

AUSTRALIAN HIV OBSERVATIONAL DATABASE ANNUAL REPORT 2018

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National characteristics and trends in antiretroviral treatment in Australia can be accurately estimated using a large clinical cohort

Background: Cohort studies are often used as a national surveillance tool to monitor trends in HIV treatment and morbidity outcomes. In this publication [1] in the *Journal of Clinical Epidemiology* we compared data from the Australian HIV Observational Database (AHOD) and a sample from Australia's subsidized prescription medication scheme, the Pharmaceutical Benefits Scheme (PBS), to assess the use of cohorts for providing representative data for surveillance and monitoring purposes.

Methods: Basic demographics and HIV treatment information from July 1, 2013, to March 31, 2016, were divided into half-yearly periods to compare trends between AHOD (n = 2,488) and PBS (n = 18,409) patients.

Results: Similar demographic profiles were observed in both datasets; where HIV patients on treatment were predominantly men, close to a half aged 50 years or older, and primarily resided in New South Wales, Victoria and Queensland (**Table 1**). Very similar antiretroviral therapy (ART) use was seen across the 3-year reporting period, with a decline in nonnucleoside analogue reverse-transcriptase inhibitor (NNRTI) and protease inhibitor (PI) use, while at the same time, a significant increase toward integrase strand transfer inhibitor (InSTI) use was observed. The rate of nucleoside analogue reverse-transcriptase inhibitor (NRTI) and entry inhibitor (EI) use remained stable during this period at approximately 55% and 0.4%, respectively. In terms of Class Combo (once daily, single-tablet, fixed-dose combination) use, a considerable increase was observed (**Figure 1**) in AHOD and PBS.

Conclusion: These results showed that observational cohort studies can serve as useful surrogate surveillance tools for monitoring patient characteristics and HIV treatment trends.

Figure 1. ART Class trend from July 2013 to March 2016 in PBS (left) compared to AHOD (right) [1].

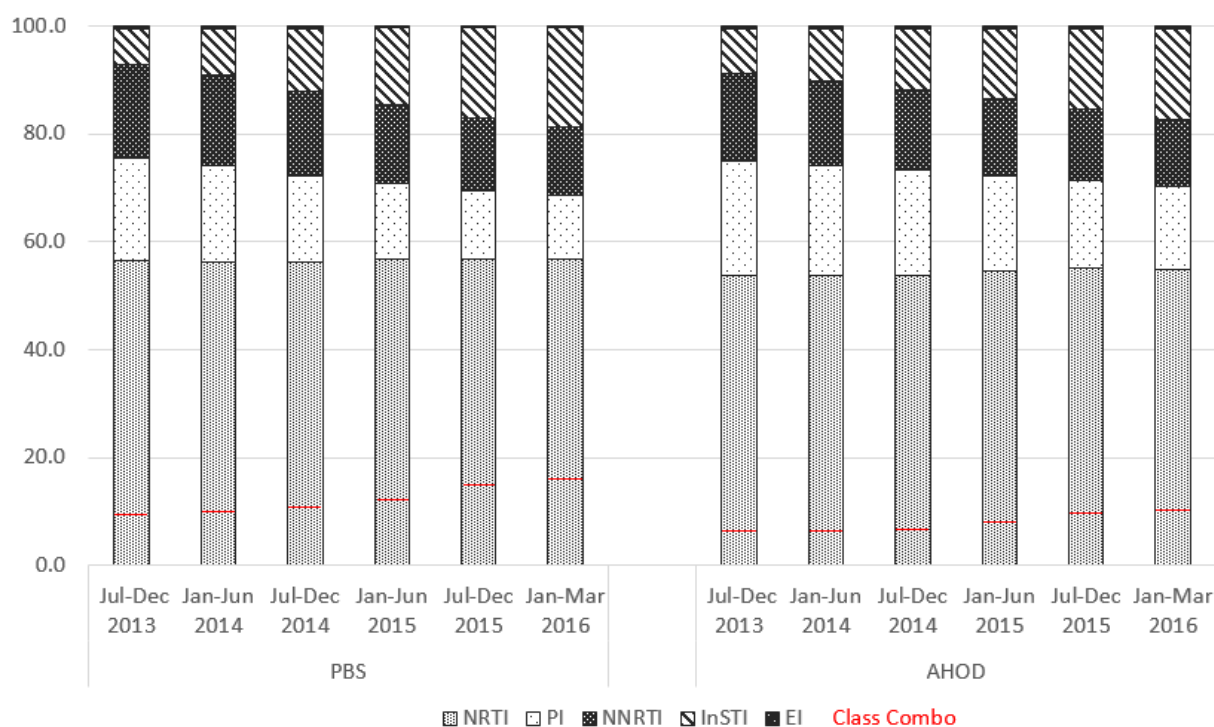


Table 1. Demographic data for PBS and AHOD from January to March 2016.

	Jan-Mar 2016	
	PBS N (%)	AHOD N (%)
Total	15 130	1 451
Age		
<21	130 (0.9)	1 (0.1)
21-30	790 (5.2)	58 (4.0)
31-40	2 640 (17.5)	175 (12.1)
41-50	4 200 (27.8)	367 (25.3)
51-60	4 710 (31.1)	479 (33.0)
61-70	1 890 (12.5)	238 (16.4)
>70	770 (5.1)	133 (9.2)
Sex		
Female	1 640 (10.8)	129 (8.9)
Male	13 490 (89.2)	1 322 (91.1)
State		
ACT	210 (1.4)	-
NSW	6 210 (41.0)	576 (39.7)
NT	70 (0.5)	21 (1.5)
QLD	2 750 (18.2)	321 (22.1)
SA	670 (4.4)	20 (1.4)
TAS	180 (1.2)	-
VIC	4 000 (26.4)	458 (31.6)
WA	1 120 (7.4)	55 (3.8)

[1] Huang R, Petoumenos K, Gray RT, McManus H, Dharan N, Guy R, Cooper DA. **National characteristics and trends in antiretroviral treatment in Australia can be accurately estimated using a large clinical cohort.** *J Clin Epidemiol.* 2018 Aug;100:82-91. doi: 10.1016/j.jclinepi.2018.04.015.

Table 1: All AHOD demographics¹ (Total – 4557)

	Number	(%)		Number	(%)
Sex			CD4 (cells/μl)¹		
Male	4136	(91)	<200	433	(11)
Female	409	(9)	200-299	427	(11)
Transgender	10	(0)	300-499	1210	(30)
			500+	1919	(48)
Age (years)¹			Missing	568	
<30	512	(11)	Mean [SD]	521	[288]
30-39	1602	(35)			
40-49	1434	(32)	HIV viral load (copies/ml)¹		
50+	1009	(22)	$\leq 400^4$	2543	(64)
Mean [SD]	42	[11]	401-10 000	636	(16)
			>10 000	804	(20)
Aboriginal/Torres Strait islander			Missing	574	
Yes	85	(2)	Median [LQ – UQ] ³	200	[49-4600]
No	3006	(66)			
Missing	1466	(32)	Prior AIDS defining illness¹		
			Yes	735	(16)
Exposure category			No	3822	(84)
Male homosexual contact	3233	(71)			
Male homosexual contact and IDU	152	(3)	Hepatitis C ever		
Injecting drug user (IDU)	109	(2)	Yes	456	(11)
Heterosexual contact	823	(18)	No	3590	(89)
Receipt of blood/blood products	32	(1)	No test	511	
Other	98	(2)			
Missing	110	(2)	Hepatitis B ever		
			Yes	187	(5)
Estimated year of HIV infection²			No	3592	(95)
<1990	114	(3)	No test	778	
1990-1999	615	(13)			
2000-2009	413	(9)	Total patients under active follow up in last 12 months (N=2 458)⁴		
2010-2017	162	(4)			
Missing	3253	(71)	Recent CD4 (cells/μl)⁵		
			< 200	21	(1)
Patient care setting			200-299	26	(1)
General Practitioner	1497	(33)	300-499	60	(3)
Hospital Tertiary Centre	986	(22)	500+	1918	(95)
Sexual Health Clinic	2074	(46)	Missing	433	
			Mean [SD]	714	[311]
Region of birth					
Australia and New Zealand	2526	(55)	Recent HIV viral load⁵		
Asia and Oceania	389	(9)	≤ 50	1918	(95)
Britain and Ireland	167	(4)	51-400	60	(3)
Europe	130	(3)	401-10 000	26	(1)
Africa and Middle East	159	(3)	>10 000	21	(1)
North America	45	(1)	Missing	433	
South and Central America	65	(1)	Median [LQ – UQ] ³	20	[19-40]
Missing	1065	(23)			

