

HIV in Australia

Annual Surveillance Report 2014 Supplement

Main findings

- A total of 1 236 cases of HIV infection were newly diagnosed in Australia in 2013, similar to levels in 2012 when the number of cases was the highest in Australia since the early 1990s. The annual number of new HIV diagnoses has gradually increased over the past 14 years, from 724 diagnoses in 1999.
- Victoria has had the largest increase over the last 10 years (40% increase) and in the last year (16% increase). No jurisdiction has a long-term decreasing trend.
- HIV continues to be transmitted primarily through sexual contact between men, accounting for 70% of new diagnoses in 2013.
- 29.6% of diagnosed cases in 2013 presented late (as defined by a CD4 count less than 350 cells/ μ l). This is stable compared with previous years, suggestive of no substantial shift in the disease stage at which people are diagnosed despite recent initiatives to increase HIV testing.

HIV care and treatment cascade

- This report introduces, for the first time, national estimates of the proportion of people with HIV in Australia who are under care, receiving treatment and having undetectable levels of HIV.
- An estimated 26 800 (plausible range 24 500 – 30 900) people were living with HIV infection in Australia at the end of 2013 (approximately 0.15% prevalence among adults aged older than 15 years).
- Between 13 200 and 19 500 were receiving antiretroviral treatment and had undetectable levels of HIV. This corresponds to 49 – 73% of all people with HIV and 57 – 84% of people with diagnosed HIV infection.

HIV among key populations in Australia

- HIV occurs at high levels among men who have sex with men.
 - Prevalence of 8 – 12% among gay community-attached men.
- HIV is low among people who inject drugs.
 - Prevalence of 1 – 2% among people attending needle and syringe programs.
- HIV remains extremely low (<0.1%) among female sex workers.
- HIV prevalence among Aboriginal and Torres Strait Islander people is estimated at 0.15%.
 - Rates of HIV diagnosis in 2013 were greater among Indigenous Australians (5.4 per 100 000) compared to the Australian-born non-Indigenous population (3.9 per 100 000). A greater proportion of HIV cases in the Aboriginal and Torres Strait Islander population were attributed to injecting drug use (12%) or heterosexual contact (21%) compared with the non-Indigenous cases (3% and 13%, respectively).
- Of 313 cases of HIV infection newly diagnosed in 2013 for which exposure to HIV was attributed to heterosexual contact, 46% were in people from high-prevalence countries or their partners.
- Over the last 10 years there was an average of one child born per year in Australia who acquired HIV through mother-to-child transmission.

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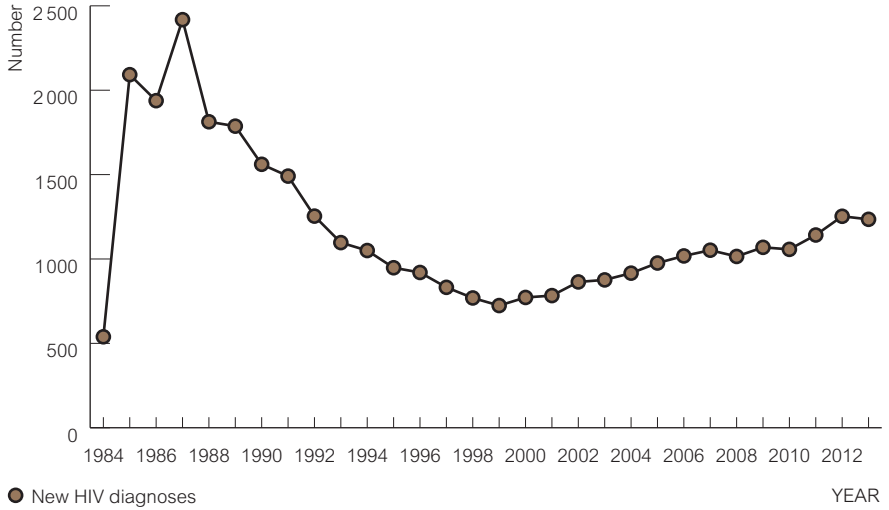
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Figure 1 Newly diagnosed HIV infection in Australia, by year

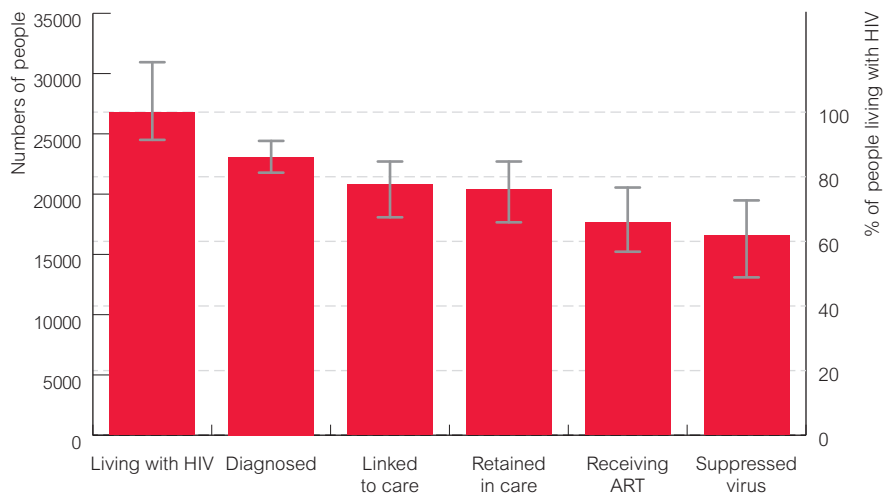


Source: State/Territory health authorities

A total of 1 236 cases of HIV infection were newly diagnosed in Australia in 2013, similar to the 2012 level. The annual number of new HIV diagnoses has been increasing over the past 14 years, from 724 diagnoses in 1999 (Figure 1).

By the end of 2013, 35 287 cases of HIV infection were diagnosed since the epidemic began (with an estimated 32 315 distinct cases). Of these, an estimated 9 900 – 11 000 have died. Approximately 14% (11 – 21%) of all HIV cases in Australia are undiagnosed. There are now an estimated 26 800 (24 500 – 30 900) people living with HIV in Australia.

Figure 2 Estimated HIV care and treatment cascade in Australia (best estimate and uncertainty bounds of plausible limits)



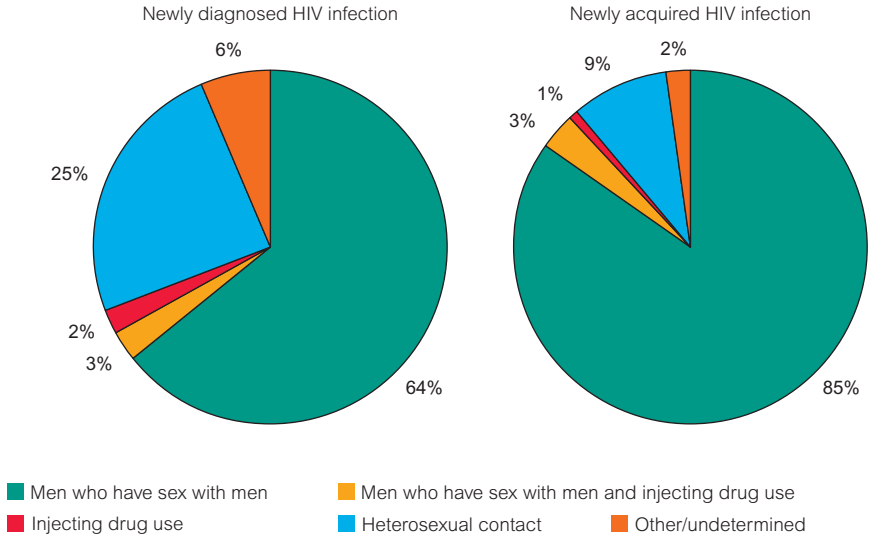
Source: The Kirby Institute

This report, for the first time, introduces estimates of the number and proportion of people with HIV who are diagnosed in Australia, in care, receiving antiretroviral treatment, and have undetectable levels of HIV. Known as the ‘HIV care and treatment cascade’, these estimates are used to support the improvement of the delivery of services to people with HIV across the entire continuum of care—from diagnosis of HIV infection and linkage in care through to initiation of antiretroviral therapy and attaining viral suppression. Using available data and accounting for uncertainties, the proportions of people in each stage of the cascade in Australia were estimated (Figure 2)¹. Methods and the associated uncertainties are described in detail in the Methodological Notes. In future years, improved data will lead to refinement of the approach and more accurate estimates of the cascade.

