HIV-1 transcripts and isolated these rare populations for transcriptomic analysis. Our findings revealed distinct mitochondrial gene expression signatures associated with latent HIV infection. Importantly, enhancing mitochondrial function stimulated HIV transcription in cells from people living with HIV, providing direct evidence that cellular metabolism contributes to the maintenance of viral latency. These results identify mitochondrial function and immunometabolic pathways as promising targets for HIV cure strategies aimed at disrupting viral persistence.

Timing of HIV Treatment Shapes Long-Term Monocyte Immune Function

Despite effective antiretroviral therapy (ART), people living with HIV often experience persistent immune dysregulation. We investigated how the timing of ART initiation influences communication between key innate immune sensing pathways in monocytes, focusing on interactions between Toll-like receptor 8 (TLR8) and RIG-I-like receptors (RLRs)[9]. Our study showed that monocytes from individuals who started ART during acute HIV infection initially displayed cytokine responses similar to those of HIV-negative individuals. However, these responses gradually declined over time and became comparable to those observed in individuals who initiated treatment during chronic infection. In contrast, chronically treated individuals exhibited reduced production of immune-regulatory cytokines and increased inflammatory responses. These findings suggest that early ART initiation temporarily preserves monocyte immune function but may not fully prevent long-term alterations in innate immune responses. The results highlight a potential early therapeutic window for interventions aimed at maintaining immune health and reducing chronic inflammation in people living with HIV.

Long-term effect of temporary ART initiated during acute HIV and the effect of long treatment interruption

In a randomized controlled trial with people treated with temporary ART versus untreated during acute HIV infection, the effect of long treatment interruption was investigated[10]. In a total of n=64 participants, either treated with 24- or 60-week ART from acute HIV infection onwards or no treatment during HIV acute infection, the participants (re)initiated ART after a median period of 116 weeks. The study revealed a long-term suppressive effect of early ART on the viral reservoir as the reservoir size and activity during chronic infection ART were lower in those who had been pre-treated during early infection several years before, compared with those who had not. Importantly, the long treatment interruption did not have a disadvantageous effect on the virological or immunological response during reinitiation of ART, as upon restart of therapy, the reservoir returned to its early-ART level. This finding provides confidence that treatment interruption, e.g. for HIV-1 curative intervention purposes, does not lead to a risk for a larger virus reservoir.

Vaccination studies: At the Laboratory of Experimental Virology of the Amsterdam UMC, HIV-1 Envelope proteins are designed to be used in vaccination strategies. Among the sequence sources used for protein structure design, there were several HIV-1 Envelope sequences from participants of the Amsterdam Cohort Studies. Because of this historical link with the ACS we include here two scientific highlights on Phase 1 vaccine clinical trials.

Phase 1 clinical trial with HIV-1 protein vaccine; Safe and capable of eliciting cross-reactive binding antibody responses in humans

A protective vaccine will be the most powerful instrument to reduce HIV-1 infections worldwide and help bring about a lasting end to the AIDS epidemic. A single-centre, randomised, open-label, uncontrolled, phase 1 clinical trial was performed to assess the safety and immunogenicity of an HIV-1 group M native-like trimer Envelope glycoprotein vaccine (ConM SOSIP.v7)[11]. The trial was done in HIV-negative adults at the Amsterdam UMC. Twenty-four individuals were enrolled to receive three doses of the protein vaccine in a liposome formulation containing a high dose of the TLR4-agonist MPLA as adjuvant. Overall, the vaccine was safe and well-tolerated. Furthermore, the vaccine elicits robust HIV-1 strain-specific binding and cross-reactive neutralising antibody responses in nearly all vaccinees. Post-hoc exploratory analyses demonstrate that female-born participants have 22- and 6-fold higher neutralisation titres after the second and third vaccination, respectively. Whether the differences found in immunological outcomes between females and males are caused by genetic, hormonal or environmental factors remains to be determined. Nevertheless, sex-based differences in response to vaccines and adjuvants need to be considered moving forward, since new HIV infections in women are on the rise, with young women and girls accounting for 45% of new HIV-1 infections globally and 63% of new infections in Sub-Saharan Africa.

Phase 1 clinical trial with HIV-1 protein vaccine; Targeting HIV broadly neutralizing antibody precursors in humans with atomic precision

It is now believed that the essential first step in a successful HIV vaccination is the activation of rare low-affinity broadly-neutralizing antibody-producing precursor B cells, also known as germline B cells, followed by vaccination-based guidance of these B cells to produce effective neutralizing antibodies. Specific engineered HIV-1 Envelop glycoproteins are needed for such a strategy, a first immunogen (prime Env) for priming precursor B cells and a second (Shape Env) and third (Polish Env) immunogen to respectively shape and polish the primed precursor B cells towards production of highly effective broadly neutralizing antibodies. In a phase 1 clinical trial with 47 participants (recruited at the Rockefeller University (USA), George Washington University (USA) and at the Amsterdam UMC) vaccination was done three times with an especially designed HIV-1 Env immunogen to establish the required maturation of B cells[12]. There were memory B cells in the vaccinees, with substantial affinity maturation indicating proper priming and maturation. Cryo-electron microscopy subsequently revealed that the antibodies from the vaccinees often resembled the VRC01-class broadly neutralizing antibodies in terms of atomic contacts with Env. Monoclonals of this class that target the receptor binding site of the virus (CD4), have the most powerful HIV-neutralising capacity known to date.

