



Safe blood – a focus on education,
epidemiology and testing

Transfusion-transmissible infections in Australia

2011

Surveillance Report

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in collaboration with

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Australian governments fully fund the Australian Red Cross Blood Service for the provision of blood products and services to the Australian community.

Preface

The Australian Red Cross Blood Service, henceforth referred to as the *Blood Service*, was established in 1996. As an operating division of the Australian Red Cross (ARC), its activities are overseen by a Board of Management, accountable to the ARC National Council. The Blood Service is a single national organisation, having progressively evolved from eight separate state and territory based bodies in the years since 1929 when the first Australian Red Cross Blood Bank was established in Melbourne.

The primary policy objective for the Australian blood sector is “to provide an adequate, safe, secure and affordable supply of blood products, blood-related products and blood-related services in Australia”¹. The Blood Service collects over 1.3 million donations per annum from over 500 000 voluntary, non-remunerated blood donors. Blood donations are processed by the Blood Service into fresh components (e.g. red blood cells, platelets and plasma) for transfusion. In addition, plasma is provided to CSL Biotherapies as a starting material for the manufacture of plasma derived blood products (e.g. albumin, clotting factors and immunoglobulins). The Blood Service operates in accord with the humanitarian principles of the ARC, and applicable Commonwealth and state/territory policy frameworks and laws, particularly those pertaining to the regulation of human blood and tissues.

The manufacture of all homologous blood components (i.e. where the donor gives blood for the general blood inventory and not for a specific patient) by the Blood Service is regulated by the Therapeutic Goods Administration (TGA) under Part 4 of the Therapeutic Goods Act 1989. Manufacturing licences are granted by the TGA subject to satisfactory compliance audits. The Council of Europe Guide to the preparation, use and quality assurance of blood components (COE ‘Guide’ 14th Edition) provides the primary standard.

The Kirby Institute (formerly the National Centre in HIV Epidemiology and Clinical Research) is funded by the Australian Government Department of Health and Ageing and is affiliated with the Faculty of Medicine, the University of New South Wales. The Surveillance and Evaluation Program for Public Health at the Kirby Institute is responsible for the public health monitoring and evaluation of patterns of transmission of specific bloodborne viral and sexually transmissible infections. Its work is overseen by the Ministerial Advisory Committee on AIDS, Sexual Health and Hepatitis.

This report is produced jointly as a collaboration between the Surveillance and Evaluation Program for Public Health at the Kirby Institute and the Australian Red Cross Blood Service. This is the first, of what are expected to become, annual reports that summarise data and trends for transfusion-transmissible infections among blood donors. The key findings are presented as text in the report, supported by the main figures and tables. Supporting figures and tables follow as well as methodological notes that provide further information.

1 National Blood Agreement, Part 1, 1 (a).

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Executive summary

Background

Internationally, Blood Services undertake a number of processes to minimise the risk of transfusion-transmissible infections (TTIs). Because no single process can completely eliminate the risk, scientific evidence demonstrates that a combination approach is most effective for minimising risk. In accordance with this, the Blood Service employs a four-tier approach to safety:

1. Through pre-donation public education using the www.donateblood.com.au website, Blood Service Community Relations staff, the media and the Blood Service National Contact Centre as well as brochures and handouts in collection facilities, donors are informed of eligibility criteria for blood donation and the reasons for deferral from donation.
2. Individuals whose behaviours or actions result in them having an increased risk of transmitting bloodborne infection are excluded by specific responses to questions asked prior to donation.
3. State-of-the-art tests are undertaken on donated blood to identify prospective donors with pre-existing infection and newly acquired infections in repeat donors.
4. Where available, physical and/or chemical measures are applied to inactivate viruses and other infectious agents (pathogen reduction technologies or PRT). Presently PRT are used for manufactured plasma products but are not routinely available in Australia for fresh blood components.

Each donation is tested for hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), human T-lymphotropic virus (HTLV) and syphilis. Despite incremental improvements, testing is not 100% effective in identifying infected donors. The primary limitation relates to the existence of a 'window period' (WP), defined as the period immediately after infection but before the agent is first detectable in the bloodstream. The window period varies in duration from several days (for HIV) to several weeks (for HBV) depending on the transfusion-transmissible infectious agent and the specific test used.

Using donation testing results, the Blood Service monitors trends in both prevalence (i.e. the frequency of infection in first time donors) and incidence (i.e. the rate of newly acquired infection in repeat donors). In addition, all viral positive donors are invited to participate in confidential interviews to establish likely routes of infection. The Blood Service also estimates the risk of transmission (termed 'residual risk') per unit transfused for each transfusion-transmissible infection and publishes annual updates.

This report analyses data from the national surveillance system for blood donors maintained electronically by the Blood Service. The report aims to inform further revision and evaluation of donor education/selection guidelines and donation testing algorithms in Australia. Finally, the residual risk estimates provide an important tool particularly for clinical stakeholders involved in patient consent for transfusion.

Objective

The main objectives of the report are to:

1. Monitor trends over time in transfusion-transmissible infections in blood donors in Australia, in particular, for HCV, HBV, HIV, HTLV and syphilis.
2. Compare the level of transfusion-transmissible infections in first time and in previously negative repeat blood donors with the general population.
3. Identify and analyse the risk factors that are associated with transfusion-transmissible infections in blood donors and compare them to the risk factors in the general population.
4. Provide estimates of the residual risk of infection in the blood supply for HCV, HBV, HIV and HTLV.
5. Estimate the rate of 'non-compliance' with transfusion-transmissible infection specific deferral questions.

Data

This report incorporates national donation testing data on Australian blood donors for the period 2005 to 2010. Anonymous donor data for all donors who donated blood between January 2005 and December 2010 were extracted from the Blood Service national donor database.

Trends in transfusion-transmissible infections among first time and previously negative repeat donors were analysed for donations in the years from 2005-2010. Demographic factors associated with transfusion-transmissible infections in blood donors were analysed for donations made from 1 January 2008 to 31 December 2010. Likely routes of exposure (termed 'infective risk factors') for each transfusion-transmissible infection in blood donors were also identified and analysed. Data from the 2009 and 2010 calendar years were combined and risk modelling conducted to derive estimates of the residual risk of transmission for HIV, HCV, HBV and HTLV in Australia.

Summary of the main findings

General characteristics of blood donors in Australia

1. Over the period 2005-2010, there were more than 7.3 million blood donations in Australia with an average of 1.2 million donations per year. The numbers of blood donations have been increasing since 2005.
2. About 3.6% of the Australian population aged between 16-80 years donated blood during 2005-2010.
3. First time and repeat donors comprised 17% and 83% of all blood donors in Australia over the period 2005-2010, respectively. This ratio remained relatively stable nationally and across all states and territories. Male donors constitute 48% of all donors.

Trends in transfusion-transmissible infections in Australian blood donors

1. A total of 1 483 blood donors were detected as having at least one transfusion-transmissible infection (HBV, HCV, HIV, HTLV or syphilis) during 2005-2010; more than 94% of these donors were infected with either HBV or HCV. In 2008-2010, 15 donors had more than one transfusion-transmissible infection. The most common combination (6 donors) was co-infection with HBV and HCV.
2. HIV and HTLV were the least common infections among first time and repeat donors, respectively.
3. Although only representing 17% of the donor population, first time blood donors contributed 89% of all donors with transfusion-transmissible infections in Australia during 2005-2010, highlighting the importance of promoting donor education of potential new donors and limiting the manufacture of some blood components from first time donors.
4. No transfusion-transmitted HIV, HCV, HTLV or syphilis infections were reported during 2008-2010. There were two probable cases of transfusion-transmitted HBV infection reported during 2009 associated with blood components from the same HBV infected donor.

HBV infection among Australian blood donors

1. Of all transfusion-transmissible infections, HBV had the highest prevalence among first time donors since 2007.
2. The most common infective risk factor for donors with HBV infection during 2008-2010 was ethnicity/country of birth (82%), consistent with the findings of a previous Blood Service study for the period 2000-2006.
3. HBV positive donors were younger (mean age 35 years versus 44 years for all donors), more likely to be male (64% versus 48% male donor proportion) and only 14% were born in Australia.

HCV infection among Australian blood donors

1. The prevalence of HCV infection among first time donors has been gradually declining over the past six years.
2. After HBV, HCV was the most common infection found in first time blood donors.
3. HCV had the highest incidence rate among previously negative repeat donors during 2006 to 2009.
4. The most common infective risk factor for donors with HCV infection during 2008-2010 was intravenous drug use (28%) which was also the predominant route (71%) of exposure in cases of newly acquired HCV infection in the general population in 2010.
5. The mean age of donors with HCV infection was 43 years. Like HBV, male donors were over-represented (60% versus 48% male donors overall) but in contrast to HBV, the majority (69%) were born in Australia.

HIV infection among Australian blood donors

1. The prevalence of HIV infection among first time donors during the 2005-2010 period remained very low (1.81 per 100 000 donations) in comparison to HBV (86.02 per 100 000 donations) and HCV (78.25 per 100 000 donations).
2. After HCV, HIV had the highest incidence rate among previously negative repeat donors and although very low, the incidence rate has had a steady but non-significant increase over the last six years.
3. The most common route of exposure for donors with HIV infection during 2008-2010 was male-to-male sexual contact (40%)², consistent with the general population where it was reported in 67% of new diagnoses in 2010.
4. HIV positive donors were generally younger (36 years versus 44 years for all donors), male (75% versus 48% male donors overall) and were born in Australia (75%).

HTLV infection among Australian blood donors

1. The prevalence of HTLV among first time donors has remained very low over the past six years.
2. There was only one incident case of HTLV among previously negative repeat donors during 2005-2010.
3. The most common infective risk factor for donors with HTLV infection during 2008-2010 was ethnicity or country of birth (73%).
4. The mean age of donors with HTLV infection was 41 years, 61% were male and 17% were born in Australia.

Active syphilis infection among Australian blood donors

1. The prevalence of active syphilis among blood donors has remained extremely low (overall prevalence of 0.34 per 100 000 donations).
2. However, the rate among first time donors has gradually increased over the past four years, paralleling the trend for increased diagnoses in the general population.

Key messages

1. Supporting the effectiveness of donor education and selection, the prevalence of transfusion-transmissible infections is substantially lower among both first time blood donors (6 to 53 times) and all donors (52 to 240 times) than in the general population and shows a stable or declining trend since 2005.
2. The prevalence of transfusion-transmissible infections among first time donors was higher than among all donors, highlighting the importance of promoting donor education of potential new donors and limiting the manufacture of some blood components from first time donors.
3. The incidence of newly acquired infection measured by the rate of seroconversion in repeat blood donors is also much lower than in the general population, indicating that repeat donors understand what constitutes 'risk behaviour' for acquiring infection.
4. Infective risk factors identified in blood donors with transfusion-transmissible infections closely parallel those for the general population with no 'unique' risk factors identified to date among blood donors.
5. Almost one-quarter of the positive donors were 'non-compliant' in that they had risk factors identified during their post-donation interview that would have deferred them from donating had they disclosed them at the pre-donation interview. Understanding the reasons for, and minimising the rate of, non-compliance is important because it reduces the risk of collecting blood from an infected donor whose infection may not be detected by testing.
6. The estimated residual risk of transmission for HIV, HCV, HBV, HTLV and syphilis in Australia is very low, less than one in one million per unit transfused for each. This supports the claim that Australia's blood supply is among the safest worldwide in respect of transfusion-transmissible infections for which testing is conducted. Despite this, there remains a minimal but real risk of transfusion-transmissible infections which must be carefully considered before any transfusion.

2 Includes declaration form compliant and non-compliant donors (see section *Non-compliance among positive donors*, page 26).

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Glossary

Active syphilis

Defined by reactivity on treponemal and non-treponemal syphilis testing and or clinically apparent infection (i.e. excluding past treated infections).

First time donor

A donor who has not previously donated in Australia.

Intravenous drug user

Defined as ever "used drugs" by injection or been injected, even once, with drugs not prescribed by a doctor or a dentist.

Incidence

The rate of newly acquired infection among repeat donors.

Infective risk factor

A potential route of infection in positive donors reported at the post-donation interview.

Non-compliance

Disclosure of information post donation that would have led to deferral from donation had it been disclosed at the pre-donation interview.

Prevalence

The frequency of infection in the first time donor population.

Positive donor

A donor confirmed (by additional testing) to have the relevant transfusion-transmissible infection.

Repeat donor

A donor who has donated in Australia on at least one occasion prior to the current donation.

Seroconverter

A positive repeat donor whose last donation tested negative for the same transfusion-transmissible infection.

Transfusion-transmissible infection

A virus, parasite, or other bloodborne infectious agent in donated blood that can be transmitted by transfusion to a recipient.

Transfusion-transmitted infection

Any infection that has been transmitted to a recipient through a transfusion.

Window period

The duration of the period from infection to the point of first detection in the bloodstream. The window period differs dependent on the infection and the test used.

Abbreviations

anti-HBc	antibody to hepatitis B core antigen
anti-HBe	antibody to hepatitis B e antigen
anti-HBs	antibody to hepatitis B surface antigen
HBsAg	hepatitis B surface antigen
ARIA	Accessibility/Remoteness Index of Australia
HBeAg	hepatitis B e antigen
Blood Service	Australian Red Cross Blood Service
HBV	hepatitis B virus
HCV	hepatitis C virus
HIV	human immunodeficiency virus
HTLV	human T-cell lymphotropic virus
IDU	intravenous drug user
NAT	nucleic acid testing
STIs	sexually transmissible infections
TTVI	transfusion-transmissible viral infections
TTIs	transfusion-transmissible infections
WP	window period

Introduction

Internationally, Blood Services undertake a number of processes to minimise the risk of transfusion-transmissible infections (TTIs). Because no single process can completely eliminate the risk, scientific evidence demonstrates that a combination approach is most effective for minimising risk. In accordance with this, the Blood Service employs a four-tier approach to safety:

1. Through pre-donation public education using the www.donateblood.com.au website, Blood Service Community Relations staff, the media and the Blood Service National Contact Centre as well as brochures and handouts in collection facilities, donors are informed of eligibility criteria for blood donation and the reasons for deferral from donation.
2. Individuals whose behaviours or actions result in them having an increased risk of transmitting bloodborne infections are excluded by specific responses to questions asked prior to donation.
3. State-of-the-art tests are undertaken on donated blood to identify prospective donors with pre-existing infection and newly acquired infections in repeat donors.
4. Where available, physical and/or chemical measures are applied to inactivate viruses and other infectious agents (pathogen reduction technologies or PRT). Presently PRT are used for manufactured plasma products but are not routinely available in Australia for fresh blood components.

The current regulatory standard applicable in Australia requires each blood donation to be tested for HIV, HBV, HCV, HTLV and syphilis. Accordingly, the Blood Service mandatory screening of each blood donation includes hepatitis B surface antigen (HBsAg), antibody to hepatitis C (anti-HCV), antibody to HIV-1 and HIV-2 (anti-HIV-1/2), antibody to HTLV-I and HTLV-II (anti-HTLV-I/II), treponemal testing for syphilis, HIV-1 RNA, HCV RNA and HBV DNA. A timeline of introduction of various screening tests for Australian blood donors is provided in Table 1 in the supporting tables.

The addition of nucleic acid tests (NAT) to existing serological assays for HIV and HCV in June 2000 substantially reduced the window period from approximately 22 days and 66 days to approximately 9 days for HIV-1 and 5 days for HCV³. During 2010, the Blood Service augmented the existing HBV test (HBsAg) by implementing NAT for HBV DNA as a mandatory screen for all blood donations, which reduced the HBV window period from approximately 38 to 24 days⁴. These advances incrementally lower the risk of not detecting a recently infected donor but importantly the window period is not eliminated. Thus, despite state-of-the-art donation testing there remains a small but non-zero risk of transmission from donors with very recently acquired infection, who may test negative if they donate during the window period.

Blood donation: from volunteer to recipient

In Australia, blood donations from each state and territory are collected, processed and tested at one of the five Blood Services' processing centres. Each of the states (excepting Tasmania) has a processing centre in their capital city. Blood donations collected during the period of the report in Tasmania, the Australian Capital Territory and the Northern Territory were sent to Melbourne, Sydney and Adelaide, respectively, for testing and further processing.

Australian volunteer blood donors may be aged 16 to 80 years of age. Each donor is required to self-complete a comprehensive donor questionnaire every time they donate. The questionnaire is reviewed at a private and confidential interview with the donor and a legally binding Declaration Form is signed in the presence of the interviewer prior to donation. There are penalties including fines and imprisonment for anyone providing false or misleading information. The questionnaire asks about various medical conditions, travel history and behaviours related to increased risk of a bloodborne infection. The Blood Service is highly reliant on the donor's complete and truthful answers to all interview questions (i.e. 'compliance'). This is particularly important for questions relating to risk behaviour for transfusion-transmissible infection, given the existence of the testing window period.

3 Busch MP, Glynn SA, Stramer SL, Strong DM, Caglioti S, Wright DJ, et al. A new strategy for estimating risks of transfusion-transmitted viral infections based on rates of detection of recently infected donors. *Transfusion*. 2005;45(2):254-64.

4 Kleinman SH, Busch MP. Assessing the impact of HBV NAT on window period reduction and residual risk. *Journal of Clinical Virology*. 2006;36, Supplement 1(0):S23-S9.

Should a donor in the window period fail to answer truthfully a question that would normally result in their deferral from donation, they will place recipients at risk because a potentially infectious unit of blood will be collected that testing may not identify.

Subsequent to satisfactorily completing the above assessment process the donor proceeds to donate. Every donation is processed and tested for the mandatory transfusion-transmissible infections. Additional testing for other transfusion-transmissible infections (e.g. malaria) as well as testing for bacteria is performed on selected donations. Donations positive for mandatory screening tests are quarantined and subsequently discarded. Confirmatory testing is conducted to determine the infectious status of the donor and if positive, they are recalled for follow-up testing and counselling.

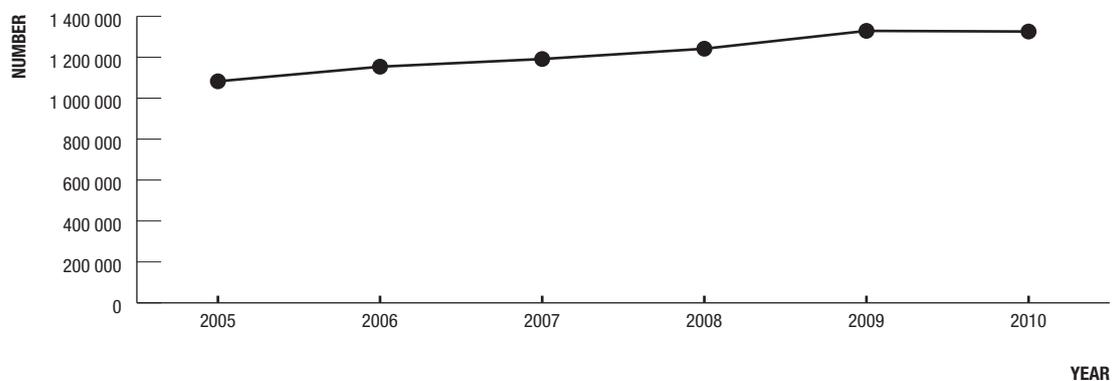
An overview of current donor selection criteria can be accessed from the Blood Service website:
www.donateblood.com.au.