During 2013, an estimated 23 100 (21 800 – 24 400) people were living with diagnosed HIV, around 90% were linked to care within 3 months of diagnosis, and 20 400 (17 700 – 22 700) were retained in care. An estimated 17 700 (15 200 – 20 500) were on antiretroviral therapy, of whom 16 600 (13 200 – 19 500) had undetectable levels of virus as a result of treatment. This corresponds to 47 – 75% of all people with HIV and 54 – 87% of people with diagnosed HIV infection being virally suppressed.

¹ Definitions for the stages of the HIV care and treatment cascade following HIV diagnosis were adapted from international evidence-based standards and surveillance reporting practices to align with local pragmatic data collection, availability and reporting systems. An individual is defined as linked to care following HIV diagnosis if s/he receives a CD4 test within 3 months of diagnosis. Individuals are retained in care if they are on ART or receive at least one CD4 or viral load test in the past 12 months. Virological suppression is defined as < 400 viral copies per ml (uncertainty bounds <50 or <1000 copies per ml). See methodological notes for all calculations.

Figure 3 Newly diagnosed HIV infection and diagnoses of newly acquired HIV infection in Australia, 2009 – 2013, by exposure category



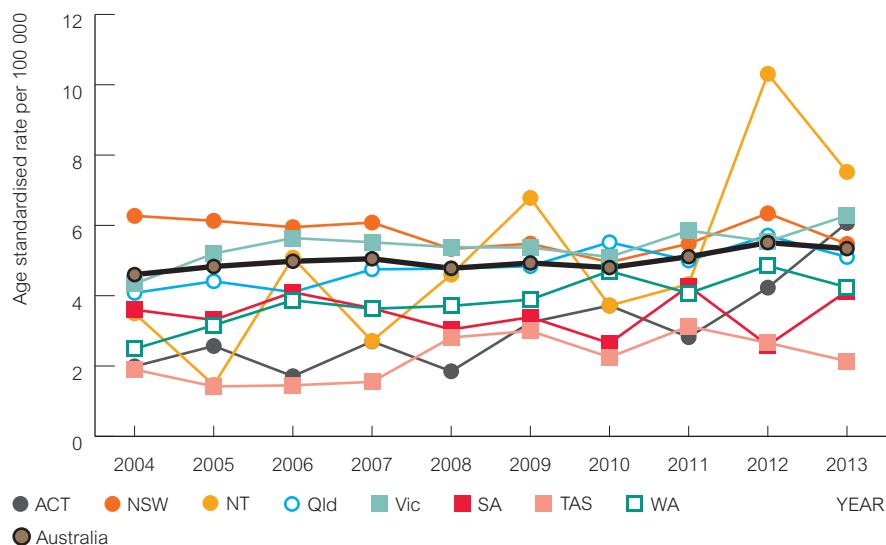
Source: State/Territory health authorities

Transmission of HIV in Australia continues to occur primarily through sexual contact between men (Figure 3). In 2009 – 2013, 67% of new HIV diagnoses occurred among men who have sex with men (70% of those with determined exposure), 25% were attributed to heterosexual contact, and 2% to injecting drug use.

A large majority (87%) of HIV diagnoses in 2013 were among males. The median age at HIV diagnosis is stable and was 37 years in 2013 (Tables 1, 2).

Men who have sex with men accounted for 88% of diagnoses of newly acquired HIV infection (where there is evidence of infection in the last 12 months) (Figure 3, Table 3).

Figure 4 Newly diagnosed HIV infection, 2004 – 2013, by year and State/Territory



Source: State/Territory health authorities

Recent trends in the population rate of newly diagnosed HIV infection have differed across Australia (Figure 4, Table 1). In Victoria, the rate of HIV diagnosis has been increasing from around 4.3 in 2004 to 6.3 per 100 000 population in 2013. The largest increase in number of diagnoses in 2013 occurred in Victoria (Table 1). The rise was predominantly due to male homosexual exposure, where there was a 32% increase in cases over the last 4 years. There was a small rise of HIV attributable to injecting drug use in Victoria, from 1 to 9 cases over the same period.

In New South Wales, the rate of HIV diagnosis has remained relatively stable, at around 5.3 per 100 000 population (Figure 4). Long-term trends in population rates of HIV diagnosis have increased in Queensland and Western Australia. Rates have fluctuated due to small numbers in other jurisdictions but have been relatively high in the Northern Territory in the last two years and rates are increasing in the Australian Capital Territory.

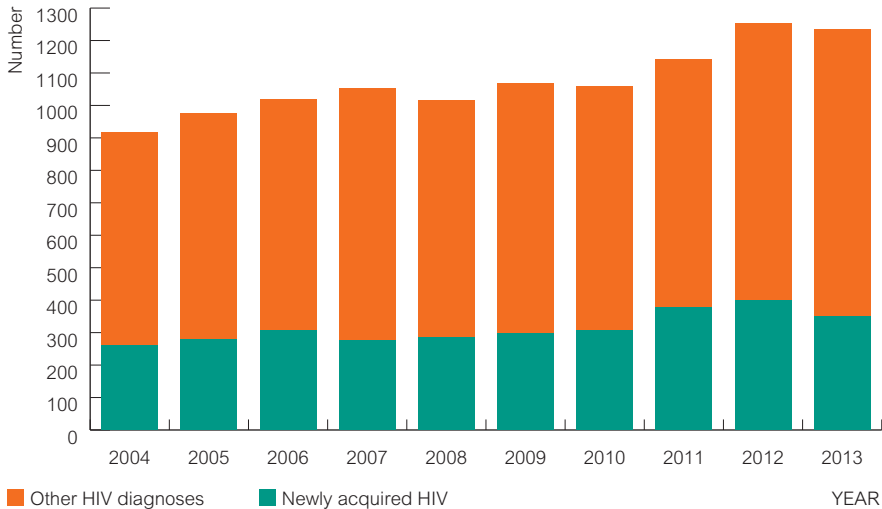
The best indicator of how long a person has had HIV is the CD4+ cell count per microlitre, which is above 500 in most people without HIV, and declines on average by 50 – 60 per year in people with HIV. The proportion of newly detected HIV cases with a late diagnosis, defined by a CD4+ cell count less than 350 cells/µl at diagnosis, has been steady over the last 3 years and was 29.6% in 2013 (Table 1). The median CD4 count at diagnosis was 432 cells/µl in 2013 (compared to 435 in 2012 and 430 in 2011). These data are suggestive of no substantial shift in the disease stage at which people are diagnosed despite recent initiatives to increase HIV testing.

For some newly diagnosed cases, it is possible to determine that they were acquired in the 12 months prior to diagnosis, on the basis of a recent prior negative test or other laboratory and clinical markers. The number of such cases has been increasing over the last 10 years (Figure 5), with 350 cases in 2013, but the proportion of all diagnoses that are newly acquired has remained stable (28% of all diagnoses in 2013).

Subtypes and transmitted drug resistance

The predominant subtype of HIV in Australia has been B. This is similar to subtypes seen mainly in Europe and the Americas. However, there has been a shift towards more non-B subtypes of HIV in Australia, from 5 – 10% in 2007 – 2009 to 20 – 25% in 2012 – 2013 (Table 4), based on reports from around 100 samples tested in two laboratories in Sydney and Melbourne.

