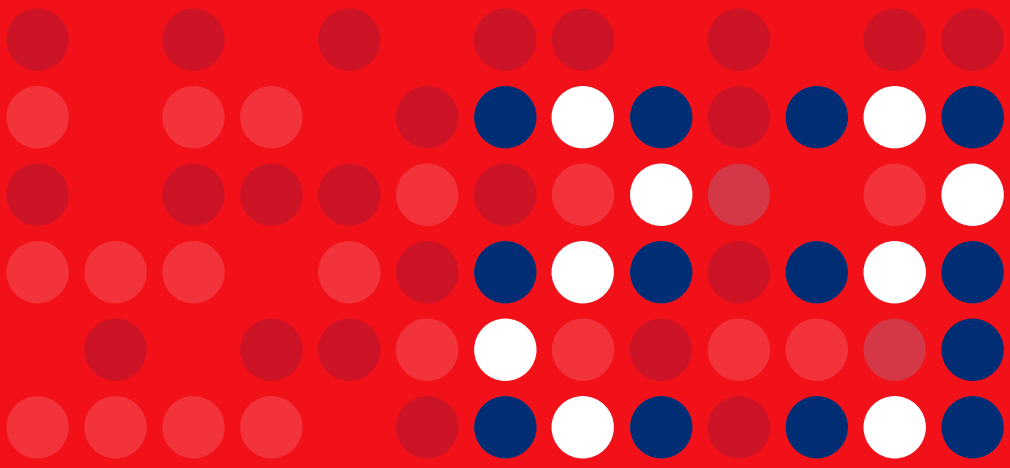
Human Immunodeficiency Virus (HIV)
Infection in the Netherlands

HIV Monitoring

HIV Monitoring Report 2023

Chapter 5: Distinct populations: Children with HIV in the Netherlands



5. Distinct populations: Children with HIV in the Netherlands

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Box 5.1: Chapter definitions.

Child 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.
Infection	The moment a child acquires HIV.
Diagnosis	The moment HIV is diagnosed in a child.
Registration	The moment an HIV physician or nurse notifies SHM of a child (in care) and the child'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.
In care in 2022	Individuals with HIV who had a documented clinic visit or lab measurement in 2022.
Vertically-acquired HIV	Transmission of HIV from a woman with HIV to a child during pregnancy, delivery, or breastfeeding.
Non-vertically-acquired HIV	Transmission of HIV through sexual contact or contact with contaminated blood or blood products.
ART	Antiretroviral therapy: a combination of at least three antiretroviral drugs from two different antiretroviral drug classes, or at least three nucleoside reverse transcriptase inhibitors.
Viral suppression_200	Any viral load measurement below 200 copies/ml, except for time points in the past where tests had quantification limits higher than 200 copies/ml.
Viral suppression_50	Any viral load measurement below 50 copies/ml, except for time points in the past where tests had quantification limits higher than 50 copies/ml.

Box 5.2: Outline of the paediatric ATHENA cohort in the Netherlands: all children with HIV registered in the ATHENA cohort before 31 December 2022. (Children = individuals under 15 years of age at the time of diagnosis who made a first visit to a Dutch HIV treatment centre before the age of 18 years.)

1. Children who were diagnosed under the age of 15 and who entered care in the Netherlands before the age of 18 (n=400).
2. Population of those diagnosed as a child and in care in 2022:
   - under the age of 15 in 2022 (n=124); includes 104 adopted children.
   - aged 15-18 years in 2022 (n=44); includes 33 adopted children.
   - aged 18 years and over in 2022 (n=159); includes 11 adopted children.

Background

Antiretroviral therapy (ART) has dramatically decreased morbidity and mortality in children with HIV worldwide[3-7]. Immediate initiation of ART, regardless of CD4 cell count or percentage, is associated with a higher survival rate when compared with delayed ART initiation guided by CD4 cell count[8-11]. Studies showing a clinical benefit of early ART initiation led to a 2015 revision of the World Health Organization (WHO) guidelines on when to start ART; they now recommend initiation in everyone with HIV (including children), irrespective of CD4 cell count[12].
In the Netherlands children with HIV generally receive health care at one of four paediatric HIV treatment centres. These children transition to adult HIV care when they reach the age of 18. However, children who acquire HIV at an older age through non-vertical transmission are more likely to enter care at an adult HIV treatment centre. Accordingly, those who are aged 15 years and over at the time of diagnosis are described in *Chapter 1* as part of the adult population.

Here we report on the following for children diagnosed with HIV before the age of 15, who have ever received care at one of the paediatric and/or adult HIV treatment centres in the Netherlands while under the age of 18 (*Box 5.2*)[a]:

- demographics
- clinical characteristics
- treatment regimens between 2013-2022.
- long-term virological and immunological responses to treatment between 2013-2022.

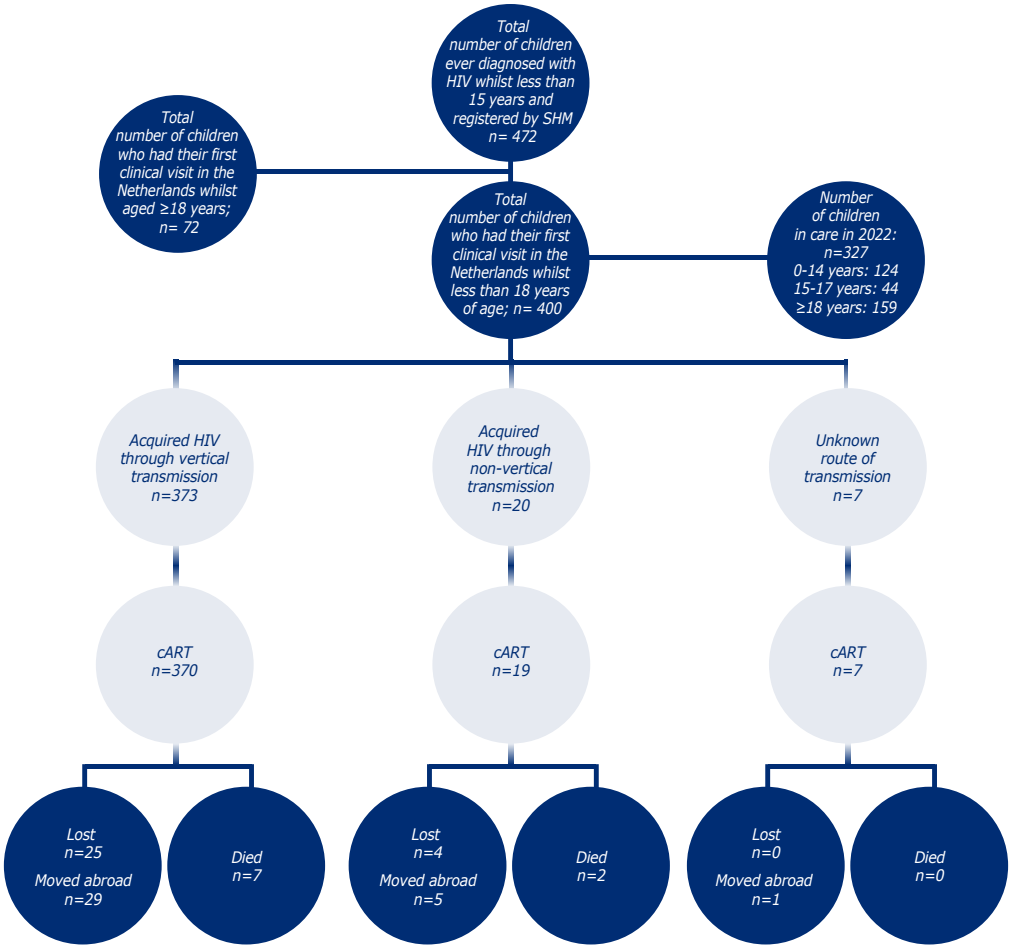
The limit of 15 years is aligned with the definition of children used by the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO)[1,2].

a The adapted inclusion of children from including children with an diagnosis before 18 years of age to those diagnosed before the age of 15 years resulted in a lower number of children described compared to the 2019 SHM Monitoring report.