Current and upcoming ACS research projects

Data collected within the ACS are currently used for multiple research projects. As 2024 marked the 40th anniversary of the study, we are studying trends in HIV and STI incidence and sexual behavior over 40 years of follow-up. Trends and current norms and negotiation experiences regarding condom use are studied in greater detail. Quantitative and qualitative studies on individual and contextual motives underlying choices of HIV prevention strategies (including condoms, PrEP, and viral load sorting) are ongoing, and conducted in collaboration with Maastricht University. A recent collaboration with the University of Groningen focuses on chemsex patterns over time and the contextual factors influencing the use of chems, such as chemsex within steady relationships and the influence of social media and dating app norms and features.

Data Preparedness of the Amsterdam Cohort Studies

The ACS team supports the Open Science movement, and aims to improve the findability, accessibility, interoperability, and reusability (FAIR) of the ACS (meta) data. In 2025, a grant was awarded by the NWO (Open Science Infrastructure | Open Science NL) to further implement the identified improvements regarding findability, accessibility, interoperability, and reusability of the ACS (meta) data. This project is a continuation of a prior project funded by ZonMw.

This project aims to facilitate Open Science practice of the Amsterdam Cohort Studies (ACS) through investment in the data infrastructure, following the FAIR principles (findability, accessibility, interoperability and reusability). Since 1984 ACS captures longitudinal data of men who have sex with men, through a unique interdisciplinary collaboration between academic (Amsterdam UMC) and public health institutes (GGD Amsterdam).

This project facilitates and accelerates (new) research by optimizing findability, making metadata and a data-request protocol accessible through a data catalogue and website. Interoperability and reusability will be improved by making the metadata machine-readable, and by publishing the provenance of the data.

Steering committee

In 2025 the steering committee met four times. Eight proposals for use of ACS data or samples (serum/PBMC) were submitted to the committee: seven from Medical Microbiology and Infection Prevention (MMI, Amsterdam UMC, location AMC) and one international collaborative project involving Imperial College London, WHO Copenhagen and the GGD Amsterdam. The ACS reviewed the proposals, after which all requests were approved.

Research Meetings

An internal ACS research meeting with Amsterdam UMC and GGD researchers was held on 23 February 2025, during which ACS researchers presented research findings.

Publications in 2025 that included ACS data

- Hage K, Koole J, Boyd A, Matser A, Davidovich U, Bakker M, van der Hoek L, Koopsen J, Rebers S, Schinkel J, Prins M. Incidence of hepatitis C virus infection and associated determinants among men who have sex with men without HIV in Amsterdam, the Netherlands, between 2012 and 2021. Eur J Gastroenterol Hepatol. 2025 Oct 1;37(10):1173-1179. doi: 10.1097/MEG.0000000000003008
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- Vlaming KE, Jansen J, de Bree GJ, Kootstra NA, Geijtenbeek TBH. Synergistic Activity of Second Mitochondrial-Derived Activator of Caspases Mimetic with Toll-like Receptor 8 Agonist Reverses HIV-1-Latency and Enhances Antiviral Immunity. Int J Mol Sci. 2025 Mar 13;26(6):2575. doi: 10.3390/ijms26062575. PMID: 40141220; PMCID: PMC11941979.
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Amsterdam Cohort Studies (ACS) participants

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13. HIV in Curaçao

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Introduction

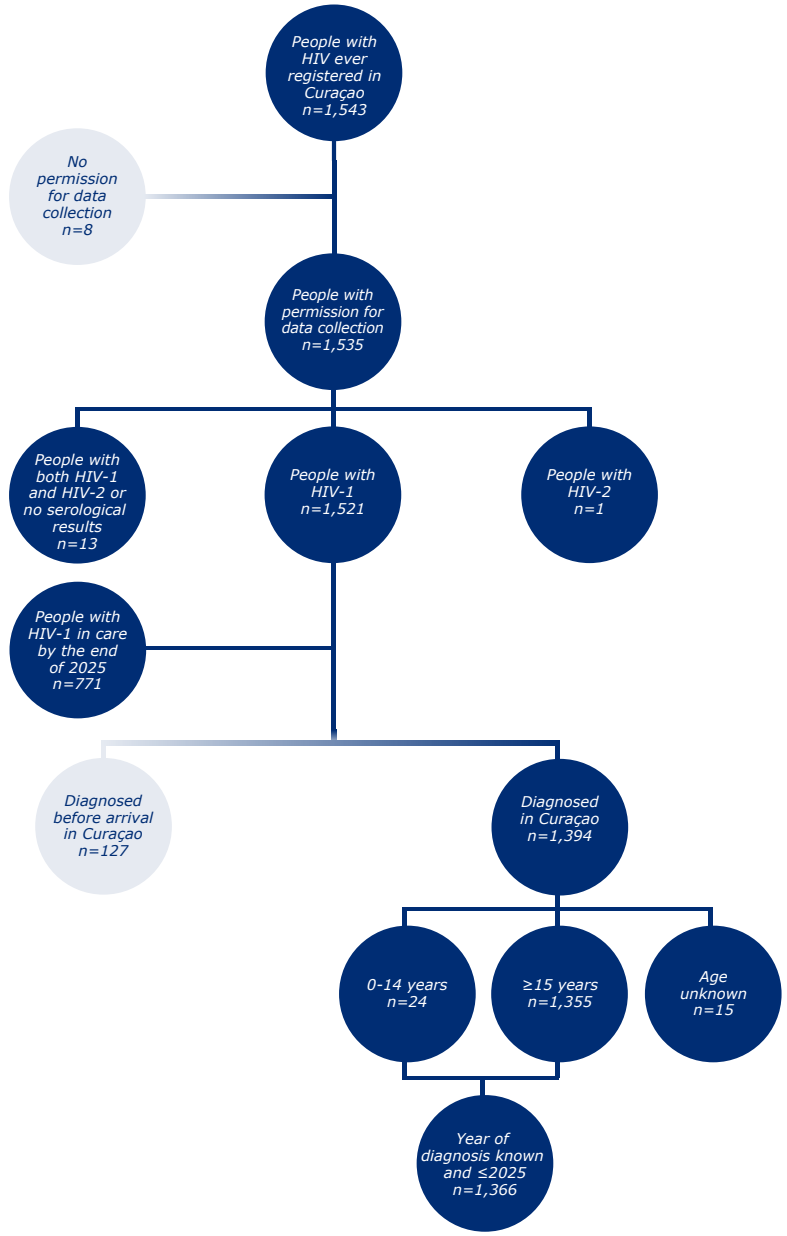
Since 2005, stichting hiv monitoring (SHM) has assisted in collecting demographic and clinical data on individuals with HIV receiving care at the sole general hospital St. Elisabeth Hospital and its successor Curaçao Medical Center in Willemstad, Curaçao. An extensive database has been established as a result of this registration and monitoring. This is quite unique for the region and gives a clear picture of the population with HIV, the effectiveness of HIV care, and the challenges that exist in this relatively small Caribbean setting. This chapter presents a concise overview of the current situation for people with HIV in Curaçao.