Figure 5 Newly diagnosed HIV infection in Australia, 2004 – 2013, by newly acquired HIV status and year



Source: State/Territory health authorities

Table 1 Characteristics of cases of newly diagnosed HIV infection by year. Number of cases, median age, language spoken at home and State/Territory of HIV diagnosis, and percent of total cases by late and advanced HIV infection status, sex and HIV exposure category

Characteristic	Year of HIV diagnosis										
	≤2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total ¹
Total cases	25 469	976	1 018	1 052	1 015	1 069	1 057	1 142	1 253	1 236	35 287
Males (%)	92.3	90	85.1	86.8	85.8	86.2	85.2	87.3	87.3	86.9	90.7
Median age (years)											
Male	33	37	38	38	37	37	37	37	36	37	34
Female	29	32	31	32	31	32	31	34	33	33	31
Language spoken at home²											
English	553	662	660	788	758	799	762	881	901	609	7 373
Other language	53	55	74	82	69	114	114	116	146	115	938
Not reported	310	259	284	182	188	156	181	145	206	512	2 423
HIV infection status at diagnosis (%)³											
Late HIV diagnosis (%) ⁴	11.4	11.7	13.4	13.6	15.0	16.2	15.8	10.8	13.4	13.8	13.6
Advanced HIV infection (%) ⁴	18.1	19.1	21.0	17.2	16.6	18.4	19.7	17.5	16.3	15.8	17.9
Median CD4+ cell count (cells/ μ l)	445	450	408	422	420	406	400	430	435	432	423
State/Territory											
Australian Capital Territory	291	8	6	9	7	12	14	11	17	24	399
New South Wales	14 661	409	400	415	368	384	351	391	458	401	18 238
Northern Territory	145	3	11	6	11	16	6	9	27	19	253
Queensland	2 706	172	164	195	201	209	242	223	259	236	4 607
South Australia	952	51	62	56	47	53	42	67	41	69	1 440

Tasmania	111	7	7	7	13	14	10	15	13	11	208
Victoria	5 293	262	288	287	286	292	282	328	316	365	7 999
Western Australia	1 310	64	80	77	82	89	110	98	122	111	2 143

HIV exposure category (%) ⁵											
Men who have sex with men	77.6	72.0	66.7	67.9	65.5	64.4	66.4	70.7	70.5	66.0	74.7
Men who have sex with men and injecting drug use	4.4	4.5	4.3	3.0	3.4	3.7	2.2	2.9	2.8	3.7	4.1
Injecting drug use ⁶	4.1	3.5	2.8	2.8	3.3	2.4	2.4	1.9	2.3	2.4	3.6
Heterosexual contact	11.0	19.4	25.5	25.2	27.1	28.3	28.3	23.3	23.8	26.6	15.3
<i>Person from a high prevalence country</i>	2.9	6.7	10.4	9.4	11.2	11.4	12.7	8.0	9.1	8.3	4.9
<i>Partner with/at risk of HIV infection</i>	4.2	8.2	7.3	9.1	7.1	6.7	7.9	8.5	8.1	7.7	5.3
<i>Not further specified</i>	3.9	4.5	7.9	6.7	8.7	10.2	7.7	6.9	6.5	10.6	5.1
Haemophilia/coagulation disorder	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Receipt of blood/tissue	1.1	0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.3	0.4	0.8
Mother with/at risk of HIV infection	0.3	0.6	0.6	0.9	0.6	1.1	0.6	0.9	0.3	0.8	0.5
Health care setting	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Other undermined exposure	14.6	8.6	6.2	6.0	4.2	5.1	6.3	4.2	5.6	4.9	11.9

1 Not adjusted for multiple reporting.

2 Language spoken at home was sought among cases of HIV infection newly diagnosed from 1 January 2004. Total number with language spoken at home in 2004 – 2013 only.

3 Late diagnosis, advanced infection and median CD4+ cell count for HIV diagnoses in 2004 only. Total percentage with late HIV diagnosis and advanced HIV infection, and median CD4+ cell count for diagnoses in 2004 – 2013 only.

4 Late HIV diagnosis was defined as newly diagnosed HIV infection with a CD4+ cell count of 200 or more to less than 350 cells/μl, and advanced HIV infection as newly diagnosed infection with a CD4+ cell count of less than 200 cells/μl.

5 The "Other/undetermined" exposure category was excluded from the calculation of the percentage of cases attributed to each HIV exposure category.

6 Excludes men who have sex with men.

Source: [State/Territory health authorities](#)

Table 2 Number of new diagnoses of HIV infection¹, cumulative to 31 December 2013, by age group, year and sex

Age group (years)	Sex	Year of HIV diagnosis										
		≤2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
0 – 1	M	45	0	1	1	1	0	1	1	0	1	51
	F	23	1	3	1	1	2	1	1	0	1	34
2 – 12	M	90	2	2	4	4	3	3	3	1	0	112
	F	24	2	1	5	1	8	2	5	0	6	54
13 – 19	M	449	10	9	8	7	10	12	12	18	14	549
	F	101	3	6	2	6	3	3	6	6	11	147
20 – 24	M	2 794	71	54	64	86	71	70	91	110	97	3 508
	F	281	13	18	11	23	12	20	9	20	16	423
25 – 29	M	4 683	113	118	129	134	153	140	172	205	185	6 032
	F	389	14	36	29	25	33	37	25	31	23	642
30 – 39	M	8 884	323	301	310	277	305	277	309	327	308	11 621
	F	474	43	49	55	57	53	61	55	64	55	966
40 – 49	M	4 353	218	242	253	234	233	245	238	241	264	6 521
	F	185	16	25	19	22	22	17	35	23	25	389
50 – 59	M	1 552	99	101	96	89	115	105	126	126	134	2 543
	F	72	4	9	12	7	10	9	6	10	20	159
60+	M	512	41	38	47	39	31	47	45	66	69	935
	F	73	1	2	4	2	3	2	2	3	4	96
Not reported	M	134	1	0	1	0	0	0	0	0	0	136
	F	32	0	0	0	0	0	0	0	0	0	32
Sub-total	M	23 496	878	866	913	871	921	900	997	1 094	1 072	32 008
	F	1 654	97	149	138	144	146	152	144	157	161	2 942
Total²		25 469	976	1 018	1 052	1 015	1 069	1 057	1 142	1 253	1 236	35 287

1 Not adjusted for multiple reporting.

2 Totals include 88 people whose sex was reported as transgender and 249 people whose sex was not reported.

Source: State/Territory health authorities

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Table 3 Characteristics of diagnoses of newly acquired HIV infection, 2004 – 2013, by year. Total number of cases, median age and number of cases by State/Territory, HIV exposure category, evidence of newly acquired infection, sex and year

Characteristic	Sex	Year of HIV diagnosis										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total ^{1,2}
Total cases		261	281	308	278	286	301	308	379	400	350	3 152
Males (%)	M	94.3	96.8	93.5	95.7	95.1	94.7	95.5	95.5	95.7	95.7	95.3
Median age	M	35	35	36	35	36	36	35	35	33	34	35
	F	23	27	35	35	31	29	38	35	26	37	31
State/Territory												
Australian Capital Territory	M	2	1	3	2	0	3	3	4	10	8	36
	F	0	0	1	0	0	0	0	0	0	1	2
New South Wales	M	113	128	110	112	123	114	125	166	178	144	1 313
	F	5	3	7	4	6	8	2	4	8	3	50
Northern Territory	M	2	1	2	1	2	4	2	2	2	3	21
	F	0	0	0	0	0	3	0	1	1	0	5
Queensland	M	42	42	57	48	44	60	54	58	61	60	526
	F	3	1	1	4	2	2	4	4	3	5	29
South Australia	M	15	15	17	7	6	6	4	5	6	7	88
	F	1	0	0	0	1	0	1	0	0	0	3
Tasmania	M	1	2	0	0	1	2	2	5	4	2	19
	F	0	0	0	0	0	0	0	0	0	0	0
Victoria	M	62	74	85	82	81	88	89	97	94	85	837
	F	4	4	8	3	5	2	5	4	2	2	39
Western Australia	M	9	9	14	14	15	8	15	25	28	26	163
	F	1	1	2	1	0	0	1	4	2	3	15

HIV exposure category												
Men who have sex with men	M	209	234	246	230	240	246	265	327	346	292	2 635
Men who have sex with men and injecting drug use	M	12	15	15	6	11	11	7	7	14	16	114
Injecting drug use	M	2	2	2	2	0	3	1	2	3	2	19
	F	4	1	2	1	3	0	1	1	1	0	14
Heterosexual contact	M	16	9	16	20	18	19	13	21	15	17	164
	F	10	8	16	10	11	14	12	15	15	14	125
Health care setting	M	2	0	0	0	0	0	0	0	0	0	2
	F	0	0	0	0	0	0	0	0	0	0	0
Other/undetermined	M	5	12	9	8	3	6	8	5	5	8	69
	F	0	0	1	1	0	1	0	1	0	0	4
Evidence of newly acquired infection												
Testing history only	M	105	128	150	122	123	136	131	142	158	161	1 356
	F	10	5	7	5	7	5	7	4	2	3	55
Primary HIV infection only	M	46	49	44	61	60	52	80	98	93	66	649
	F	3	2	9	5	5	6	1	9	10	5	55
Testing history and primary HIV infection	M	95	95	94	83	89	97	83	122	132	108	998
	F	1	2	3	2	2	4	5	4	4	6	33

1 Newly acquired HIV infection was defined as newly diagnosed infection with a negative or indeterminate HIV antibody test result or a diagnosis of primary HIV infection within one year of HIV diagnosis.