1. Age & prior AIDS defining illness at time of cohort enrolment. CD4 count & HIV viral load closest to and within 3 months of cohort enrolment date.

2. Year of HIV infection = mid date between date of first positive and last negative test (coded as not reported if either first positive or last negative date are missing).

3. LQ = Lower quartile UQ = Upper quartile.

4. Patients who had the most recent visit between 1 April 2017 and 31 March 2018 and have not died.

5. Most recent CD4 count & HIV viral load between 1 April 2017 and 31 March 2018.

Table 2: Follow up status by calendar year¹

Year	Entered study	Deaths	Lost to Follow up
1999 ²	815	6	34
2000	859	25	42
2001	247	29	62
2002	164	23	61
2003	193	22	53
2004	83	19	72
2005	96	26	60
2006	118	28	55
2007	98	26	83
2008	88	22	94
2009	306	16	68
2010	243	25	88
2011	204	21	75
2012	279	18	107
2013	131	14	104
2014	168	25	125
2015	79	11	152
2016	153	12	181
2017	190	16	81
Total	4514	384	1597

Complete follow-up (percentage of patients)³: 66 %

Loss to follow-up (per 100 person years): 3.94 (95% CI: 3.74-4.14)

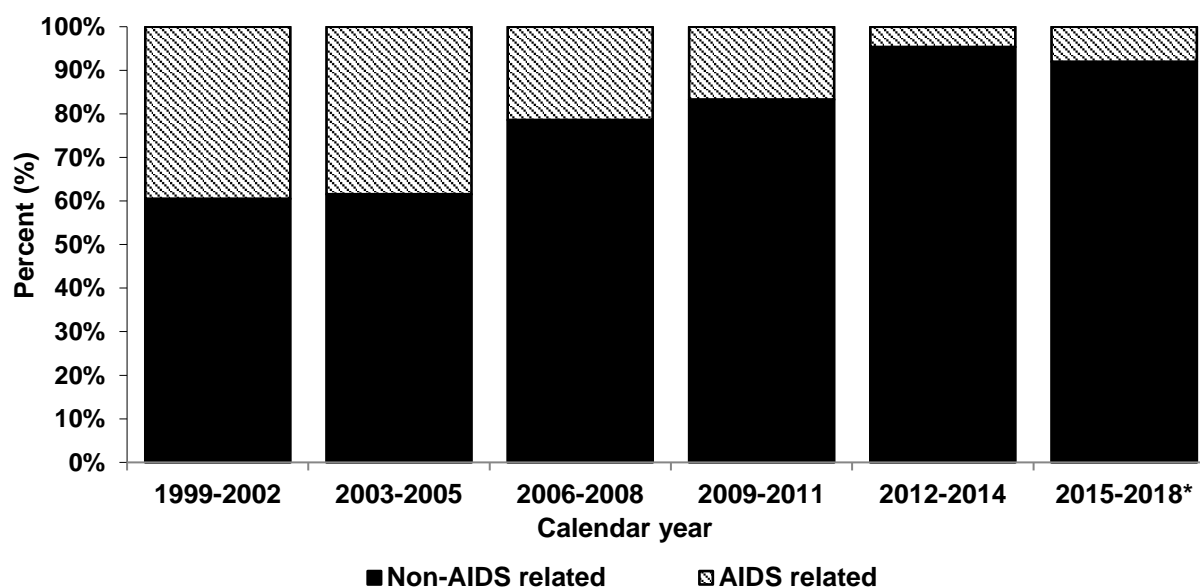
Mortality (per 100 person years): 1.02 (95% CI: 0.93-1.13)

1. 4 sites (309 patients) were censored 31 March 2006, 31 March 2008, 31 March 2013, and 31 March 2015 respectively.

2. 1 July – 31 December 1999.

3. Patients who have died or any patients seen at clinic site within the last 12 months (1 April 2017 – 31 March 2018) are considered to have complete follow-up.

Figure 1: Proportion of AIDS and non-AIDS related deaths in AHOD since cohort inception by year grouping



* 1 January 2015 to 31 March 2018.

Table 3: Total number of deaths in AHOD since cohort inception, by AIDS or non-AIDS related death classification and year grouping

	1999-2002	2003-2005	2006-2008	2009-2011	2012-2014	2015-2018 ¹	All years
Non-AIDS related	49	40	55	40	41	23	248
AIDS related	32	25	15	8	2	2	84
Unknown	2	2	2	11	4	5	26
No CoDe Form ²	0	0	4	3	10	10	27
Total deaths	83	67	76	62	57	40	385

1. 1 January 2015 to 31 March 2018.

2. Coding of Death classification (CoDe)

Table 4: Summary of deaths reported in the last 5 year period¹

Coding of Death Classification ²	Number
Cancer	24
AIDS (ongoing active disease)	3
MI or other ischemic heart disease	5
Other heart or vascular disease	5
Suicide	2
Chronic viral hepatitis (progression of / complication to)	2
Other Causes	11
Unknown (autopsy inconclusive, died overseas, etc)	11
Missing information ³	15

1. 1 January 2013 to 31 December 2017.