Main findings

Blood donors in Australia

More than 7.3 million donations were tested for transfusion-transmissible infections in Australia during 2005-2010 with an average of about 1.2 million donations per year. The number of blood donations steadily increased during 2005 to 2009 and then slightly declined (0.67%), in 2010 (Figure 1). About 3.6% of the Australian population who were aged between 16-80 years donated blood over the past six years. More than 85% of all donations during 2005-2010 were from repeat donors; however, 89% of all positive donations were made by first time donors.

Figure 1 Number of blood donations in Australia by year of donation, 2005-2010

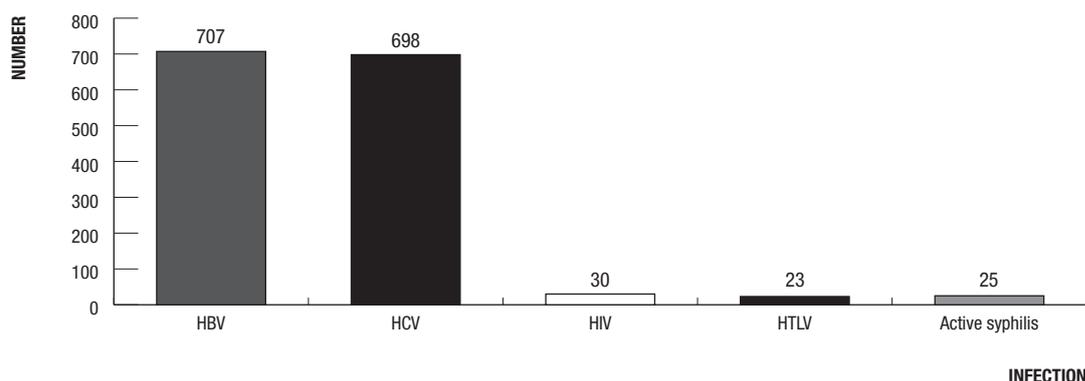


Among all blood donors who donated between 2008 and 2010, 52% were female, 28% were younger than 30 years and 31% were from New South Wales. Median ages of male and female donors were 37 years and 41 years, respectively. Together, New South Wales, Queensland and Victoria accounted for more than 75% of all blood donations in Australia in 2008-2010.

Trends in incidence and prevalence of transfusion-transmissible infections

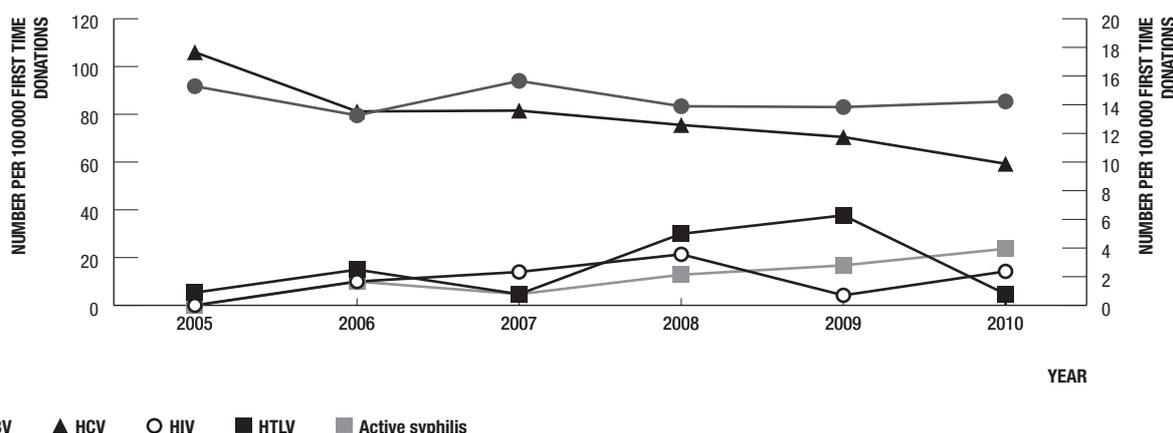
During 2005-2010, a total of 1 483 (20.25 per 100 000 donations) were found positive for at least one of the transfusion-transmissible infections – HBV, HCV, HIV, HTLV and active syphilis. In 2008-2010, 15 donors had more than one transfusion-transmissible infection. The most common combination (6 donors) was co-infection with HBV and HCV. Overall, HCV and HBV were the two most common infections diagnosed in Australian blood donors during 2005-2010, together contributing more than 94% of all infections (Figure 2). HBV and HCV were the most common infections in first time and repeat donors, respectively. In general, the presence of any transfusion-transmissible infection among Australian blood donations has remained low during 2005-2010 and has decreased steadily over the past three years, from 22.3 per 100 000 donations in 2008 to 16.9 per 100 000 donations in 2010.

Figure 2 Number of blood donors with transfusion-transmissible infections in Australia, 2005-2010, by infection



Among all donors during 2005-2010, the overall prevalence of HCV infection has significantly⁵ decreased (by 10%); however, prevalence of active syphilis infection increased significantly by 50%. Both HIV and HTLV prevalence showed a slight, non-significant overall increase and HBV prevalence remained relatively stable.

Figure 3 Prevalence of transfusion-transmissible infections in first time blood donors in Australia, 2005-2010, by infection¹ and year of donation



¹ Prevalence of HIV, HTLV and active syphilis are provided according to the scale on the secondary axis on the right hand side.

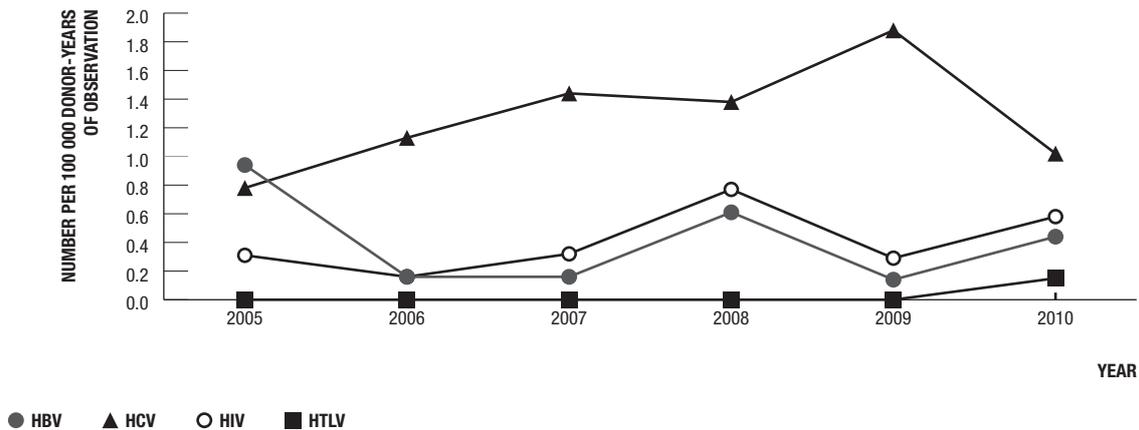
Prevalence of HBV in first time donors has remained steady at around 80 per 100 000 donations during last three years, after a substantial decline from 94 per 100 000 donations in 2007 to 83 per 100 000 donations in 2008 (Figure 3). There has been significant decrease in HCV prevalence in first time donors in Australia over the last six years. This trend is also apparent in the *per capita* rate of diagnosis of HCV infection reported through the National Notifiable Disease Surveillance System⁶ which declined in the period 2006-2009.

In contrast with HBV and HCV, the prevalence of HIV, HTLV and active syphilis in first time donors remained very low over the last six years. Both HIV and HTLV prevalence demonstrated a slight, non-significant increased trend in first time donors in Australia. However, prevalence of active syphilis in first time donors has significantly increased during 2005-2010 (Figure 3).

⁵ Throughout the document the term 'significant' is used only where a statistical test has a p value <0.05

⁶ The Kirby Institute. *HIV, viral hepatitis and sexually transmissible infections in Australia Annual Surveillance Report 2011*. The Kirby Institute, the University of New South Wales, 2011.

Figure 4 Incidence of transfusion-transmissible infection in repeat blood donors in Australia, 2005-2010, by infection and year of donation



HCV was the most frequent infection in repeat donors in Australia followed by HBV and HIV (Table 1). Incidence of HCV among repeat donors has sharply declined from 1.88 per 100 000 donor-years of observation in 2009 to 1.02 per 100 000 donor-years of observation in 2010 (Figure 4). However, although not significant, there was an overall increase in both HCV (by 8%) and HIV (by 18%) incidence in repeat blood donors over the past six years. No clear trend was observed for HBV incidence in 2005-2010. HTLV incidence remained very low with only one incident case diagnosed in 2010.

Trends in HBV infection by state/territory

The prevalence of HBV among first time donors differed markedly across Australia during 2005-2010 with the national average prevalence rate being 86 per 100 000 donations (Table 1). In New South Wales/Australian Capital Territory, HBV prevalence among first time donors declined from 113 per 100 000 donations in 2005 to 72 per 100 000 donations in 2006 and thereafter remained stable. In Victoria, the prevalence of HBV in first time donors was higher and fluctuated between 99 and 186 per 100 000 donations. Queensland had a lower rate but a recent increasing trend from 42 per 100 000 donations in 2009 to 68 per 100 000 donations in 2010. In Western Australia, HBV prevalence in first time donors was stable at around 60-70 per 100 000 donations in 2005-2008 and then there was a slight tendency towards an increase over the last two years.

There was no obvious trend in blood donor HBV incidence in any state/territory except a gradual decline in HBV incidence among donors in New South Wales/Australian Capital Territory. HBV incidence declined steadily from 1.05 per 100 000 donor-years of observation in 2005 to 0.52 per 100 000 donor-years of observation in 2007 and remained zero over the next three years.

Trends in HCV infection by state/territory

Prevalence of HCV in first time donors has gradually declined during 2007-2009 in both Victoria and Queensland and then remained stable over the last two years. Rates have also decreased substantially in Tasmania and Western Australia during the last six years. In New South Wales/Australian Capital Territory, the prevalence of HCV in first time donors has decreased by 25% from 103 in 2008 to 77 per 100 000 donations in 2010.

In contrast to the declining prevalence across most jurisdictions, HCV incidence in repeat donors has tended to increase, or remain stable. There was a gradual increase in New South Wales/Australian Capital Territory from 0.42 per 100 000 donor-years of observation in 2006 to 1.41 per 100 000 donor-years of observation in 2008 with a subsequent decline over the next two years. The rate in Queensland was higher and increased from 2.25 in 2005 to 3.75 per 100 000 donor-years of observation in 2008 and then declined markedly in 2009 with a similar rate in 2010. The rate in Victoria was lower and stable around 1.0 per 100 000 donor-years of observation until 2009 when there was a substantial increase to 3.59 per 100 000 donor-years of observation. However the rate in 2010 declined substantially to 1.25 per 100 000 donor-years of observation.

Trends in HIV infection by state/territory

The prevalence of HIV infection in first time donors remained very low in comparison with HBV and HCV in 2005-2010. In New South Wales/Australian Capital Territory, HIV prevalence was stable around 2 per 100 000 first time donations in 2005-2008 before declining further. Similarly, there was a gradual decrease in HIV prevalence in first time donors in Victoria since 2007. HIV prevalence in other jurisdictions remained variable with no obvious trend.

Nationally, there was an 18% increase in HIV incidence but apart from an increasing trend in Queensland and a spike in 2008 in Victoria there are no other clear jurisdictional trends. The rate in Queensland steadily increased from 0.83 per 100 000 donor-years of observation in 2007 to 1.44 per 100 000 donor-years of observation in 2009 and then remained stable (1.43 per 100 000 donor-years of observation) in 2010. The rate increased sharply in Victoria in 2008 to 2 per 100 000 donor-years of observation but has since stabilised at the pre-existing level of approximately 0.5 per 100 000 donor-years of observation.

Trends in HTLV infection by state/territory

HTLV remained a rare infection across Australia in both first time and repeat donors. In 2010, HTLV prevalence remained zero in all jurisdictions except Victoria where the rate was 3.56 per 100 000 first time donations. HTLV incidence remained very low with only one incident case reported during 2005-2010.

Trends in active syphilis infection by state/territory

The rate of active syphilis infection remained very low in blood donors across Australia over the six year period. However, in both Queensland and Victoria prevalence of active syphilis infection in first time blood donors has substantially increased from 2008. Overall, active syphilis infections have increased by 51% in all donors in 2005-2010. This trend may be at least in part explained by an increase in diagnoses of syphilis in the general population over the past decade^{7,8}.

7 The Kirby Institute. *op. cit.*

8 National Centre in HIV Epidemiology and Clinical Research. HIV, viral hepatitis and sexually transmissible infections in Australia Annual Surveillance Report 2010. National Centre in HIV Epidemiology and Clinical Research, The University of New South Wales, Sydney, NSW, 2010.

Table 1 The number and rate of transfusion-transmissible infections in Australia by type of donation and state/territory, 2005-2010

State/Territory of donation	All accepted donations						HBV			HCV			HIV			HTLV			Active syphilis			Total positive donations		
	First time	Repeat	All	First time	Repeat	All	First time	Repeat	All	First time	Repeat	All	First time	Repeat	All	First time	Repeat	All	First time	Repeat	All	First time	Repeat	All
NSW/ACT	286 963	2 074 818	2 361 781	248	18	266	250	29	279	4	3	7	4	1	5	0	2	2	506	53	559	506	53	559
Number (Number per 100 000 donations)				86.42	0.87	11.26	87.12	1.40	11.81	1.39	0.14	0.30	1.39	0.05	0.21	0.00	0.10	0.08	176.33	2.55	23.67	176.33	2.55	23.67
NT	5 302	60 366	65 668	6	1	7	5	1	6	0	0	0	0	0	0	2	2	4	13	4	17	13	4	17
Number (Number per 100 000 donations)				113.16	1.66	10.66	94.30	1.66	9.14	0.00	0.00	0.00	0.00	0.00	0.00	37.72	3.31	6.09	245.19	6.63	25.89	245.19	6.63	25.89
QLD	169 920	1 344 014	1 513 934	106	5	111	137	30	167	6	6	12	5	0	5	5	2	7	259	43	302	259	43	302
Number (Number per 100 000 donations)				62.38	0.37	7.33	80.63	2.23	11.03	3.53	0.45	0.79	2.94	0.00	0.33	2.94	0.15	0.46	152.42	3.20	19.95	152.42	3.20	19.95
SA	68 687	684 642	753 329	41	5	46	39	10	49	0	2	2	2	0	2	3	0	3	85	17	102	85	17	102
Number (Number per 100 000 donations)				59.69	0.73	6.11	56.78	1.46	6.50	0.00	0.29	0.27	2.91	0.00	0.27	4.37	0.00	0.40	123.75	2.48	13.54	123.75	2.48	13.54
TAS	19 927	193 401	213 328	2	0	2	16	2	18	0	0	0	0	0	0	0	1	1	18	3	21	18	3	21
Number (Number per 100 000 donations)				10.04	0.00	0.94	80.29	1.03	8.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.47	90.33	1.55	9.84	90.33	1.55	9.84
VIC	154 773	1 531 140	1 685 913	205	10	215	113	16	129	3	5	8	7	0	7	2	1	3	330	32	362	330	32	362
Number (Number per 100 000 donations)				132.45	0.65	12.75	73.01	1.04	7.65	1.94	0.33	0.47	4.52	0.00	0.42	1.29	0.07	0.18	213.22	2.09	21.47	213.22	2.09	21.47
WA	66 338	662 111	728 449	56	4	60	44	6	50	1	0	1	4	0	4	3	2	5	108	12	120	108	12	120
Number (Number per 100 000 donations)				84.42	0.60	8.24	66.33	0.91	6.86	1.51	0.00	0.14	6.03	0.00	0.55	4.52	0.30	0.69	162.80	1.81	16.47	162.80	1.81	16.47
National	771 910	6 550 492	7 322 402	664	43	707	604	94	698	14	16	30	22	1	23	15	10	25	1 319	164	1 483	1 319	164	1 483
Number (Number per 100 000 donations)				86.02	0.66	9.66	78.25	1.44	9.53	1.81	0.24	0.41	2.85	0.02	0.31	1.94	0.15	0.34	170.87	2.50	20.25	170.87	2.50	20.25

Comparison of prevalence of transfusion-transmissible infections among blood donors and the general population

Consistent with a previous Blood Service study for the period 2000-2006⁹, a marked reduction is evident in the prevalence of HBV, HCV and HIV in blood donors compared with the general population (Table 2). Prevalence of these infections are substantially lower in blood donors than in the general population, with a 6 to 53-fold reduction in first time donors and 52 to 240-fold reduction among all donors. The greatest comparative reduction among first time donors (53-fold lower) was observed for HIV infection. Given blood donors are drawn from the general population the prevalence reduction observed in first time donors is interpreted to reflect the effectiveness of donor education and donor selection policies.

Table 2 Comparison of prevalence of transfusion-transmissible infections in blood donors with population prevalence by infection, 2005-2010

Infection	Population prevalence (per 100 000 people)	Prevalence in all blood donors (per 100 000 donations)	Prevalence in first time blood donors (per 100 000 donations)	Overall prevalence reduction in all blood donors	Prevalence reduction in first time blood donors
HBV	500-800	9.66	86.02	52-83 times	6-10 times
HCV	1400	9.53	78.24	147 times	18 times
HIV	96	0.41	1.81	240 times	53 times
HTLV ¹	–	0.31	2.85	–	–

1 Population prevalence for HTLV is unknown.

Demographic factors associated with transfusion-transmissible infections in blood donors

Data on the demographic characteristics (sex, age group, state/territory and year of donation) for all blood donors for the period 2008-2010 was analysed¹⁰ to determine the association between demographic factors and presence of transfusion-transmissible infections among Australian blood donors (Table 3-6). Male donors, donors aged less than 20 years and donors from New South Wales were used as reference groups for comparison of positivity rate by sex, age group and state/territory of donation, respectively.

HBV positivity and associated demographic risk factors

Table 3 presents demographic characteristics of donors who tested positive for HBV infection in 2008-2010. While there were no significant trends over the 3 years by different age group, sex or state/territory of the donor, within individual periods the following points were noted.