In total, 1,535 individuals with HIV recorded by SHM have been registered in Curaçao who gave permission for further data collection. Of these people, the majority were diagnosed with HIV-1 (n=1,521, or 99%), while one individual was diagnosed with HIV-2, and three had antibodies against both HIV-1 and HIV-2 (*Figure 13.1*). For 10 individuals, serological results on HIV type were not available in the SHM database.

The population with HIV-1 in Curaçao

Of the 1,521 individuals in Curaçao with HIV-1, 127 (8%) had a documented HIV diagnosis prior to arrival in Curaçao (*Figure 13.1*). The remaining 1,394 individuals were newly diagnosed while living in Curaçao, or their date of arrival in Curaçao has not yet been recorded in the SHM database.

Figure 13.1: *Overview of the population with HIV registered in Curaçao.*



Individuals diagnosed before arriving in Curaçao

The 127 individuals with a documented HIV-1 diagnosis prior to arrival in Curaçao included 104 (82%) people who were registered with an HIV treatment centre in the Netherlands prior to moving to Curaçao (*Figure 13.1*). The majority of these 104 individuals (n=77, or 74%) originated from the former Netherlands Antilles, while 22 (21%) were born in the Netherlands and five (5%) were born elsewhere. The other 23 individuals with pre-migration diagnosis were also born abroad, including 6 in Venezuela and 6 in Colombia. Twelve of the 17 people arriving in Curaçao in 2023-2025 with a documented HIV-1 diagnosis prior to arrival had a suppressed viral load below 200 copies/ml (*Figure 13.2*).

Individuals newly diagnosed in Curaçao

Altogether, 1,394 individuals were newly diagnosed while living in Curaçao, or information on where they lived at the time of diagnosis was not yet available (*Figure 13.1*). For 28 (1%) of these 1,394 individuals, the date or interval of diagnosis was not recorded in the SHM database, or they were diagnosed in 2026. Of the remaining 1,366 individuals, 1,014 (74%) were born in the former Netherlands Antilles, 117 (9%) originated from Haiti, 98 (7%) from the Dominican Republic, 29 (2%) from Jamaica, 29 (2%) from Colombia, 25 (2%) from Venezuela, and 54 (4%) from other countries.

The 1,366 individuals comprised (*Table 13.1*):

- 274 (20%) men who have sex with men (MSM);
- 579 (42%) other men,
  - 337 (58%) of whom reported sex with women as the most likely mode of transmission
  - 242 (42%) reported other or unknown modes of transmission;
- 482 (35%) women,
  - 469 (97%) of whom reported sex with men as the most likely mode of transmission
  - 13 (3%) reported other or unknown modes of transmission;
- 7 (1%) transgender individuals;
- 24 (2%) children diagnosed before the age of 15 years.

Between 2002 and 2018, the annual number of newly-diagnosed infections hovered around 50, before decreasing to around 20 in most recent calendar years (*Table 13.1; Figure 13.2*).