2. Coding of Death classification (CoDe)

3. Still awaiting forms

Table 5: Trends in antiretroviral treatment^{1,2}

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Patients under active follow up ¹	(n=2056)	(n=2035)	(n=2152)	(n=2311)	(n=2402)	(n=2585)	(n=2591)	(n=2617)	(n=2531)	(n=2519)	(n=2516)
Treatment	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
<i>Never treatment</i>	67 (3)	64 (3)	49 (2)	60 (3)	61 (3)	60 (2)	51 (2)	48 (2)	34 (1)	29 (1)	36 (1)
<i>Ever treatment</i>	n=1989	n=1971	n=2103	n=2251	n=2341	n=2525	n=2540	n=2569	n=2497	n=2490	n=2480
Currently ³	1745 (85)	1776 (87)	1924 (89)	2093 (91)	2192 (91)	2425 (94)	2470 (95)	2512 (96)	2452 (97)	2462 (98)	2462 (98)
Previously, not currently	244 (12)	195 (10)	179 (8)	158 (7)	149 (6)	100 (4)	70 (3)	57 (2)	45 (2)	28 (1)	18 (1)
Number of drugs ever⁴											
≤3	532 (27)	495 (25)	621 (30)	706 (31)	767 (33)	834 (33)	813 (32)	783 (30)	674 (27)	634 (25)	557 (22)
4-6	838 (42)	812 (41)	793 (38)	826 (37)	853 (36)	951 (38)	984 (39)	1017 (40)	1002 (40)	970 (39)	998 (40)
7-9	464 (23)	482 (24)	482 (23)	498 (22)	490 (21)	500 (20)	493 (19)	508 (20)	540 (22)	581 (23)	570 (23)
10+	155 (8)	182 (9)	207 (10)	220 (10)	230 (10)	240 (10)	250 (10)	261 (10)	281 (11)	305 (12)	355 (14)
Number of drug classes ever^{4,5}											
1	88 (5)	79 (4)	89 (5)	98 (5)	101 (5)	90 (4)	65 (3)	50 (2)	35 (1)	31 (1)	46 (2)
2	990 (54)	977 (53)	1076 (54)	1152 (54)	1215 (55)	1388 (56)	1414 (57)	1372 (54)	1191 (48)	1144 (46)	1080 (44)
3	673 (37)	649 (35)	616 (31)	617 (29)	614 (28)	653 (27)	654 (26)	716 (28)	804 (32)	831 (34)	856 (35)
4	63 (3)	103 (6)	148 (7)	211 (10)	236 (11)	264 (11)	290 (12)	320 (13)	366 (15)	388 (16)	390 (16)
5	15 (1)	29 (2)	46 (2)	53 (2)	59 (3)	64 (3)	71 (3)	76 (3)	79 (3)	73 (3)	69 (3)

1. Treatment status for all patients under active follow during the calendar year. Table includes prospective data only (i.e. records prior to AHOD enrolment are excluded).

2. Ritonavir is recorded separately unless recorded as part of a combination drug, regardless of whether it is a low dose (boosted PI).

3. Currently on treatment is defined as receiving treatment at some point during the calendar year.

4. Denominator is the number of patients who have ever received treatment.

5. Broad class ARV groupings are: nucleos(t)ide reverse transcriptase inhibitors; non-nucleoside reverse transcriptase inhibitors; protease inhibitors; integrase inhibitors; entry inhibitors;

Table 6: Trends in combination antiretroviral treatment^{1,2}

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Combination ³	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
1 st combination	253 (14)	246 (13)	360 (18)	369 (17)	431 (19)	538 (22)	514 (21)	470 (19)	402 (16)	374 (15)	331 (13)
2 nd combination	349 (19)	345 (19)	341 (17)	416 (20)	434 (20)	510 (21)	539 (22)	568 (23)	532 (22)	513 (21)	504 (21)
3 rd combination	289 (16)	285 (15)	273 (14)	314 (15)	327 (15)	353 (14)	383 (15)	395 (16)	409 (17)	429 (17)	450 (18)
≥4 th combination	952 (52)	963 (52)	997 (51)	1026 (48)	1022 (46)	1046 (43)	1042 (42)	1079 (43)	1116 (45)	1145 (47)	1169 (48)

1. Includes patients who commenced their first combination ART after 1 January 1996 for at least 14 days. The denominator includes all AHOD patients that received combination antiretroviral treatment in any calendar year (i.e. HIV positive), who commenced their first combination ART after 1 January 1996 for at least 14 days. Includes prospective and retrospective data.

2. Ritonavir is recorded separately unless recorded as part of a combination drug, regardless of whether it is a low dose (boosted PI).

3. Combinations include 3 or more antiretroviral drugs, does not include mono/dual therapy. Regimens with interruptions of less than 7 days were considered as continuous treatment.

Figure 2: Trends in combination antiretroviral treatment (as above)

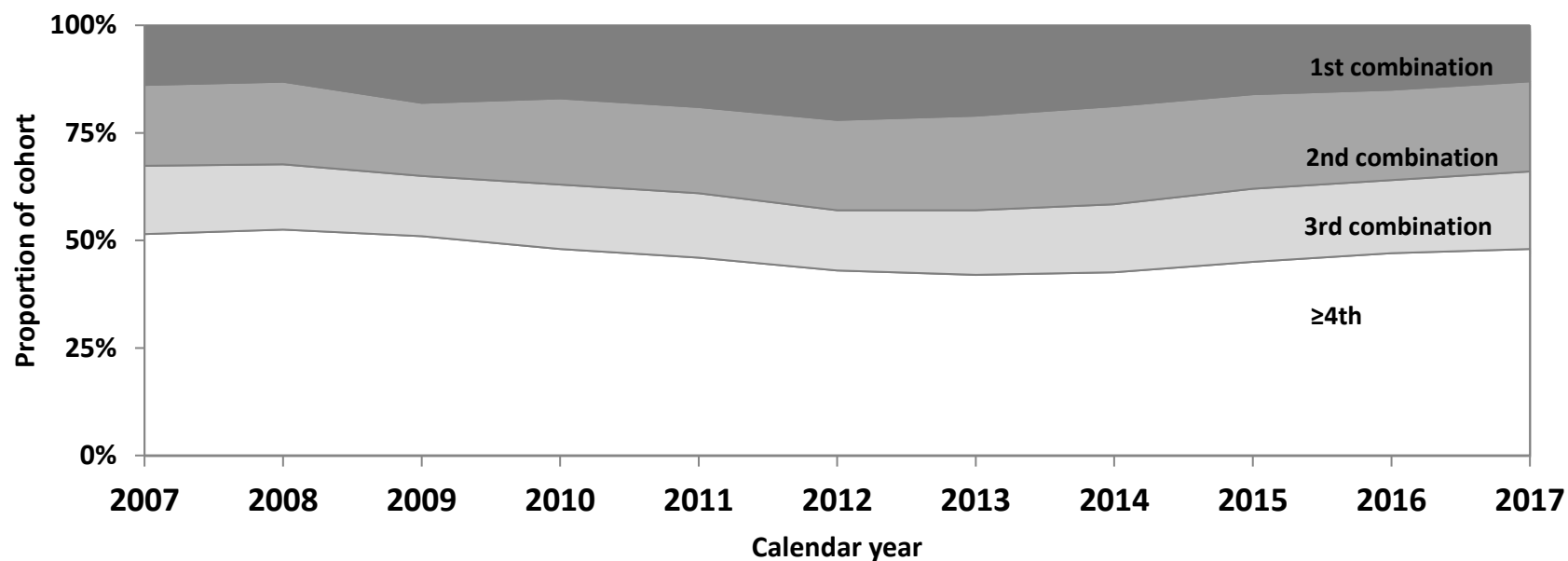


Table 7: Immunological and virological trends¹

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Viral load (copies/ml)											
Total N (with measure)	2321	2372	2308	2283	2410	2478	2499	2400	2317	2242	2037
Off Treatment²											
No. with a viral load count ⁴	427	386	330	263	241	185	133	116	69	62	49
Median	13480	11650	11850	9076	5800	6900	6726	4832	315	40	20
IQR	3000-40738	2400-37000	2130-37188	752-36718	871-40096	259-34721	150-27800	40-29800	20-21458	20-3855	20-40
On Treatment³											
No. with a viral load count ⁴	1894	1986	1978	2020	2169	2293	2366	2284	2248	2180	1988
Median	50	49	49	49	40	39	25.25	20	20	20	20
IQR	45-50	40-50	40-50	40-50	34-49	20-49	19-40	19-40	19-40	19-40	19-40
<hr/>											
CD4 count (cells/μl)											
Total N (with measure)	2294	2354	2334	2349	2464	2506	2513	2399	2375	2400	2205
Off Treatment²											
No. with a CD4 count ⁵	428	391	339	279	253	197	140	117	76	67	49
Median	503.75	494	505	490	520	560	617	640	640	615	750
IQR	403-637	392-666	397-660	397-655	400-660	470-730	483-815	500-810	520-799	475-900	530-920
On Treatment³											
No. with a CD4 count ⁵	1866	1963	1995	2070	2211	2309	2373	2282	2299	2333	2156
Median	522.25	529	540	550	570	580	600	630	647	670	665
IQR	360-718	371-740	377-732	397-736	415-764	423-775	438-788	455-820	468-849	485-868	490-870

1. Includes retrospective and prospective data. Off treatment if never on a regimen of duration greater than 14 days for given calendar year. Viral load taken as median value during given calendar year. Undetectable assay level taken as ≤50 copies/ml.