2008-2010

- Female donors were approximately half as likely to have acquired HBV infection
- Donors from Victoria, followed by New South Wales were most likely to be HBV positive

2008

- Donors aged 50 years and older were significantly less likely to be HBV positive

2009

- Donors aged 30 years and older were at significantly lower risk of HBV infection

9 Polizzotto MN, Wood EM, Ingham H, Keller AJ. Reducing the risk of transfusion-transmissible viral infection through blood donor selection: the Australian experience 2000 through 2006. *Transfusion*. 2008;48(1):55-63. Epub 2007/09/27.

10 See methodological notes for details

Table 3 Association of demographic characteristics with HBV infection among blood donors in Australia by year of donation, 2008-2010

	2008			2009			2010		
	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR ¹ and their 95% CI ² (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)
Sex									
Male	259 712	78 (30.03)	1 (ref)	272 318	79 (29.01)	1 (ref)	269 297	84 (31.19)	1 (ref)
Female	277 014	46 (16.61)	0.52 (0.36 - 0.75)	296 372	45 (15.18)	0.49 (0.34 - 0.71)	285 284	43 (15.07)	0.47 (0.32 - 0.68)
Age group (years)									
Less than 20	46 652	13 (27.87)	1 (ref)	39 039	16 (40.98)	1 (ref)	51 378	9 (17.52)	1 (ref)
20-29	111 245	51 (45.84)	1.68 (0.91 - 3.11)	120 340	46 (38.23)	0.94 (0.53 - 1.67)	117 246	42 (35.82)	2.12 (1.03 - 4.37)
30-39	84 925	32 (37.68)	1.36 (0.71 - 2.59)	91 707	19 (20.72)	0.49 (0.25 - 0.95)	86 037	23 (26.73)	1.5 (0.69 - 3.25)
40-49	105 699	14 (13.25)	0.49 (0.23 - 1.04)	107 560	18 (16.73)	0.4 (0.2 - 0.79)	102 736	25 (24.33)	1.4 (0.65 - 3.0)
50 and above	188 205	14 (7.44)	0.27 (0.13 - 0.58)	210 044	25 (11.9)	0.28 (0.15 - 0.53)	197 184	28 (14.2)	0.81 (0.38 - 1.73)
State/Territory									
NSW	161 421	45 (27.88)	1 (ref)	175 490	44 (25.07)	1 (ref)	173 277	49 (28.28)	1 (ref)
ACT	15 118	1 (6.61)	0.23 (0.03 - 1.68)	15 434	1 (6.48)	0.27 (0.04 - 1.98)	14 829	1 (6.74)	0.23 (0.03 - 1.68)
NT	4 638	0	-	4 732	2 (42.27)	1.94 (0.47 - 8.02)	4 461	1 (22.42)	0.79 (0.11 - 5.78)
QLD	111 227	16 (14.38)	0.53 (0.3 - 0.94)	115 220	12 (10.41)	0.45 (0.24 - 0.85)	115 314	19 (16.48)	0.58 (0.34 - 0.98)
SA	56 388	8 (14.19)	0.56 (0.26 - 1.19)	56 899	9 (15.82)	0.72 (0.35 - 1.47)	53 303	7 (13.13)	0.49 (0.22 - 1.09)
TAS	15 319	1 (6.53)	0.26 (0.04 - 1.92)	16 013	0	-	16 319	1 (6.13)	0.23 (0.032 - 1.67)
VIC	125 481	46 (36.66)	1.25 (0.83 - 1.89)	135 498	36 (26.57)	1.11 (0.71 - 1.73)	127 498	38 (29.8)	1.03 (0.67 - 1.58)
WA	47 134	7 (14.85)	0.57 (0.25 - 1.26)	49 404	20 (40.48)	1.77 (1.04 - 3.02)	49 580	11 (22.19)	0.78 (0.41 - 1.51)
Total	536 726	124 (23.1)		568 690	124 (21.8)		554 581	127 (22.9)	

1 IRR = Incident Rate Ratio

2 CI = Confidence Intervals

HCV positivity and associated demographic risk factors

The results of analyses of demographic characteristics of donors who tested positive for HCV infection in 2008-2010 are presented in Table 4. While there were no significant trends over the 3 years for different age groups, sex or donor location within individual periods the following points were noted.

2008-2010

- Female donors were significantly less likely to be HCV positive
- Donors aged 40 years or above were 3-5 times more likely to be HCV positive

2008

- Donors from South Australia, Victoria and Western Australia were at significantly lower risk of HCV infection

2009

- There was a significantly lower risk of HCV infection among donors from Queensland and Victoria

HIV and HTLV positivity and associated demographic risk factors

Given the small number of positive donors in each year meaningful analysis was not possible. The results of analyses of demographic characteristics of donors who tested positive for HIV and HTLV infection in 2008-2010 are presented in Table 20 and Table 25, respectively in the supporting tables section.

Table 4 Association of demographic characteristics with HCV infection among blood donors in Australia by year of donation, 2008-2010

	2008			2009			2010		
	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR ¹ and their 95% CI ² (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)
Sex									
Male	259 712	80 (30.8)	1 (ref)	272 318	72 (26.44)	1 (ref)	269 297	53 (19.68)	1 (ref)
Female	277 014	54 (19.49)	0.64 (0.45 - 0.91)	296 372	50 (16.87)	0.65 (0.45 - 0.94)	285 284	33 (11.57)	0.6 (0.39 - 0.93)
Age group (years)									
Less than 20	46 652	6 (12.86)		39 039	3 (7.68)	1 (ref)	51 378	6 (11.68)	1 (ref)
20-29	111 245	22 (19.78)	1.78 (0.72 - 4.4)	120 340	18 (14.96)	2.19 (0.64 - 7.46)	117 246	11 (9.38)	0.84 (0.31 - 2.29)
30-39	84 925	16 (18.84)	1.64 (0.64 - 4.2)	91 707	14 (15.27)	2.18 (0.62 - 7.59)	86 037	17 (19.76)	1.71 (0.67 - 4.34)
40-49	105 699	47 (44.47)	3.89 (1.66 - 9.11)	107 560	39 (36.26)	5.19 (1.6 - 16.82)	102 736	24 (23.36)	2.05 (0.83 - 5.03)
50 and above	188 205	43 (22.85)	1.97 (0.84 - 4.65)	210 044	48 (22.85)	3.23 (1 - 10.38)	197 184	28 (14.20)	1.25 (0.52 - 3.03)
State/Territory									
NSW	161 421	63 (39.03)	1 (ref)	175 490	51 (29.06)	1 (ref)	173 277	33 (19.04)	1 (ref)
ACT	15 118	0	-	15 434	2 (12.96)	0.43 (0.1 - 1.76)	14 829	6 (40.46)	2.08 (0.87 - 4.98)
NT	4 638	0	-	4 732	1 (21.13)	0.68 (0.09 - 4.91)	4 461	1 (22.42)	1.15 (0.16 - 8.4)
QLD	111 227	30 (26.97)	0.66 (0.43 - 1.02)	115 220	20 (17.36)	0.57 (0.34 - 0.95)	115 314	14 (12.14)	0.62 (0.33 - 1.17)
SA	56 388	9 (15.96)	0.4 (0.2 - 0.8)	56 899	12 (21.09)	0.69 (0.37 - 1.3)	53 303	7 (13.13)	0.68 (0.3 - 1.55)
TAS	15 319	4 (26.11)	0.64 (0.23 - 1.76)	16 013	5 (31.22)	1.01 (0.4 - 2.53)	16 319	2 (12.26)	0.64 (0.15 - 2.65)
VIC	125 481	22 (17.53)	0.43 (0.27 - 0.7)	135 498	22 (16.24)	0.54 (0.32 - 0.88)	127 498	19 (14.9)	0.77 (0.44 - 1.35)
WA	47 134	6 (12.73)	0.31 (0.13 - 0.72)	49 404	9 (18.22)	0.59 (0.29 - 1.2)	49 580	4 (8.07)	0.41 (0.15 - 1.17)
Total	536 726	134 (24.97)		568 690	122 (21.45)		554 581	86 (15.51)	

1 IRR = Incident Rate Ratio

2 CI = Confidence Intervals

Risk factors associated with infected donors

In total, 775 donors were confirmed positive for at least one of the transfusion-transmissible infections during 2008-2010. Among them, 21 donors were positive for active syphilis. As risk factor data was not available for donors with active syphilis, the data on the remaining 754 donors who were positive for any of the other transfusion-transmissible infections (HBV, HCV, HIV and HTLV) were analysed to determine the key attributes of blood donors with transfusion-transmissible infections, stratified by year of donation (Table 5-8).

Donors with HBV infection, 2008-2010

Of 375 HBV positive donors during 2008-2010, 91% were first time donors, 64% were male, with a mean age of 35 years (Table 5). Most of the HBV positive donors were born overseas which reflects the epidemiology of HBV in the general population. Most (84%) reside in major cities in Australia. There were only six blood donors who seroconverted for HBV during the last three years, consistent with a low incidence rate. Ethnicity or country of birth (82%) was the most frequent risk factor for HBV positivity, followed by having a sexual partner with known risk or known to be positive for any transfusion-transmissible infection (3.7%).

Table 5 Attributes of donors positive for HBV infection by year of donation, 2008-2010

Characteristics	2008	2009	2010	2008-2010
Number of positive donors	124	124	127	375
Number of positive first time donors (%)	116 (93%)	118 (95%)	108 (85%)	342 (91%)
% male	78 (63%)	79 (63%)	84 (66%)	242 (64%)
Mean age (range) in years	32 (16 to 63)	34 (16 to 69)	37 (16 to 71)	35 (16 to 71)
Number of seroconverters	2	1	3	6
% born in Australia	15%	14%	14%	14%
% resident in major cities in Australia ¹	83%	88%	80%	84%
Main reported risk factor	Ethnicity/COB ²	Ethnicity/COB	Ethnicity/COB	Ethnicity/COB
	87%	77%	83%	82%
Second reported risk factor	Partner with known risk or known to be positive	Household contact	Partner with known risk or known to be positive	Partner with known risk or known to be positive
	2.4%	6%	4.0%	3.7%

1 According to ABS remoteness categories using ARIA index

2 COB = Country of birth

Donors with HCV infection, 2008-2010

Of 342 donors positive for HCV, 73% were first time donors (Table 6). The mean age of HCV positive donors was 43 years which remained fairly steady over the last three years. Male donors and donors from major Australian cities each represented 60% of all donors with HCV infection but unlike HBV where birth overseas predominated, the majority (69%) of HCV positive donors were born in Australia. The number of HCV seroconverters (25 donors) was the highest among all transfusion-transmissible infections. The most important risk factor for HCV positivity was intravenous drug use (28%) followed by tattoo or body piercing (20%).

Table 6 Attributes of donors positive for HCV infection by year of donation, 2008-2010

Characteristics	2008	2009	2010	2008-2010
Number of positive donors	134	122	86	342
Number of positive first time donors (%)	98 (73%)	83 (68%)	67 (79%)	248 (73%)
% male	80 (59%)	72 (59%)	53 (62%)	205 (60%)
Mean age (range) in years	42 (17 to 65)	44 (17 to 71)	42 (16 to 63)	43 (16 to 71)
Number of seroconverters	4	11	10	25
% born in Australia	85 (63%)	90 (74%)	61 (71%)	236 (69%)
% resident in major cities in Australia ¹	58%	55%	64%	58%
Main reported risk factor	Intravenous drug use 25%	Intravenous drug use 35%	Tattoo/Body piercing 21%	Intravenous drug use 28%
Second reported risk factor	Tattoo/Body piercing 22%	Tattoo/Body piercing 18%	Intravenous drug use 19%	Tattoo/Body piercing 20%

1 According to ABS remoteness categories using ARIA index

Donors with HIV infection, 2008-2010

In contrast to the donors with HBV or HCV infection, the majority of donors with HIV infection during 2008-2010 were repeat donors (65%) (Table 7). Most were male (75%) of younger age (mean age 36 years), Australian born (75%) and were from major cities (75%). This pattern is very similar to new HIV diagnoses in the general population. According to the recent population data, people born in Australia accounted for 58% of cases of HIV infection newly diagnosed in 2006-2010, most of the newly diagnosed HIV cases were male (86.2%) in 2008-2010 with a mean age of 37 years and most of them (84%) reside in major cities in Australia¹¹. Of 13 HIV positive repeat donors, 9 donors seroconverted for HIV during the last three years. Male-to-male sexual contact (40%) and having a sexual partner with known risk or known to be positive for any transfusion-transmissible infection (40%) were the two most important risk factors for HIV positivity in blood donors.

Table 7 Attributes of donors positive for HIV infection by year of donation, 2008-2010

Characteristics	2008	2009	2010	2008-2010
Number of positive donors	10	3	7	20
Number of positive first time donors (%)	5 (50%)	1 (33%)	1 (14%)	7 (35%)
% male	8 (80%)	2 (67%)	5 (71%)	15 (75%)
Mean age (range) in years	35 (19 to 53)	38 (26 to 50)	37 (23 to 57)	36 (19 to 57)
Number of seroconverters	3	2	4	9
% born in Australia	7 (70%)	2 (67%)	6 (86%)	15 (75%)
% resident in major cities in Australia ¹	80%	100%	57%	75%
Main reported risk factor	Male-to-male sexual contact 60%	Male-to-male sexual contact 33%	Partner with known risk or known to be positive 57%	Male-to-male sexual contact 40%
Second reported risk factor	Partner with known risk or known to be positive 33%	Partner with known risk or known to be positive 33%	Male-to-male sexual contact 14%	Partner with known risk or known to be positive 40%

1 According to ABS remoteness categories using ARIA index

11 The Kirby Institute. *op. cit.*

Donors with HTLV infection, 2008-2010

Only 18 donors were positive for HTLV infection during the study period, 88% were first time donors and 59% were male, with a mean age of 41 years (Table 8). Most of the HTLV positive donors (83%) were born overseas and almost all (94%) were from major cities in Australia. There was only one donor who seroconverted for HTLV in 2010. Ethnicity or country of birth (73%) was the most important risk factor for HTLV infection in accepted blood donors in Australia.

Table 8 Attributes of donors positive for HTLV infection by year of donation, 2008-2010

Characteristics	2008	2009	2010	2008-2010
Number of positive donors	7	9	2	18
Number of positive first time donors (%)	7 (100%)	8 (89%)	1 (50%)	16 (89%)
% male	4 (57%)	6 (67%)	1 (50%)	11 (61%)
Mean age (range) in years	35 (27 to 49)	38 (18 to 65)	70 (70)	41 (18 to 70)
Number of seroconverters	0	0	1	1
% born in Australia	0 (0%)	3 (33%)	0 (0%)	3 (17%)
% resident in major cities in Australia ¹	100%	88%	100%	94%
Main reported risk factor	Ethnicity/COB 86%	Ethnicity/COB 44%	Ethnicity/COB 50%	Ethnicity/COB 73%
Second reported risk factor	Partner with known risk or known to be positive 10%	BTR ² , HHC ³ , HCE ⁴ each 11%	–	BTR, HHC, HCE, PRP ⁵ each 7%

1 According to ABS remoteness categories using ARIA index

2 BTR = Blood/tissue recipient

3 HHC = Household contact

4 HCE = Exposure in healthcare setting

5 PRP = Partner with known risk/known to be positive

Comparison of major exposure categories among blood donors and the general population

A comparison of major exposure categories between blood donors and the general population was conducted to determine if any unique source of infection exists for Australian donors (Table 9).

The most frequent risk for HBV positive donors was ethnicity or country of birth which accounted for 82% of the HBV positive donors in 2008-2010. This finding is similar with the population data that shows that country of birth is the strongest risk factor for chronic HBV infection in Australia^{12,13,14}. However, intravenous drug use (36.2%) was reported to be the most common route of infection for newly acquired HBV infection in the general population during 2008-2010.

The most frequent risk factor for HCV infection in blood donors in 2008-2010 was intravenous drug use followed by tattoo or body piercing. These were also the two most important risk factors for HCV in general population in the past three years, both for new HCV diagnoses and for newly acquired HCV infection. Nonetheless, prevalence of intravenous drug use in newly acquired HCV infection in the general population¹⁵ (58.4%) was notably greater than in the donor population (28.1%) in Australia reflecting the impact of the Blood Services' permanent deferral for intravenous drug use.

12 Nguyen VTT, Razali K, Amin J, Law MG, Dore GJ. Estimates and projections of hepatitis B-related hepatocellular carcinoma in Australia among people born in Asia-Pacific countries. *Journal of Gastroenterology and Hepatology*. 2008;23(6):922-9.

13 O'Sullivan BG, Gidding HF, Law M, Kaldor JM, Gilbert GL, Dore GJ. Estimates of chronic hepatitis B virus infection in Australia, 2000. *Australian and New Zealand Journal of Public Health*. 2004;28(3):212-6.

14 Williams S., V., H., Fielding, J., Cowie, B. 2011. Hepatitis B prevention in Victoria, Australia – the potential to protect. *Euro Surveillance*, 16.

15 The Kirby Institute. *op. cit.*

Table 9 Comparison between positive blood donors and the general population in Australia by infection and major risk categories, 2008-2010

Major risk category	HBV ¹		HCV ¹		HIV ²		HTLV	
	General population (%)	Blood donors (%)						
Intravenous drug users	36.2	1.1	58.4	28.1	2.5	0.0	–	0.0
Country of birth/Ethnicity	–	82.0	–	11.0	12.3	0.0	–	73.3
Sexual contact ³	17.9	3.9	4.3	7.3	79.5	80.0	–	–
Blood or tissue recipient	1.3	1.9	0.1	12.2	0.0	0.0	–	6.7
Tattoo or body piercing	3.3	1.7	4.8	21.4	0.0	5.0	–	0.0
Exposure in health care setting	3.6	1.9	1.4	4.9	0.0	0.0	–	6.7
Household contact	2.1	2.2	0.7	7.0	0.0	0.0	–	6.7
Other blood to blood contact	–	0.6	–	2.8	–	5.0	–	0.0
Other/undetermined	35.6	0.3	30.0	2.4	5.6	0.0	–	0.0
No risk factors identified	–	0.5	–	2.6	–	10	–	0.0
Not reported	–	3.9	–	0.2	–	0	–	6.7

1 Includes exposure categories for newly acquired HBV and newly acquired HCV infections only

2 Includes exposure categories for new HIV diagnoses

3 Includes three sub-groups: Male-to-male sexual contact, Partner with known risk or known to be positive and Engaged in sex work

Sexual contact that included male-to-male sexual contact, partners with known risk and engagement in sex work, together contributed 80% of the risk for HIV positive donors and 79.5% of newly diagnosed HIV infection in Australia. Overall, 65% of all newly diagnosed HIV infections in the general population were attributed to male-to-male sexual contact compared with 40% of HIV-positive donors who had male-to-male sexual contact. Having a sexual partner with known risk or known to be positive for any transfusion-transmissible infection also accounted for 40% of all HIV positive donors.