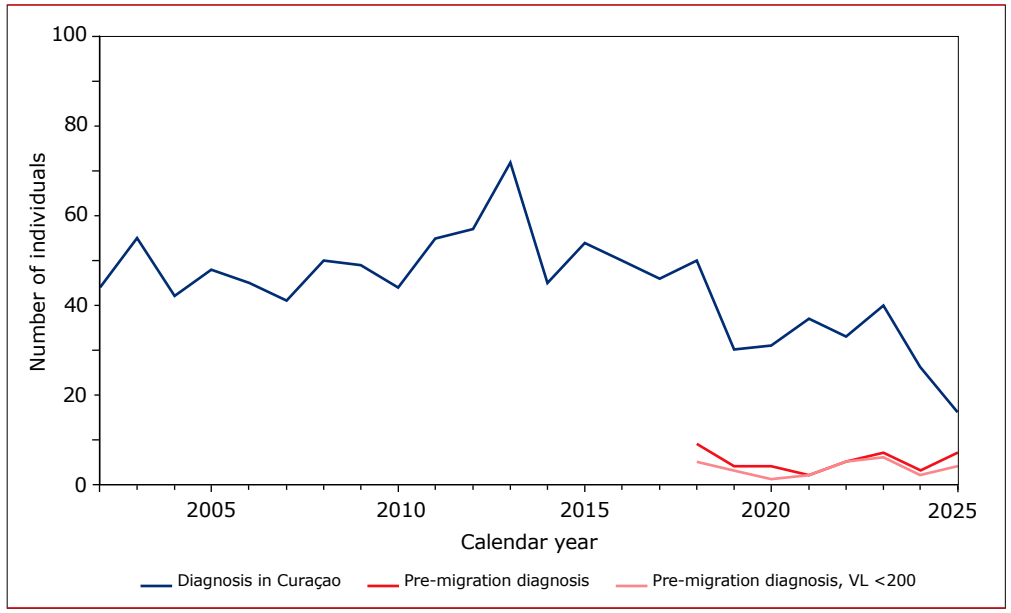
Table 13.1: Annual number of HIV-1 diagnoses in Curaçao among men who have sex with men, other men, women, and trans individuals diagnosed at 15 years of age and over, and children under 15 years.

Year of diagnosis	MSM	Other men	Women	Trans individuals	<15 years of age	Total
≤2001	41	136	109	1	19	306
2002	7	20	17	0	0	44
2003	8	28	19	0	0	55
2004	3	23	16	0	0	42
2005	12	19	17	0	0	48
2006	6	22	17	0	0	45
2007	12	18	11	0	0	41
2008	10	17	20	2	1	50
2009	10	17	21	0	1	49
2010	4	19	21	0	0	44
2011	12	19	24	0	0	55
2012	13	18	26	0	0	57
2013	19	29	22	1	1	72
2014	17	14	14	0	0	45
2015	16	23	13	1	1	54
2016	11	23	15	1	0	50
2017	15	18	13	0	0	46
2018	17	13	19	1	0	50
2019	7	15	8	0	0	30
2020	7	12	12	0	0	31
2021	4	22	10	0	1	37
2022	3	16	14	0	0	33
2023	9	19	12	0	0	40
2024	7	11	8	0	0	26
2025	4	8	4	0	0	16
Total	**274**	**579**	**482**	**7**	**24**	**1,366**

Legend: *MSM = men who have sex with men.*

Note: *data collection for 2025 may not have been finalised at the time of writing.*

Figure 13.2: Annual number of individuals newly diagnosed with HIV-1 in Curaçao (by year of diagnosis) or with documented diagnosis abroad before moving to Curaçao (by year of arrival). VL <200: individuals with documented diagnosis abroad before moving to Curaçao who already had a suppressed viral load below 200 copies/ml by the time they entered HIV care in Curaçao. NB: information on diagnosis abroad and date of arrival in Curaçao has been recorded for all newly registered individuals since early 2018, but is not yet available for everyone.



Among the 82 individuals diagnosed in 2023-2025, the median age at diagnosis was 39 years (interquartile range [IQR] 29-48), with no differences between men and women. Of these 82 individuals:

- 22 (27%) were younger than 30 years of age at the time of diagnosis;
- 22 (27%) were aged between 30 and 39 years;
- 20 (24%) were aged between 40 and 49 years; and
- 18 (22%) were aged 50 years and over.

People in clinical care

In total, 771 (51%) of the 1,521 registered individuals with HIV-1 were known to be in clinical care in Curaçao by the end of 2025. People were considered to be in clinical care if they had visited their treating physician in 2025, or had a CD4 cell count or HIV RNA measurement during that year, and had not moved abroad. Of the 750 individuals who, according to this definition, were not in care by the end of 2025:

- 253 (34%) were known to have died;
- 216 (29%) had moved abroad; and
- 268 (36%) were lost to care

The remaining 13 individuals only entered HIV care after 2025. Of the 268 people lost to care, 51 (19%) had their last visit within a year of entering care, while another 32 (12%) had no follow-up visit after entering care. Of those lost to care:

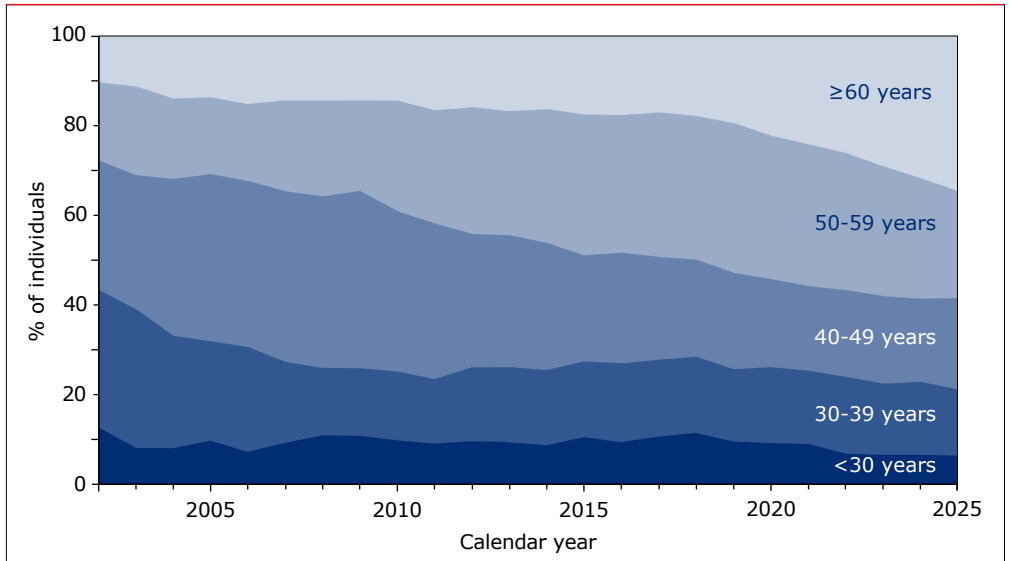
- 152 (57%) originated from the former Netherlands Antilles;
- 48 (18%) were from Haiti;
- 28 (10%) were from the Dominican Republic; and
- 40 (15%) were from other countries.