2. Patients who have not received treatment during the calendar year.

3. Patients who have received any treatment during the calendar year.

4. Includes patients with a viral load measured during the relevant calendar year.

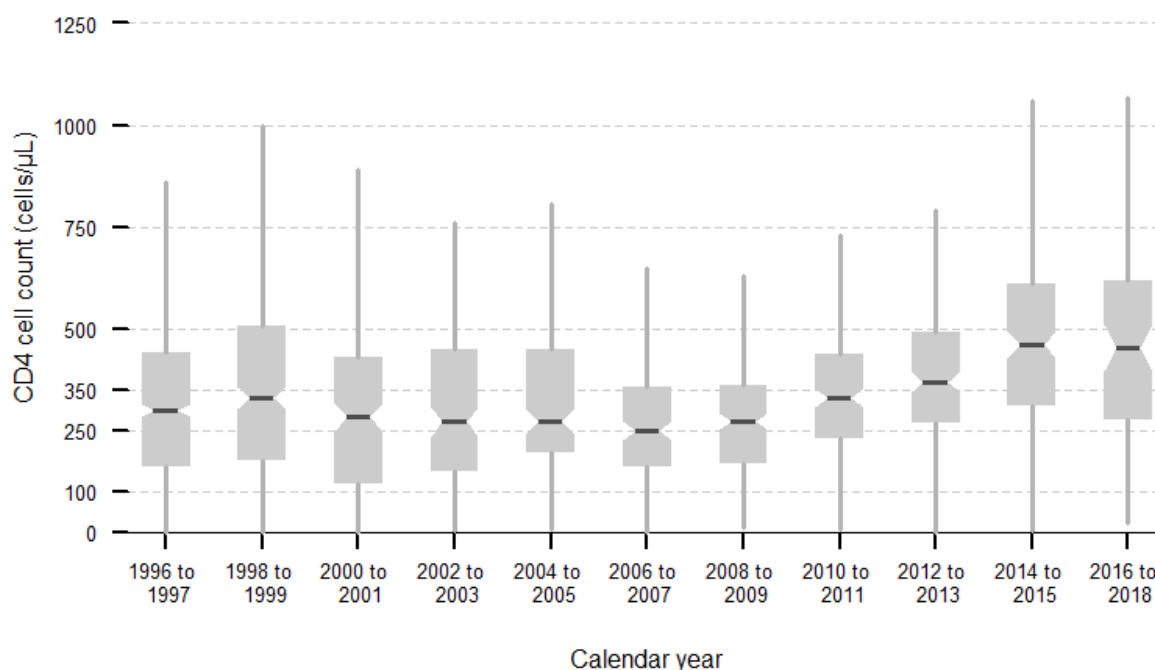
5. Includes patients with a CD4 count measured during the relevant calendar year.

Table 8: CD4 cell count at antiretroviral therapy initiation by calendar year¹

	1998 to 1999	2000 to 2001	2002 to 2003	2004 to 2005	2006 to 2007	2008 to 2009	2010 to 2011	2012 to 2013	2014 to 2015	2016 to 2018 ⁴
Number of participants initiating ART¹										
N=	403	188	177	159	175	224	222	180	178	88
CD4 cell count (copies/μl)^{2,3}										
Mean	368	303	334	356	280	285	345	383	473	481
Median	330	283	271	273	250	273	331	370	460	455
IQR	174-506	120-430	150-450	196-450	160-360	170-360	230-438	270-490	309-610	278-619.5

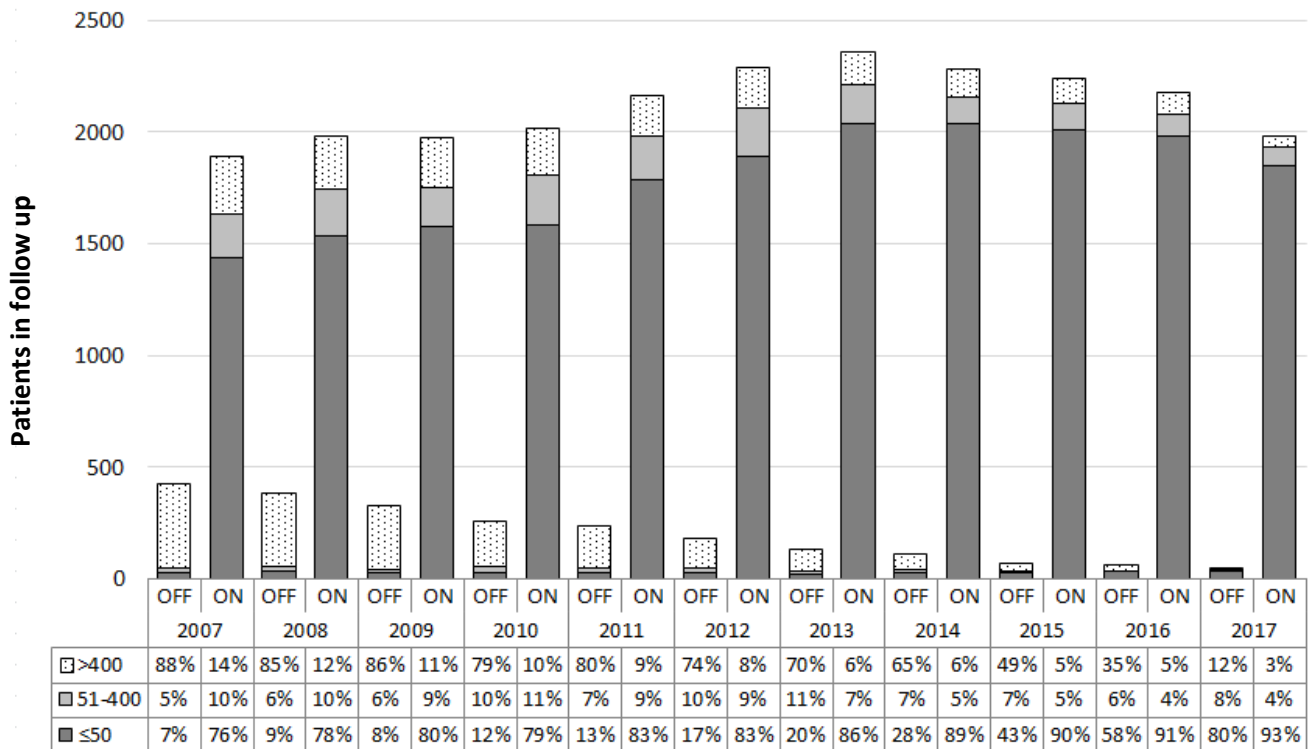
1. First ART defined as a combination of 3 or more antiretroviral agents and a duration of ART>14 days. Includes both retrospective and prospective data. ATRAS sub study participants were excluded from analysis.
2. CD4 cell count selected from the observation closest to ART start date within a timeframe window of 12 months prior to ART start date and one-month post ART start date.
3. Patients were excluded from the analysis if an undetectable viral load was recorded prior to initiating ART or was missing a viral load measurement prior to initiating ART.
4. Includes data reported from 1 January 2016 to 31 March 2018.