2 Totals include 6 people whose sex was reported as transgender.

3 Excludes men who have sex with men.

Source: [State/Territory health authorities](#)

Table 4 Number and percentage of isolates with resistance at one or more loci, by drug class against which resistance was detected and year

Year of diagnosis	Drug class against which resistance was detected				
	Total	% non-B subtypes	PI ¹ Number (%)	NRTI ¹ Number (%)	NNRTI ¹ Number (%)
2009	108	7	1 (0.9)	6 (5.5)	8 (7.4)
2010	88	14	1 (1.1)	7 (7.9)	4 (4.5)
2011	94	11	2 (2.1)	4 (4.3)	1 (1.1)
2012	91	25	0 (0.0)	4 (3.3)	7 (7.7)
2013	97	22	3 (1.0)	4 (4.1)	3 (3.1)

1 PI: protease inhibitor; NRTI: Nucleoside reverse transcriptase inhibitor; NNRTI: Non-nucleoside reverse transcriptase inhibitor

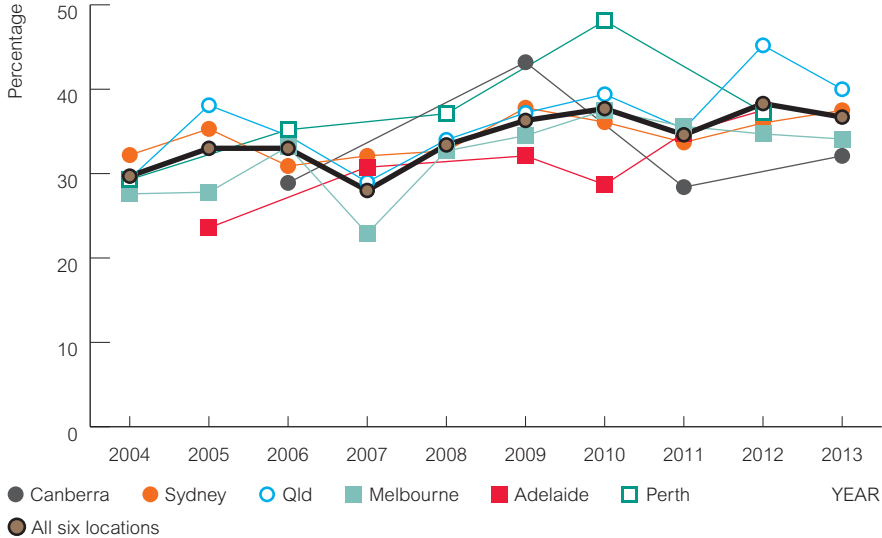
Source: NSW State Reference Laboratory for HIV/AIDS, Victorian Infectious Diseases Reference Laboratory

HIV among gay and other men who have sex with men

- The population size of men who have sex with men (MSM) is estimated to be around 180 000 – 200 000 ^[1].
- HIV has been concentrated among gay men in Australia since the epidemic began; 75% of all HIV infections diagnosed in Australia with recorded exposure category are due to male homosexual contact.
- HIV continues to predominantly affect gay and other MSM in Australia with 70% of all diagnoses in 2013 among this group.
- HIV prevalence is estimated to be 8 – 12% among gay community-attached men² in Australia.
- The rate of unprotected anal intercourse with casual partners among MSM, according to the Gay Community Periodic Surveys (GCPS), has slightly increased from ~30% to ~37% over the past 10 years (Figure 6).
- In 2013, about 60% of the non-HIV-positive participants in the GCPS reported having an HIV test in the 12 months prior to the survey. This proportion has been stable over the last ten years although there is jurisdictional variation (Figure 7).

2 Zablotska, I.B., et al., *Behavioural surveillance among gay men in Australia: methods, findings and policy implications for the prevention of HIV and other sexually transmissible infections*. Sexual Health, 2011. 8(3): p. 272 – 279.

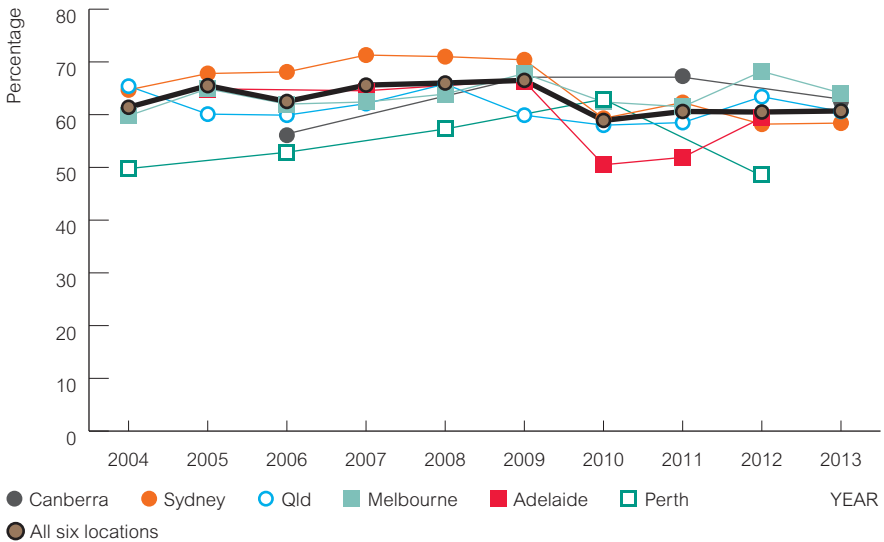
Figure 6 Trend in any unprotected anal intercourse among casual partnerships in men for the six months prior to participation in Gay Community Periodic Surveys, adjusted for age and recruitment venue type³, 2004 – 2013



Source: Centre for Social Research in Health

3 Since 2010, in CSRH's Annual Report of Trends in Behaviour (ARTB), direct age standardisation has been used with reference to adult male population age-stratified data published by the Australian Bureau of Statistics. A set of sampling weights, as determined by the actual sizes of recruitment types (e.g., community sites vs clinics vs sex-on-premises venues) was further applied to adjust for sampling variations. In general, national trends for the key indicators have been calculated, so each state and territory can be compared to the 'national average'.

Figure 7 Trend in self-reported HIV testing, adjusted for age and recruitment venue type, in the last 12 months among non-HIV-positive men who have sex with men, 2004 – 2013