The 771 people in clinical care in 2025 included 11 individuals who did not have a clinical visit, CD4 cell count or HIV RNA measurement in 2024, but had previously received care for their HIV infection. Four of these individuals had not been in care for more than three years.

Ageing population

The median age of the population in care by the end of 2025 was 54 years (IQR 42-63), a figure which has been increasing since 2002 (*Figure 13.3*). This increase is mainly a result of the improved life expectancy of individuals with HIV following the introduction of combination antiretroviral therapy (ART). As a result, 58% all people currently in care are aged 50 years and over, including 56% of men and 63% of women. More than a third of those in care (35%) are 60 years and over.

Figure 13.3: *Increasing age of the population with HIV-1 in clinical care in Curaçao over calendar time. In 2002, 13% of the people in care were younger than 30 years of age, whereas 28% were 50 years and over. In 2025, these proportions were 6% and 58%, respectively, while 35% of people in care were 60 years of age and over. The proportion of people in clinical care as of 31 December of each calendar year is shown according to those who were <30 years of age, 30-39 years, 40-49 years, 50-59 years, and 60 years and over.*



Duration since diagnosis

People in care by the end of 2025 had been diagnosed with HIV a median of 13.1 years (IQR 7.4-19.9) previously. Therefore, a large group (64%) has lived with HIV for more than 10 years; 24% for more than 20 years (*Table 13.2*). The median time since diagnosis was 12.5 years for MSM, 12.3 years for other men, and 14.5 years for women.

Table 13.2: *Characteristics of the 771 individuals with an HIV-1 infection in clinical care in Curaçao by the end of 2025.*

	MSM (n=175, 23%)		Other men (n=307, 40%)		Women (n=287, 37%)		Total* (n=771)	
	n	%	n	%	n	%	n	%
Transmission								
Sex with men	133	76	–	–	277	97	412	53
Sex with women	1	1	161	52	0	0	162	21
Sex, partner unspecified	39	22	7	2	0	0	46	6
Other/unknown	2	1	139	45	10	3	151	20
Current age (years)								
0-14	0	0	1	0	2	1	3	0
15-24	2	1	7	2	6	2	15	2
25-29	8	5	15	5	8	3	31	4
30-39	34	19	41	13	39	14	114	15
40-49	46	26	58	19	52	18	157	20
50-59	41	23	71	23	72	25	185	24
60-69	34	19	83	27	80	28	197	26
≥70	10	6	31	10	28	10	69	9
Country of origin								
Former Netherlands Antilles	142	81	235	77	188	66	566	73
The Dominican Republic	2	1	11	4	44	15	57	7
Haiti	0	0	25	8	26	9	51	7
Colombia	9	5	10	3	5	2	25	3
Venezuela	9	5	10	3	1	0	20	3
Jamaica	0	0	4	1	13	5	17	2
The Netherlands	8	5	3	1	1	0	12	2
Other	5	3	9	3	9	3	23	3
Years aware of HIV infection								
<1	4	2	8	3	4	1	16	2
1-2	17	10	28	9	18	6	63	8
3-4	5	3	33	11	22	8	60	8
5-9	40	23	53	17	40	14	134	17
10-19	72	41	120	39	117	41	310	40
20-29	29	17	49	16	73	25	151	20
≥30	8	5	16	5	11	4	35	5
Unknown	0	0	0	0	2	1	2	0