Figure 3: Empirical CD4 cell count distribution (boxplot) at antiretroviral therapy initiation by year of ART initiation¹⁻³ (median CD4 indicated by horizontal grey bar)



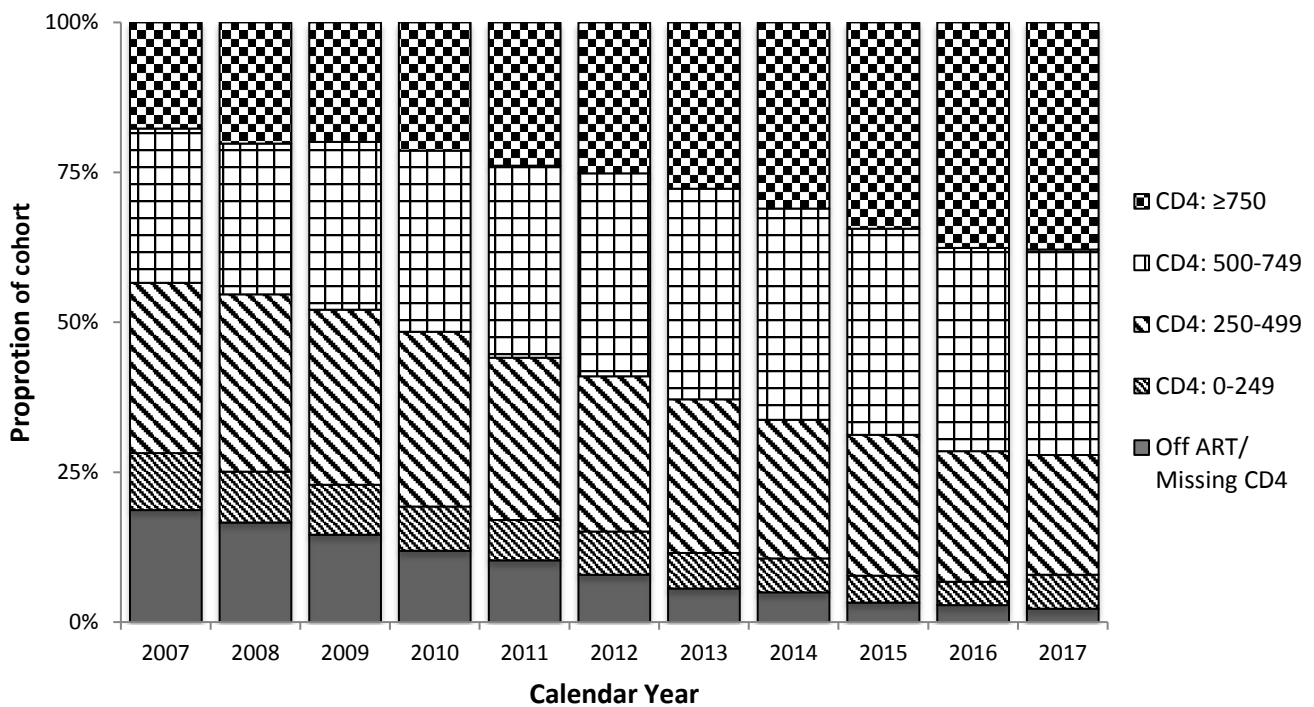
1. First ART defined as a combination of 3 or more antiretroviral agents and a duration of ART>14 days. Includes both retrospective and prospective data. ATRAS sub study participants excluded from analysis.
2. CD4 cell count selected from the observation closest to ART start date within a timeframe window of 12 months prior to ART start date and 7 days post ART start date.
3. Patients were excluded from the analysis if an undetectable viral load was recorded prior to initiating ART or was missing a viral load measurement prior to initiating ART.
4. '2016 to 2018' includes data reported from 1 January 2016 to 31 March 2018.

Figure 4: Patients with an undetectable viral load, by treatment status (off /on treatment) and year¹



1. Off treatment if never on a regimen of duration greater than 14 days for given calendar year. Viral load taken as median value during regimen of longest duration for given calendar year.

Figure 5: CD4 cell counts (cells/ μ l) in patients receiving treatment by calendar year¹⁻³



1. Includes patients with a prospective CD4 measure during the relevant calendar year.
2. For patients on treatment, analysis based on the initial treatment intent, not on treatment administered (ITT), i.e. no adjustments are made for off-treatment following ART initiation.
3. Patients off treatment include those who have enrolled and have not initiated combination antiretroviral therapy.

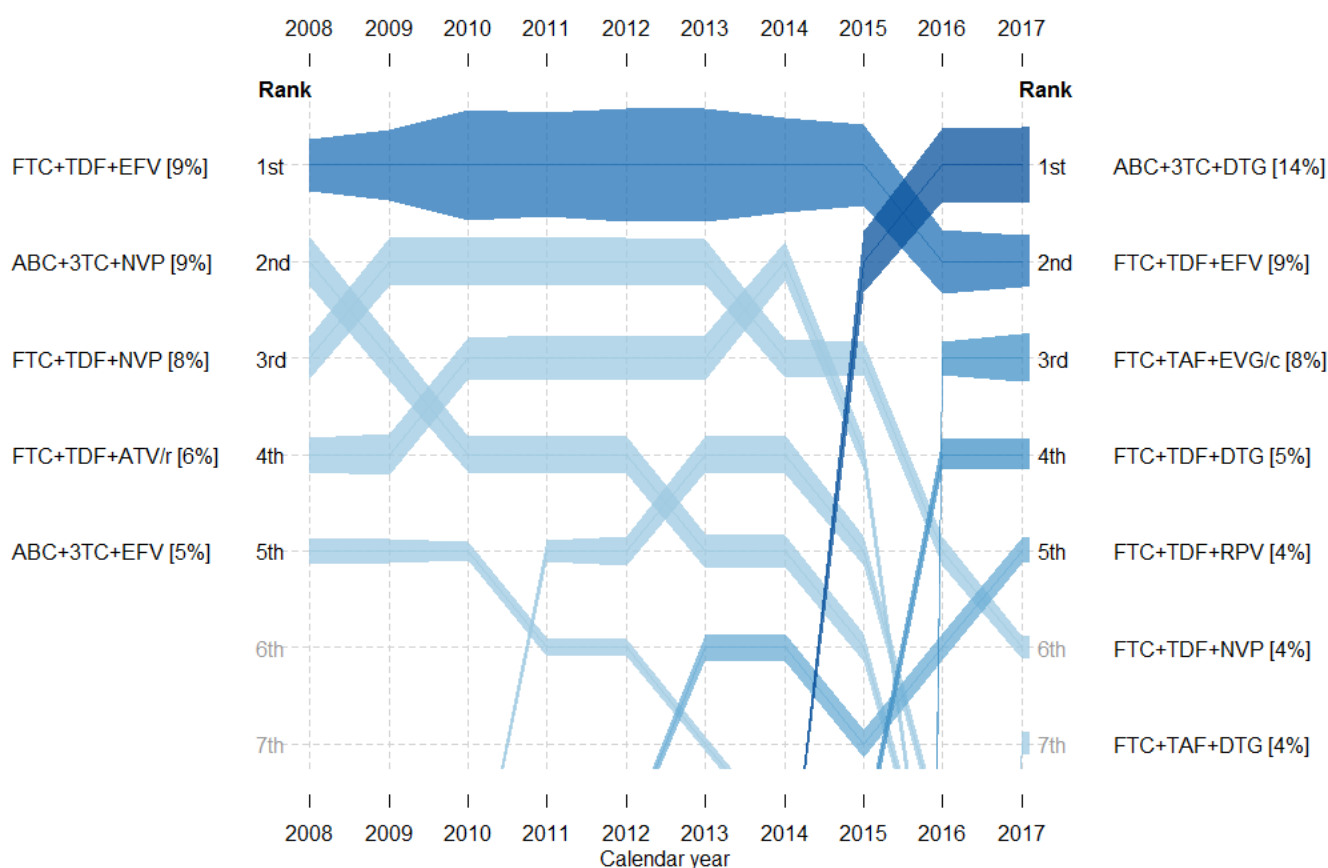
Table 9: Top ten treatment combinations among the AHOD cohort¹: January-December 2017