Due to the scarcity of reliable data on prevalence of key risk factors for HTLV in the Australian population, no meaningful comparison was possible. However, HTLV is highly endemic in certain geographic regions including Japan, the Caribbean and central Africa and to a lesser extent in Iran, Iraq, southern India and China¹⁶. This is consistent with our finding that ethnicity or country of birth was the infective risk in the majority (73.3%) of 18 HTLV positive donors. Among them, 44% were either born in India or had sexual contact with a partner from India.

Non-compliance among infected donors

Almost one-quarter of the positive donors had risk factors identified during their post-donation interview that would have deferred them from donating had they disclosed their risk behaviour at the pre-donation interview (Table 10). This is termed 'non-compliance' with donor selection guidelines and the Blood Service remains highly committed to minimise it by developing improved methods of ascertaining donor risk behaviour. A donor who does not appropriately report a risk behaviour for a transfusion-transmissible infection poses a risk to the safety of the blood supply for two reasons. Firstly, if a donor with a history of risk behaviour for a transfusion-transmissible infection donates blood within the window period, there is a very small but real possibility that infection is not detected by testing and the blood is included in the blood supply. Secondly, even where successfully detected there is an extremely remote risk of erroneously issuing this positive unit (i.e. a process failure). The Blood Service takes measures including the use of computerised release systems to minimise this risk. These are both avoidable risks if a positive donor appropriately discloses their risk (i.e. complies) as a unit will not be collected.

The rate of non-compliance in positive donors appears to have been stable for the past decade but there is some evidence of a declining trend since 2008. The rate observed in the previous Blood Service study¹⁷ for 2000-2006 was 22%. The number of donors and rates for 2008, 2009 and 2010 are 67 (24.4%), 61 (23.6%) and 45 (20.4%), respectively, indicating a small decline in recent years. However, further data will be required to confirm this trend.

¹⁶ Verdonck K, González E, Van Dooren S, Vandamme A-M, Vanham G, Gotuzzo E. Human T-lymphotropic virus 1: recent knowledge about an ancient infection. *The Lancet Infectious Diseases*. 2007;7(4):266-81.

¹⁷ Polizzotto. *op. cit.*

Table 10 Non-compliance rate among donors who were positive for HBV, HCV, HIV and HTLV, and reason for non-compliance, 2008–2010

Reasons for donor deferral	2008 number	2009 number	2010 number	Total number (%) of non-compliant donors by reason for deferral
Intravenous drug user	37	47	30	114 (65.9)
Known status : previous positive	18	10	8	36 (20.8)
Male-to-male sexual contact within the past 12 months	6	1	2	9 (5.2)
Partner with known risk or known to be positive	4	3	1	8 (4.6)
Others	2	0	4	6 (3.5)
Total number of non-compliant donors by year	67	61	45	173
Total number of positive donors	275	258	221	
Rate of non-compliance by year (per 100 positive donors)	24.4	23.6	20.4	

The majority of non-compliant positive donors in 2008-2010 had a history of intravenous drug use (65.9%), which is a permanent donor deferral criterion in Australia irrespective of time since last episode of intravenous drug use. The other key deferral reasons identified among non-compliant donors were known status of previously being positive for a virus (20.8%), male-to-male sexual contact within the last 12 months (5.2%) and having a sexual partner with known risk or known to be positive for any transfusion-transmissible infection (4.6%).

While the rate of non-compliance among donors with transfusion-transmissible infections is known, the rate in non-positive donors has yet to be measured in the Australian donor population. This rate is arguably even more important as recently infected, window period donors (who would test negative) pose the greatest risk if they fail to self-defer. Based on anonymous surveys of donors in the UK and North America,^{18,19} the non-compliance rate among test negative donors ranged from 0.2-11% dependent on the deferral risk question. Perhaps not surprisingly the highest rates of non-compliance were for permanent deferrals, for example intravenous drug users. The Blood Service plans to survey a random sample of donors to determine the rate of non-compliance in Australian donors.

Seroconverters

The Blood Service uses the rate of seroconversion as a measure of the incidence rate of newly acquired infection in donors which correlates directly with the risk of transmission. During 2005-2010, a total of eighty three donors whose previous donation tested negative were positive for that transfusion-transmissible infection, designating them as 'seroconverters'. The greatest annual frequency of seroconversion occurred for HCV, accounting for 61% of all seroconverters. This was followed by both HIV and HBV, accounting for 19% each of all donors who seroconverted during the last six years. No donors seroconverted for active syphilis and only one donor seroconverted for HTLV in 2010.

Seroconverters were disproportionately male (68%) and likely to be born in Australia (76%). The mean age of seroconverted blood donors during 2008-2010 was 39 years (35 years for HBV, 42 years for HCV and 39 years for HIV).

Residual risk estimates/estimated risk of window period donation

The rate of seroconversion can be used to estimate the risk of collecting a unit of blood from a donor with very early infection (window period) which might test negative. Individuals donating in the window period (incident infection) pose the majority of the risk in terms of transmission because they may be missed by testing whereas long standing (prevalent) infections are more readily detected by modern screening tests.

18 Grenfell P, Nutland W, McManus S, Datta J, Soldan K, Wellings K. Views and experiences of men who have sex with men on the ban on blood donation: a cross sectional survey with qualitative interviews. *BMJ*. 2011;343.

19 Goldman M, Yi Q-L, Ye X, Tessier L, O'Brien SF. Donor understanding and attitudes about current and potential deferral criteria for high-risk sexual behavior. *Transfusion*. 2011;51(8):1829-34.

Using the number of seroconversions reported for the 2009 and 2010 calendar year period and applying these to three published risk models, residual risk estimates²⁰ (per unit transfused) were derived for the four transfusion-transmissible viral infections (Table 11). The risk estimate for active syphilis is not derived by the same method but rather assumed from the lack of reported cases of transfusion-transmission for several decades. The estimates for all fall below the 'negligible' risk threshold of 1 in 1 million used by the Blood Service to contextualise the risks for transfusion recipients. Further information can be obtained from the following website: http://www.transfusion.com.au/adverse_events/risks/estimates .

Table 11 Estimated risk of window period donation/risk of not detecting true infection for HBV, HCV, HIV, HTLV and syphilis in Australian blood donations (2009-2010)

	HBV	HCV	HIV	HTLV	Active syphilis
Estimated rate of collecting infectious unit (per million donations)	<1	<1	<1	<1	<1
Residual Risk to recipient - per unit transfused	Less than 1 in 1 million				

Based on the estimates and assuming approximately 1.3 million donations collected per annum (2009-2010) no more than one potential transfusion-transmission per agent would be predicted per annum. The reported frequency of transfusion-transmission supports the accuracy of this modelling with no cases of transfusion-transmitted HCV reported in Australia since 1991, none for HTLV since testing commenced in 1993, none for HIV since 1998 and two possible cases of HBV in the 2005-2010 period.

20 Seed CR, Kiely P, Keller AJ. Residual risk of transfusion transmitted human immunodeficiency virus, hepatitis B virus, hepatitis C virus and human T lymphotropic virus. *Internal Medicine Journal*. 2005;35(10):592-8.

Conclusions

1. Supporting the effectiveness of donor education and selection, the prevalence of transfusion-transmissible infections is substantially lower among both first time blood donors (6 to 53 times) and all donors (52 to 240 times) than in the general population and shows a stable or declining trend since 2005.
2. The prevalence of transfusion-transmissible infections among first time donors was higher than among all donors, highlighting the importance of promoting donor education of potential new donors and limiting the manufacture of some blood components from first time donors.
3. The incidence of newly acquired infection measured by the rate of seroconversion in repeat blood donors is also much lower than in the general population, indicating repeat donors understand what constitutes 'risk behaviour' for acquiring infection.
4. Infective risk factors identified in transfusion-transmissible infection positive blood donors closely parallel those for the general population with no 'unique' risk factors identified to date among blood donors.
5. Almost one-quarter of the positive donors were 'non-compliant' in that they had risk factors identified during their post-donation interview that would have deferred them from donating had they disclosed them at the pre-donation interview. Understanding the reasons for, and minimising the rate of, non-compliance is important because it reduces the risk of collecting blood from an infected donor that may not be detected by testing.
6. The estimated residual risk of transmission for HIV, HCV, HBV, HTLV and active syphilis in Australia is very low, less than one in one million per unit transfused for each. This supports the claim that Australia's blood supply is among the safest worldwide in respect of transfusion-transmissible infections for which testing is conducted. Despite this, there remains a real risk to patients which must be carefully considered before any transfusion.

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Figure 1 Percentage of age-eligible general population who donated blood in 2008-2010, by state/territory

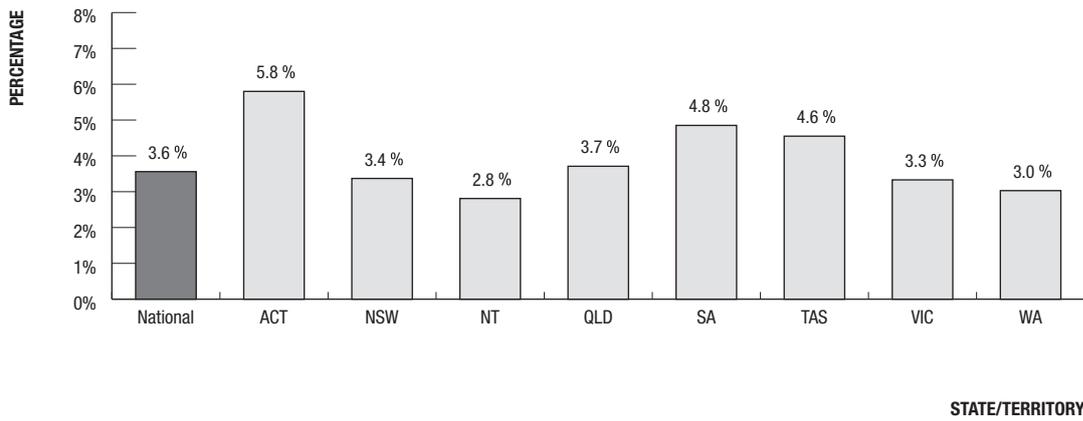


Figure 2 Percentage of donations made by first time and repeat donors among all blood donations in Australia, 2005-2010

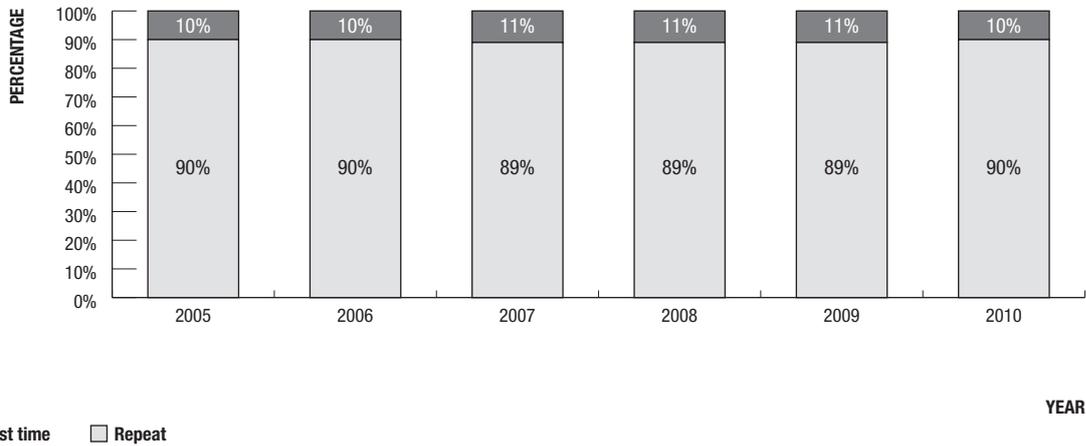


Figure 3 Distribution of blood donors in Australia by age group and sex, 2008-2010

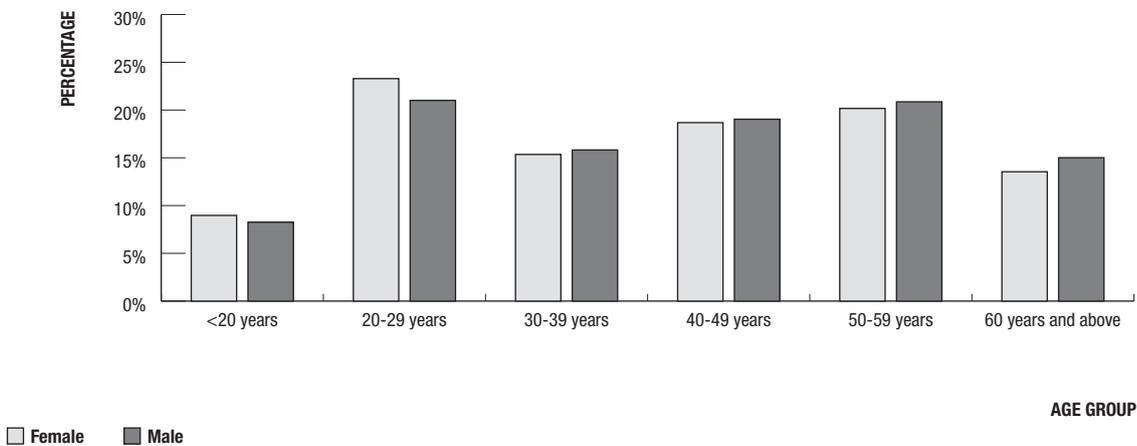


Figure 4 Prevalence of any transfusion-transmissible infection among all accepted donations, 2005-2010

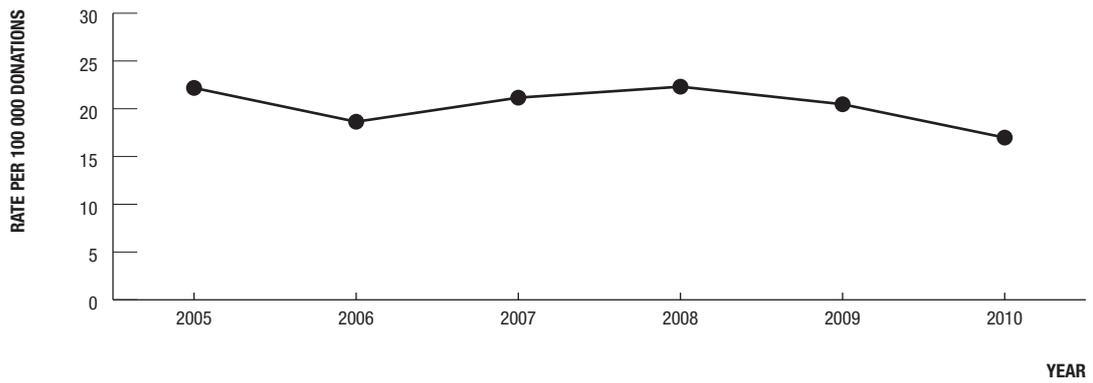


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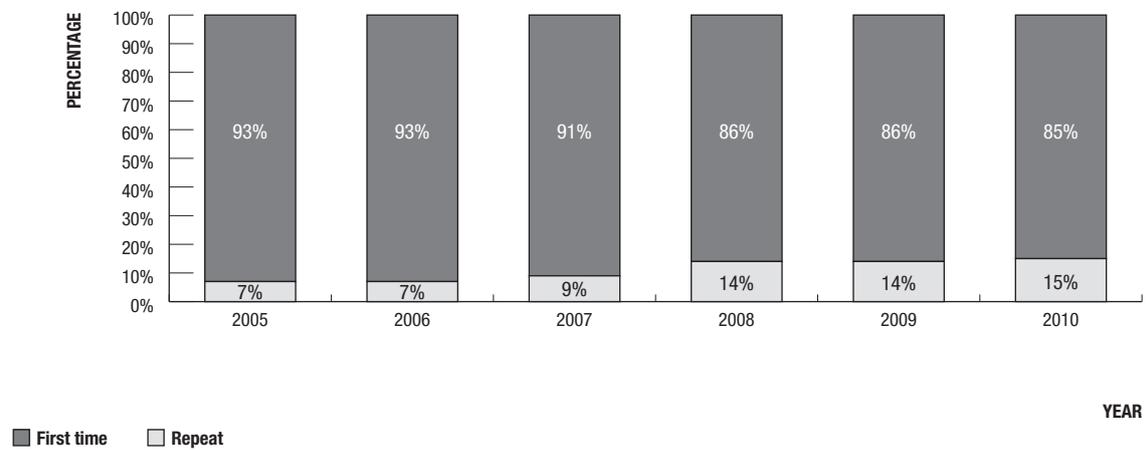


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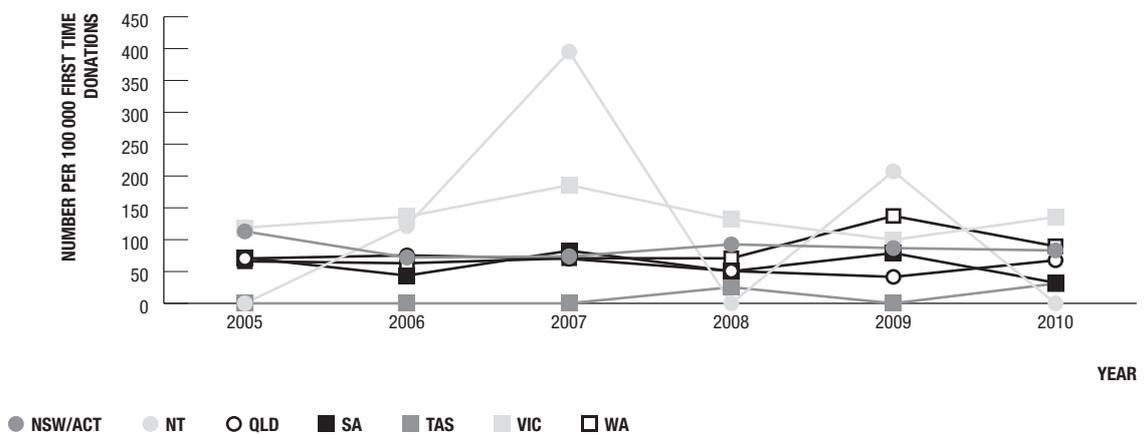