Ever registered

As of 31 December 2022 the SHM database includes 472 individuals diagnosed with HIV while under 15 years of age (*Figure 5.1*). Of these, 400 children entered care in the Netherlands before the age of 18. The remaining 72 individuals who were diagnosed as a child, entered care in the Netherlands *after* the age of 18; 78% (n=56) of those were born outside the Netherlands. And the other 16 were born in the Netherlands.

Figure 5.1: *Overview of total population children with HIV registered in SHM database as of 31 December 2022.*



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.*

The remainder of this chapter will focus on the 400 children diagnosed under the age of 15 and entered care in the Netherlands before the age of 18.

The majority (98%) of this group entered HIV care at a paediatric HIV treatment centre in the Netherlands; nine children entered care at an adult HIV treatment centre at a median age of *16.9 years* (*IQR 16.2-17.6*) (*Table 5.1*). The most commonly reported region of birth was Sub Saharan Africa (n=235, 59%) and the Netherlands (n=114, 29%); 51 (13%) children were born in other regions, including the Caribbean, Latin America, Europe and Asia. Per 31 December 2022 4 children born in Ukraine were registered.

Table 5.1: *Demographic and HIV-related characteristics of 400 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	Vertical transmission*	Non-vertical transmission*	Route of transmission unknown*
Total	373 (93)	20 (5)	7 (2)
HIV treatment centre			
Paediatric care	368 (99)	16(80)	7 (100)
Adult care	5 (1)	4 (20)	0
Gender			
Male	181 (49)	8 (40)	5 (71)
Female	192 (51)	12 (60)	2 (29)
Child's country of origin			
The Netherlands	112 (30)	2 (10)	0
Sub-Saharan Africa	212 (57)	16 (80)	7 (100)
Other	49 (13)	2 (10)	0
Mother's country of origin			
The Netherlands	33 (9)	2 (10)	0
Sub-Saharan Africa	189 (51)	8 (40)	5 (72)
Other/unknown	151 (40)	10 (50)	2 (28)
Adopted	149 (41)	0	3 (25)
Age at HIV diagnosis	1.1 (0.25-3.6)	11.5 (7.14-14.4)	10.9 (10.1-11.7)
ART-treated	370 (99)	19 (95)	7 (100)
Therapy-naïve at ART initiation	325(87)	16 (80)	7 (100)
CD4 at ART initiation	550 (278-1220)	324 (171-508)	475 (320-570)
CD4 Z-score at ART initiation	-0.6 (-1.0- -0.10)	-0.6 (-1.13- -0.01)	-0.50 (-0.7- -0.19)
VL (log copies/ml) at ART initiation	5.2 (4.5-5.8)	4.3 (4.0-5.5)	4.9 (4.6-5.1)

Legend: **Data are number (%) of children or median (interquartile range).*
ART = antiretroviral therapy; VL = viral load.

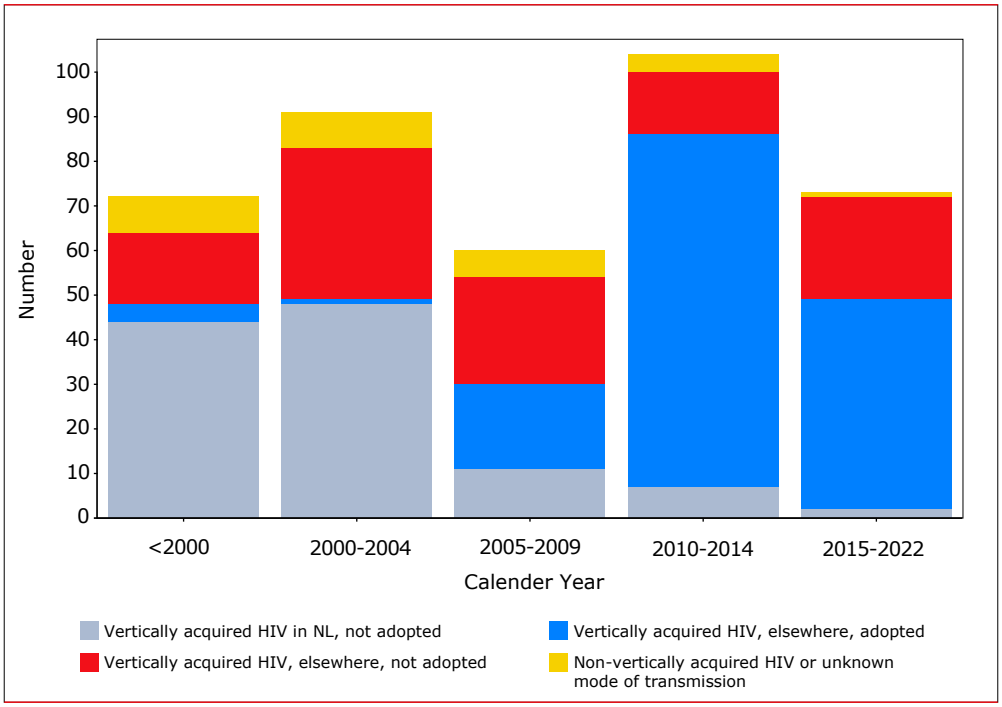
Mode of transmission

The majority (93%) of the children registered acquired HIV through vertical transmission. (*Figure 5.1*).

Vertical transmission

- Between 1998 and 2022, 373 children entered care after acquiring HIV through vertical transmission. (*Table 5.1*)
- The median age at which they received their first reported HIV-positive test result (including self-reported tests performed in their country of origin), was 1.1 years (interquartile range [IQR] 0.3-3.6 years).
- 99% received care in a paediatric HIV treatment centre in the Netherlands.
- ART initiation was documented for 99% of the children.
- 57% (n=212) of the children were born in sub-Saharan Africa.
- 30% (n=112) of the children were born in the Netherlands.
- 9% of the children born in the Netherlands (10 out of 112), had two Dutch parents.

***Figure 5.2:** 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.*

Decline in vertical transmission of HIV in the Netherlands since 2005

Figure 5.2 shows the number of registered children by year of entering care, mode of transmission, and region of origin. The number newly entering care in the Netherlands has fallen over time from 104 in 2010-14 to 73 in 2015-22. This drop is likely linked to the declining number of adopted children newly entering care over time. Standard HIV screening for pregnant women, introduced nationally in 2004[13,14], is responsible for the strong decline in vertical transmission in the Netherlands from 2005 onwards.

Non-vertical transmission

- Between 1998 and 2022, 20 children were registered as having acquired HIV through non-vertical transmission (*Table 5.1*); the most likely modes (reported in the medical chart) were heterosexual transmission (n=8) and contact with contaminated blood and blood products or medical procedures (n=12). Reporting on the latter category stopped in 1997 for children born in the Netherlands, and in 2009 for all children, regardless of country of birth. Further details regarding this latter category are not available. Six out of these 12 individuals are still in care and currently all of them are older than 18 years.
- The median age for children with a registered mode of non-vertical HIV transmission to receive their diagnoses was 11.5 years (IQR 7.14-14.4); the median age of diagnosis for those who acquired HIV by heterosexual transmission was higher at 14.7 years (IQR 13.8-14.9); those who acquired HIV through contact with contaminated blood and blood products or medical procedures were younger at time of HIV diagnosis (median age 8.59 (IQR: 5.89-11.5).
- In total, 95% of these children had started ART.
- 40% of children acquired HIV through heterosexual contact.
- 80% were born in sub-Saharan Africa.
- 25% received care in an adult HIV treatment centre.

