Trends in hepatitis B prevalence and associated risk factors among Indigenous and non-Indigenous prison entrants in Australia, 2004 to 2013

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Abstract

Objective: This study describes and compares prevalence trends of markers for hepatitis B (HBV) from 2004 to 2013 and HBV risk factors between Indigenous and non-Indigenous prison entrants.

Methods: A cross-sectional survey carried out over two weeks in 2004, 2007, 2010 and 2013 in reception prisons in New South Wales, Queensland, Western Australia and Tasmania.

Results: The study included 2,223 prison entrants; 544 were Indigenous. Indigenous prison entrants had significantly higher hepatitis B core antibody (anti-HBc) prevalence than non-Indigenous prisoners in 2004 (29% *vs.* 18%, *P*=0.026), 2007 (40% *vs.* 15%, *P*<0.001) and 2010 (21% *vs.* 16% 2010, *P*=0.002), and similar anti-HBc prevalence to non-Indigenous entrants in 2013 (14% *vs.* 14%, *P*=0.888), with a significant decline from 2007 for Indigenous entrants (*P*=0.717).^ Being more than 30 years old and coming from an area classified as 'non-highly accessible' were associated with anti-HBc positivity in both populations. For Indigenous prison entrants, first time in prison and survey year was associated with anti-HBc positivity. For non-Indigenous participants, a history of injecting drug use and body piercings was associated with anti-HBc positivity.

Conclusion: There are unique risk factors associated with HBV prevalence for both Indigenous and non-Indigenous prison entrants.

Implications for public health: In developing public health programs and policies for HBV, consideration of similarities and differences of associated HBV risk factors between Indigenous and non-Indigenous offenders is required.

Key words: prison, Indigenous health, viral hepatitis

Prisoners are at increased risk of contracting bloodborne viruses (BBV) as a result of high levels of engagement with injecting drug use (IDU). It is estimated that approximately 45% of those entering prisons in Australia have injected drugs in the past.[1] Compounding this is a lack of harm reduction strategies available in prison settings.[2] Sharing injecting equipment presents a risk of BBV transmission, with harm reduction initiatives such as needle and syringe exchange programs uncommon in prisons internationally.[3]

Aboriginal and Torres Strait Islander people (from here on referred to as Indigenous) represent almost 3% of the Australian population yet account for 27% of the Australian prisoner population.[4] Indigenous people in contact with the justice system are recognised as a priority population in the Australian Government's National Aboriginal and Torres Strait Islander Blood Borne Viruses and Sexually Transmissible Infections Strategy.[5] Priority action areas in this strategy include strengthening evidence-based harm reduction approaches in the custodial setting, and surveillance and monitoring research. In the general Indigenous Australian population, 3.9% are estimated to have acute or chronic hepatitis B virus (HBV) infection.[6] Those living with chronic, untreated HBV are estimated to have a 15–40% risk of developing complications including cirrhosis or hepatocellular carcinoma.[7] The sequelae of chronic HBV infection poses a significant socioeconomic burden, in the form of hospitalisation, reduced health-related quality of life and loss of productivity.[7] Before 2000, the prevalence of HBV surface antigen (HBsAg), which is a marker of acute or chronic HBV infection, was 6.47% among Indigenous Australians compared with 0.36% in non-Indigenous Australians. Post 2000, following the introduction of a national HBV vaccination program, the prevalence was 2.25% and 0.90%, respectively.[8]

Australian studies examining HBV risk factors among prisoners are scarce. Five studies were identified that reported on the prevalence

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Correction added on 2 April 2019, after first online publication: This article has been updated to correct the name of the author from 'John Kaldo' to 'John Kaldor'. The second line of the 'Results' section of the Abstract has also been corrected to read 'Hepatitis B' instead of 'Hepatitis C', as indicated by the symbol ^.

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of HBV markers such as HBV core antibody (anti-HBc), which indicates previous or ongoing infection, and HBsAg, and associated risk factors by Indigenous status. Of these, only two analysed data from multiple jurisdictions. Butler et al.[9] analysed 2004 data from New South Wales (NSW), Queensland, Western Australia (WA) and Tasmania, reporting anti-HBc prevalence to be 27% in Indigenous participants compared with 18% in their non-Indigenous counterparts. In 2007, Gidding et al.[10] collected data from all jurisdictions except the Northern Territory, reporting anti-HBc prevalence of 33% in Indigenous participants while only 7.3% among non-Indigenous participants. Using 2004, 2007, 2010 and 2013 survey data, this study describes the prevalence and factors associated with HBV antibodies among Indigenous and non-Indigenous prison entrants.