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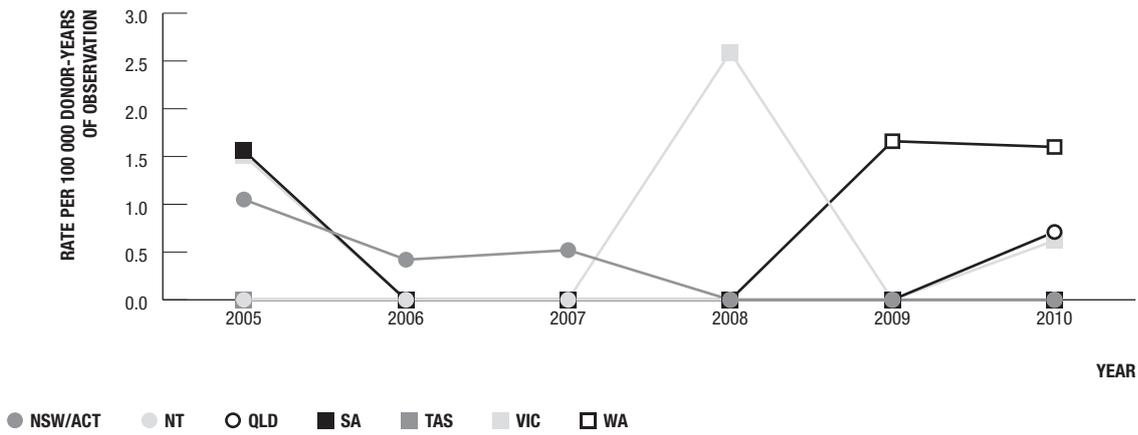


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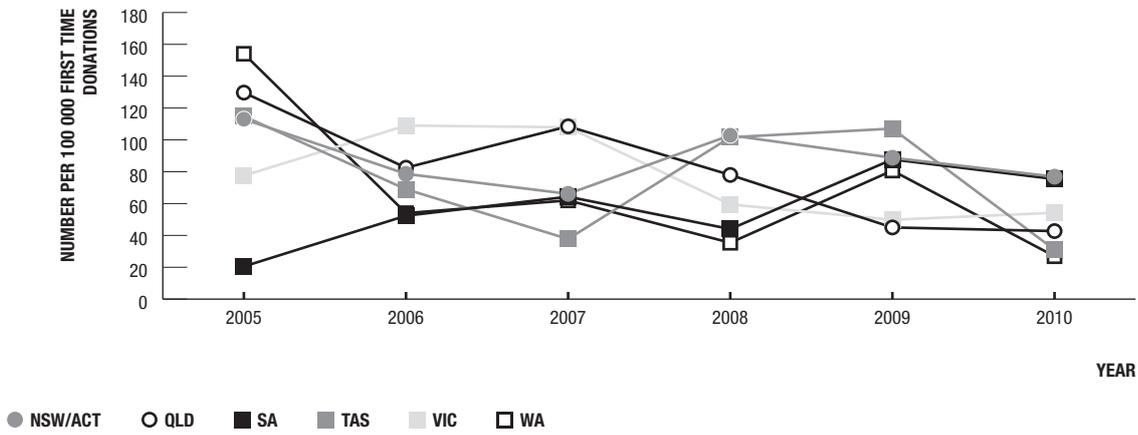


Figure 9 Incidence of HCV among repeat donors by state/territory and year of donation, 2005-2010

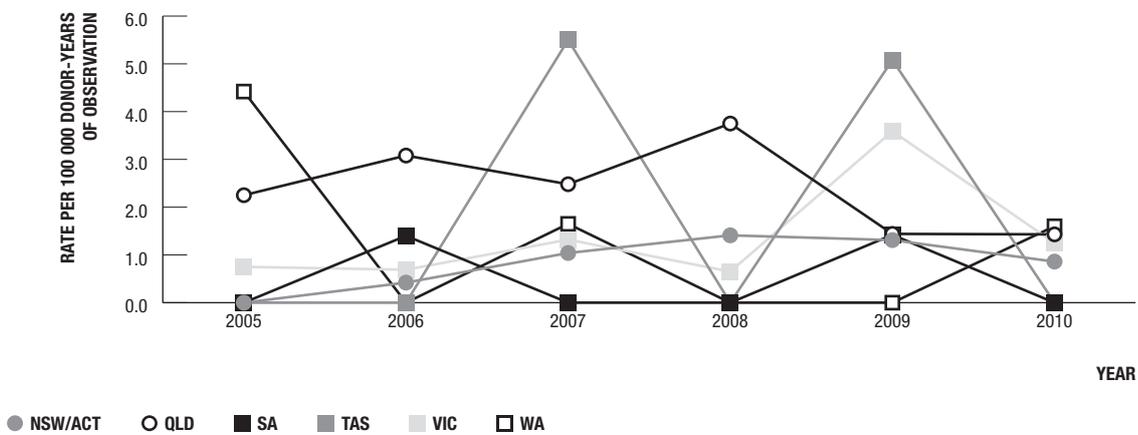


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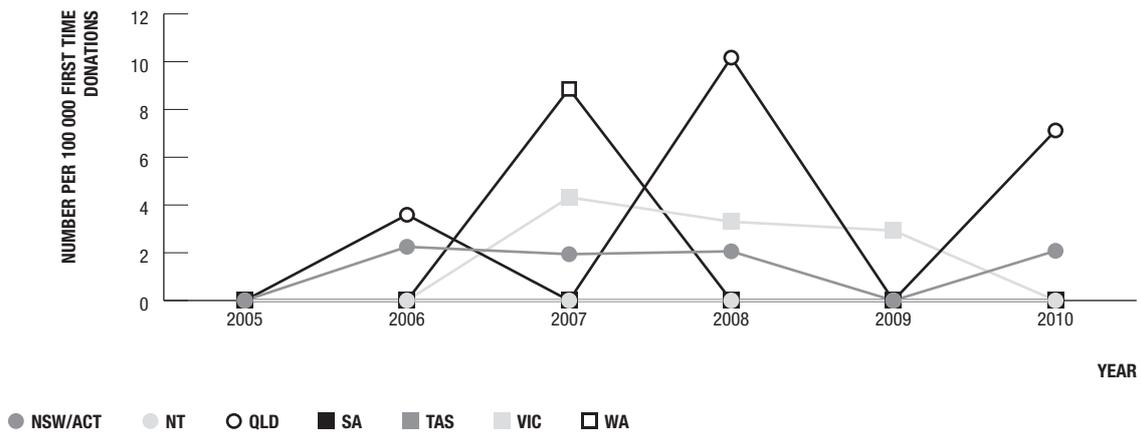


Figure 11 Incidence of HIV among repeat donors by state/territory and year of donation, 2005-2010

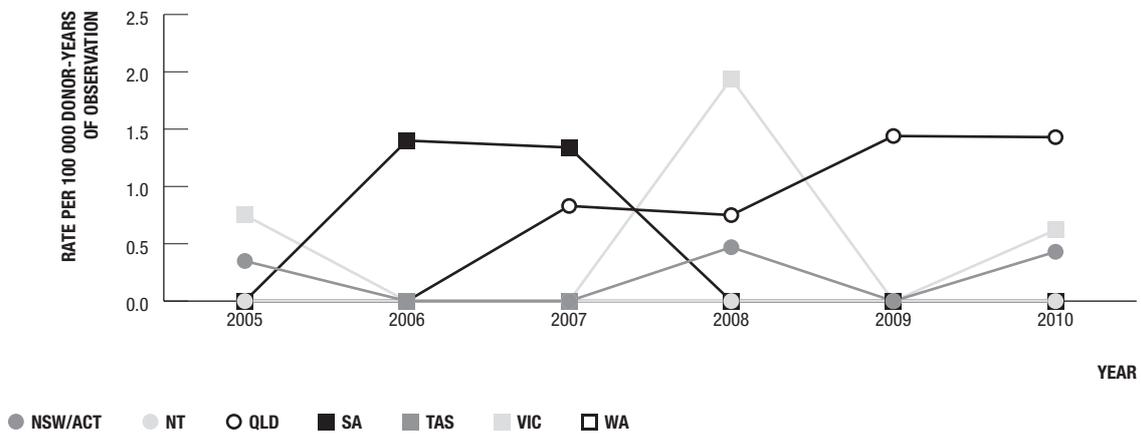


Figure 12 Prevalence of HTLV among first time donors by state/territory and year of donation, 2005-2010

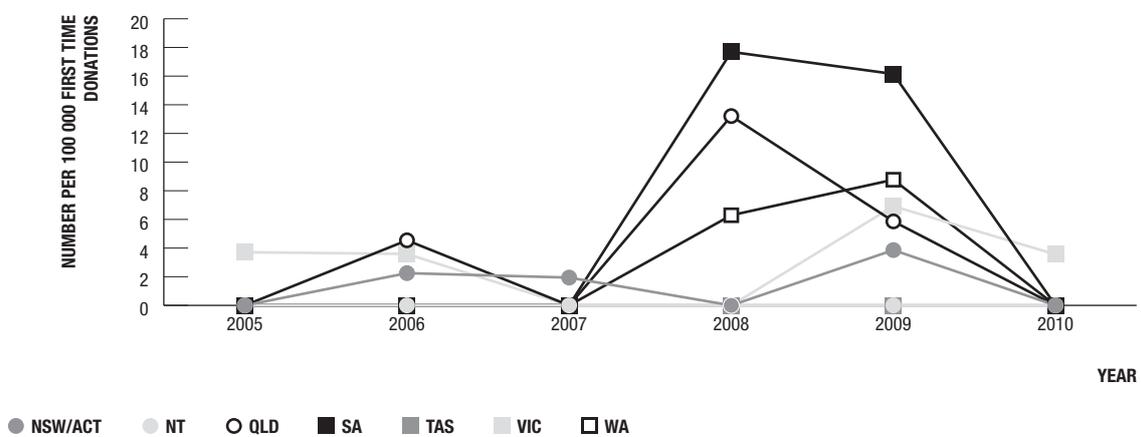
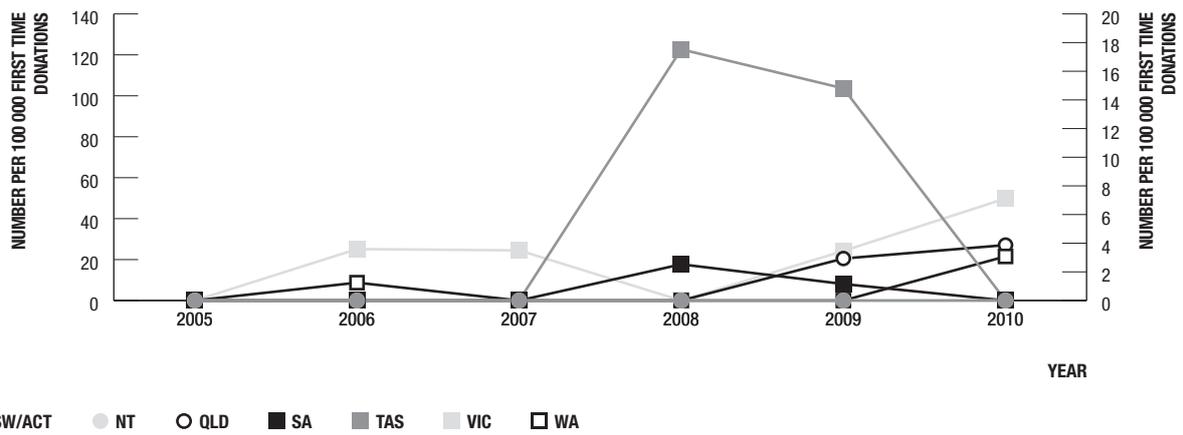


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¹ Prevalence in QLD and VIC are provided according to the scale on the secondary axis on the right hand side.

Figure 14 Donors with HBV infection by sex and donor status, 2008-2010

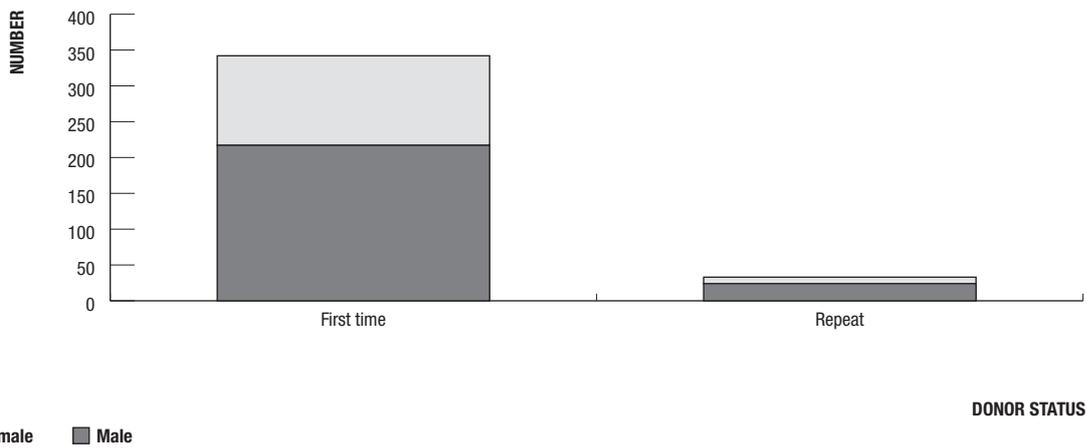


Figure 15 Rate of HBV infection among blood donors by age group and year of donation, 2008-2010

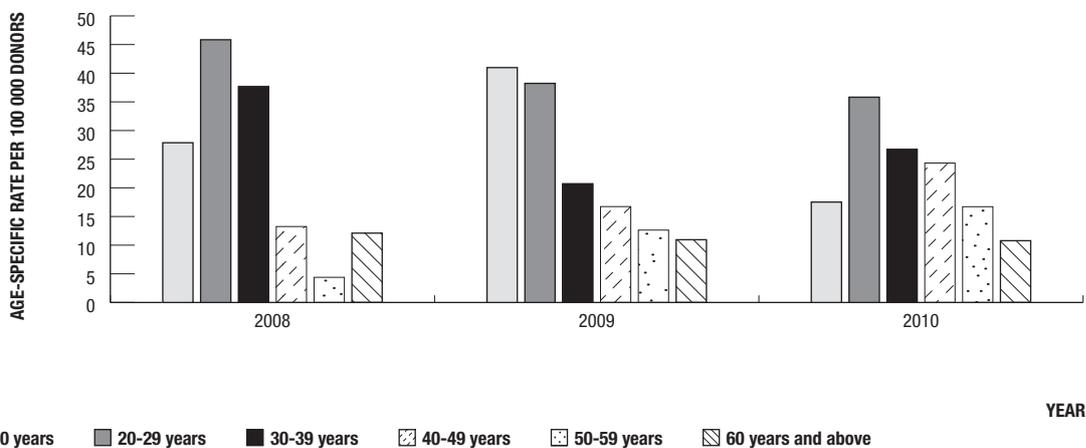


Figure 16 Donors with HBV infection by region of birth, 2008-2010

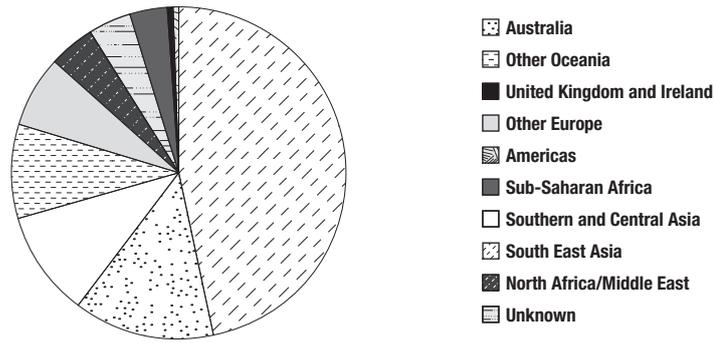


Figure 17 Donors with HCV infection by sex and donor status, 2008-2010

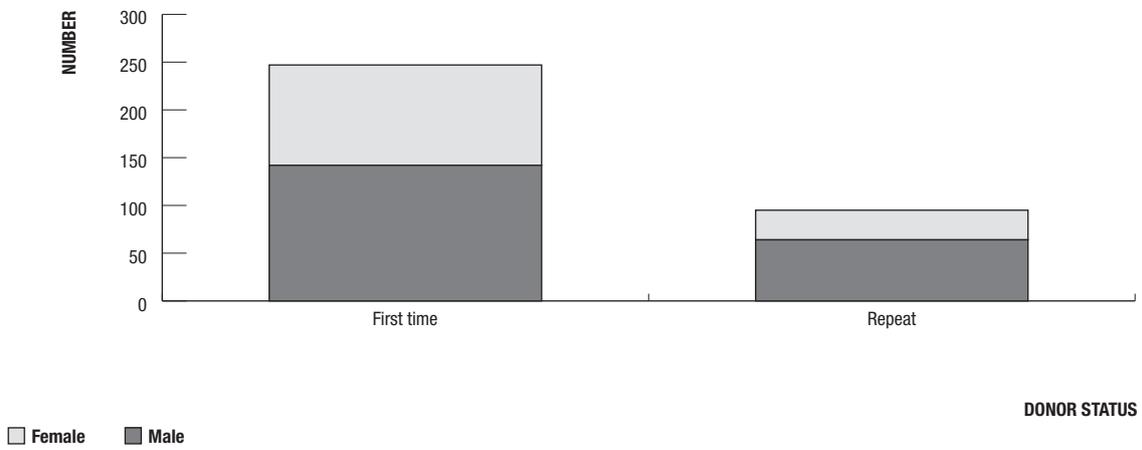


Figure 18 Rate of HCV infection among blood donors by age group and year of donation, 2008-2010