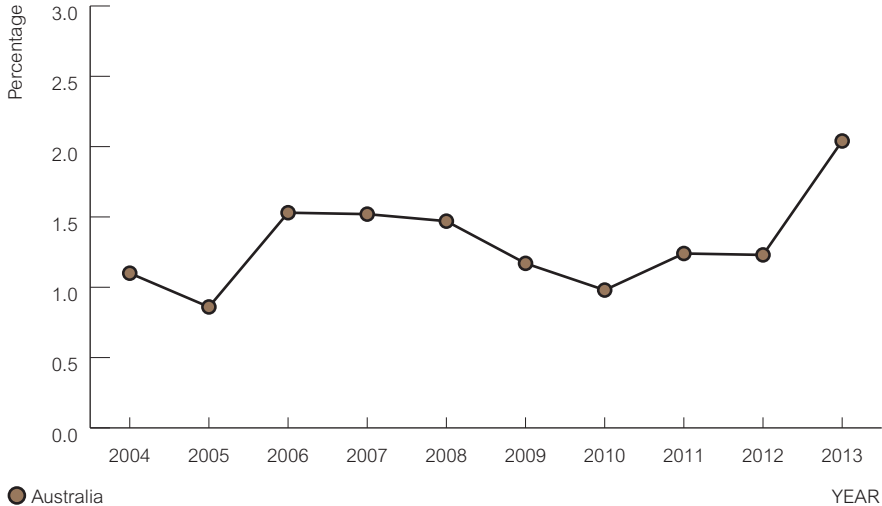


Source: Centre for Social Research in Health

HIV among people who inject drugs

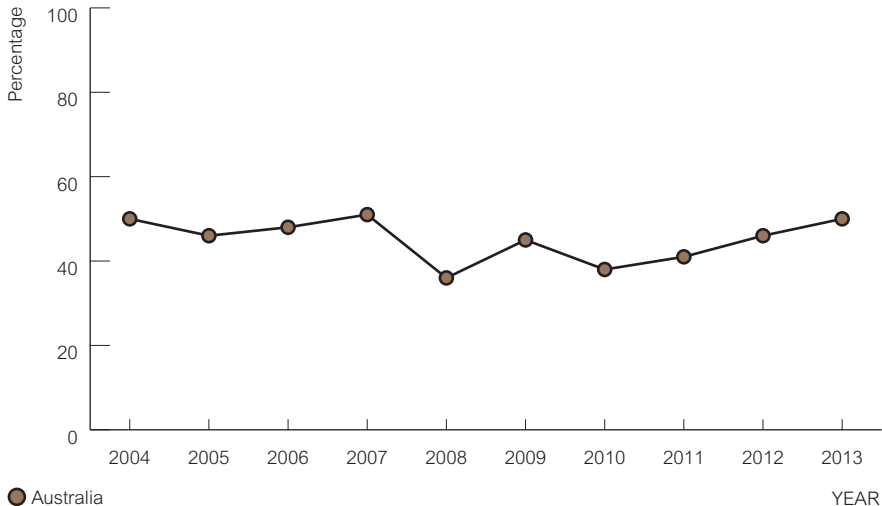
- The population size of people who inject drugs is estimated to be 89 000 – 205 000 in Australia ^[3].
- HIV prevalence among people who inject drugs in Australia, as measured in the Australian Needle and Syringe Program Survey ^[4], increased from 1.1% in 2004 to 2.1% in 2013 (Figure 8); the recent increase was predominantly among male participants in the survey who reported themselves as homosexual or bisexual (there was an increase in MSM respondents in the survey).
- There is no obvious trend over time in HIV diagnoses attributable to injecting drug use, with around 30 cases each year and 29 cases in 2013.
- In 2013, about 50% of the non-HIV-positive participants of the Australian Needle and Syringe Program Survey reported having an HIV test in the 12 months prior to the survey. Testing rates appear to be stable-to-increasing in this population (Figure 9).
- The prevalence of use of a needle and syringe after someone else used it among people who inject drugs has remained stable at around 15% (Figure 10).

Figure 8 HIV antibody prevalence (%) among people who inject drugs in the Australian Needle and Syringe Program Survey, 2004 – 2013



Source: Collaboration of Australian Needle and Syringe Programs

Figure 9 Percentage of people who inject drugs in the Australian Needle and Syringe Program Survey who report having an HIV test in the last year, 2004 – 2013



Source: Collaboration of Australian Needle and Syringe Programs

Figure 10 Percentage of people who inject drugs in the Australian Needle and Syringe Program Survey who report using a needle and syringe after someone else in the last month, 2004 – 2013



Source: Collaboration of Australian Needle and Syringe Programs

HIV among female sex workers

- The population size of female sex workers is estimated to be about 20 000 in Australia⁴.
- HIV prevalence remains low among women self-identifying as sex workers who were seen at sexual health clinics (<0.1%) (Figure 11).
- Around 68% of female sex workers attending sexual health clinics were tested for HIV during a clinic visit during 2013.

Figure 11 HIV prevalence among heterosexually active women seen at sexual health clinics, 2004 – 2013, by year and HIV exposure category



Source: Collaborative group on sentinel HIV surveillance in sexual health clinics

4 Extrapolation of estimated number of sex workers in NSW to national levels, by Basil Donovan

Perinatal exposure to HIV among Australian-born children

- The number of children born to women with HIV infection increased from 9.7 per 100 000 live births in 2004 – 2005 to 17.5 in 2012 – 2013, with a total of 372 such births in Australia over the period 2004 – 2013 (Tables 5,6).
- Among these children, there were 13 cases of HIV infection, for an average of 1.3 per year. In over half of these cases, the woman was diagnosed with HIV after the birth of the child (Table 6).

Table 5 Number and population rate¹ of perinatal exposure to HIV among children born in Australia, 2004 – 2013, by State/Territory and year of birth

State/ Territory	Year of birth									
	2004 – 2005		2006 – 2007		2008 – 2009		2010 – 2011		2012 – 2013	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
ACT	0	0.0	0	0.0	1	10.3	3	29.2	7	64.1
NSW	26	14.7	19	10.1	28	14.1	30	15.0	36	18.3
NT	0	0.0	0	0.0	0	0.0	0	0.0	1	12.2
QLD	13	12.8	14	12.3	13	10.1	10	7.8	8	6.3
SA	1	2.9	4	10.5	4	10.0	4	10.0	5	12.2
TAS	0	0.0	1	7.6	1	7.5	3	23.1	0	0.0
VIC	7	5.6	17	12.5	32	22.5	31	21.8	45	29.1
WA	3	5.8	2	3.5	0	0.0	7	11.0	6	8.9
Total	50	9.6	57	10.1	79	13.1	88	14.5	108	17.4

1 Average annual rate of perinatal HIV exposure per 100 000 livebirths. Number of livebirths by State/Territory and year from Births, Australia (Australian Bureau of Statistics).

Source: [Australian Paediatric Surveillance Unit; State/Territory health authorities](#)

Table 6 Number of perinatally exposed children born in Australia, 2004 – 2013, and number with diagnosed HIV infection by year of the child's birth and time of the woman's HIV diagnosis relative to the child's birth

Child's year of birth	Interval of the woman's HIV diagnosis					
	Before or at the birth		After the birth		Total	
	Number exposed	Number with HIV	Number exposed	Number with HIV	Number exposed ¹	Number with HIV ²
2004 – 2005 ¹	45	0	4	2	50	2
2006 – 2007	52	3	5	3	57	6
2008 – 2009 ²	76	0	0	0	79	1
2010 – 2011 ³	85	1	2	0	88	1
2012 – 2013 ⁴	99	1	3	2	108	3
Total	357	5	14	7	382	13

1 Total includes 1 HIV negative child born in 2004 – 2005 whose mother's date of HIV diagnosis was not reported.

2 Total includes 3 child born in 2008 – 2009 (2 HIV negative and 1 with HIV infection) whose mother's date of HIV diagnosis was not reported.

3 Total includes 1 HIV negative child born in 2010 – 2011 whose mother's date of HIV diagnosis was not reported.

4 Total includes 5 children born in 2012 – 2013 (all HIV negative) whose mother's date of HIV diagnosis was not reported.

Source: Australian Paediatric Surveillance Unit; State/Territory health authorities

Table 7 Characteristics of cases of newly diagnosed HIV infection in Aboriginal and Torres Strait Islander people, 2004 – 2013, by year. Number of cases, median age and percent (number) of total cases by sex, newly acquired infection, HIV status at diagnosis, State/Territory and HIV exposure category

Characteristic	Year of HIV diagnosis										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total ^{1,2}
Total cases	22	20	23	19	19	24	22	23	33	26	231
Males (%)	72.7	85.0	73.9	84.2	79.0	83.3	68.2	73.9	81.8	84.6	78.8
Median age (years)	29	33	31	33	36	37	35	33	27	37	33
Newly acquired HIV infection (%) ¹	31.8 (7)	15.0 (3)	30.4 (7)	26.3 (5)	31.6 (6)	29.2 (7)	22.7 (5)	21.7 (5)	30.3 (10)	34.6 (9)	27.7 (64)
HIV infection status at diagnosis (%)^{2,3}											
Late HIV diagnosis	4.5	5.0	13.0	26.3	21.1	12.5	18.2	4.3	9.1	15.4	12.6
Advanced HIV infection	31.8	10.0	8.7	10.5	15.8	33.3	9.1	34.8	21.2	26.9	20.8
State/Territory											
Australian Capital Territory	0	0	0	0	0	0	0	0	0	0	0
New South Wales	4	3	9	8	8	9	7	5	11	8	72
Northern Territory	1	0	0	0	1	0	1	2	2	1	8
Queensland	5	9	6	5	2	8	8	8	14	9	74
South Australia	2	0	0	1	4	2	1	1	1	2	14
Tasmania	1	0	0	0	0	1	0	1	0	1	4
Victoria	4	2	2	3	0	1	3	1	5	5	26
Western Australia	5	6	6	2	4	3	2	5	0	0	33