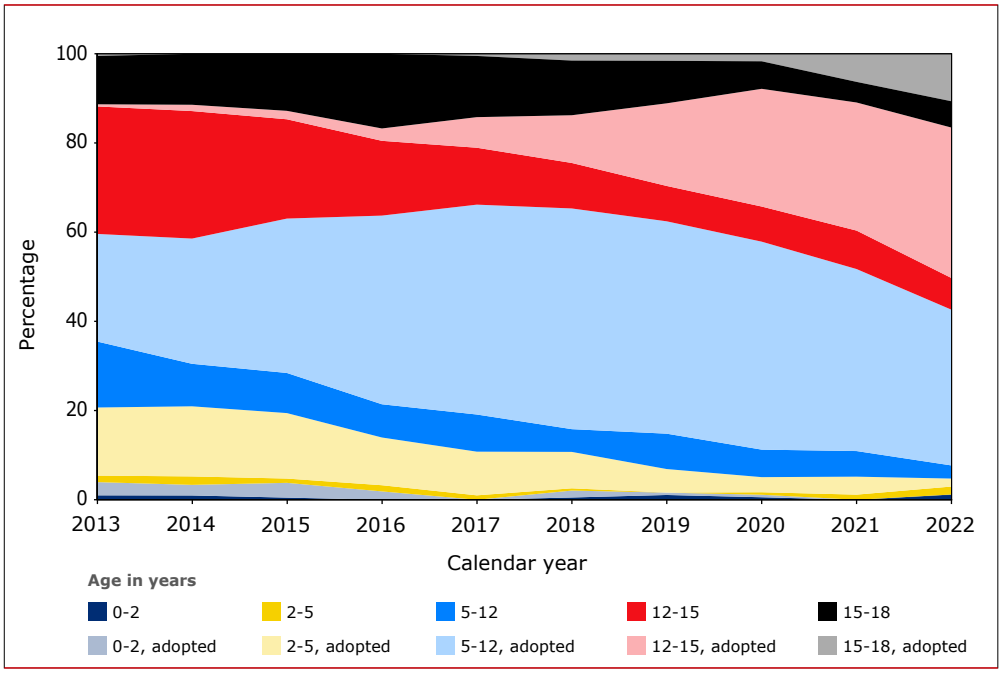
Unknown route of HIV transmission

- For 7 children with HIV, the route of transmission remains unknown (*Table 5.1*).
- Their median age at diagnosis was 10.9 years (IQR 10.1-11.7).
- All children had started ART.

Age distribution

Figure 5.3 shows the age distribution of children receiving HIV care in the last 10 years (2013-2022). Over time, the proportion of children aged 5-12 and 12-15 increased. This was mainly due to a relative increase in the rates of children adopted in those age groups. In 2022, 79% of children with HIV aged between 5 and 15 years was adopted.

Figure 5.3: Time-dependent age distribution of children with HIV in care over time.



Low mortality rates

No children registered with SHM were reported to have died before the age of 18 between 2013 and 2022. The mortality rate therefore remains very low, with a total of two deaths when aged <18 years recorded since the start of registration. Both children died from AIDS before 2010. However, between 2013 and 2022 seven young adults who had been diagnosed with HIV as children, died in adulthood; their median age at death was 26.8 years (IQR 24-30). Four of these young adults died from AIDS, two of a non-AIDS related cause and for one young adult the cause of death is unknown.

Antiretroviral treatment

Of the 400 children who entered care in the Netherlands before 18 years of age, 396 (99%) started ART; 348 (88%) of them were treatment-naive at the start of ART and 48 (12%) had previously been exposed to monotherapy or dual therapy (i.e. were pre-treated). In total, four children never received ART; all are no longer in care, and the last date of contact for them was between 1998 and 2010.

For the purposes of this analysis, both pre-treated and treatment-naive children who initiated ART from 2013 onwards have been included. Children were grouped by calendar year of ART initiation: 65 children started an ART regimen in 2013-2017 and 15 in 2018-22. For 14 children, the year of ART initiation is not known. All these children were born outside the Netherlands.

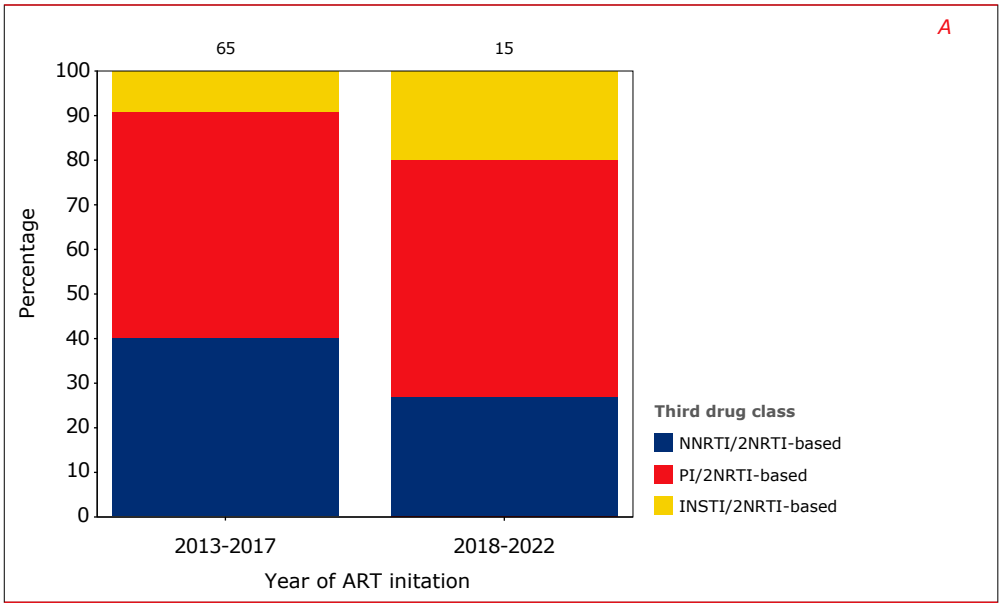
Initial antiretroviral regimen

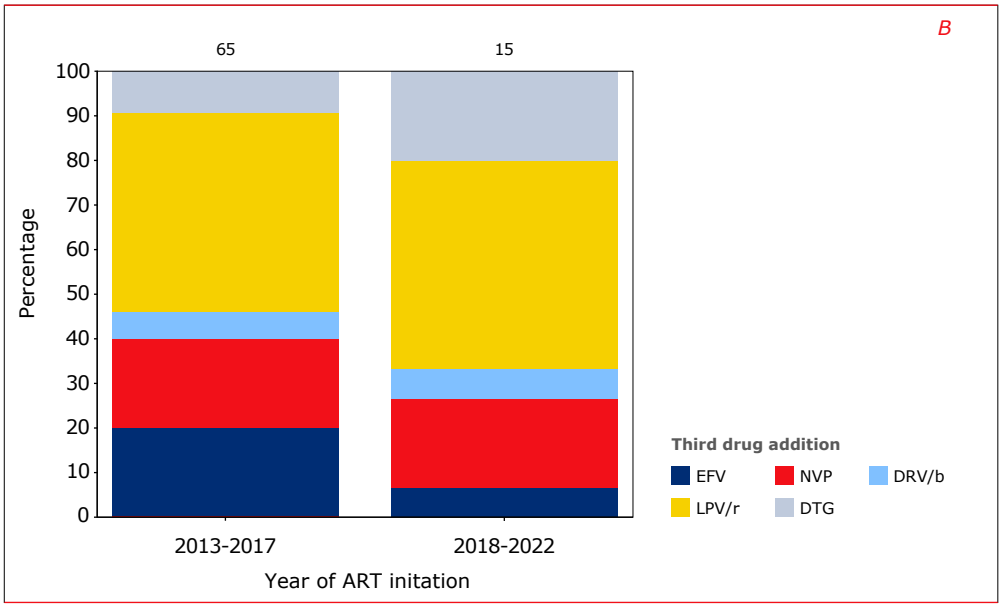
Of the 80 registered children known to have initiated ART between 2013 and 2022:

- 51% were treated with a first-line regimen that included a protease inhibitor (PI) and two or more nucleoside reverse transcriptase inhibitors (NRTIs);
- 38% were treated with a non-nucleoside reverse transcriptase inhibitor (NNRTI) with two or more NRTIs; and
- 11% were treated with an integrase inhibitor-based first-line with two or more NRTs regimen.

Figure 5.4 shows the trends over time for the third-drug additions to the NRTI backbone as part of the initial ART regimens, stratified by calendar period of starting ART. Among children, ritonavir boosted lopinavir was the most commonly-used PI (47%). Following its introduction in 2014, the integrase inhibitor dolutegravir was included in the initial ART regimen given to 20% of the children who initiated a first-line regimen between 2018-2022.