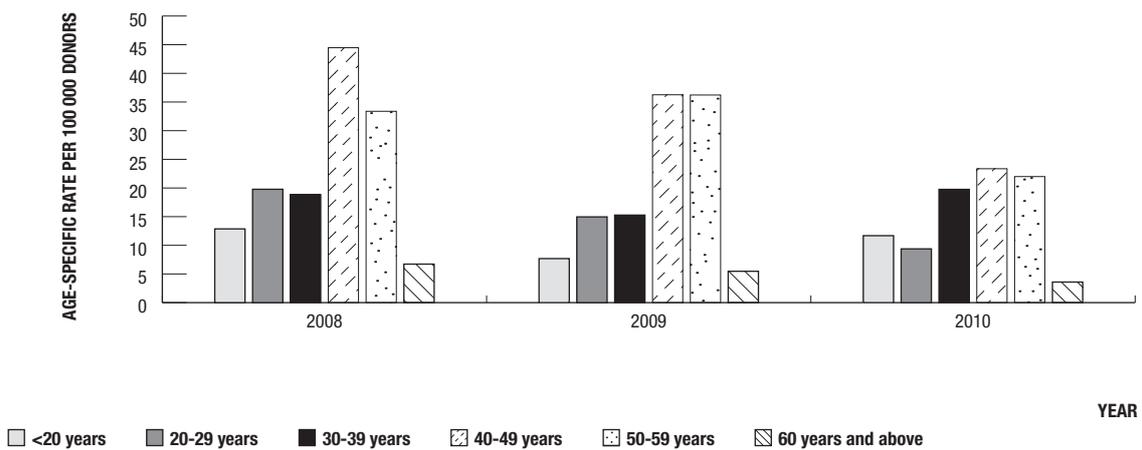


Figure 19 Donors with HCV infection by region of birth, 2008-2010

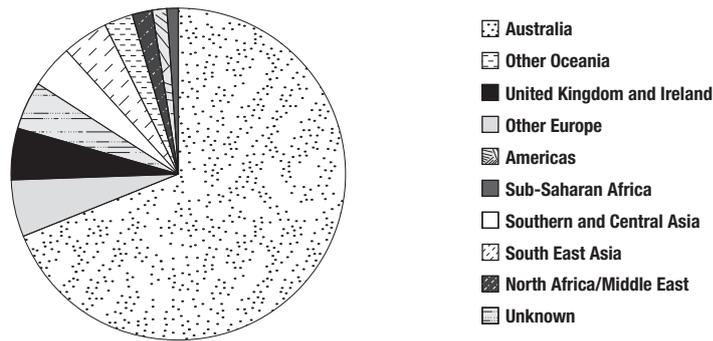


Figure 20 Donors with HIV infection by sex and donor status, 2008-2010

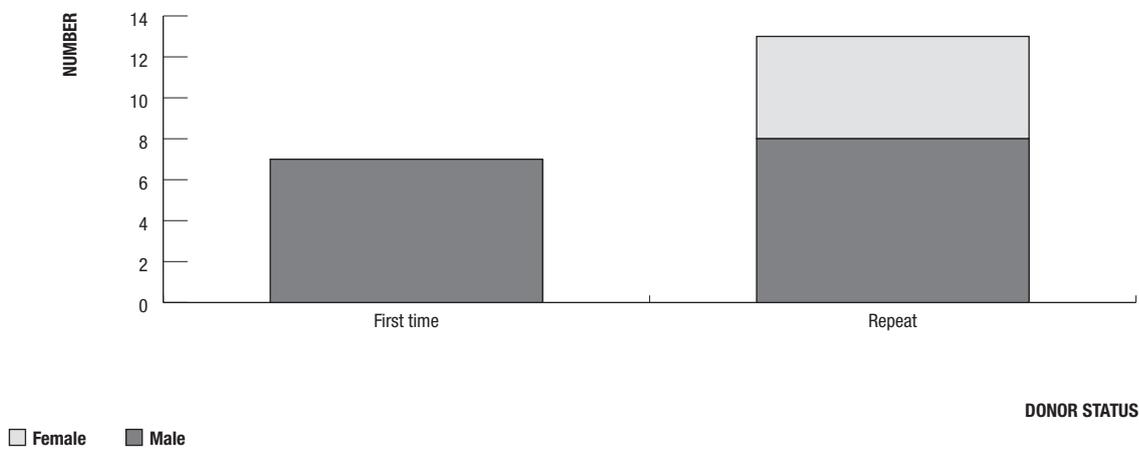


Figure 21 Rate of HIV infection among blood donors by age group and year of donation, 2008-2010

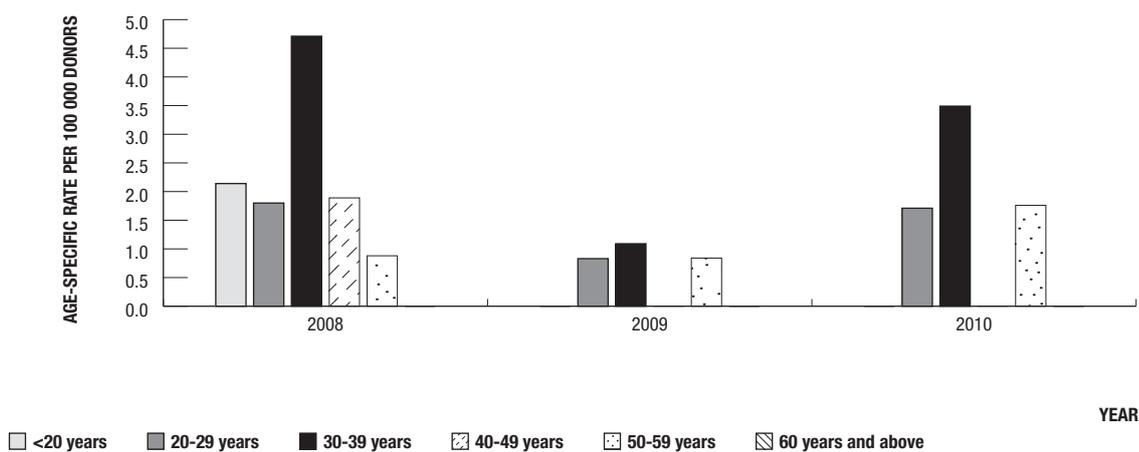


Figure 22 Donors with HIV infection by region of birth, 2008-2010

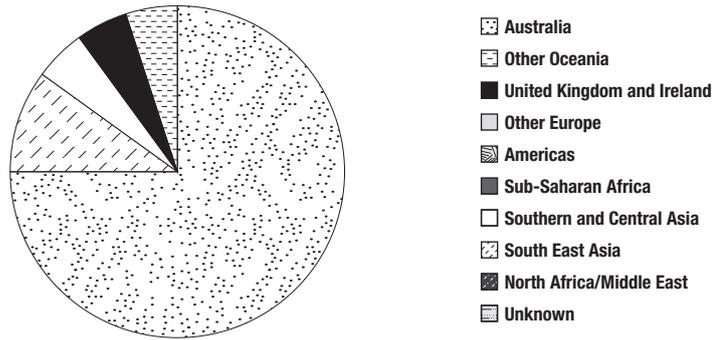


Figure 23 Donors with HTLV infection by sex and donor status, 2008-2010

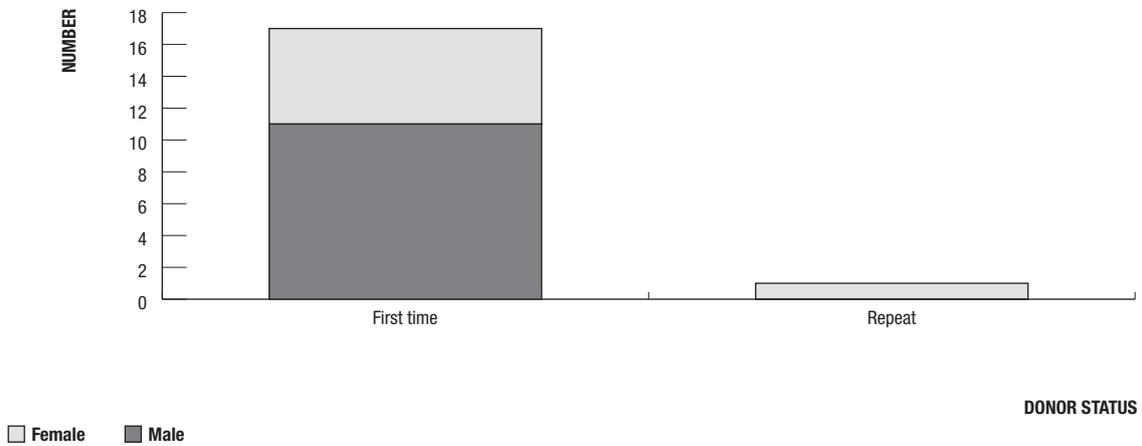


Figure 24 Rate of HTLV infection among blood donors by age group and year of donation, 2008-2010

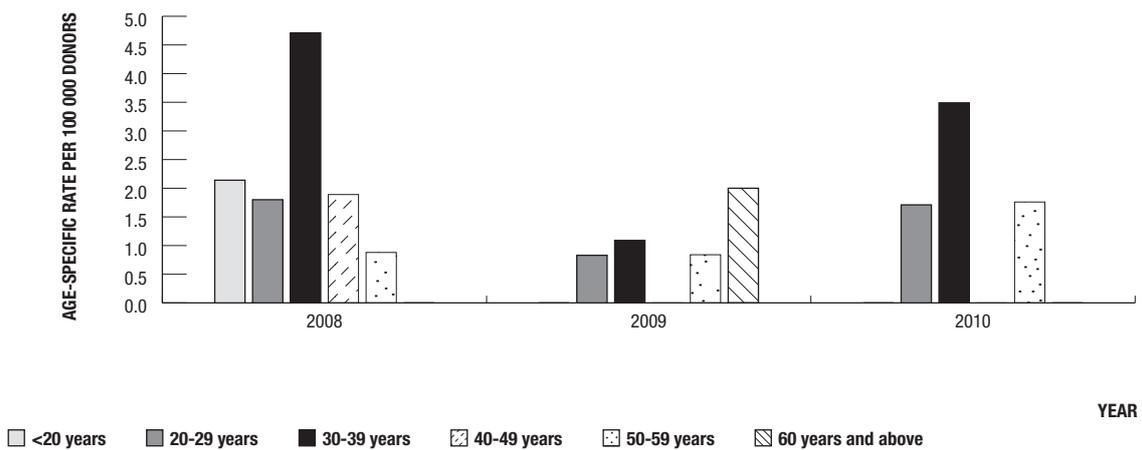
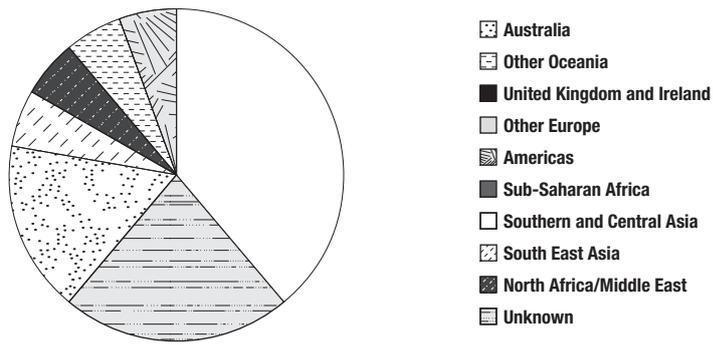


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Table 1 Screening tests for transfusion-transmissible infections

Transfusion-Transmissible infection	Mandatory screening tests	Test Target	Year of introduction	Median window period estimate	Estimated risk of window period donation (per million transfusion)
Syphilis	<i>Treponema pallidum</i> Haemagglutination Assay (TPHA)	Antibodies to <i>Treponema pallidum</i>	~1949	45 days	–
HBV	HBsAg ¹	Hepatitis B surface antigen (HBsAg)	1970	38 days	–
	Nucleic Acid Test for HBV	HBV DNA	2010	23.9 days	<1 in 1 million
HIV	anti-HIV-1 ¹ anti-HIV-2 ¹	Antibody to both HIV-1 and HIV-2 (anti-HIV-1/2)	1985 (HIV-1) 1993 (HIV-1/HIV-2)	22 days	–
	Nucleic Acid Test for HIV-1 ²	HIV-1 RNA	2000	9 days	<1 in 1 million
HCV	anti-HCV ¹	Antibody to HCV	1990	66 days	–
	Nucleic Acid Test for HCV ²	hepatitis C RNA	2000	5.4 days	<1 in 1 million
HTLV	anti-HTLV-1 ¹ anti-HTLV-2 ¹	Antibody to both HTLV-1 and HTLV-2	1993	51 days	<1 in 1 million

1 Currently Abbott PRISM (Abbott Diagnostics, Wiesbaden-Delkenheim, Germany) Chemiluminescent Immunoassay system.

2 Chiron Procleix HIV-1/HCV (Multiplex) assay (Chiron Blood Testing, Emeryville, California) from June 2000 until July 2010. Subsequently replaced by Novartis HIV-1/HCV/HBV Procleix Ultrio assay using a fully automated testing system (Procleix Tigris).

Table 2 Number and prevalence¹ of HBV infection among first time donors, 2005–2010, by state/territory and year of donation

State/ Territory	2005			2006			2007			
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	42 479	48	113.00	44 499	32	71.91	51 427	38	73.89	
NT	1 141	0	0.00	823	1	121.51	759	3	395.26	
QLD	26 988	19	70.40	27 873	21	75.34	28 575	20	69.99	
SA	9 752	7	71.78	11 457	5	43.64	10 886	9	82.67	
TAS	3 484	0	0.00	2 899	0	0.00	2 650	0	0.00	
VIC	19 346	23	118.89	22 016	30	136.26	23 172	43	185.57	
WA	9 087	6	66.03	11 116	7	62.97	11 292	8	70.85	
Total	112 277	103	91.74	120 683	96	79.55	128 761	121	93.97	
State/territory	2008			2009			2010			Total 2005-2010
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	48 607	45	92.58	51 821	45	86.84	48 130	40	83.11	286 963
NT	815	0	0.00	965	2	207.25	799	0	0.00	5 302
QLD	29 498	15	50.85	28 889	12	41.54	28 097	19	67.62	169 920
SA	15 908	8	50.29	11 400	9	78.95	9 284	3	32.31	68 687
TAS	3 936	1	25.41	3 736	0	0.00	3 222	1	31.04	19 927
VIC	30 286	40	132.07	34 133	34	99.61	25 820	35	135.55	154 773
WA	11 307	8	70.75	12 387	17	137.24	11 149	10	89.69	66 338
Total	140 357	117	83.36	143 331	119	83.02	126 501	108	85.37	771 910

1 Rate per 100 000 first time donations

Table 3 Number and rate¹ of HBV infection among repeat donors, 2005–2010, by state/territory and year of donation

State/Territory	2005			2006			2007		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	311 513	4	1.28	333 250	5	1.50	338 173	3	0.89
NT	8 862	0	0.00	8 496	0	0.00	10 214	0	0.00
QLD	205 398	0	0.00	216 496	0	0.00	209 556	0	0.00
SA	93 172	1	1.07	107 934	0	0.00	114 618	0	0.00
TAS	24 577	0	0.00	28 726	0	0.00	28 019	0	0.00
VIC	225 332	2	0.89	238 684	0	0.00	252 340	0	0.00
WA	101 063	0	0.00	99 376	0	0.00	109 425	0	0.00
Total	969 917	7	0.72	1 032 962	5	0.48	1 062 345	3	0.28

State/Territory	2008			2009			2010			Total 2005-2010		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate			
NSW/ACT	339 062	1	0.29	372 806	1	0.27	380 014	4	1.05	2 074 818	18	0.87
NT	11 166	0	0.00	11 158	0	0.00	10 470	1	9.55	60 366	1	1.66
QLD	226 726	1	0.44	242 001	1	0.41	243 837	3	1.23	1 344 014	5	0.37
SA	118 476	1	0.84	126 855	0	0.00	123 587	3	2.43	684 642	5	0.73
TAS	33 321	0	0.00	37 274	0	0.00	41 484	0	0.00	193 401	0	0.00
VIC	259 052	4	1.54	276 835	1	0.36	278 897	3	1.08	1 531 140	10	0.65
WA	113 274	0	0.00	118 327	3	2.54	120 646	1	0.83	662 111	4	0.60
Total	1 101 077	7	0.64	1 185 256	6	0.51	1 198 935	15²	1.25	6 550 492	43	0.66

1 Rate per 100 000 repeat donations

2 The increase is attributed to the introduction of HBV NAT which identified chronic occult HBV cases among repeat donors

Table 4 Number and percentage of donors with HBV infection, 2008-2010, by year of donation, sex and age group

Donor status	Year of donation								Total	%
	2008		2009		2010		2008-2010			
	M	F	M	F	M	F	M	F		
First time donors										
<20 years	7	6	10	6	5	4	22	16	38	10.1
20-29 years	32	18	29	16	23	17	84	51	135	36.0
30-39 years	23	8	12	6	16	6	51	20	71	18.9
40-49 years	7	4	10	7	15	4	32	15	47	12.5
50-59 years	1	4	10	3	7	5	18	12	30	8.0
60 years and above	2	4	5	4	3	3	10	11	21	5.6
Repeat donors										
<20 years	0	0	0	0	0	0	0	0	0	0.0
20-29 years	1	0	0	1	0	2	1	3	4	1.1
30-39 years	1	0	1	0	1	0	3	0	3	0.8
40-49 years	1	2	1	0	6	0	8	2	10	2.7
50-59 years	0	0	0	2	6	1	6	3	9	2.4
60 years and above	3	0	1	0	2	1	6	1	7	1.9
Total	78	46	79	45	84	43	241	134	375	100

Table 5 Number and percentage of donors with HBV infection, 2008-2010, by year of donation and region of birth¹

Region of birth	2008		2009		2010		2008-2010		
	Number	%	Number	%	Number	%	Number	%	
Born in Australia	18	15	16	13	17	13	51	14	
Overseas born									
<i>Other Oceania</i>	11	9	9	7	14	11	34	9	
<i>United Kingdom and Ireland</i>	1	1	1	1	0	0	2	1	
<i>Other Europe</i>	7	6	12	10	8	6	27	7	
<i>Middle East/North Africa</i>	7	6	6	5	3	2	16	4	
<i>Sub-Saharan Africa</i>	3	2	6	5	4	3	13	3	
<i>South East Asia</i>	55	44	54	44	67	53	176	47	
<i>Southern and Central Asia</i>	13	10	16	13	9	7	38	10	
<i>North America</i>	1	1	0	0	0	0	1	0	
<i>South/Central America and the Caribbean</i>	0	0	1	1	0	0	1	0	
Total with a reported country of birth	116	94	121	98	122	96	359	96	
Not reported	8	6	3	2	5	4	16	4	
Total	124	100	124	100	127	100	375	100	

1 Region of birth from the Australian Bureau of Statistics.

Table 6 Number and percentage of first time donors with HBV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	66	39	63	32	62	34	191	105	296	86.5
Intravenous drug user	0	0	1	0	0	0	1	0	1	0.3
Tattoo/Piercing	1	0	1	1	0	0	2	1	3	0.9
Partners with any risks or known to be positive	1	0	2	2	1	0	4	2	6	1.8
Male-to-male sexual contact	0	0	0	0	0	0	0	0	0	0.0
Exposure in health care setting	0	0	1	2	0	0	1	2	3	0.9
Engaged in sex work	0	0	0	0	0	0	0	0	0	0.0
Blood or tissue recipient	0	2	1	1	2	1	3	4	7	2.0
Household contact	0	0	3	4	0	0	3	4	7	2.0
Other blood to blood contact	0	0	1	0	0	1	1	1	2	0.6
Other	1	0	1	0	0	0	2	0	2	0.6
No risk factors identified	0	0	1	0	1	1	2	1	3	0.9
Not reported	3	3	1	0	3	2	7	5	12	3.5
Total	72	44	76	42	69	39	217	125	342	100