HIV exposure category (%) ⁴												
Men who have sex with men	52.4 (11)	35.0 (7)	47.8 (11)	47.4 (9)	47.4 (9)	52.6 (10)	60.0 (12)	63.6 (14)	71.9 (23)	24.0 (6)	50.9 (112)	
Men who have sex with men and injecting drug use	0.0 (0)	25.0 (5)	4.3 (1)	15.8 (3)	5.3 (1)	15.8 (3)	5.0 (1)	0.0 (0)	3.1 (1)	20.0 (5)	9.1 (20)	
Injecting drug use ⁵	19.0 (4)	15.0 (3)	21.7 (5)	15.8 (3)	36.8 (7)	10.5 (2)	20.0 (4)	4.5 (1)	6.3 (2)	24.0 (6)	16.8 (37)	
Heterosexual contact	28.6 (6)	25.0 (5)	26.1 (6)	21.1 (4)	10.5 (2)	21.1 (4)	15.0 (3)	27.3 (6)	18.8 (6)	32.0 (8)	22.7 (50)	
Haemophilia/coagulation disorder	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	
Receipt of blood/tissue	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	
Mother with/at risk of HIV infection	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	4.5 (1)	0.0 (0)	0.0 (0)	0.5 (1)	
Health care setting	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	
Other/undermined exposure	4.5 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	20.8 (5)	9.1 (2)	4.3 (1)	3.0 (1)	3.8 (1)	4.8 (11)	

- 1 Newly acquired HIV infection was defined as newly diagnosed infection with a negative or indeterminate HIV antibody test result or a diagnosis of primary HIV infection within one year of HIV diagnosis.
- 2 Late diagnosis and advanced infection for HIV diagnoses in 2004 only. Total percentage with late HIV diagnosis and advanced HIV infection in 2004 – 2013 only.
- 3 Late HIV diagnosis was defined as newly diagnosed HIV infection with a CD4+ cell count of 200 or more to less than 350 cells/µl, and advanced HIV infection as newly diagnosed infection with a CD4+ cell count of less than 200 cells/µl.
- 4 The "Other/undetermined" exposure category was excluded from the calculation of the percentage of cases attributed to each HIV exposure category.
- 5 Excludes men who have sex with men.

Source: [State/Territory health authorities](#)

HIV among Aboriginal and Torres Strait Islander people

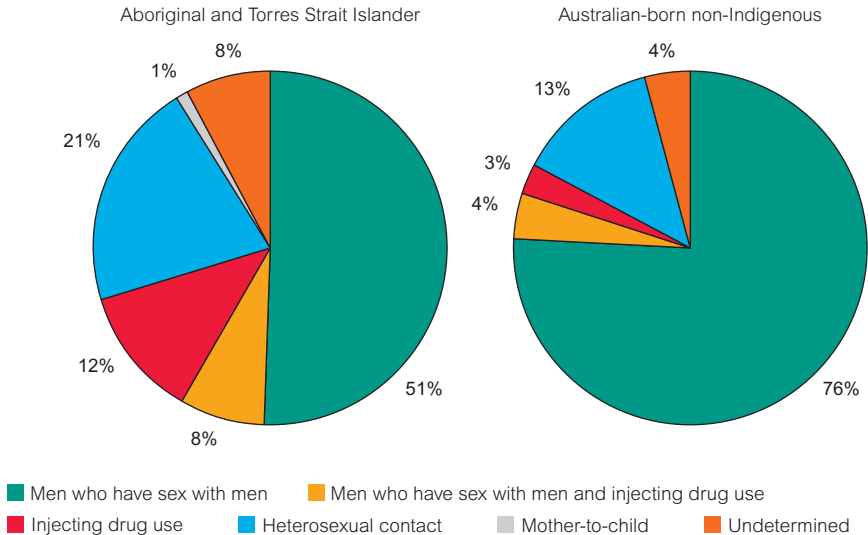
- The estimated Aboriginal and Torres Strait Islander population in Australia is around 669 900 people, or 3% of the total Australian population [5].
- The estimated prevalence of HIV among the Aboriginal and Torres Strait Islander population is similar to the overall non-Indigenous population at around 0.15%.
- There were 26 new HIV diagnoses in 2013 among people who identified as Aboriginal, Torres Strait Islander or both (Table 7).
- In 2013, the rate of newly diagnosed HIV infection was greater in the Aboriginal and Torres Strait Islander population (5.4 per 100 000) compared to the Australian-born non-Indigenous population (3.9 per 100 000).
- The rate of HIV diagnosis among Aboriginal and Torres Strait Islander women was substantially greater than that among Australian-born non-Indigenous women (1.5 compared with 0.4 per 100 000 population). For males, HIV diagnosis rates over the last two years in the Aboriginal and Torres Strait Islander population have been greater (Figure 12).
- During the period 2004 – 2013, 231 cases of HIV infection were diagnosed among Aboriginal and Torres Strait Islander people; 79% of these cases were diagnosed in males; the median age at diagnosis was 33 years; 28% of cases were classified as newly acquired and 33% were classified as a late HIV diagnosis (CD4+ cell count of less than 350 cells/ μ l) (Table 7).
- In the period 2009 – 2013, the most frequently reported route of HIV transmission was sexual contact between men in both the non-Indigenous cases (76%) and in the Aboriginal and Torres Strait Islander cases (51%). A greater proportion of Aboriginal and Torres Strait Islander cases were attributed to injecting drug use (12% vs 3%) and heterosexual contact (21% vs 13%) compared with the Australian-born non-Indigenous cases (Figure 13).

Figure 12 HIV diagnoses in the Australian-born population, 2004 – 2013, by Aboriginal and Torres Strait Islander status, sex and year



Source: State/Territory health authorities

Figure 13 Notifications of newly diagnosed HIV infection, 2009 – 2013, by Aboriginal and Torres Strait Islander status and HIV exposure category

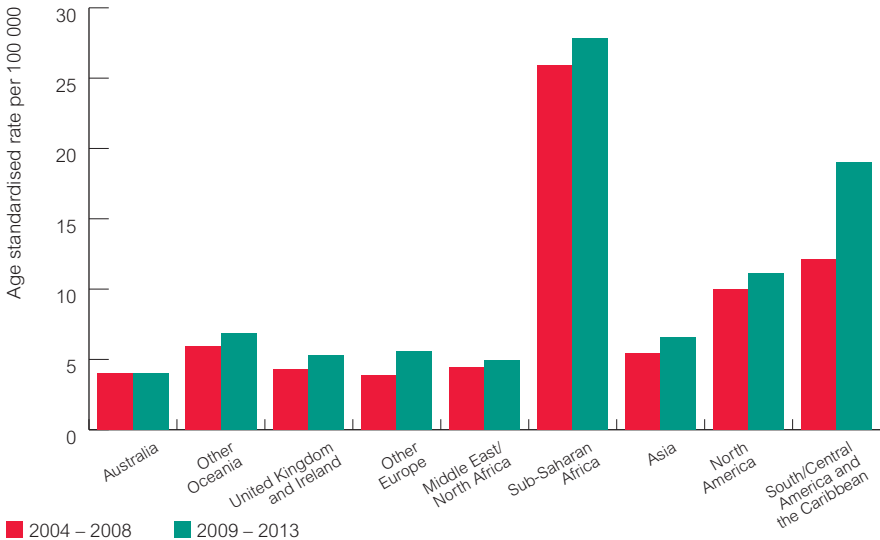


Source: State/Territory health authorities

HIV infection attributed to heterosexual contact in Australia and among people from high prevalence countries

- An estimated 4 100 – 4 900 people living with HIV in Australia acquired their infection through heterosexual contact; this translates to an estimated HIV prevalence of 0.02 – 0.04% among the heterosexual population in Australia.
- The number of diagnoses attributed to heterosexual contact increased from 203 in 2004 to 313 in 2013.
- Of the 313 heterosexually acquired cases newly diagnosed in 2013, 46% were in people from high prevalence countries⁵ or their partners.
- The highest rates of HIV diagnosis in Australia were in people born in countries of sub-Saharan Africa, South/Central America and the Caribbean, and North America (Figure 14).
- The rate of HIV diagnosis in Australia, where the likely route of exposure was heterosexual contact, has increased in Australians born in high prevalence countries from 1.1 per 100 000 in 2004 – 2008 to 1.3 per 100 000 in 2009 – 2013.