Figure 5.4: *Third-drug additions to the nucleoside reverse transcriptase backbone used as part of the initial ART regimen, stratified by calendar year period, according to (A) antiretroviral class, and (B) specific third drugs. Numbers above the bars represent the total number of individuals initiating ART in that calendar year period. Median ages and interquartile ranges above the bars represent the ages of individuals at the time of ART initiation.*





Legend: *ART = antiretroviral therapy; ENTRY = entry inhibitor; INSTI = integrase inhibitor; NRTI = nucleoside reverse transcriptase inhibitor; NNRTI = non-NRTI; PI = protease inhibitor; EFV = efavirenz; NVP = nevirapine; LPV/r = ritonavir-boosted lopinavir; IDV = indinavir; SQV = saquinavir; NFV = nelfinavir; RAL = raltegravir; DRV/b = cobicistat- or ritonavir-boosted darunavir; ATV/r = ritonavir-boosted atazanavir; DTG = dolutegravir; EVG/c = cobicistat-boosted elvitegravir.*

Discontinuation of the initial ART regimen

Among those who discontinued their first-line treatment regimen, the median time spent on first-line regimen among children who had started ART between 2013 and 2022 was 15.0 months (IQR 3-38). Discounting weight-related dose changes, 60 children (75%) discontinued their first-line treatment regimen. The most important reasons for changing included simplification (37%) and toxicity (13%). Virological failure was the reason given in 7% of cases and in 17% the reason was unknown.

Virological response

Virological response to ART was assessed based on viral suppression (i.e. viral load below 200 copies/ml and 50 copies/ml, [*Box 5.1*]). Initial virological response is reported for the first two years after starting ART between 2013-2022. Long-term virological response is reported by time-updated age for those who used ART for at least 24 months.

Initial response to ART

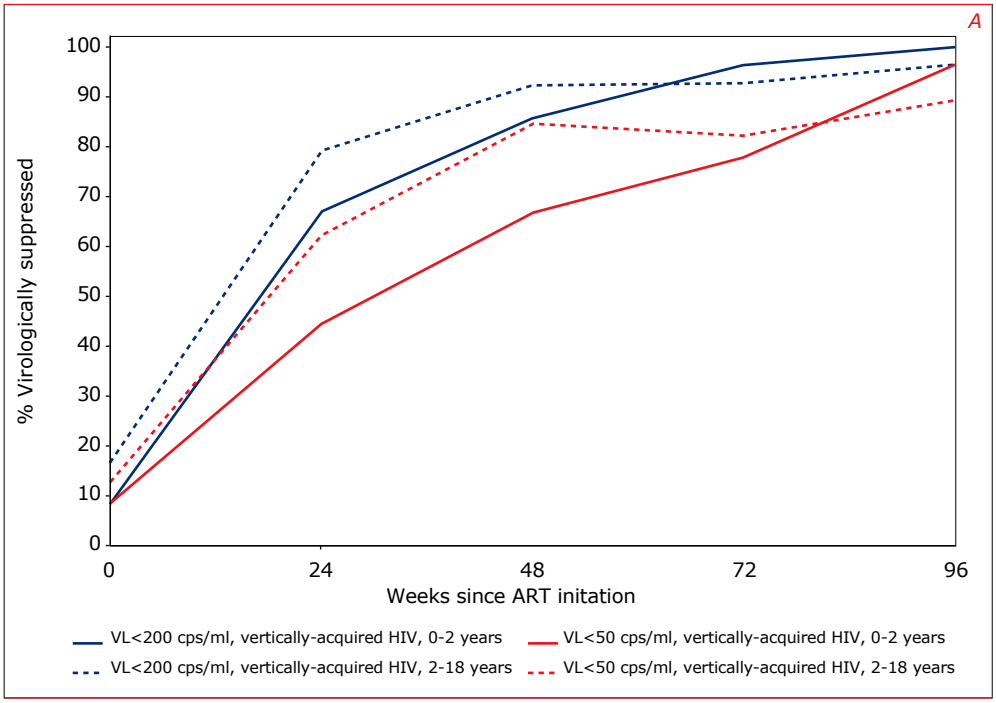
This analysis used data from the 80 children who were registered with SHM and had started ART between 2013-2022, and who had viral load data available in the first 24 months after ART initiation. Children were stratified by age at ART initiation, resulting in the following categories:

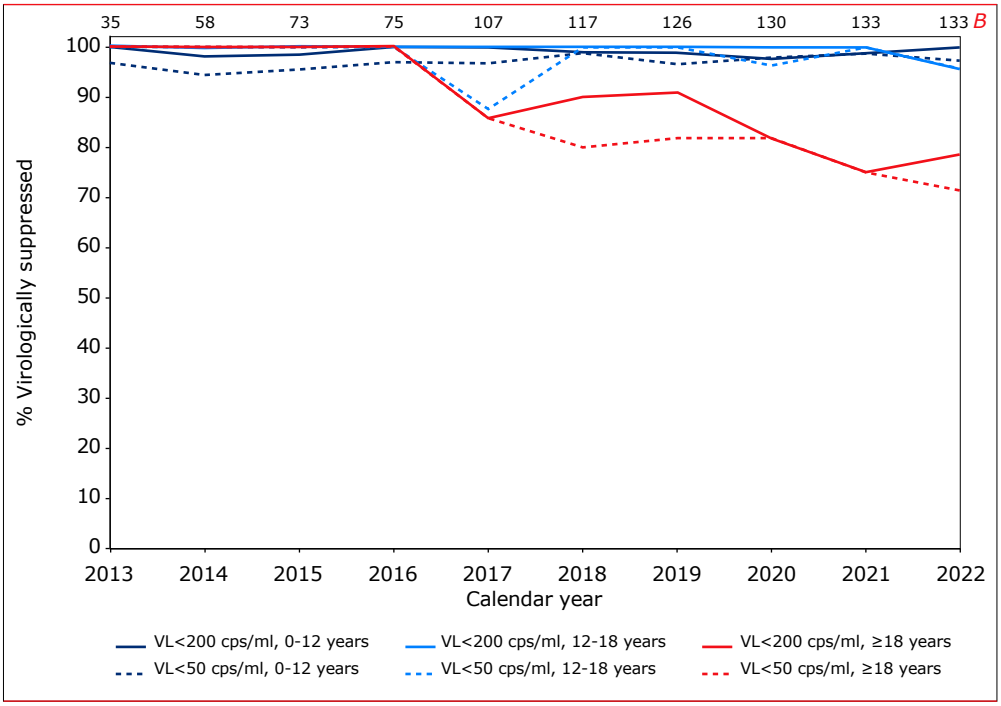
(1) 0-2 years
(2) 2-18 years

Among the children who started ART, we assessed their viral suppression rates at 24-week intervals while they were on ART. Viral load measurements closest to each 24-week time point (plus or minus 8 weeks) were included in the analysis. Viral suppression rates are shown for the calendar period 2013-2022 of ART initiation. *Figures 5.5A* shows viral suppression rates among children who initiated ART between 2013 and 2022:

- Among children who were aged 0-2 years at the time of ART initiation, viral suppression <200 copies/ml rates increased from 67% after 24 weeks, to 85% after one year of ART, to 100% after two years. Viral suppression <50 copies/ml rates were 44%, 67% and 96% after 24 weeks, one and two years.
- Among children who were aged 2-18 years at ART initiation, viral suppression <200 copies/ml rates increased from 79% after 24 weeks, to 92% after one year of ART, and 96% after two years, viral suppression <50 copies/ml rates were: 63%, 84% and 89% after 24 weeks, one and two years.

Figure 5.5: *Viral suppression following antiretroviral therapy (ART) initiation: (A) during the first two years of ART 2013–2022, (B) time-dependent and age-dependent viral suppression rates for children in care between 2013 and 2022 after two years of ART with ART initiation from 2010 onwards. Viral suppression is defined as any viral load measurements below 200 copies/ml and below 50 copies/ml, except for time points in the past where tests were used with quantification limits above 200 copies/ml or 50 copies/ml. The numbers above the bars represent the total number of individuals with an viral load measurement.*





Legend: *ART = antiretroviral therapy; cps = copies; VL = viral load.*

Long-term virological response

Among the children who were using ART for more than 24 months, we assessed viral suppression rates by calendar year of follow up. The latest viral load measurement in each calendar year was included in the analysis.