In 2017, there were a total of 472 unique antiretroviral treatment (ART) combinations (16 of which contain trial drugs) among the 2404 AHOD patients on combination ART. A total of 3029 combination regimens were recorded among these patients throughout 2016. The top ten most common ART combinations are described below.

ART combinations	Number of regimens recorded during 2017
abacavir+lamivudine+dolutegravir	413
emtricitabine+tenofovir+efavirenz	278
emtricitabine+TAF+elvitegravir+cobicistat	254
emtricitabine+tenofovir+dolutegravir	160
emtricitabine+tenofovir+rilpivirine	135
emtricitabine+tenofovir+nervirapine	122
emtricitabine+TAF+dolutegravir	119
abacavir+lamivudine+nervirapine	111
emtricitabine+tenofovir+raltegravir	100
emtricitabine+tenofovir+atazanavir+ritonavir	76

1. Includes retrospective and prospective data. Combinations include 3 or more antiretroviral drugs. Fixed dose combinations are separated into individual component antiretroviral drugs.

Figure 6: Top five treatment combinations among the AHOD cohort¹ ranked by proportion² of total ART regimens recorded in years 2008-2017



1. Includes retrospective and prospective data. Combinations include 3 or more antiretroviral drugs. Fixed dose combinations are separated into individual component antiretroviral drugs.

2. Proportion defined as frequency of ART line divided by total number of ART regimens recorded. For example, 2017 Rank 1 proportion calculated by 413/3023=13.66%. Thickness of line over time is proportional to calculated percentage.

Table 10: Current use of individual antiretroviral treatments¹

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Nucleoside analogue reverse transcriptase inhibitors (RTI)																						
Abacavir	388	(16)	367	(15)	269	(11)	255	(10)	234	(9)	199	(7)	183	(7)	179	(7)	159	(6)	129	(5)	102	(4)
Combivir ²	325	(14)	268	(11)	232	(9)	217	(8)	177	(7)	147	(5)	118	(4)	97	(4)	82	(3)	68	(3)	57	(2)
Descovy ³	1	(0)	1	(0)	1	(0)	2	(0)	2	(0)	2	(0)	2	(0)	2	(0)	4	(0)	49	(2)	288	(11)
Didanosine	136	(6)	94	(4)	63	(3)	53	(2)	34	(1)	29	(1)	21	(1)	19	(1)	15	(1)	9	(0)	5	(0)
Emtricitabine	82	(3)	125	(5)	158	(6)	206	(8)	231	(9)	242	(9)	250	(9)	182	(7)	178	(7)	185	(7)	198	(8)
Kivexa ⁴	383	(16)	428	(18)	424	(17)	403	(16)	432	(16)	453	(16)	451	(16)	476	(17)	468	(17)	311	(12)	235	(9)
Lamivudine	647	(27)	547	(23)	416	(17)	385	(15)	355	(13)	316	(11)	286	(10)	282	(10)	270	(10)	251	(9)	210	(8)
Stavudine	94	(4)	73	(3)	56	(2)	44	(2)	30	(1)	27	(1)	21	(1)	17	(1)	12	(0)	11	(0)	6	(0)
Tenofovir	531	(23)	503	(21)	482	(20)	486	(19)	467	(18)	442	(16)	420	(15)	329	(12)	289	(11)	265	(10)	245	(10)
Tenofovir (TAF)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	1	(0)	1	(0)	1	(0)	19	(1)	64	(3)
Trizivir ⁵	89	(4)	69	(3)	56	(2)	45	(2)	41	(2)	27	(1)	22	(1)	19	(1)	15	(1)	11	(0)	8	(0)
Truvada ⁶	552	(23)	723	(30)	921	(38)	963	(37)	823	(31)	904	(33)	934	(34)	912	(33)	838	(31)	759	(28)	584	(23)
Zalcitabine	3	(0)	3	(0)	2	(0)	2	(0)	1	(0)	1	(0)	1	(0)	1	(0)	1	(0)	1	(0)	1	(0)
Zidovudine	119	(5)	97	(4)	60	(2)	50	(2)	38	(1)	34	(1)	32	(1)	28	(1)	24	(1)	19	(1)	12	(0)
Non-nucleoside analogue RTI																						
Delavirdine	9	(0)	3	(0)	2	(0)	2	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Efavirenz	556	(24)	573	(24)	584	(24)	543	(21)	350	(13)	359	(13)	305	(11)	235	(9)	198	(7)	146	(5)	100	(4)
Nevirapine	660	(28)	689	(29)	685	(28)	658	(26)	629	(24)	628	(23)	580	(21)	542	(20)	486	(18)	407	(15)	341	(14)
Etravirine	24	(1)	53	(2)	85	(3)	107	(4)	112	(4)	119	(4)	124	(4)	125	(5)	128	(5)	115	(4)	96	(4)
Rilpivirine	0	(0)	0	(0)	2	(0)	3	(0)	4	(0)	16	(1)	34	(1)	40	(1)	44	(2)	52	(2)	63	(3)
Entry Inhibitor																						
Enfurvitide	62	(3)	45	(2)	28	(1)	16	(1)	8	(0)	6	(0)	5	(0)	3	(0)	0	(0)	1	(0)	1	(0)
Fostemsavir	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	1	(0)	2	(0)	2	(0)
Maraviroc	8	(0)	15	(1)	23	(1)	30	(1)	34	(1)	43	(2)	51	(2)	56	(2)	56	(2)	53	(2)	43	(2)

1. All treatment records of ≥2 weeks of treatment in any calendar year were included in this analysis. The denominator includes all patients that could have been on antiretroviral therapy (i.e. HIV positive) in any calendar year. The proportion of patients on each drug in any calendar year does not add up to 100% across all ART drug groups in each calendar year as patients on more than one ARV during a calendar year period will be counted in all of the relevant ART groups. Includes retrospective and prospective data.

2. Lamivudine & zidovudine. 3. Tenofovir (TAF) & emtricitabine. 4. Abacavir & lamivudine. 5. Abacavir, lamivudine & zidovudine. 6. Tenofovir & emtricitabine.