Methods

Survey

The National Prison Entrants Blood-borne Virus Survey (NPEBBVS) is a triennial cross-sectional survey established in 2004. The NPEBBVS monitors the prevalence of Human Immunodeficiency Virus (HIV), hepatitis C virus (HCV), HBV, sexually transmissible infections (STIs) and risk behaviours among people entering Australian prisons.

The NPEBBVS survey methods have been described in detail elsewhere.[9,11,12] Briefly, data collection takes place over an approximate two-week period. For the 2004 survey, this period occurred in May. For the 2007 and 2010 surveys, data collection periods occurred in October. For the 2013 survey, data collection happened in February, except for NSW, where it occurred from 27 May to 9 June. The survey is offered to incoming inmates immediately after the reception health and welfare assessments. Due to operational issues, every third incoming inmate in NSW in 2013 was invited to participate. The screening procedures are made up of several stages to ensure consistency of administration of the survey. These include recruitment, obtaining informed participant consent, administration of a short risk-behaviour questionnaire, and collecting blood and urine samples. A blood sample is collected to test for markers of HCV, HBV, HIV, and syphilis; a urine specimen is used to test for chlamydia and gonorrhoea. Anti-HBc was used as a marker of HBV in this analysis.[13] The demographic data of participants and prevalence of anti-HBc from survey years 2004, 2007, 2010 and 2013 were examined. Only those jurisdictions that had participated in all four survey years (NSW, WA, Queensland and Tasmania) were included in the analysis. Survey participants with missing data on Indigenous status were excluded from the analysis.

Data analysis

Categorical data for participant characteristics, including HBV risk behaviours, are presented as frequencies (percentages) and continuous data as medians with interquartile range (IQR). Continuous variables were compared across survey years using the Kruscal-Wallis test and categorical variables using the Chi-squared or Fisher exact test. The Chi-squared test was used to test for trends for anti-HBc and HBsAg prevalence.

To study correlates of anti-HBc prevalence, we used univariate and multivariate logistic regression models. Association with the following factors were considered: survey year, gender, age, any body piercings, prior imprisonment, ever injected drugs, any tattoos, and residential remoteness (i.e. Accessibility/Remoteness Index of Australia [ARIA]). ARIA calculations were based on participant's postcode of last residence prior to entering prison and classified into two categories: highly accessible (locations with higher access to service provision); and non-highly accessible (locations with less access to service provision). These variables were selected because of their theoretical relevance and because we were specifically interested in their effect based on prior research. Variables were included in the full model if they were associated with anti-HBc prevalence in univariate analysis with a *P* value of 0.20. A final model was then created, by using a forward stepwise procedure with a *P* value of 0.05 considered statistically significant in the adjusted analysis. The estimated adjusted odds ratios (aOR) were reported with their 95% confidence intervals (95% CIs). In order to focus on populations that are more homogenous than the entire sample, two multivariate models were created using this methodology for Indigenous and non-Indigenous groups. Due to the small number of events, no logistic regression analysis was undertaken for HBsAG. Data analysis was conducted in SPSS 22.

Results

Participants

Overall, 2,223 prison entrants participated: 2004: n=595 (26.8%); 2007: n=537 (24.2%); 2010: n=610 (27.4%); and 2012: 472 (21.2%). Participation rates by survey year were: 77% (2004), 76% (2007), 76% (2010) and 64% (2013). Six individuals participated in more than one survey. A sensitivity analysis was conducted to assess the extent to which findings were affected by the inclusion and exclusion of these six participants, as well as the inclusion of their first survey responses only. This analysis showed no noticeable changes in statistical findings and thus data collected from the participants in all years were included.

Overall, the majority of participants were men (89.2%) and identified as heterosexual (96.2%), with 544 (24.5%) identifying as Indigenous Australian. The median age was 28 (IQR-14) for Indigenous participants and 31 (IQR-14) for non-Indigenous participants, respectively.

Characteristics of Indigenous and non-Indigenous prison entrants by survey year are presented in Table 1. The proportion of Indigenous and non-Indigenous participants entering prison from a non-highly accessible area significantly increased ($P<0.001$, and $P<0.001$, respectively) in more recent years. However, the proportion of non-Indigenous prison entrants from a non-highly accessible area was considerably lower over time when compared to Indigenous participants (17.0% *vs.* 4.8% in 2004; 11.5% *vs.* 5.2% in 2007; 46.6% *vs.* 11.2% in 2010; and 36.6% *vs.* 12.3% in 2013). The proportion of non-Indigenous participants entering prison for the first time increased over time (26.7% in 2004; 33.3% in 2007; 37.8% in 2010; and 35.6% in 2013; $P=0.002$). For Indigenous participants, the proportion that entered prison for the first time did not significantly change across survey years.