Time-updated age of HIV RNA measurements was calculated, and children were stratified by the following time-updated age ranges:

(1) 0-12 years
(2) 12-18 years
(3) 18 years or older

Age and time-updated HIV RNA viral suppression rates were consistently high among children aged below 18 years. However, viral suppression rates decreased once the age of 18 years was reached (*Figure 5.5B*). Of note: the small patient size per calendar year made the oldest age group more susceptible to having larger differences in viral suppression rates.

Immunological response

Earlier reports have shown that the clinical benefit of ART is strongly related to the degree to which the CD4 cell count recovers[15]. Given that normal CD4 cell counts in younger children are highly age-dependent[16], it is more appropriate to analyse time-dependent CD4 count trajectories, expressing CD4 counts as Z-scores in which counts are standardised in relation to age.

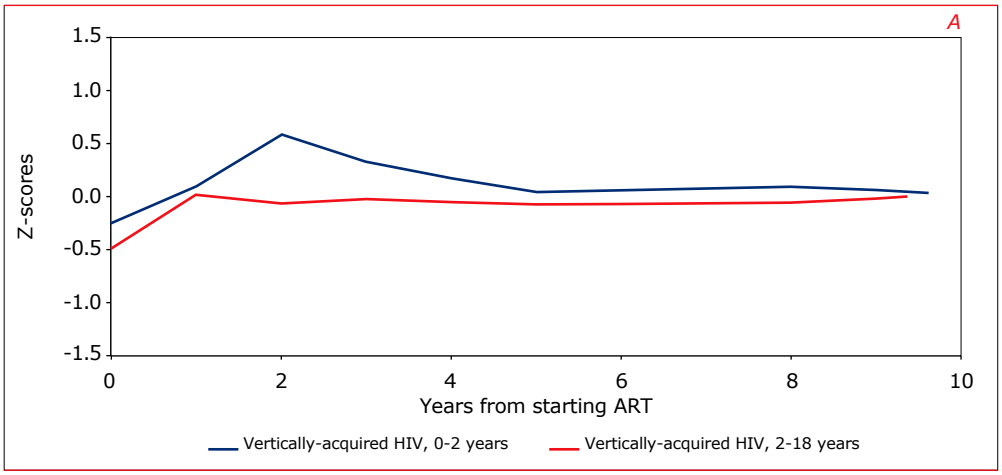
CD4 Z-scores represent the standard deviation from the reference values for HIV-negative children. They were calculated for CD4 cell counts to correct for age-related differences. All absolute CD4 T-cell counts were transformed into Z-scores by subtracting the age-related reference value for the age at the time of the CD4 measurement[17] and dividing the outcome by the age-related standard deviation.

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 5.6 shows the changes in CD4 T-cell Z-scores among children with HIV, stratifying those with vertically-acquired HIV by age at initiation of ART.

For those who initiated ART between 2013 and 2022, CD4 Z-scores increased significantly for both age groups in the year following ART initiation. However, in the second year the increase in CD4 Z-scores was less pronounced for children aged between 2-18 years at time of ART initiation, resulting in higher CD4 Z-scores among the youngest children (*Figure 5.6*).

Figure 5.6: Changes in Z-scores for CD4 T-cell counts among children with HIV, stratified by age at initiation of antiretroviral therapy (ART), who initiated ART between 2013 and 2022).



Legend: ART = antiretroviral therapy.

Currently in clinical care

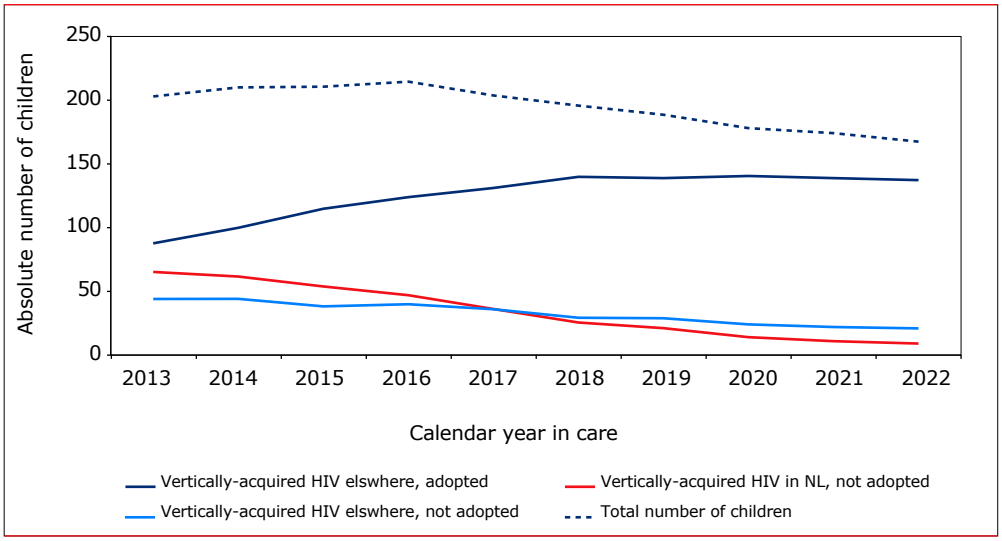
Of the 400 children with HIV ever registered by SHM, and who entered care in the Netherlands before the age of 18, 327 (82%) were still in care in 2022 and 73 were no longer in care. Of these 73 individuals :

- Nine had died;
- 35 had moved abroad;
- 29 were lost to care.

Of the 327 individuals still in care, 168 of them were under the age of 18 (*Figure 5.1*).

Figure 5.7 shows the number of children under 18 years of age in care, for each calendar year. This figure reached its peak in 2016, with 215 children. However by 2022, this figure had declined to 168, mainly due to the fact that more children are reaching the age of 18 years and, at the same time, fewer children are newly entering care.

Figure 5.7: 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

- 168 were younger than 18 years at the end of 2022
- 124 were younger than 15 years
- The median age was 13 years (IQR 10-15) as of 31 December 2022.

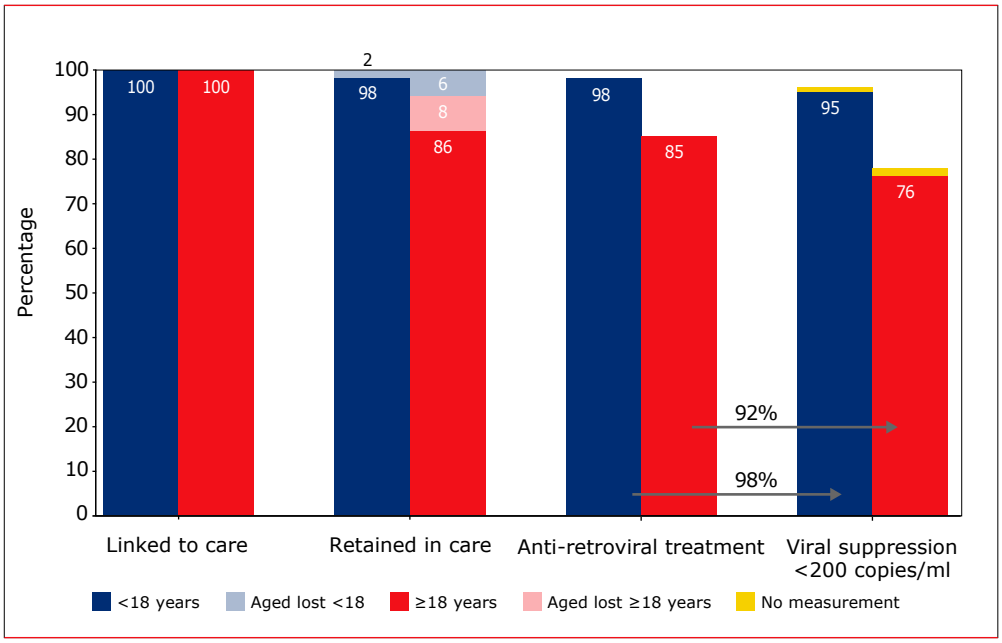
Currently in clinical care and 18 years or older

- 159 were older than 18 years at the end of 2022
- The median age was 25 years (IQR 22-29) as of 31 December 2022

Continuum of care

A 'continuum of care' was constructed based on the total number of children with HIV ever registered by SHM, who were still alive on 31 December 2022 and were not reported to have moved abroad. This continuum of care depicts engagement in HIV care across a number of key indicators. The final one of these is the number of children whose most recent HIV RNA measurement was below 200 copies/ml (*Figure 5.8*).