Table 10 continued: Current use of individual antiretroviral treatments¹

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Protease Inhibitor																						
Amprenavir	27	(1)	25	(1)	24	(1)	23	(1)	20	(1)	19	(1)	17	(1)	14	(1)	10	(0)	6	(0)	6	(0)
Atazanavir	491	(21)	547	(23)	562	(23)	588	(23)	586	(22)	582	(21)	545	(20)	491	(18)	408	(15)	308	(12)	216	(9)
Darunavir	76	(3)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Evotaz ⁷	76	(3)	123	(5)	170	(7)	206	(8)	239	(9)	280	(10)	293	(11)	321	(12)	327	(12)	324	(12)	293	(12)
Fosamprenavir	35	(1)	34	(1)	28	(1)	20	(1)	17	(1)	14	(1)	12	(0)	11	(0)	8	(0)	6	(0)	5	(0)
Indinavir	34	(1)	21	(1)	11	(0)	7	(0)	6	(0)	6	(0)	5	(0)	3	(0)	3	(0)	3	(0)	2	(0)
Kaletra ⁸	398	(17)	368	(15)	345	(14)	340	(13)	300	(11)	257	(9)	217	(8)	179	(7)	131	(5)	83	(3)	58	(2)
Nelfinavir	37	(2)	10	(0)	9	(0)	8	(0)	7	(0)	7	(0)	6	(0)	5	(0)	4	(0)	4	(0)	4	(0)
Prezcobix ⁹	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	15	(1)	59	(2)
Ritonavir	626	(27)	684	(28)	692	(28)	750	(29)	776	(29)	816	(30)	789	(28)	762	(28)	693	(25)	587	(22)	446	(18)
Saquinavir	55	(2)	48	(2)	32	(1)	25	(1)	22	(1)	19	(1)	16	(1)	13	(0)	11	(0)	8	(0)	5	(0)
Integrase Inhibitors																						
Bictegravir	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(0)	2	(0)
Dolutegravir	0	(0)	0	(0)	0	(0)	0	(0)	2	(0)	8	(0)	11	(0)	206	(7)	387	(14)	367	(14)	451	(18)
Elvitegravir	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	4	(0)	19	(1)	24	(1)	28	(1)	49	(2)	45	(2)
Raltegravir	64	(3)	186	(8)	311	(13)	456	(18)	524	(20)	624	(23)	690	(25)	709	(26)	612	(22)	492	(18)	402	(16)
Cabotegravir	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(0)	2	(0)
Class Combinations																						
Atripla ¹⁰	5	(0)	6	(0)	20	(1)	299	(12)	401	(15)	444	(16)	492	(18)	458	(17)	407	(15)	328	(12)	260	(10)
Eviplera ¹¹	0	(0)	0	(0)	0	(0)	0	(0)	3	(0)	62	(2)	127	(5)	147	(5)	149	(5)	143	(5)	130	(5)
Stribild ¹²	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(0)	4	(0)	77	(3)	124	(5)	128	(5)	37	(1)
Triumeq ¹³	1	(0)	1	(0)	1	(0)	1	(0)	1	(0)	1	(0)	1	(0)	2	(0)	271	(10)	398	(15)	418	(17)
Genvoya ¹⁴	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(0)	2	(0)	5	(0)	216	(8)	300	(12)
Odefsey ¹⁵	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	1	(0)	52	(2)

7. Atazanavir & cobicistat. 8. Lopinavir & ritonavir. 9. Darunavir & cobicistat. 10. Tenofovir, emtricitabine & efavirenz. 11. Tenofovir, emtricitabine & rilpivirine. 12. Tenofovir, emtricitabine, elvitegravir & cobicistat. 13. Abacavir, lamivudine, dolutegravir. 14. Tenofovir (TAF), emtricitabine, elvitegravir & cobicistat. 15. Rilpivirine, emtricitabine & Tenofovir (TAF)

MONITORING DISPENSED ANTIRETROVIRALS VIA THE S100 PROGRAM

Table 11 reports the number of people dispensed antiretroviral (ARV) treatment through the Australian Government's Highly Specialised (HSD) (s100) program. Data up to and including 2013 were based on data reported in the Public Health Dispensed National Patient report. The number of patients who were dispensed antiretroviral drugs per state per financial year quarter were analysed together with data on ARV use from the AHOD sample.

For the time period 2009 – 2013, to estimate the number of patients receiving ART, we combined data on the proportion of patients receiving certain mutually exclusive ARVs in AHOD with data from the s100 program on the total number of people receiving the same ARVs. For example, lamivudine and emtricitabine are a common component of combination ART regimens in Australia, but should not be prescribed in combination. We calculated the proportion of all treated patients in AHOD who received lamivudine or emtricitabine as part of an ART regimen by year and state. We also estimated the total number of patients dispensed lamivudine or emtricitabine for HIV infection each year through the s100 program by calculating the average number of patients prescribed each drug from the corresponding four financial year quarters. An estimate of the total number of people receiving any ART was then obtained by dividing the total number of patients receiving lamivudine or emtricitabine through the s100 program by the proportion of treated patients in AHOD receiving the same ARV drugs.

Note: Prior to 2009, the HSD Report provided prescribed patient numbers by each antiretroviral agent. However, after noting some inconsistencies with their methodology, they have since ceased providing these numbers. For years 2009-2010, instead we (The Kirby Institute) evaluated patient numbers by using a combination of total packs dispensed and an average "packs-per-patient" adjustment ratio. The packs-per-patient adjustment figure was calculated from 2008 data, where total packs dispensed and patient numbers were available. However, due to the relatively recent diversification of pack sizes, newer dosing schedules and the introduction of antiretroviral agents that were absent in 2008, we are uncertain as to how our packs-per-patient adjustment ratio has changed over time. Therefore, we caution our estimates for 2011- 2013 data for Table 11.

From 2014 onwards, we report the number of people receiving ART based on a 10% sample of the Pharmaceutical Benefits Scheme (PBS) data, including s100 drugs. Data on dispensed prescriptions for a PBS 10% sample is updated every quarter and supplied to a number of approved users or clients including Prospecction which provides a dashboard interface (PharmDash) for querying the PBS 10% sample [1, 2]. The 10% sample of the PBS is a randomised patient level, de-identified PBS script claims data set from 2006-present. Currently the data set has 170 million script claims and 3 million patients. It includes all PBS listed drugs with HIV indications. The presented figures are annual totals of unique patients in December each year. This represents total number of patients obtaining at least one prescription for the indicated drug anytime during a year. This methodology is preferable due to increased accuracy of the source data and the removal of assumptions and extrapolations previously required. This may also explain the considerable increase in estimated number of patients receiving ART from 2013 to 2014.

[1] <http://www.pbs.gov.au/info/industry/useful-resources/sources/>, 22 September 2015.

[2] <http://www.prospecction.com.au/>, 22 September 2015.