**includes two transgender individuals*

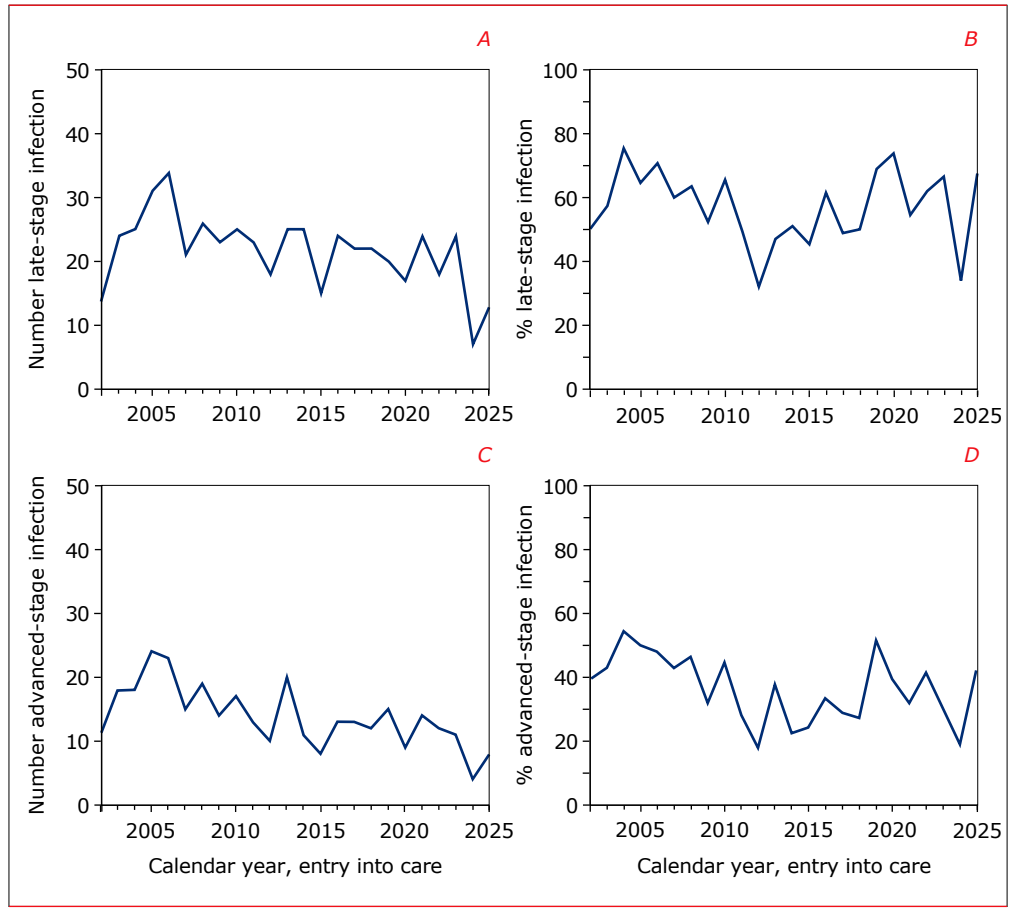
Legend: *MSM = men who have sex men.*

Late presentation

Among the 1,366 people diagnosed with HIV-1 while living in Curaçao, a large proportion of those who have entered care since 2002 were late presenters. This refers to individuals who entered care with a CD4 cell count below 350 cells/mm³, or with an AIDS-defining event, regardless of CD4 cell count, and who had no HIV-negative test in the 12 months prior to entry into care[1]. The proportion of late presenters was 56% among individuals entering care in 2002-2022, and remained at a high level of 58% among those entering care in 2023-2025 (*Figures 13.4A* and *13.4B*). There were no significant differences in the proportion of individuals with late presentation in 2023-2025 between MSM (82%), other men (53%), and women (48%).

Advanced HIV infection (i.e. with a CD4 cell count below 200 cells/mm³ or AIDS) was found in 36% of individuals entering care in 2002-2022 and in 30% of those entering care in 2023-2025 (*Figures 13.4C* and *13.4D*). In total, 2 (2%) of the individuals who entered care in 2023-2025 presented with an AIDS-defining disease.

Figure 13.4: *Number and proportion of people classified as presenting with (A, B) late-stage, or (C, D) advanced-stage HIV infection at the time of entry into care. In 2023-2025, 44 (58%) individuals presented with late HIV disease while 23 (30%) were advanced presenters. Late-stage HIV infection: CD4 cell counts below 350 cells/mm³ or having AIDS, regardless of CD4 cell count, and no HIV-negative test in the 12 months prior to entry into care. Advanced-stage HIV infection: CD4 cell counts below 200 cells/mm³ or having AIDS, and no HIV-negative test in the 12 months prior to entry into care. As a pre-therapy CD4 cell count measurement close to the time of entry into care was sometimes missing, the stage of HIV infection could not be determined for all individuals. In 2023-2025, the stage of infection was unknown for 16 (17%) individuals.*



Antiretroviral therapy (ART)

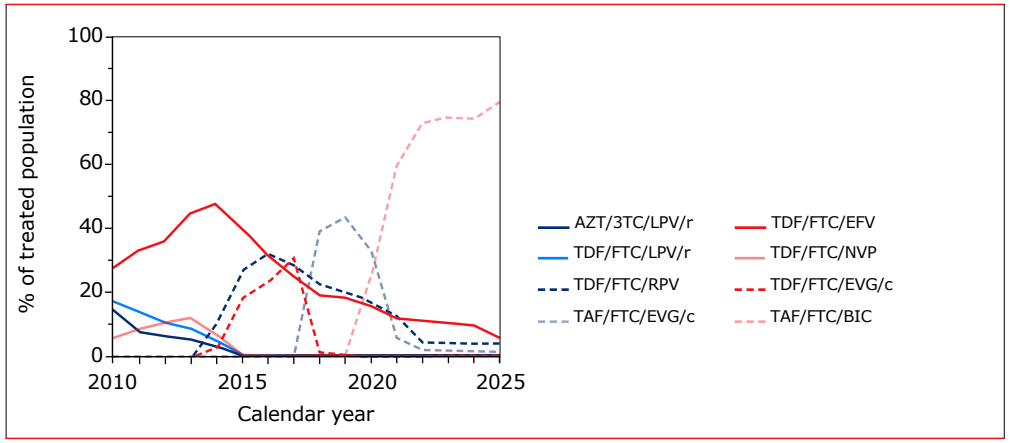
In total, 1,406 (92%) of the 1,521 registered individuals with HIV-1 had started antiretroviral therapy by the end of 2025. Of the 115 people who had not started therapy by that time, two managed to achieve HIV RNA levels below the lower limit of quantification without therapy, while 91 people were no longer in care, including 35 who had died. The other 22 individuals started therapy in 2026, or their ART may not have been recorded yet.