Figure 5.8: Continuum of care by age, as of 31 December 2022. The numbers in and above the bars indicate the proportion of individuals.



Individuals were stratified by age on 31 December 2022 and categorised as:
(1) current age, under 18 years
(2) current age, 18 years or older

Continuum of care: current age under 18 years

- 171 children were linked to care, registered by SHM, still alive and not reported to have moved abroad.
- 99% (168) were retained in care: three children, all were born outside the Netherlands, were lost to care.
- 98% (168) had ART during their last clinical visit in 2022.
- 95% (163) of all individuals linked to care had a most recent HIV RNA measurement below 200 copies/ml (98% of those on ART).

Continuum of care: current age 18 years or older

- 185 individuals were linked to care, registered by SHM, still alive and not reported to have moved abroad.
- 86% (159) were retained in care. The remaining 26 (15 of whom were born outside the Netherlands) were lost to care: 11 before they turned 18; 15 when they were older than 18 years of age.
- 85% (157) had ART during their last clinical visit in 2022.
- 76% (141) of all individuals linked to care had a most recent HIV RNA measurement below 200 copies/ml (92% of those on ART).

It is worth noting that 19 of the 26 young adults who were lost to care had their last clinical contact at a paediatric HIV treatment centre. They were deregistered and may have been lost during transition to adult care, or may be waiting to be re-registered at an adult treatment centre.

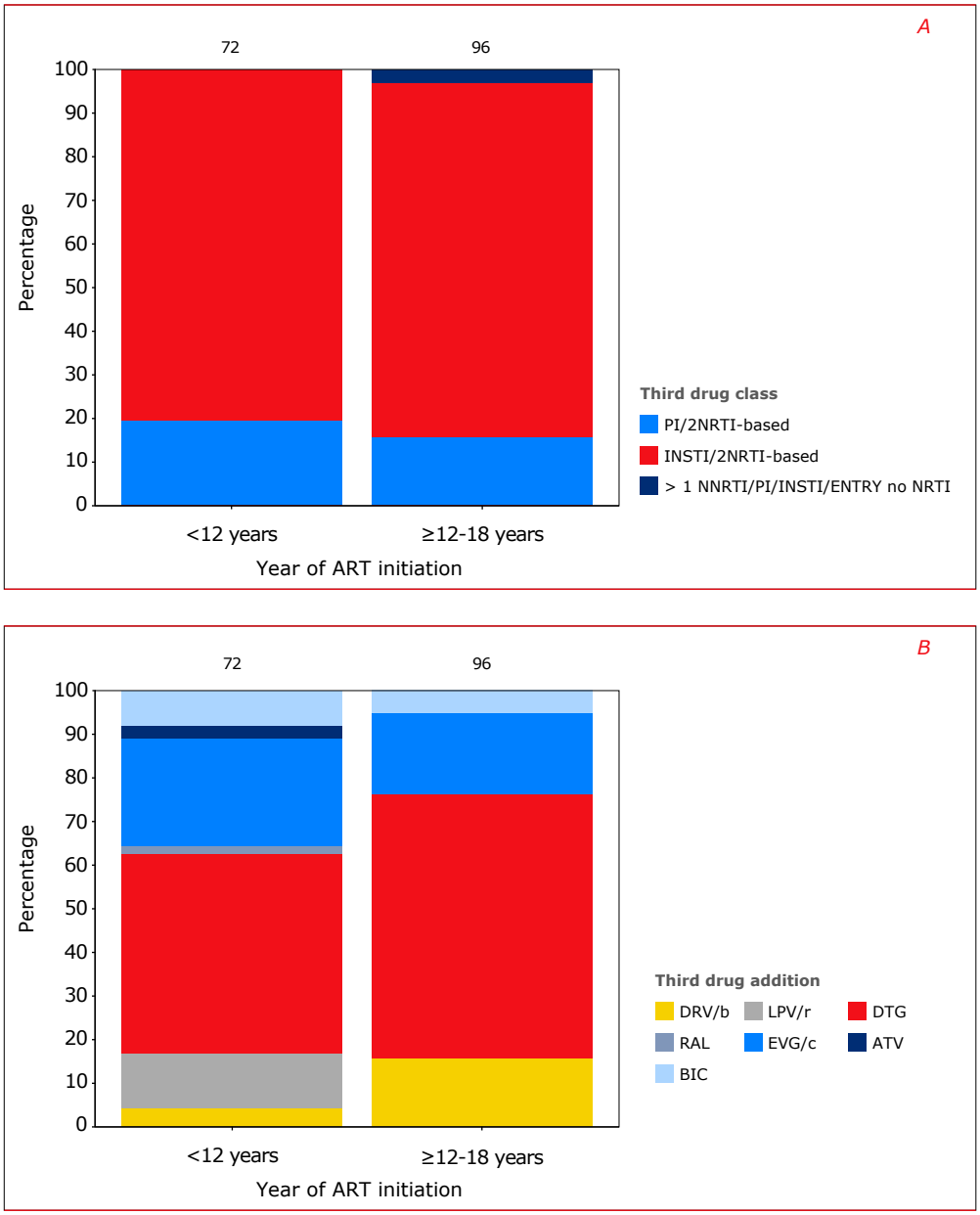
In care and on ART in 2022

Of the 168 children known to be in care in 2022 and under 18 years of age, all had ART during their last reported clinical visit. The distribution of current ART use is shown in *Figure 5.9*, according to age on 31 December 2022.

Among those under 12 years of age, INSTI-based regimens were the most commonly-used (81%), with dolutegravir (46%) and elvitegravir (25%) the most common individual third agents.

In children aged between 12 and 18 years, 81% were using an INSTI-based regimen and 18% a PI-containing regimen. Among those using an INSTI-based regimen, dolutegravir was most common (60%), followed by elvitegravir (19%). Overall, 11 children used bictegravir.

Figure 5.9: Third-drug additions to the nucleoside reverse transcriptase backbone used as part of the current regimen, stratified by current age: (A) antiretroviral class, and (B) specific drug. Numbers above the bars represent the total number of individuals initiating ART in that particular calendar year period.



Legend: *ENTRY = entry inhibitor; INSTI = integrase inhibitor; NRTI = nucleoside reverse transcriptase inhibitor; NNRTI = non-NRTI; PI = protease inhibitor; EFV = efavirenz; NVP = nevirapine; DRV/b = cobicistat/ritonavir-boosted darunavir; LPV/r = ritonavir-boosted lopinavir; DTG = dolutegravir; RAL = raltegravir; EVG/c = cobicistat-boosted elvitegravir; ATV/r = ritonavir-boosted atazanavir; BIC = bictegravir.*

Special Populations

Adopted children

Of the 400 children ever registered by SHM who were under 18 years of age when they entered care in the Netherlands, 152 (38%) had been adopted by Dutch parents. The percentage of adopted children newly entering care increased from 5% <2000 to 76% between 2010-2015, and was 64% between 2011-2022 (*Figure 5.2*), with a median age at the time of entering care of 2.7 years (IQR 1.6-5.0). Overall:

- 109 (72%) children were already receiving ART before they entered care in the Netherlands;
- 17 (11%) children were treated with monotherapy or dual therapy before the start of ART;
- All children had ART during follow up in clinical care at one of the Dutch HIV treatment centres;
- Four adopted children are no longer in care because of lost to follow up, moved abroad or died);
- All children known to be in care were still receiving treatment in 2022;
- 99% of those still in care had an undetectable viral load (equal to or below 200 copies/ml) in their most recent HIV RNA measurement and 95% had an undetectable viral load <50 copies/ml.