Figure 14 Rate of HIV diagnosis in Australia, 2004 – 2013, by country/region of birth



Source: State/Territory health authorities

5 High prevalence countries are defined as those with an estimated adult HIV prevalence of 1% or above.

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Methodological notes

National surveillance for newly diagnosed HIV infection

Newly diagnosed HIV infection is a notifiable condition in each State/Territory health jurisdiction in Australia. Cases of newly diagnosed HIV infection were notified through State/Territory health authorities to the Kirby Institute on the first occasion of diagnosis in Australia. Information sought at notification of HIV infection included State/Territory of diagnosis, namecode (based on the first two letters of the family name and the first two letters of the given name), sex, date of birth, Aboriginal and Torres Strait Islander status, date of HIV diagnosis, CD4+ cell count at diagnosis, source of exposure to HIV and evidence of newly acquired HIV infection. Information on country of birth has been reported by all health jurisdictions for cases of HIV infection newly diagnosed in Australia from 1 January 2002. Information on language spoken at home has been reported by New South Wales, Victoria and Queensland for cases of HIV infection newly diagnosed from 1 January 2004 and by all jurisdictions from 2008. Reporting of a previous HIV diagnosis overseas was introduced for cases of HIV infection newly diagnosed in Australia from 1 January 2007 (Table 1). Advanced HIV infection was defined as newly diagnosed HIV infection with a CD4+ cell count less than 200 cells/ μ l, and late HIV diagnosis was defined as newly diagnosed HIV infection with a CD4+ cell count of 200 or more and less than 350 cells/ μ l. In New South Wales, information on cases of newly diagnosed HIV infection was sought only from the diagnosing doctor prior to 2008. From 2008, information was also sought from the doctors to whom the person with HIV infection was referred, and follow up was carried out for cases for which the information sought at HIV notification was incomplete. These new procedures resulted in more complete information on new HIV diagnoses and reassignment of cases found to have been newly diagnosed in earlier years. The surveillance systems for newly diagnosed HIV infection are described in Guy *et al* [6] and McDonald *et al* [7]. The National Serology Reference Laboratory, Australia [8], carried out monitoring of HIV antibody testing.

Information on the date of the last negative or indeterminate test or date of onset of primary HIV infection has been routinely sought through each State/Territory health jurisdiction for cases of HIV infection newly diagnosed in Australia from 1 January 1991. Newly acquired HIV infection was defined as newly diagnosed infection with evidence of a negative or indeterminate HIV antibody test or a diagnosis of primary HIV infection within 12 months of HIV diagnosis. The surveillance system for newly acquired HIV infection is described in McDonald *et al* [7].

Monitoring incident HIV infection using specialised serological laboratory tests

Cases of HIV infection, newly diagnosed in Queensland, South Australia, Victoria, Western Australia and at the NSW State Reference Laboratory for HIV, were tested for incident HIV infection using the BED capture enzyme immunoassay (BED-CEIA; [9]). Cases with a normalised optical density of less than 0.8 were classified as incident HIV infection and

cases with a normalised optical density of 0.8 or higher were classified as established HIV infection. The cut-off of 0.8 corresponds to detection of incident HIV infection within 160 days of HIV acquisition. Cases of HIV infection with a BED-CEIA result were linked to cases notified to the National HIV Registry to retrieve the date of first HIV diagnosis in Australia, evidence of newly acquired HIV infection and self-report of exposure to HIV.

Monitoring transmitted drug resistance in Australian HIV-1 isolates

The NSW State Reference Laboratory for HIV/AIDS at St Vincent's Hospital, Sydney, and the Victorian Infectious Diseases Reference Laboratory, Melbourne, perform genotypic antiretroviral drug resistance testing on a selection of cases of newly acquired HIV-1 infection. Results from these tests, including HIV-1 subtype and HIV-1 drug resistance mutations, were compiled and forwarded to the Surveillance and Evaluation Program at The Kirby Institute for analysis. The specific drug resistance mutations collected were based on the recommended World Health Organisation form, as published by Shafer *et al*^[10]. For this analysis, HIV-1 drug resistance mutations were grouped by the class of drug they conferred resistance against.

National surveillance for perinatal exposure to HIV

Cases of perinatal exposure to HIV were reported to the national HIV surveillance centre by paediatricians, through the Australian Paediatric Surveillance Unit, and through assessment of perinatal exposure in children born to women with diagnosed HIV infection. Cases of newly diagnosed HIV infection in women and their exposed children were notified through national HIV/AIDS surveillance procedures. Further details are given in McDonald *et al*^[11, 12].

Estimates of the HIV care and treatment cascade

Estimating HIV prevalence and level of diagnosed infection

Australia's National HIV Registry may contain multiple reports for some individuals, mainly because of incomplete or inaccurate recording of name codes. To account for multiple reporting, the number of distinct cases was estimated by using a formula described elsewhere^[13] and which has previously been applied to Australia's National HIV Registry^[14]. This calculation resulted in 8% duplicate cases.

Two approaches were used to estimate the number of deaths among people diagnosed with HIV infection. Both approaches are based on a linkage study which was conducted between Australia's National Death Index and the National HIV Registry for cases to the end of 2003^[15]; this study calculated HIV- and AIDS-related deaths and also calculated standardized mortality ratios for people with HIV during different ART eras. It was calculated that there were 8 519 deaths among people diagnosed with HIV or AIDS to the end of 2013^[15]. The first approach to calculating the number of deaths post 2013 used general

population mortality rates reported by the Australian government ^[16] and the standardized mortality rates for people with HIV in Australia in the combination ART era calculated from the linkage study ^[15] to calculate the expected number of deaths among people with HIV after 2003. The second approach estimated the number of deaths from mortality in an observational cohort of people living with HIV who were linked to clinical care (AHOD, see next section); standardized mortality ratios compared with the general Australian population have been calculated for a subset of 2 675 HIV-positive participants in this cohort ^[17]. This observational database has also been linked to the National Death Index (unpublished, Kirby Institute); similar mortality rates were calculated regardless of whether people were retained, lost or returned to follow up, with values around 12 per 1000 person-years (95% CIs around 8 – 15 per 1000 person years). These mortality rates were applied to the cumulative diagnosed and still alive population after 2003. It was found that the two approaches had overlapping ranges of estimated numbers living with diagnosed HIV; thus, the broadest ranges across both approaches were used as the uncertainty bounds around our estimated numbers living with diagnosed HIV.

HIV has been concentrated among gay men in Australia since the epidemic began; 79% of all HIV diagnoses in Australia with recorded exposure category are reported to be due to male homosexual contact. Therefore, to estimate the level of undiagnosed infection in Australia, separate calculations for men who have sex with men (MSM) and non-MSM were included in a weighted average (79%:21%).

The Working Group on Estimation of HIV Prevalence in Europe conducted a review of methods for estimating undiagnosed HIV infection which are in current use ^[18]. These can be broadly classified into those based on prevalence surveys and those based on reported HIV and AIDS cases. Both approaches have been applied in Australia. There are three cross-sectional prevalence surveys which have been conducted among gay men in Australia: (1) among gay men in Melbourne, Victoria in 2008, which recruited men from gay community facilities ^[19, 20]; (2) among gay men in Brisbane, Queensland in 2006, recruited from sex-on-premises venues and gay bars ^[21]; (3) a larger study conducted alongside routine behavioural surveillance surveys in which gay and homosexually active men from Sydney, Melbourne, Canberra and Perth were recruited from a range of gay community sites in 2013 – 2014 ^[22]. There are two back-projection methods which have been applied to HIV/AIDS case reporting data in Australia: (1) a modified statistical approach based on assumed distributions of durations from infection to diagnosis of HIV and/or AIDS and accounting for testing patterns ^[23 – 25]; (2) an algorithm which produces a distribution of likely time since infection based on known recent infections and CD4 counts at HIV diagnosis, assuming rates of CD4 decline have not changed over time, to estimate historical and projected incidence and infer levels of undiagnosed cases ^[26, 27].