Over time there have been clear shifts in the ART regimens prescribed in Curaçao (*Figure 13.5*). Of the 761 people who were still in care and had started ART by the end of 2025:

- 606 (80%) were being treated with a combination of tenofovir alafenamide, emtricitabine, and bictegravir;
- 45 (6%) with tenofovir disoproxil, emtricitabine, and efavirenz; and
- 32 (4%) with tenofovir disoproxil, emtricitabine, and rilpivirine.

Among the 761 people, 24 (3%) had (temporarily) interrupted ART by the end of 2025. Of the remaining 737 individuals on ART, the majority (733, 99%) used a once-daily regimen, with 695 (94%) being treated with a fixed-dose, single tablet regimen.

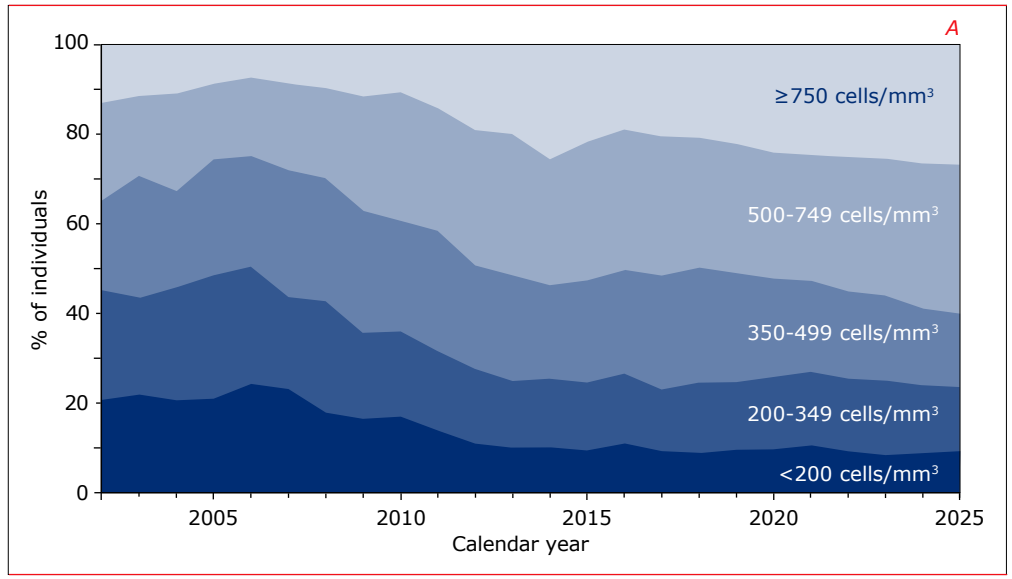
Figure 13.5: *Percentage of individuals treated with antiretroviral therapy (ART) by specific regimens over calendar time. At the end of 2025, 80% were receiving TAF/FTC/BIC, 6% TDF/FTC/EFV, and 4% TDF/FTC/RPV.*

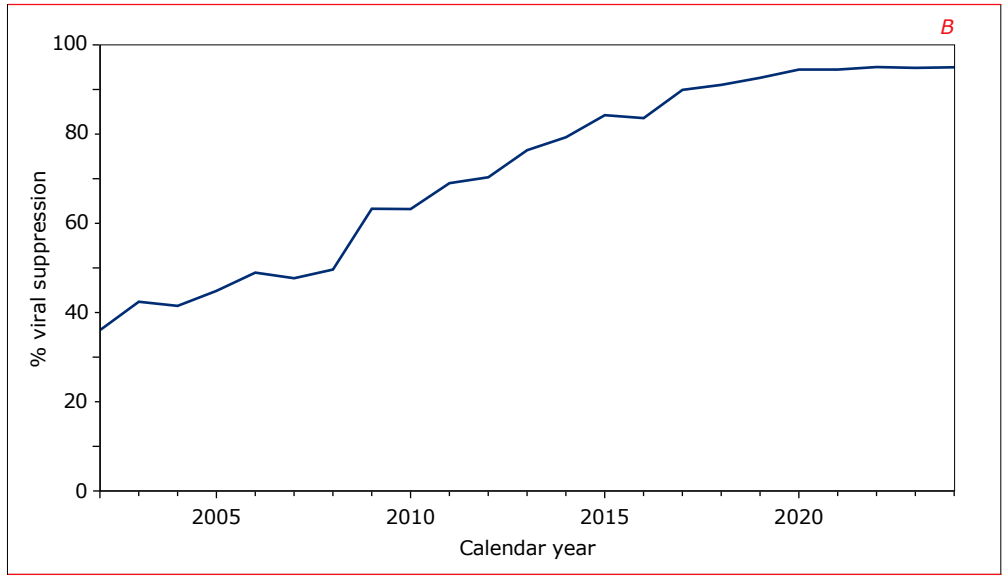


Therapy outcome

In the total population still in care by the end of 2025, the median current CD4 cell count was 454 cells/mm³ (IQR 278-656). CD4 cell counts were highest in women (542 cells/mm³; IQR 323-740) followed by MSM (483 cells/mm³; IQR 288-656) and other men (429 cells/mm³; IQR 250-627). The proportion of individuals with a most recent CD4 cell count below 350 cells/mm³ decreased from 45% in 2002 to 23% in 2025 (*Figure 13.6A*). During the same time, among individuals with a viral load measurement, the proportion with HIV RNA levels lower than 200 copies/ml increased from 36% to 94% (*Figure 13.6B*).