Table 7 Number and percentage of repeat donors with HBV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	1	2	0	1	9 ¹	1	10	4	14	42.4
Intravenous drug user	0	0	1	1	1	0	2	1	3	9.1
Tattoo/Piercing	0	0	0	0	1	0	1	0	1	3.0
Partners with any risks or known to be positive	2	0	2	0	3	1	7	1	8	24.2
Male-to-male sexual contact	0	0	0	0	0	0	0	0	0	0.0
Exposure in health care setting	2	0	0	0	1	1	3	1	4	12.1
Engaged in sex work	0	0	0	0	0	0	0	0	0	0.0
Blood or tissue recipient	0	0	0	0	0	0	0	0	0	0.0
Household contact	0	0	0	1	0	0	0	1	1	3.0
Other blood to blood contact	0	0	0	0	0	1	0	1	1	3.0
Other	0	0	0	0	0	0	0	0	0	0.0
No risk factors identified	1	0	0	0	0	0	1	0	1	3.0
Not reported	0	0	0	0	0	0	0	0	0	0.0
Total	6	2	3	3	15	4	24	9	33	100

1 The increase is attributed to the introduction of HBV NAT which identified chronic occult HBV cases among repeat donors

Table 8 Number and rate¹ of HCV infection among first time donors, 2005-2010, by state/territory and year of donation

State/Territory	2005			2006			2007					
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate			
NSW/ACT	42 479	48	113.00	44 499	35	78.65	51 427	34	66.11			
NT	1 141	1	87.64	823	2	243.01	759	0	0.00			
QLD	26 988	35	129.69	27 873	23	82.52	28 575	31	108.49			
SA	9 752	2	20.51	11 457	6	52.37	10 886	7	64.30			
TAS	3 484	4	114.81	2 899	2	68.99	2 650	1	37.74			
VIC	19 346	15	77.54	22 016	24	109.01	23 172	25	107.89			
WA	9 087	14	154.07	11 116	6	53.98	11 292	7	61.99			
Total	112 277	119	105.99	120 683	98	81.20	128 761	105	81.55			
State/Territory	2008			2009			2010			Total 2005-2010		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	48 607	50	102.87	51 821	46	88.77	48 130	37	76.88	286 963	250	87.12
NT	815	0	0.00	965	1	103.63	799	1	125.16	5 302	5	94.30
QLD	29 498	23	77.97	28 889	13	45.00	28 097	12	42.71	169 920	137	80.63
SA	15 908	7	44.00	11 400	10	87.72	9 284	7	75.40	68 687	39	56.78
TAS	3 936	4	101.63	3 736	4	107.07	3 222	1	31.04	19 927	16	80.29
VIC	30 286	18	59.43	34 133	17	49.81	25 820	14	54.22	154 773	113	73.01
WA	11 307	4	35.38	12 987	10	80.73	11 149	3	26.91	66 338	44	66.33
Total	140 357	106	75.52	143 331	101	70.47	126 501	75	59.29	771 910	604	78.25

¹ Rate per 100 000 first time donations

Table 9 Number and rate¹ of HCV infection among repeat donors, 2005-2010, by state/territory and year of donation

State/Territory	2005			2006			2007		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	311 513	1	0.32	333 250	1	0.30	338 173	7	2.07
NT	8 862	0	0.00	8 496	1	11.77	10 214	0	0.00
QLD	205 398	2	0.97	216 496	4	1.85	209 556	3	1.43
SA	93 172	2	2.15	107 934	2	1.85	114 618	0	0.00
TAS	24 577	0	0.00	28 726	0	0.00	28 019	1	3.57
VIC	225 332	1	0.44	238 684	1	0.42	252 340	3	1.19
WA	101 063	2	1.98	99 376	0	0.00	109 425	2	1.83
Total	969 917	8	0.82	1 032 962	9	0.87	1 062 345	16	1.51

State/Territory	2008			2009			2010			Total 2005-2010		
	Donations	Positive	Rate									
NSW/ACT	339 062	11	3.24	372 806	6	1.61	380 014	3	0.79	2 074 818	29	1.40
NT	11 166	0	0.00	11 158	0	0.00	10 470	0	0.00	60 366	1	1.66
QLD	226 726	8	3.53	242 001	9	3.72	243 837	4	1.64	1 344 014	30	2.23
SA	118 476	2	1.69	126 855	4	3.15	123 587	0	0.00	684 642	10	1.46
TAS	33 321	0	0.00	37 274	1	2.68	41 484	0	0.00	193 401	2	1.03
VIC	259 052	2	0.77	276 835	7	2.53	278 897	2	0.72	1 531 140	16	1.04
WA	113 274	1	0.88	118 327	0	0.00	120 646	1	0.83	662 111	6	0.91
Total	1 101 077	24	2.18	1 185 256	27	2.28	1 198 935	10	0.83	6 550 492	94	1.44

¹ Rate per 100 000 repeat donations

Table 10 Number and percentage of donors with HCV infection, 2008-2010, by year of donation, sex and age group

Donor status	Year of donation								Total	%
	2008		2009		2010		2008-2010			
	M	F	M	F	M	F	M	F		
First time donors										
<20 years	3	2	0	3	6	0	9	5	14	4.1
20-29 years	14	6	10	4	6	3	30	13	43	12.6
30-39 years	7	4	9	2	9	5	25	11	36	10.5
40-49 years	17	14	12	13	12	7	41	34	75	21.9
50-59 years	10	16	14	12	9	8	33	36	69	20.2
60 years and above	2	2	2	2	0	2	4	6	10	2.9
Repeat donors										
<20 years	1	0	0	0	1	0	2	0	2	0.6
20-29 years	1	1	1	3	1	1	3	5	8	2.3
30-39 years	3	2	3	0	1	2	7	4	11	3.2
40-49 years	13	3	11	3	3	1	27	7	34	9.9
50-59 years	9	3	9	7	5	2	23	12	35	10.2
60 years and above	0	1	1	1	1	1	2	3	5	1.5
Total	80	54	72	50	54	32	206	136	342	100

Table 11 Number and percentage of donors with HCV infection, 2008-2010, by year of donation and region of birth¹

Region of birth	2008		2009		2010		2008-2010	
	Number	%	Number	%	Number	%	Number	%
Australia	85	63	90	74	61	71	236	69
Overseas born								
<i>Other Oceania</i>	3	2	4	3	2	2	9	3
<i>United Kingdom and Ireland</i>	10	7	5	4	2	2	17	5
<i>Other Europe</i>	8	6	6	5	5	6	19	6
<i>Middle East/North Africa</i>	3	2	3	2	1	1	7	2
<i>Sub-Saharan Africa</i>	1	1	1	1	1	1	3	1
<i>South East Asia</i>	6	4	7	6	2	2	15	4
<i>Southern and Central Asia</i>	7	5	4	3	4	5	15	4
<i>North America</i>	1	1	0	0	1	1	2	1
<i>South/Central America and the Caribbean</i>	0	0	1	1	2	2	3	1
Total with a reported country of birth	124	93	121	99	81	94	326	95
Not reported	10	7	1	1	5	6	16	5
Total	134	100	122	100	86	100	342	100

1 Region of birth from the Australian Bureau of Statistics.

Table 12 Number and percentage of first time donors with HCV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	9	8	7	2	8	2	24	12	36	14.6
Intravenous drug user	6	13	19	10	10	4	35	27	62	25.1
Tattoo/Piercing	15	10	5	9	8	7	28	26	54	21.9
Partners with any risks or known to be positive	4	2	1	4	1	2	6	8	14	5.7
Male-to-male sexual contact	0	0	0	0	0	0	0	0	0	0.0
Exposure in health care setting	2	1	5	1	1	1	8	3	11	4.5
Engaged in sex work	0	0	0	1	0	0	0	1	1	0.4
Blood or tissue recipient	5	4	7	6	2	5	14	15	29	11.7
Household contact	3	4	2	2	5	2	10	8	18	7.3
Other blood to blood contact	3	0	0	0	2	0	5	0	5	2.0
Other	2	0	1	0	2	0	5	0	5	2.0
No risk factors identified	1	0	0	1	1	0	2	1	3	1.2
Not reported	3	2	0	0	2	2	5	4	9	3.6
Total	53	44	47	36	42	25	142	105	247	100

Table 13 Number and percentage of repeat donors with HCV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	0	0	0	0	0	0	0	0	0	0.0
Intravenous drug user	12	3	9	4	1	1	22	8	30	31.6
Tattoo/Piercing	2	3	4	4	2	1	8	8	16	16.8
Partners with any risks or known to be positive	1	2	1	2	1	2	3	6	9	9.5
Male-to-male sexual contact	0	0	0	0	0	0	0	0	0	0.0
Exposure in health care setting	1	0	1	1	1	1	3	2	5	5.3
Engaged in sex work	0	0	0	0	0	0	0	0	0	0.0
Blood or tissue recipient	0	1	5	1	2	1	7	3	10	10.5
Household contact	3	1	0	0	1	0	4	1	5	5.3
Other blood to blood contact	2	0	2	0	0	0	4	0	4	4.2
Other	2	0	0	0	1	0	3	0	3	3.2
No risk factors identified	1	1	2	2	1	1	4	4	8	8.4
Not reported	4	0	0	0	0	1	4	1	5	5.3
Total	28	11	24	14	10	8	62	33	95	100

Table 14 Number and rate¹ of HIV infection among first time donors, 2005-2010, by state/territory and year of donation

State/Territory	2005			2006			2007					
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate			
NSW/ACT	42 479	0	0.00	44 499	1	2.25	51 427	1	1.94			
NT	1 141	0	0.00	823	0	0.00	759	0	0.00			
QLD	26 988	0	0.00	27 873	1	3.59	28 575	0	0.00			
SA	9 752	0	0.00	11 457	0	0.00	10 886	0	0.00			
TAS	3 484	0	0.00	2 899	0	0.00	2 650	0	0.00			
VIC	19 346	0	0.00	22 016	0	0.00	23 172	1	4.32			
WA	9 087	0	0.00	11 116	0	0.00	11 292	1	8.86			
Total	112 277	0	0.00	120 683	2	1.66	128 761	3	2.33			
State/Territory	2008			2009			2010			Total 2005-2010		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	48 607	1	2.06	51 821	0	0.00	48 130	1	2.08	286 963	4	1.39
NT	815	0	0.00	965	0	0.00	799	0	0.00	5 302	0	0.00
QLD	29 498	3	10.17	28 889	0	0.00	28 097	2	7.12	169 920	6	3.53
SA	15 908	0	0.00	11 400	0	0.00	9 284	0	0.00	68 687	0	0.00
TAS	3 936	0	0.00	3 736	0	0.00	3 222	0	0.00	19 927	0	0.00
VIC	30 286	1	3.30	34 133	1	2.93	25 820	0	0.00	154 773	3	1.94
WA	11 307	0	0.00	12 987	0	0.00	11 149	0	0.00	66 338	1	1.51
Total	140 357	5	3.56	143 331	1	0.70	126 501	3	2.37	771 910	14	1.81

¹ Rate per 100 000 first time donations

Table 15 Number and rate¹ of HIV infection among repeat donors, 2005-2010, by state/territory and year of donation

State/Territory	2005			2006			2007		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	311 513	1	0.32	333 250	0	0.00	338 173	0	0.00
NT	8 862	0	0.00	8 496	0	0.00	10 214	0	0.00
QLD	205 398	0	0.00	216 496	0	0.00	209 556	1	0.48
SA	93 172	0	0.00	107 934	1	0.93	114 618	1	0.87
TAS	24 577	0	0.00	28 726	0	0.00	28 019	0	0.00
VIC	225 332	1	0.44	238 684	0	0.00	252 340	0	0.00
WA	101 063	0	0.00	99 376	0	0.00	109 425	0	0.00
Total	969 917	2	0.21	1 032 962	1	0.10	1 062 345	2	0.19

State/Territory	2008			2009			2010			Total 2005-2010
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	339 062	1	0.29	372 806	0	0.00	380 014	1	0.26	2 074 818
NT	11 166	0	0.00	11 158	0	0.00	10 470	0	0.00	60 366
QLD	226 726	1	0.44	242 001	2	0.83	243 837	2	0.82	1 344 014
SA	118 476	0	0.00	126 855	0	0.00	123 587	0	0.00	684 642
TAS	33 321	0	0.00	37 274	0	0.00	41 484	0	0.00	193 401
VIC	259 052	3	1.16	276 835	0	0.00	278 897	1	0.36	1 531 140
WA	113 274	0	0.00	118 327	0	0.00	120 646	0	0.00	662 111
Total	1 101 077	5	0.45	1 185 256	2	0.17	1 198 935	4	0.33	6 550 492

¹ Rate per 100 000 repeat donations

Table 16 Number and percentage of donors with HIV infection, 2008-2010, by year of donation, sex and age group

Donor status	Year of donation								Total	%
	2008		2009		2010		2008-2010			
	M	F	M	F	M	F	M	F		
First time donors										
<20 years	1	0	0	0	0	0	1	0	1	5.0
20-29 years	0	0	1	0	0	0	1	0	1	5.0
30-39 years	3	0	0	0	1	0	4	0	4	20.0
40-49 years	0	0	0	0	0	0	0	0	0	0.0
50-59 years	1	0	0	0	0	0	1	0	1	5.0
60 years and above	0	0	0	0	0	0	0	0	0	0.0
Repeat donors										
<20 years	0	0	0	0	0	0	0	0	0	0.0
20-29 years	2	0	0	0	1	1	3	1	4	20.0
30-39 years	0	1	0	1	2	0	2	2	4	20.0
40-49 years	1	1	0	0	0	0	1	1	2	10.0
50-59 years	0	0	1	0	1	1	2	1	3	15.0
60 years and above	0	0	0	0	0	0	0	0	0	0.0
Total	8	2	2	1	5	2	15	5	20	100

Table 17 Number and percentage of donors with HIV infection, 2008-2010, by year of donation and region of birth¹

Region of birth	2008		2009		2010		Total 2008-2010	
	Number	%	Number	%	Number	%	Number	%
Australia	7	70	2	67	6	86	15	75
Overseas born								
<i>Other Oceania</i>	0	0	0	0	1	14	1	5
<i>United Kingdom and Ireland</i>	1	10	0	0	0	0	1	5
<i>Other Europe</i>	0	0	0	0	0	0	0	0
<i>Middle East/North Africa</i>	0	0	0	0	0	0	0	0
<i>Sub-Saharan Africa</i>	0	0	0	0	0	0	0	0
<i>South East Asia</i>	1	10	1	33	0	0	2	10
<i>Southern and Central Asia</i>	1	10	0	0	0	0	1	5
<i>North America</i>	0	0	0	0	0	0	0	0
<i>South/Central America and the Caribbean</i>	0	0	0	0	0	0	0	0
Total with a reported country of birth	10	100	3	100	7	100	20	100
Not reported	0	0	0	0	0	0	0	0
Total	10	100	3	100	7	100	20	100

¹ Region of birth from the Australian Bureau of Statistics.

Table 18 Number and percentage of first time donors with HIV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	0	0	0	0	0	0	0	0	0	0.0
Intravenous drug user	0	0	0	0	0	0	0	0	0	0.0
Tattoo/Piercing	1	0	0	0	0	0	1	0	1	14.3
Partners with any risks or known to be positive	1	0	0	0	1	0	2	0	2	28.6
Male-to-male sexual contact	3	0	1	0	0	0	4	0	4	57.1
Exposure in health care setting	0	0	0	0	0	0	0	0	0	0.0
Engaged in sex work	0	0	0	0	0	0	0	0	0	0.0
Blood or tissue recipient	0	0	0	0	0	0	0	0	0	0.0
Household contact	0	0	0	0	0	0	0	0	0	0.0
Other blood to blood contact	0	0	0	0	0	0	0	0	0	0.0
Other	0	0	0	0	0	0	0	0	0	0.0
No risk factors identified	0	0	0	0	0	0	0	0	0	0.0
Not reported	0	0	0	0	0	0	0	0	0	0.0
Total	5	0	1	0	1	0	7	0	7	100

Table 19 Number and percentage of repeat donors with HIV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	0	0	0	0	0	0	0	0	0	0.0
Intravenous drug user	0	0	0	0	0	0	0	0	0	0.0
Tattoo/Piercing	0	0	0	0	0	0	0	0	0	0.0
Partners with any risks or known to be positive	0	2	0	1	2	2	2	5	7	53.8
Male-to-male sexual contact	3	0	0	0	1	0	4	0	4	30.8
Exposure in health care setting	0	0	0	0	0	0	0	0	0	0.0
Engaged in sex work	0	0	0	0	0	0	0	0	0	0.0
Blood or tissue recipient	0	0	0	0	0	0	0	0	0	0.0
Household contact	0	0	0	0	0	0	0	0	0	0.0
Other blood to blood contact	0	0	0	0	1	0	1	0	1	7.7
Other	0	0	0	0	0	0	0	0	0	0.0
No risk factors identified	0	0	1	0	0	0	1	0	1	7.7
Not reported	0	0	0	0	0	0	0	0	0	0.0
Total	3	2	1	1	4	2	8	5	13	100

Table 20 Association of demographic characteristics with HIV infection among blood donors in Australia by year of donation, 2008-2010

	2008			2009			2010		
	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR ¹ and their 95% CI ² (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)
Sex									
Male	259 712	8 (3.08)	1 (ref)	272 318	2 (0.73)	1 (ref)	269 297	5 (1.86)	1 (ref)
Female	277 014	2 (0.72)	0.24 (0.05 - 1.11)	296 372	1 (0.34)	0.46 (0.04 - 5.07)	285 284	2 (0.7)	0.38 (0.07 - 1.98)
Age group (years)									
Less than 20	46 652	1 (2.14)	1 (ref)	39 039	0	1 (ref)	51 378	0	1 (ref)
20-29	111 245	2 (1.8)	0.76 (0.07 - 8.47)	120 340	1 (0.83)	-	117 246	2 (1.71)	-
30-39	84 925	4 (4.71)	1.87 (0.21 - 16.91)	91 707	1 (1.09)	-	86 037	3 (3.49)	-
40-49	105 699	2 (1.89)	0.76 (0.07 - 8.52)	107 560	0	-	102 736	0	-
50 and above	188 205	1 (0.53)	0.22 (0.01 - 3.5)	210 044	1 (0.48)	-	197 184	2 (1.01)	-
State/Territory									
NSW	161 421	2 (1.24)	1 (ref)	175 490	0	1 (ref)	173 277	2 (1.15)	1 (ref)
ACT	15 118	0	-	15 434	0	-	14 829	0	-
NT	4 638	0	-	4 732	0	-	4 461	0	-
QLD	111 227	4 (3.6)	2.97 (0.54 - 16.31)	115 220	2 (1.74)	-	115 314	4 (3.47)	2.9 (0.53 - 15.86)
SA	56 388	0	-	56 899	0	-	53 303	0	-
TAS	15 319	0	-	16 013	0	-	16 319	0	-
VIC	125 481	4 (3.19)	2.5 (0.45 - 13.75)	135 498	1 (0.74)	-	127 498	1 (0.78)	0.63 (0.06 - 6.99)
WA	47 134	0	-	49 404	0	-	49 580	0	-
Total	536 726	10 (1.86)		568 690	3 (0.53)		554 581	7 (1.26)	