The Melbourne study found that 31% (19/61) of the HIV-positive men were unaware of their infection ^[19, 20]. The Brisbane study found that 19.5% (8/41) of the confirmed HIV-positive men were unaware of their infection ^[21]. The larger national and recent study, which is more likely to be representative of a general, community sample of gay men, found that 10% (16/160) of the HIV-positive men were unaware of their infection ^[28]. The statistical back-projection approach estimated that 12% of HIV infections among MSM are undiagnosed

(ranging 10 – 18% across different states) [23] and 20% of HIV infections among non-MSM are undiagnosed (ranging 12 – 23% across different exposure routes) [24]. The CD4-based back-projection method estimated that 11.6% (95% uncertainty bound: 9.6 – 13.6%) of HIV infections among MSM, and 22.5% (95%UB: 18.4 – 26.9%) among non-MSM, are undiagnosed [26, 27]. Taken together, it was assumed that the best estimate of undiagnosed infection was 12% among MSM [10 – 20%, lower-upper plausible range] and 20% [15 – 25%] among non-MSM for a national weighted average estimate of 13.7% [11.1 – 21.1%] undiagnosed HIV infections at the end of 2013. Since the back-projection methods from data on case reports yielded results which were highly consistent with the empirical studies and best estimate, they were used to infer historical trends in undiagnosed infections.

The overall prevalence of HIV in Australia was then estimated by inflating the calculated number of people living with diagnosed infection by the estimated level of undiagnosed infection.

Estimating linkage to, and retention in, care

We defined that an individual is linked to care following HIV diagnosis if s/he receives a CD4 test within 3 months of diagnosis. CD4 counts within 3 months of diagnosis are recorded in the National HIV Registry of notified cases, managed by the Kirby Institute. It is possible that data reporting is not complete and therefore linkage to care may be underestimated. There may be 'leakage' from the HIV cascade following HIV diagnosis; individuals not retained in the cascade may die, become lost to follow-up immediately or after a period of retention in care, drop out of ART, or become non-adherent to ART and not virologically suppressed. Individuals who exit the cascade of care at any stage may re-enter HIV care at various points. Our characterizations of the cascade are snapshots in time of the numbers of people living with HIV estimated to be within each stage of the cascade. We defined that an individual is retained in HIV care if they have had at least one CD4 or viral load test in the prior 12 month period. In Australia, Medicare is the national universal health coverage scheme against which health and medical benefits, including tests for CD4 and viral load, are claimed. It is important to note that some sexual health and infectious disease clinics do not bill pathology to Medicare but fund these tests from their own cost centre. Therefore, our calculations using Medicare data may underestimate retention in care (roughly thought to be around 10 – 15%). The total number of CD4 tests [Medicare item number 71139] and HIV viral load tests [Medicare item number 69381 or 69378] billed to Medicare were available. The numbers of tests carried out were adjusted by the distribution of combinations of numbers of CD4 and viral load tests carried out among people in HIV care from the Australian HIV Observational Database (AHOD, see next paragraph), by calendar year and by whether they are receiving ART or not receiving ART. Specifically, the total number of CD4 tests billed to Medicare for people on ART was estimated by multiplying the average number of CD4 counts per year among people on ART according to the AHOD data by the estimated number of people on ART (see next section). The difference between this number and the total tests billed to Medicare was taken to be the number of CD4 tests for people not on ART; this number, divided by the average number of CD4 counts per person not on ART but retained in care and then inflating by the small proportion of people in care who had no CD4 tests but had a viral load test according to AHOD, provided the best estimate of number of people not on ART but retained in care. Upper and lower uncertainty bounds

in the numbers of people retained in care was based on upper limits of those linked to care and the estimated number of people on ART.

AHOD collects data from patients attending numerous clinical sites from hospitals, general practitioner sites and sexual health centres across Australia [29]. AHOD contains ~4 000 people living with HIV in clinical care in Australia. Routinely collected clinical data from clinical visits are collated in AHOD, including CD4 and viral load. Although AHOD may not be representative of people living with HIV in Australia, it is the best national HIV clinical data source and assumed to be reasonably representative of clinical monitoring activities of people who are in HIV care.

Estimating antiretroviral treatment coverage

There is not a registry to monitor all people receiving ART in Australia. Multiple approaches were used to estimate ART coverage: (1) adjusting antiretroviral drug prescription counts with data from AHOD of regimen combinations used by people on ART in Australia and adherence measurements; (2) self-reported ART use among HIV-positive people in a large national survey; (3) pharmacy dispensing data from Australia's largest state jurisdiction, New South Wales (NSW); (4) a study conducted in the state of Victoria which analysed data on antiretrovirals and non-identified individuals receiving ART dispensed in Melbourne; (5) clinical service data for people retained in care in NSW.

Approach 1: All antiretroviral treatments for HIV infection are funded through the Highly Specialized Drugs (HSDs) program, a joint Australian Government and State/Territory mechanism for the supply of HSDs. The number of specific (antiretroviral) drugs dispensed is recorded for this program. The number of people dispensed each antiretroviral drug during a calendar year was estimated by adjusting total drugs dispensed to reflect regimen combinations of antiretroviral drugs. Total allocated doses were calculated as the product of dispensed pack numbers and doses per pack. The total number of person-years of treatment for HIV infection was estimated by summing the number of people dispensed (lamivudine + Kivexa + Combivir + Trizivir + emtricitabine + Truvada + Atripla + Eviplera) through the HSD Program, divided by the proportion of people enrolled in AHOD [29] who were receiving any of these mutually exclusive antiretroviral treatments during the same calendar year. The number of person-years on ART was then adjusted for adherence levels in the treated population. ART adherence data are not routinely collected in Australia. However, a recent pilot study among people with long-term diagnosed HIV and had achieved viral suppression whilst on ART in NSW indicated that 85% of participants reported 100% adherence over the last week [30]; therefore, we assumed that daily adherence is between 85% and 95%. This approach was applied each year to 2012; 2013 data were not available and so 2013 estimates were extrapolated from the trends from the prior four years.

Approach 2: Self-reported use of antiretroviral therapy for the treatment of HIV infection is monitored among men who have sex with men who are also living with HIV infection and participate in the Gay Community Periodic Surveys in Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney since 1998 [22].

Approach 3: In December 2013, Health Share NSW completed the NSW state rollout of a standardized pharmacy system. The system enables the collection of data from public health pharmacies about pharmacy dispensing activities including dispensing of ART. Pharmacy dispensing data for the state of NSW indicates that in the one-year period to 31 March 2014, at least 8 773 people living with diagnosed HIV in NSW were on ART (it is a lower estimate because some pharmacies were not included until late 2013). The denominator of the estimated number of people living with diagnosed HIV in NSW is not well-known but was taken to be the proportion of all national HIV diagnoses in NSW (51.7%) multiplied by the estimated national number of people living with diagnosed HIV.

Approach 4: A study released in January 2014 analysed data from the Commonwealth Department of Health and Department of Human Services on ART dispensed in Victoria, through the HSD program, combined with non-identifiable data from the Alfred Hospital, outpatient pharmacies, Caulfield General Medical Centre and Melbourne Sexual Health Centre from January 2012 to November 2013 ^[31]. This study covered 3 903 individuals which represented 83.8% of all antiretrovirals dispensed in Victoria through the Pharmaceutical Benefits Scheme (PBS) over the same period. Therefore, an estimated 4 658 people received ART in Victoria during 2012 – 2013. As in Approach 3, the estimated number of people living with diagnosed HIV in Victoria was calculated as the proportion of all national HIV diagnoses in Victoria (22.7%) multiplied by the estimated national number of people living with diagnosed HIV.

Approach 5: Data on the treatment status of clients who received HIV care in NSW public sexual health and HIV services in the one-year period to 31 March 2014 were collected; of the 4 796 clients who received HIV care during that period and for whom treatment information was available, 88% were on ART ^[32]. The use of Approach 5 is cyclic because calculating the number of people retained in care in Australia uses the number on ART. Therefore, Approach 5 is used for comparison and validation purposes only (we found that the estimate from Approach 5 was within the range of estimates from other approaches).

We assume that the coverage of ART among people with diagnosed infection is the average of Approaches 1 – 4 with uncertainty bounds between the minimum and maximum estimates.

Estimating levels of virological suppression

Clinical monitoring data for patients on ART are collected in AHOD ^[29]. We define virological suppression as less than 400 viral copies per ml. The proportion of people on ART with viral suppression is taken to be the proportion of people recorded in AHOD who had less than 400 copies per ml at their last viral load test. Uncertainty bounds were taken to be the proportion of people recorded in AHOD who had less than 1000 copies per ml and 50 copies per ml at their last viral load test. Self-reported levels of undetectable viral load among HIV-positive men recruited in the Gay Community Periodic Surveys were also available ^[22] and generally consistent with the AHOD data; but the clinical measured endpoints were solely used in our study.

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