Figure 13.6: *Proportion of people in care by the end of each calendar year (A) stratified by most recent CD4 cell count, and (B) with HIV RNA <200 copies/ml at their last viral load measurement in each calendar year.*





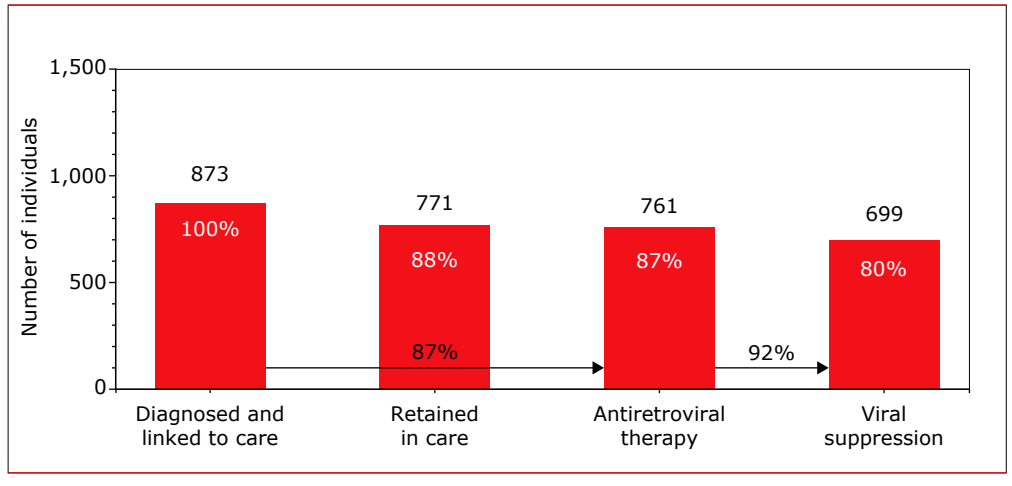
Continuum of HIV care

In total, 873 individuals had been diagnosed and linked to care, registered by SHM, had received HIV care in 2015 or later, and were not recorded in the SHM database as having died or moved abroad (*Figure 13.7*). Altogether:

- 771 people (or 88% of those diagnosed and linked to care) were still in care, having had at least one HIV RNA or CD4 cell count measurement, or a clinical visit in 2025;
- 761 (or 87% of those diagnosed and linked to care) of whom had started ART;
- 745 (98% of those who started therapy) of whom had an HIV RNA measurement available in 2025; and
- 699 (94%, or 92% of those treated) of those had a most recent HIV RNA level below 200 copies/ml.

Overall, 80% of the 873 individuals diagnosed and ever linked to care, had a suppressed viral load. In terms of the Joint United Nations Programme on HIV/AIDS' (UNAIDS) 95-95-95 targets for 2025, the current estimate for the second and third "95" for Curaçao stands at 87-92: 87% of all people diagnosed receive antiretroviral therapy, and 92% of people receiving ART have a suppressed viral load[2].

Figure 13.7: Continuum of HIV care for the population with HIV-1 in Curaçao diagnosed and linked to care by the end of 2025. Percentages at the top of the bars are calculated relative to the number of people diagnosed and linked to care, while percentages at the bottom correspond to the second and third of UNAIDS' 95-95-95 targets.



It is worth noting that we did not estimate the total number of people with HIV, including those not yet diagnosed. Estimation of the undiagnosed population is based on trends over calendar time in observed diagnoses and CD4 cell counts at the time of diagnosis. A requirement for this estimate is that all diagnoses are reported in the SHM database, and this was not yet the case. In addition, the estimated number with undiagnosed HIV would not include populations that are less likely to reach HIV care in Curaçao, such as undocumented migrants, and would therefore underestimate the true number with undiagnosed HIV.

Viral suppression

Of the 761 individuals who had started ART, 62 (8%) did not have a suppressed viral load. On closer inspection, 16 (26%) of these individuals were found to have no documented HIV RNA measurement in 2025. The remaining 46 (74%) had a viral load measurement in 2025, but with HIV RNA levels exceeding 200 copies/ml. Of these 46 individuals, two only started ART within the six month-period prior to their last measurement and may not have had sufficient follow up to achieve a documented suppressed viral load. The remaining 44 individuals with HIV RNA levels above 200 copies/ml had started ART longer than six months previously.

Lost to care

In total, 268 individuals were lost to care by the end of 2025, of whom:

- 166 (62%) were last seen for care before the end of 2015;
- 66 (25%) between 2015 and 2021;
- 5 (2%) in 2022;
- 7 (3%) in 2023; and
- 24 (9%) in 2024.

The 166 individuals who were lost to care before the end of 2015 were excluded from the number of people diagnosed and linked to care. It is unlikely that these 166 individuals are still living in Curaçao without requiring care or ART. In total, 41 (40%) of the 102 individuals lost to care after 2015 were born outside the former Netherlands Antilles, including 13 in Haiti, 9 in Venezuela, and 8 in the Dominican Republic. For those still in care by the end of 2025, the percentage of people born outside the former Netherlands Antilles falls to 27%. This suggests that some of those lost to care may have moved abroad; in particular, back to their country of birth. It also shows that, overall, a considerable proportion was not retained in care.

Conclusion

Over the years, the quality of care offered to individuals with HIV in Curaçao has improved considerably, as evidenced by the increasing proportion of individuals with a suppressed viral load. In addition, timely registration of HIV RNA measurements in the SHM database has also improved, enabling better monitoring of progress towards achieving UNAIDS' 95-95-95 goals for 2025. However, the proportion of people entering care with late-stage HIV infection remained high in recent years. Furthermore, the relatively high proportion of people lost to care is worrisome and may result in underreporting of death and outmigration.

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