Initially, at the time of entering care in the Netherlands, only 66 (43%) of the 152 children had a viral load below 200 copies/ml and 27% below 50 copies/ml.

Figure 5.7 shows the number of adopted children still in care and under 18 years of age. As of 31 December 2022, 148 children were alive and in care and 137 of them were aged below 18 years. Their median age was 12.3 years (IQR 10.4-15.0).

Transfer to adult care

Of the 400 children ever registered by SHM who were under the age of 18 when they entered care in the Netherlands, 169 children had reached the age of 18 and above, and had transferred from paediatric care to adult care by 31 December 2022.

Figure 5.10: Follow up status, as of 31 December 2022, of children who transferred to adult care.

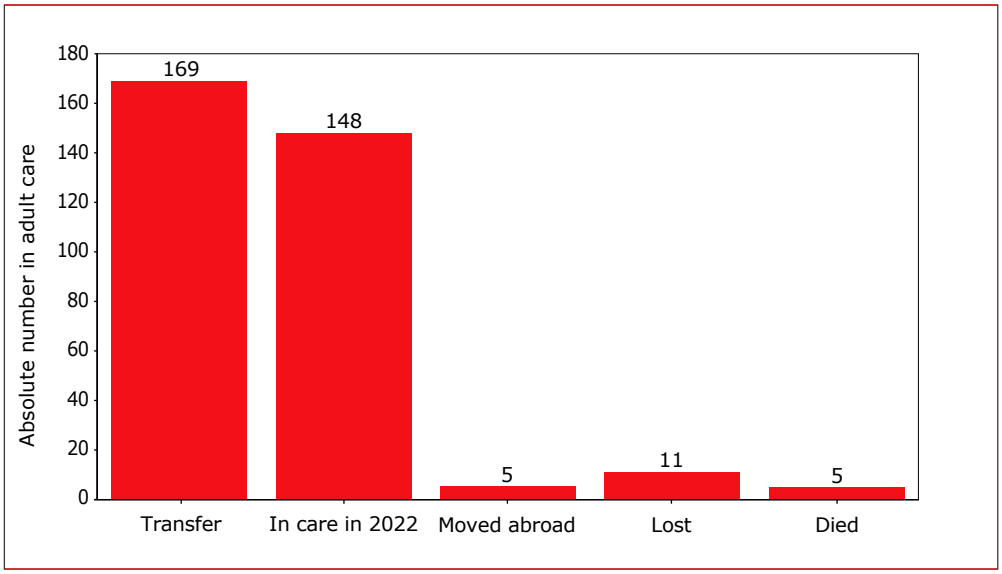
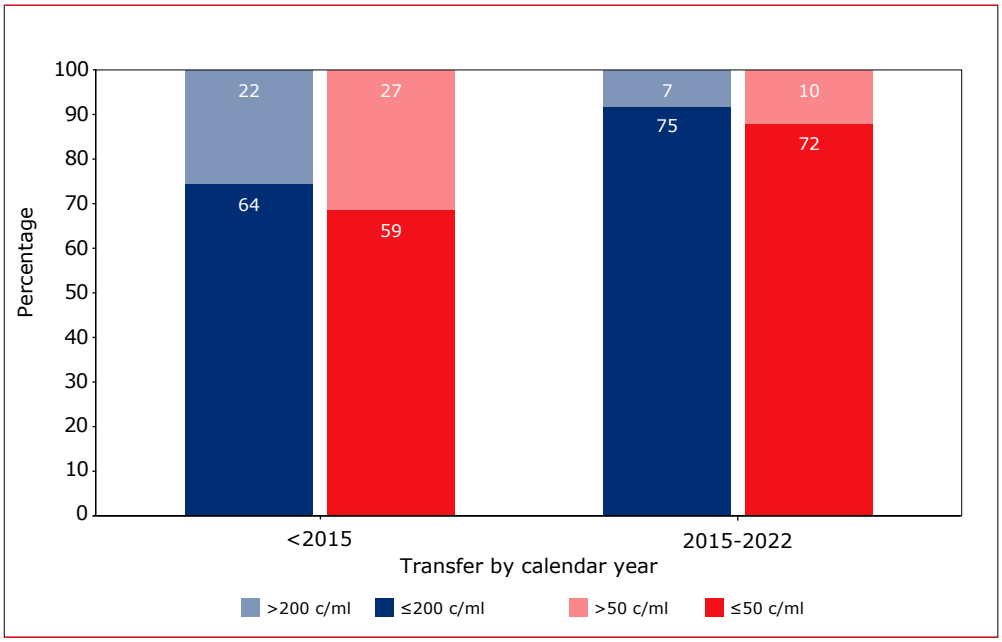
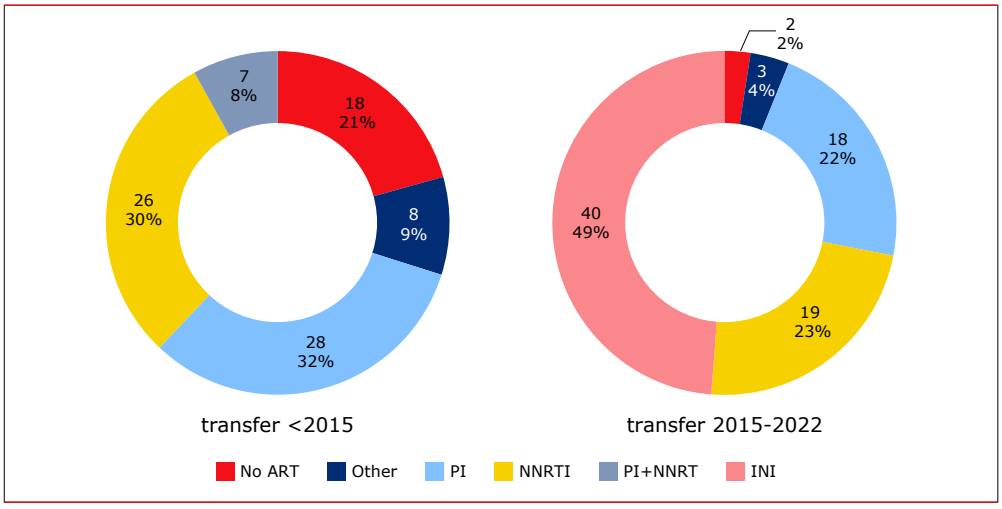


Figure 5.11: HIV RNA (A) and ART regimens (B) at last visit in paediatric care of children who transferred to adult care, stratified by calendar year of transfer (A).





The median age for their last visit to paediatric care was 18.3 years (IQR 18.0-19.0). The median time between their last visit to paediatric care and their first visit to adult care was 3.8 months (IQR 2.7-5.7). Time in care after transfer until their last documented clinical visit was 7.2 years (IQR 4.4-10.2).

Figure 5.10 shows the follow up status of the 169 adolescents who transferred to adult care:

- 148(88%) were still in care in 2022;
- 11 (7%) were lost to care – 5 of these were deregistered at the paediatric centre but have not yet been registered at an adult treatment centre (which could be due to an administrative delay);
- five (3%) had moved abroad; and
- five (3%) had died.

Overall, at the time of their last clinical visit to paediatric care, 29 adolescents (17%) had an HIV RNA level above 200 copies/ml (median 3444; IQR 1220-27065). When taking into account 50 copies/ml, 37 adolescents had an HIV RNA < 50 copies/ml (22%). This figure is more or less comparable to results from the UK and Ireland, where three quarters of adolescents were virologically suppressed at the time of transition[18]. However, we observed a lower proportion of detectable HIV RNA levels among young adolescents who made their transfer to adult care in or after 2015 compared to those who transferred before 2015, from 25% to 8% and from 31% to 12% for >200 copies/ml and 50 copies/ml respectively (Figure 5.11a).