1 IRR = Incident Rate Ratio

2 CI = Confidence intervals

Table 21 Number and rate¹ of HTLV infection among first time donors, 2005-2010, by state/territory and year of donation

State/ Territory	2005			2006			2007		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	42 479	0	0.00	44 499	1	2.25	51 427	1	1.94
NT	1 141	0	0.00	823	0	0.00	759	0	0.00
QLD	26 988	1	3.71	27 873	1	3.59	28 575	0	0.00
SA	9 752	0	0.00	11 457	0	0.00	10 886	0	0.00
TAS	3 484	0	0.00	2 899	0	0.00	2 650	0	0.00
VIC	19 346	0	0.00	22 016	1	4.54	23 172	0	0.00
WA	9 087	0	0.00	11 116	0	0.00	11 292	0	0.00
Total	112 277	1	0.89	120 683	3	2.49	128 761	1	0.78

State/ Territory	2008			2009			2010			Total 2005-2010
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	48 607	0	0.00	51 821	2	3.86	48 130	0	0.00	286 963
NT	815	0	0.00	965	0	0.00	799	0	0.00	5 302
QLD	29 498	0	0.00	28 889	2	6.92	28 097	1	3.56	169 920
SA	15 908	1	6.29	11 400	1	8.77	9 284	0	0.00	68 687
TAS	3 936	0	0.00	3 736	0	0.00	3 222	0	0.00	19 927
VIC	30 286	4	13.21	34 133	2	5.86	25 820	0	0.00	154 773
WA	11 307	2	17.69	12 387	2	16.15	11 149	0	0.00	66 338
Total	140 357	7	4.99	143 331	9	6.28	126 501	1	0.79	771 910

¹ Rate per 100 000 first time donations

Table 22 Number and percentage of donors with HTLV infection, 2008-2010, by year of donation, sex and age group

Donor status	Year of donation								Total	%
	2008		2009		2010 ¹		2008-2010			
	M	F	M	F	M	F	M	F		
First time donors										
<20 years	0	0	1	0	0	0	1	0	1	5.9
20-29 years	0	1	1	1	0	0	1	2	3	17.6
30-39 years	3	0	3	0	0	0	6	0	6	35.3
40-49 years	1	2	0	0	0	0	1	2	3	17.6
50-59 years	0	0	1	1	0	0	1	1	2	11.8
60 years and above	0	0	0	0	0	1	0	1	1	5.9
Repeat donors										
<20 years	0	0	0	0	0	0	0	0	0	0.0
20-29 years	0	0	0	0	0	0	0	0	0	0.0
30-39 years	0	0	0	0	0	0	0	0	0	0.0
40-49 years	0	0	0	0	0	0	0	0	0	0.0
50-59 years	0	0	0	1	0	0	0	1	1	5.9
60 years and above	0	0	0	0	0	0	0	0	0	0.0
Total	4	3	6	3	0	1	10	7	17	100

1 Age of one HTLV positive repeat male donor in 2010 was unknown

Table 23 Number and percentage of donors with HTLV infection, 2008-2010, by year of donation and region of birth¹

Region of birth	2008		2009		2010		2008-2010		
	Number	%	Number	%	Number	%	Number	%	
Australia	0	0	3	33	0	0	3	17	
Overseas born									
<i>Other Oceania</i>	1	14	0	0	0	0	1	6	
<i>United Kingdom and Ireland</i>	0	0	0	0	0	0	0	0	
<i>Other Europe</i>	0	0	0	0	0	0	0	0	
<i>Middle East/North Africa</i>	1	14	0	0	0	0	1	6	
<i>Sub-Saharan Africa</i>	0	0	0	0	0	0	0	0	
<i>South East Asia</i>	0	0	1	11	0	0	1	6	
<i>Southern and Central Asia</i>	5	71	2	22	0	0	7	39	
<i>North America</i>	0	0	0	0	0	0	0	0	
<i>South/Central America and the Caribbean</i>	0	0	0	0	1	50	1	6	
Total with a reported country of birth	7	100	6	67	1	50	14	78	
Not reported	0	0	3	33	1	50	4	22	
Total	7	100	9	100	2	100	18	100	

1 Region of birth from the Australian Bureau of Statistics.

Table 24 Number and percentage of first time donors with HTLV infection, 2008-2010, by exposure category, year and sex

Exposure categories	2008		2009		2010		Total (2008-2010)			%
	Male	Female	Male	Female	Male	Female	Male	Female	Total	
Ethnicity/Country of birth	4	2	3	1	0	1	7	4	11	68.8
Intravenous drug user	0	0	0	0	0	0	0	0	0	0.0
Tattoo/Piercing	0	0	0	0	0	0	0	0	0	0.0
Partners with any risks or known to be positive	0	1	0	0	0	0	0	1	1	6.3
Male-to-male sexual contact	0	0	0	0	0	0	0	0	0	0.0
Exposure in health care setting	0	0	0	0	0	0	0	0	0	0.0
Engaged in sex work	0	0	0	0	0	0	0	0	0	0.0
Blood or tissue recipient	0	0	0	1	0	0	0	1	1	6.3
Household contact	0	0	1	0	0	0	1	0	1	6.3
Other blood to blood contact	0	0	0	0	0	0	0	0	0	0.0
Other	0	0	0	0	0	0	0	0	0	0.0
No risk factors identified	0	0	0	0	0	0	0	0	0	0.0
Not reported	0	0	2	0	0	0	2	0	2	12.5
Total	4	3	6	2	0	1	10	6	16	100

Table 25 Association of demographic characteristics with HTLV infection among blood donors in Australia by year of donation, 2008-2010

	2008			2009			2010		
	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR ¹ and their 95% CI ² (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)	Number of donors	Number of positive donors (Number per 100 000 donors)	IRR and their 95% CI (Multivariate adjusted)
Sex									
Male	259 712	4 (1.54)	1 (ref)	272 318	6 (2.2)	1 (ref)	269 297	1 (0.37)	1 (ref)
Female	277 014	3 (1.08)	0.69 (0.15 - 3.08)	296 372	3 (1.01)	0.43 (0.11 - 1.75)	285 284	1 (0.35)	-
Age group (years)*									
Less than 20	46 652	0	1 (ref)	39 039	1 (2.56)	1 (ref)	51 378	0	1 (ref)
20-29	111 245	1 (0.9)	-	120 340	2 (1.66)	0.75 (0.08 - 7.34)	117 246	0	-
30-39	84 925	3 (3.53)	-	91 707	3 (3.27)	0.93 (0.1 - 9.11)	86 037	0	-
40-49	105 699	3 (2.84)	-	107 560	0 (0)	-	102 736	0	-
50 and above	188 205	0	-	210 044	3 (1.43)	0.27 (0.02 - 2.99)	197 184	1 (0.51)	-
State/Territory									
NSW	161 421	0	1 (ref)	175 490	1 (0.56)	1 (ref)	173 277	1 (0.58)	1 (ref)
ACT	15 118	0	-	15 434	0	-	14 829	0	-
NT	4 638	0	-	4 732	0	-	4 461	0	-
QLD	111 227	0	-	115 220	0	-	115 314	1 (0.87)	-
SA	56 388	1 (1.77)	-	56 899	1 (1.75)	3.61 (0.22 - 58.16)	53 303	0	-
TAS	15 319	0	-	16 013	0	-	16 319	0	-
VIC	125 481	4 (3.19)	-	135 498	4 (2.95)	5.5 (0.61 - 49.91)	127 498	0	-
WA	47 134	2 (4.24)	-	49 404	3 (6.07)	11.97 (1.23 - 116.72)	49 580	0	-
Total	536 726	7 (1.3)		568 690	9 (1.58)		554 581	2 (0.36)	

1 IRR = Incident Rate Ratio

2 CI = Confidence Intervals

Table 26 Number and rate¹ of active syphilis among first time donors, 2005-2010, by state/territory and year of donation

State/Territory	2005			2006			2007		
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate
NSW/ACT	42 479	0	0.00	44 499	0	0.00	51 427	0	0.00
NT	1 141	0	0.00	823	0	0.00	759	0	0.00
QLD	26 988	0	0.00	27 873	1	3.59	28 575	1	3.50
SA	9 752	0	0.00	11 457	1	8.73	10 886	0	0.00
TAS	3 484	0	0.00	2 899	0	0.00	2 650	0	0.00
VIC	19 346	0	0.00	22 016	0	0.00	23 172	0	0.00
WA	9 087	0	0.00	11 116	0	0.00	11 292	0	0.00
Total	112 277	0	0.00	120 683	2	1.66	128 761	1	0.78

State/Territory	2008			2009			2010			Total 2005-2010
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	48 607	0	0.00	51 821	0	0.00	48 130	0	0.00	0
NT	815	1	122.70	965	1	103.63	799	0	0.00	2
QLD	29 498	0	0.00	28 889	1	3.46	28 097	2	7.12	5
SA	15 908	0	0.00	11 400	0	0.00	9 284	2	21.54	3
TAS	3 936	0	0.00	3 736	0	0.00	3 222	0	0.00	0
VIC	30 286	0	0.00	34 133	1	2.93	25 820	1	3.87	2
WA	11 307	2	17.69	12 387	1	8.07	11 149	0	0.00	3
Total	140 357	3	2.14	143 331	4	2.79	126 501	5	3.95	15

¹ Rate per 100 000 first time donations

Table 27 Number and rate¹ of active syphilis among repeat donors, 2005-2010, by state/territory and year of donation

State/Territory	2005			2006			2007			
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	311 513	0	0.00	333 250	0	0.00	338 173	0	0.00	
NT	8 862	0	0.00	8 496	0	0.00	10 214	0	0.00	
QLD	205 398	0	0.00	216 496	0	0.00	209 556	0	0.00	
SA	93 172	0	0.00	107 934	0	0.00	114 618	0	0.00	
TAS	24 577	0	0.00	28 726	0	0.00	28 019	0	0.00	
VIC	225 332	0	0.00	238 684	0	0.00	252 340	1	0.40	
WA	101 063	0	0.00	99 376	0	0.00	109 425	0	0.00	
Total	969 917	0	0.00	1 032 962	0	0.00	1 062 345	1	0.09	
State/Territory	2008			2009			2010			Total 2005-2010
	Donations	Positive	Rate	Donations	Positive	Rate	Donations	Positive	Rate	
NSW/ACT	339 062	1	0.29	372 806	0	0.00	380 014	1	0.26	2 074 818
NT	11 166	0	0.00	11 158	1	8.96	10 470	1	9.55	60 366
QLD	226 726	0	0.00	242 001	1	0.41	243 837	1	0.41	1 344 014
SA	118 476	0	0.00	126 855	0	0.00	123 587	0	0.00	684 642
TAS	33 321	1	3.00	37 274	0	0.00	41 484	0	0.00	193 401
VIC	259 052	0	0.00	276 835	0	0.00	278 897	0	0.00	1 531 140
WA	113 274	1	0.88	118 327	1	0.85	120 646	0	0.00	662 111
Total	1 101 077	3	0.27	1 185 256	3	0.25	1 198 935	3	0.25	6 550 492
										10
										0.15

¹ Rate per 100 000 repeat donations

Methodological notes

Age-specific rate

Age-specific rate is defined as the proportion of blood donors in a particular age group who have the infection, usually expressed per 100 000 donors in the specified age group. Age-specific rate was calculated as follows:

$$\text{Age-specific rate of HBV infection among donors aged 20-29 years} = \left(\frac{\text{Number of donors with HBV infection aged 20-29 years}}{\text{Total number of donors aged 20-29 years}} \right) \times 100\,000$$

Donor-years of observation

Data on the interval between each donation by all donors who donated at least twice in 2008-2010 were available from the Blood Service database. For all donors with negative tests for transfusion-transmissible viral infections, donor-years of observation were calculated as the sum of all inter-donation intervals. For positive donors, donor-years of observation were calculated as the sum of all inter-donation intervals between the first negative and the positive donation.

Exposure categories

A single most important risk factor for each positive donor was identified using the primary risk factor data from the Blood Service risk factor database. The key exposure categories for positive donors were classified as follows:

1. Intravenous drug use (IDU)
2. Country of birth (COB)/Ethnicity
3. Partners with any risks or known to be positive
4. Engaged in sex work within the previous 12 months
5. Male-to-male sexual contact within the previous 12 months
6. Blood or tissue recipient
7. Tattoo or body piercing
8. Exposure in health care setting (both occupational and non-occupational)
9. Household contact
10. Other blood to blood contact
11. Others
12. No risk factors identified
13. Not reported

For a consistent comparison of the proportion of major exposure categories between blood donors and the general population, *Partners with any risks or known to be positive*, *Engaged in sex work within the previous 12 months* and *Male-to-male sexual contact within the previous 12 months* were combined to create a broader risk category named *Sexual contact*. Thus, from the above thirteen key categories, the following exposure groups were established to match the main exposure groups in the general population for each of the transfusion-transmissible infections.

The key exposure categories modified for comparison with general population were as follows:

1. Intravenous drug use (IDU)
2. Country of birth (COB)/Ethnicity
3. Sexual contact
 - a. Partners with any risks or known to be positive
 - b. Engaged in sex work within the previous 12 months
 - c. Male-to-male sexual contact within the previous 12 months
4. Blood or tissue recipient
5. Tattoo or body piercing
6. Exposure in health care setting
7. Household contact
8. Other blood to blood contact
9. Others
10. No risk factors identified
11. Not reported

Please note that unlike the general population the risk categories *Engaged in sex work* and *Male-to-male sexual contact* are time restricted for blood donors in Australia. Any history of engagement in sex work within the past 12 months and a history of male-to-male sexual contact within the past 12 months are defined as the risk factors for transfusion-transmissible infections in blood donors.

Incidence

Incidence of transfusion-transmissible infection is defined as a rate per 100 000 donor-years of observation. It was calculated as follows:

$$\text{Incidence per 100 000 donor-years of observation} = \left(\frac{\text{Number of seroconverters}}{\text{Total donor-years of observation}} \right) \times 100\,000$$

Newly acquired infection

Newly acquired infection is defined as newly diagnosed infection with evidence of acquisition of infection in the 12 months (HIV) or 24 months (HBV and HCV) prior to diagnosis.

Newly diagnosed infection

Newly diagnosed infection is defined as the first occasion of diagnosis in Australia.

Prevalence

Prevalence is defined as the number of positive donations per 100 000 donations. It was calculated as follows:

$$\text{Prevalence in first time donors} = \left(\frac{\text{Number of positive first time donations}}{\text{Total number of first time donations}} \right) \times 100\,000$$

$$\text{Prevalence in all donors} = \left(\frac{\text{Number of donations (both first time and repeat) positive for a TTI marker}}{\text{Total number of accepted donations (both first time and repeat)}} \right) \times 100\,000$$

Remoteness categories

Remoteness of residence for a donor was determined using postcode data. The Australian Bureau of Statistics (ABS) remoteness index plus (ARIA plus) was used to assign any of the following for each of the positive donors in 2008-2010.

ARIA plus index	Remoteness Area Name
0 to 0.2	Major Cities of Australia
Greater than 0.2 and less than or equal to 2.4	Inner Regional Australia
Greater than 2.4 and less than or equal to 5.92	Outer Regional Australia
Greater than 5.92 and less than or equal to 10.53	Remote Australia
Greater than 10.53	Very Remote Australia
Off-shore, migratory and shipping Census Collection Districts (CCDs)	Migratory

More information on ABS geography including remoteness categories and ARIA index are available via <http://www.abs.gov.au/geography> .

Residual risk estimates

Estimates were derived based on a minor refinement to the method described in earlier studies^{21,22}. Briefly, viral point estimates are derived by determining the probability of an undetected 'window period' donation in a given time period. Three models are applied providing a median and an upper and lower plausible estimate. The models essentially assess the rate of seroconversion (i.e. positive donors who have previously tested negative for the same marker) in the repeat donor (RD) population as a measure of viral incidence (i.e. early or acute infection). In order to incorporate the incidence in first time donors (FTD) (who have no previous testing at the Blood Service), one model uses a separate calculation whereas the other two use a correction factor for the RD incidence based on the proportion of NAT positive/antibody negative (i.e. NAT yield) donors in the FTD and RD populations respectively. Two models also incorporate the average inter-donation interval for all seroconverters (in days) between the positive result and previous negative result. The longer this interval for an individual donor, the less risk the donor was in the WP at the time of donation i.e. the inter-donation interval is inversely proportional to the risk.

The models assume that the risk of collecting blood from an infectious donor predominantly relates to them being in the WP (i.e. incident infection) and the best estimate of incidence is the rate of seroconversion in the RD population. While the assumption that WP donors account for the majority of risk seems to hold true for HIV, HCV and HTLV, HBV is problematic because of 'chronic' infection (i.e. HBsAg negative/anti-HBc positive). Whereas one model includes a correction factor for the incidence to compensate for chronic infection the other two do not. This is a potential confounder for HBV RR estimation with the relative impact dependent on the proportion of acute versus chronic HBV infection in the donor population.

The number of seroconverters for the 2009-2010 period used in the models is as shown in tables 4-7 for the appropriate virus. Further information is available at http://www.transfusion.com.au/adverse_events/risks/estimates

Statistical tests to analyse trends in transfusion-transmissible infections

Trends in prevalence and incidence of transfusion-transmissible infections were examined for the year 2005-2010. Poisson regression analysis was used to calculate incidence rate ratios (IRRs) and their 95% confidence intervals. A p-value of less than 0.05 was considered as statistically significant.

Tabulated count data on the demographic characteristics (sex, age group, state/territory and year of donation) for all blood donors (both positive and negative donors) were retrieved for the period 2008-2010. The association between demographic factors and presence of any transfusion-transmissible viral infections (HBV, HCV, HIV and HTLV) among Australian blood donors were assessed using multivariate Poisson regression model for each year separately. For each factor, non-overlapping confidence intervals were considered to be an indication of significant trends across the years.

21 Seed CR, Kiely P, Keller AJ. op. cit. 2005

22 Seed Clive R, Cheng A, Ismay Susan L, Bolton Wayne V, Kiely P, Cobain Trevor J, et al. Assessing the accuracy of three viral risk models in predicting the outcome of implementing HIV and HCV NAT donor screening in Australia and the implications for future HBV NAT. *Transfusion*. 2002;42(10):1365-72.