Table 11: Number of people dispensed antiretroviral treatment through the Highly Specialised Drugs (s100) program by year and antiretroviral agent

Antiretroviral agent	Year of prescription ^{1, 2}					
	2012	2013	2014 ³	2015 ³	2016 ³	2017 ³
Nucleoside analogue reverse transcriptase inhibitors						
Abacavir	425	400	460	440	330	240
Didanosine	84	60	130	80	≤30	≤30
Emtricitabine	157	60	90	120	110	100
Lamivudine	609	540	650	710	610	570
Stavudine	36	20	50	40	≤30	≤30
Zidovudine	70	60	70	60	≤30	≤30
Lamivudine & Zidovudine	461	400	420	370	300	270
Abacavir & Lamivudine	2041	2500	3470	3350	1710	1270
Abacavir, Lamivudine & Zidovudine	103	100	100	60	40	≤30
Tenofovir	2039	2480	770	660	590	470
Tenofovir & Emtricitabine	4404	4340	6150	5890	5380	3090
TAF & Emtricitabine	-	-	-	-	420	3730
Non-nucleoside analogue reverse transcriptase inhibitors						
Efavirenz	738	700	830	670	420	370
Nevirapine	2376	2260	2780	2550	2140	1770
Etravirine	454	520	580	540	510	440
Rilpivirine	18	40	140	240	260	250
Protease inhibitors						
Atazanavir	2582	2380	2790	2190	1660	1090
Darunavir	1131	1140	1800	1980	2000	1530
Fosamprenavir	111	80	120	100	60	40
Indinavir	18	20	≤30	≤30	≤30	≤30
Lopinavir & Ritonavir	1341	960	1030	690	380	210
Ritonavir	2652	3180	4010	3740	3170	2110
Saquinavir	72	40	≤30	≤30	≤30	≤30
Tipranavir	11	<5	≤30	≤30	≤30	
Darunavir & Cobicistat	-	-	-	-	130	660
Atazanavir & Cobicistat	-	-	-	-	100	230
Entry inhibitors						
Enfuvirtide	13	20	-	-	-	
Maraviroc	122	160	310	250	290	270
Integrase inhibitor						
Raltegravir	2250	2740	3900	3200	2610	2270
Dolutegravir	-	-	1910	2990	2380	3060
Combination Class Agents						
Tenofovir, Emtricitabine & Efavirenz	2786	3100	3710	3250	2620	1860
Tenofovir, Emtricitabine & Rilpivirine	217	1040	2250	2550	2300	1860
Tenofovir, Emtricitabine, Elvitegravir & Cobicistat	-	-	880	1690	1800	380
TAF, Emtricitabine, Elvitegravir & Cobicistat	-	-	-	-	2820	4700
Abacavir, Lamivudine & Dolutegravir	-	-	-	2840	4690	5550
Total patients	12,800⁴	13,700⁴	17,500	18,720	19,940	21,060
Total cost⁵ (\$'000s)	210,005	229,000	230,872	250,688	260,811	294,935

1. For 2012 and 2013 the number of people dispensed each antiretroviral drug during a calendar year was estimated by calculating the average of the total number of people dispensed each drug during the corresponding financial year quarters. Number of person years 2012 estimated from the HSD Program Public Hospital Dispensed National Pack Number Report because of changes to S100 data collection methodology. Number of person years for 2013 estimated from the PBS item reports on services and benefits.

2. Dashes (-) indicate that data were not available.

3. PharmDash (<http://www.prospection.com.au/>, 14 August 2018)

4. Total patients calculated as (Lamivudine + Combivir (Lamivudine & Zidovudine)+Trizivir (Abacavir, Lamivudine & Zidovudine)+Kivexa (Abacavir & Lamivudine)+Emtricitabine +Truvada(Tenofovir & Emtricitabine) + Atripla(Tenofovir & Emtricitabine & Efavirenz) + Exiplera(Tenofovir & Emtricitabine & Rilpivirine))/the proportion of patients in the Australian HIV Observational Database receiving any of the previously mentioned drugs in each year. Estimates of total patients are rounded to nearest 100 patients.

5. Public Hospital Expenditure until 2013, PBS + patient contributions thereafter, calculation were adapted by PharmDash in 2017.

Sources: PharmDash, Highly Specialised Drugs (S100) Program

Publications since September 2017:

R Huang, K Petoumenos, RT Gray, H McManus, N Dharan, R Guy, *et al.* **National characteristics and trends in antiretroviral treatment in Australia can be accurately estimated using a large clinical cohort.** *J Clin Epidemiol.* 2018 Aug;100:82-91. doi: 10.1016/j.jclinepi.2018.04.015.

C Hughes, R Puhr, S Ojaimi, K Petoumenos, AW Bartlett, DJ Templeton, CC O'Connor, M Gunathilake, I Woolley. **HIV infected young people in Australia: data from the Australian HIV Observational Database (AHOD).** *Intern Med J.* 2018 Jul 24. doi: 10.1111/imj.14040. Epub ahead of print.

A full list of publications is available online:

<https://kirby.unsw.edu.au/project/ahod>

Australian HIV Observational Database contributors

Asterisks indicate steering committee members in 2018.

New South Wales: D Ellis, Plaza Medical Centre, Coffs Harbour; M Bloch, T Vincent, Holdsworth House Medical Practice, Sydney; D Allen, Holden Street Clinic, Gosford; D Smith, A Rankin, Lismore Sexual Health & AIDS Services, Lismore; D Baker*, East Sydney Doctors, Surry Hills; DJ Templeton*, Niveditha Manokaran, R Jackson, RPA Sexual Health, Camperdown; Eva Jackson, K McCallum, Nepean and Blue Mountains Sexual Health and HIV Clinic, Penrith; N Ryder, G Sweeney, B Moran, Clinic 468, HNE Sexual Health, Tamworth; A Carr, K Hesse, T Chronopoulos, F Bascombe, St Vincent's Hospital, Darlinghurst; R Finlayson, C Tan, J Le, Taylor Square Private Clinic, Darlinghurst; K Brown, V Aldous, JL Little, Illawarra Sexual Health Service, Warrawong; R Varma, H Lu, Sydney Sexual Health Centre, Sydney; D Couldwell, J Walsh, Western Sydney Sexual Health Clinic; DE Smith*, V Furner, D Smith, Albion Street Centre; S Fernando, Clinic 16 – Royal North Shore Hospital; A Cogle*, National Association of People living with HIV/AIDS; C Lawrence*, National Aboriginal Community Controlled Health Organisation; B Mulhall*, Department of Public Health and Community Medicine, University of Sydney; M Boyd*, University of Adelaide; M Law*, K Petoumenos*, R Puhr*, J Hutchinson*, T Dougherty, The Kirby Institute, University of NSW.

Northern Territory: M Gunathilake, K Jackson, Centre for Disease Control, Darwin.

Queensland: M O'Sullivan, S White, Gold Coast Sexual Health Clinic, Southport; D Russell, F Bassett, M Rodriguez, Cairns Sexual Health Service, Cairns; D Sowden, K Taing, P Smith, Clinic 87, Sunshine Coast Hospital and Health Service, Nambour; D Orth, D Youds, Gladstone Road Medical Centre, Highgate Hill; D Rowling, J Langton-Lockton, N Latch, F Taylor, Sexual Health and HIV Service in Metro North, Brisbane; B Dickson*, CaraData.

South Australia: W Donohue, O'Brien Street General Practice, Adelaide.

Victoria: R Moore, S Edwards, S Boyd, Northside Clinic, North Fitzroy; NJ Roth*, H Lau, Prahran Market Clinic, South Yarra; T Read, J Silvers*, W Zeng, Melbourne Sexual Health Centre, Melbourne; J Hoy*, M Giles*, K Watson*, M Bryant, S Price, The Alfred Hospital, Melbourne; I Woolley, T Korman, J O'Bryan, K Cisera, Monash Medical Centre, Clayton.

Western Australia: D Nolan, A Allen, G Guelfi. Department of Clinical Immunology, Royal Perth Hospital, Perth.

New Zealand: G Mills, C Wharry, Waikato District Hospital Hamilton; N Raymond, K Bargh, Wellington Hospital, Wellington.

CoDe reviewers: D Templeton, M Giles, K Brown and J Hoy.

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The Australian HIV Observational Database
The Kirby Institute
Wallace Wurth Building
UNSW Sydney, Sydney, NSW 2052.

Tel: +612 9385 0900
Fax: +612 9385 0920