During their last visit to paediatric care, 88% of the 169 adolescents received ART, 2% adolescents had not yet started ART and 10% had discontinued ART. Reported reasons for discontinuation were: decision by adolescent or parents; low adherence; or toxicity. Before 2015 there were more frequent occurrences of individuals not on ART at time of transfer, compared to 2015 or later (20% and 4%, respectively, Figure 5.11b).

Among adolescents who transferred to adult care before 2015, 31% were on an NNRTI-based regimen and 30% on a PI-based regimen. These percentages differed for adolescents who transferred in or after 2015: 49% were on an integrase-based regimen, 23% on an NNRTI-based regimen and 20% on a PI-based regimen.
Of the 148 adolescents who transferred to adult care, and who were still in care in 2022, 146 (99%) were receiving ART in 2022. Just over half of these were on an integrase inhibitor-based regimen (55%). In total, 90% of the 148 had HIV RNA levels below 200 copies/ml and 84% below 50 copies/ml in 2022.

Summary

Of the 400 children with HIV ever registered by SHM who were under the age of 18 when they entered care in the Netherlands, 82% remained in care in the Netherlands.
A substantial proportion of the children newly registered since 2010 are children who were adopted by Dutch parents. It is worth noting that the annual number of newly registered children who were adopted by Dutch parents has been decreasing since 2016. In the last three years this has dropped to only a few cases, which has contributed to the decline in the overall number of newly registered children with HIV in the Netherlands since 2016.
Vertical transmission is the main mode of HIV transmission for children with HIV in the Netherlands. The majority of children with vertically-acquired HIV were born outside the Netherlands. Vertical transmission of HIV within the Netherlands has become rare, reflecting the success of standardised HIV screening during the first trimester of pregnancy[13].

Non-vertical transmission of HIV is less frequently reported in the Netherlands. Five percent of children included in the SHM database had acquired HIV through non-vertical modes of transmission. Contact with contaminated blood or blood products and medical procedures were most commonly reported modes of transmission for this group. These modes have not been reported since 2009.

None of the children in care over the last 10 years died before the age of 18. However seven young adults over the age of 18, who had been diagnosed with HIV as a child, did die in the past 10 years. These deaths included AIDS-related causes of death.

In total 99% of children with HIV, who had ever received care in the Netherlands, have received ART. Those who did not receive ART are no longer in care, but had been in care at an earlier point in time before guidelines were revised to recommend that ART be initiated for everyone with HIV, regardless of CD4 counts. All children in care in 2022 were receiving ART. Current regimens in use include an integrase inhibitor for 81% of the children.

Very high long-term viral suppression rates were observed in children with HIV who initiated ART in or after 2013. However, those response rates fell when children reached the age of 18. We have seen overall viral suppression rates of 82% at the time of transition to adult care, which is around the age of 18. Nonetheless, transition to adult care with an undetectable viral load increased over time, from 75% to 92%.

The continuum of care showed a high retention-in-care rate among children under 18 years of age. Moreover, a substantially lower proportion of those aged 18 years and over had suppressed HIV RNA levels by the end of 2022, when compared to children under the age of 18 (92% versus 98% among those in care and receiving ART).

Recommendations

The provision of care for children with HIV in the Netherlands has resulted in generally favourable outcomes, with no reported mortalities in recent years and good long-term virological and immunological responses to treatment for those under the age of 18. Additionally, the number of children with HIV in paediatric care is decreasing as a result of targeted efforts to prevent mother-to-child transmission, as well as a fall in the number of adopted HIV-positive children in recent years. However, an increasing proportion of the children registered with SHM has now reached the age of 18 and transitioned to adult care. This period of transition is associated with lower levels of viral suppression and lower care retention rates, hence this group requires special attention.

References

1. UNAIDS. Start Free, Stay Free, AID Free. Final report on 2020 targets. https://www.unaids.org/sites/default/files/media_asset/2021_start-free-stay-free-aids-free-final-report-on-2020-targets_en.pdf. Published 2021.
2. WHO. HIV/AIDS. https://www.who.int/news-room/fact-sheets/detail/hiv-aids. Published 2021.
3. Goetghebuer T, Haelterman E, Le Chenadec J, et al. Effect of early antiretroviral therapy on the risk of AIDS/death in HIV-infected infants. *AIDS*. 2009;23(5):597-604. doi:10.1097/QAD.0b013e328326ca37
4. Judd A, Chappell E, Turkova A, et al. Long-term trends in mortality and AIDS-defining events after combination ART initiation among children and adolescents with perinatal HIV infection in 17 middle- and high-income countries in Europe and Thailand: A cohort study. Deeks SG, ed. *PLOS Med*. 2018;15(1):e1002491. doi:10.1371/journal.pmed.1002491
5. Gibb DM. Decline in mortality, AIDS, and hospital admissions in perinatally HIV-1 infected children in the United Kingdom and Ireland. *BMJ*. 2003;327(7422):1019-0. doi:10.1136/bmj.327.7422.1019
6. Gortmaker SL, Hughes M, Cervia J, et al. Effect of combination therapy including protease inhibitors on mortality among children and adolescents infected with HIV-1. *N Engl J Med*. 2001;345(21):1522-1528. doi:10.1056/NEJMoa011157

7. de Martino M, Tovo PA, Balducci M, et al. Reduction in mortality with availability of antiretroviral therapy for children with perinatal HIV-1 infection. Italian Register for HIV Infection in Children and the Italian National AIDS Registry. *JAMA*. 2000;284(2):190-197.
8. Foster C, Pace M, Kaye S, et al. Early antiretroviral therapy reduces HIV DNA following perinatal HIV infection. *AIDS*. 2017;31(13):1847-1851. doi:10.1097/QAD.0000000000001565
9. Shiau S, Strehlau R, Technau KG, et al. Early age at start of antiretroviral therapy associated with better virologic control after initial suppression in HIV-infected infants. *AIDS*. 2017;31(3):355-364. doi:10.1097/QAD.0000000000001312
10. Violari A, Cotton MF, Gibb DM, et al. Early antiretroviral therapy and mortality among HIV-infected infants. *N Engl J Med*. 2008;359(21):2233-2244. doi:10.1056/NEJMoa0800971
11. Newell M-L, Patel D, Goetghebuer T, Thorne C. CD4 cell response to antiretroviral therapy in children with vertically acquired HIV infection: is it associated with age at initiation? *J Infect Dis*. 2006;193(7):954-962. doi:10.1086/500842
12. World Health Organization. Guidelines Guideline on When To Start Antiretroviral Therapy and on Pre-Exposure Prophylaxis for HIV. *World Heal Organ*. 2015;(September):78. doi:978 92 4 150956 5
13. Boer K, Smit C, Van Der Flier M, De Wolf F. The comparison of the performance of two screening strategies identifying newly-diagnosed HIV during pregnancy. *Eur J Public Health*. 2011;21(5):632-637. doi:10.1093/eurpub/ckq157
14. Op de Coul ELM, Hahné S, van Weert YWM, et al. Antenatal screening for HIV, hepatitis B and syphilis in the Netherlands is effective. *BMC Infect Dis*. 2011;11(1):185. doi:10.1186/1471-2334-11-185
15. The Antiretroviral Therapy Cohort Collaboration. Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies. *Lancet*. 2008;372(9635):293-299. doi:10.1016/S0140-6736(08)61113-7
16. Bunders M, Cortina-Borja M, Newell M-L, European Collaborative Study. Age-related standards for total lymphocyte, CD4+ and CD8+ T cell counts in children born in Europe. *Pediatr Infect Dis J*. 2005;24(7):595-600. http://www.ncbi.nlm.nih.gov/pubmed/15998999. Accessed September 16, 2016.
17. Comans-Bitter WM, De Groot R, Van den Beemd R, et al. Immunophenotyping of blood lymphocytes in childhood: Reference values for lymphocyte subpopulations. *J Pediatr*. 1997;130(3):388-393. doi:10.1016/S0022-3476(97)70200-2
18. Collins IJ, Foster C, Tostevin A, et al. Clinical Status of Adolescents with Perinatal HIV at Transfer to Adult Care in the UK/Ireland. *Clin Infect Dis*. 2017;64(8):1105-1112. doi:10.1093/cid/cix063