Significant differences in HBV risk behaviours were observed among both Indigenous and non-Indigenous prison entrants over time (Table 1). The proportion of entrants who had a tattoo significantly increased ($P<0.001$) across survey years among non-Indigenous participants. Additionally, the proportion of Indigenous and non-Indigenous participants who reported ever injecting amphetamine significantly increased ($P<0.001$) from 2010 to 2013, while ever injecting heroin significantly decreased ($P<0.001$) during this same period.

Table 1: Characteristics of Indigenous and non-Indigenous prison entrants by survey year.

Characteristic	Indigenous					Non-Indigenous				
	2004 N=100	2007 N=113	2010 N=167	2013 N=164	*P* value	2003 N=495	2007 N=424	2010 N=452	2013 N=308	*P* value
Gender										
Male	80 (80.0)	96 (85.0)	147 (88.0)	142 (86.6)	0.324	447 (90.3)	385 (90.8)	419 (92.7)	266 (86.4)	0.088
Age, years										
≤ 29	48 (48.5)	59 (52.2)	98 (59.0)	84 (52.2)	0.357	234 (47.5)	203 (48.0)	213 (47.2)	120 (39.3)	0.078
≥ 30	51 (51.5)	54 (47.8)	68 (41.0)	77 (47.8)		259 (52.5)	220 (52.0)	238 (52.8)	185 (60.7)	
Median (IQR)	30 (22-35)	28 (23-37)	28 (21-35)	29 (23-37)	0.301	30 (24-38)	30 (24-36)	31 (24-38)	32 (25-41)	0.134
ARIA[a]										
Highly accessible	80 (80.0)	88 (77.9)	84 (51.5)	98 (59.8)	<0.001	453 (91.5)	379 (89.4)	387 (86.8)	258 (83.8)	<0.001
Not highly accessible	17 (17.0)	13 (11.5)	76 (46.6)	60 (36.6)		24 (4.8)	22 (5.2)	50 (11.2)	38 (12.3)	
First time in prison										
Yes	18 (18.0)	23 (20.4)	35 (21.3)	37 (22.6)	0.844	132 (26.7)	140 (33.3)	169 (37.8)	109 (35.6)	0.002
Ever injected drugs										
Yes	64 (64.0)	68 (60.2)	75 (45.2)	89 (54.3)	0.012	285 (57.7)	224 (52.8)	206 (46.0)	154 (50.0)	0.004
Injected in last month[b]										
Yes	41 (64.1)	44 (64.7)	45 (60.0)	62 (69.7)	0.819	185 (64.9)	125 (55.8)	113 (54.9)	108 (70.1)	0.040
Missing	0 (0)	1 (1.5)	1 (1.3)	1 (1.1)		3 (1.1)	5 (2.2)	2 (1.0)	1 (0.6)	
Shared injecting equipment in past month[b]										
Yes	11 (17.2)	19 (27.9)	15 (20.0)	14 (15.7)	0.013	52 (18.2)	50 (22.3)	32 (15.5)	18 (11.7)	<0.001
Missing	24 (37.5)	27 (39.7)	34 (45.3)	29 (32.6)		97 (34.0)	109 (48.7)	94 (45.6)	49 (31.8)	
Tattoos										
Yes	62 (62.0)	77 (68.1)	98 (58.7)	128 (78.0)	<0.001	301 (60.8)	268 (63.2)	303 (67.0)	228 (74.0)	<0.001
Missing	0 (0)	0 (0)	11 (6.6)	1 (0.6)		1 (0.2)	0 (0)	5 (1.1)	1 (0.3)	
Body piercings										
Yes	47 (47.0)	60 (53.1)	73 (43.7)	65 (39.6)	0.149	204 (41.2)	205 (48.3)	168 (37.2)	122 (39.6)	0.007
Missing	0 (0)	0 (0)	0 (0)	2 (1.2)		2 (0.4)	5 (1.2)	5 (1.1)	0 (0)	
Ever injected amphetamines?										
Yes	0 (0)	0 (0)	49 (31.0)	71 (43.8)	<0.001	0 (0)	0 (0)	120 (27.1)	140 (45.5)	<0.001
Missing	100 (100)	113 (100)	38 (24.1)	35 (21.6)		495 (100)	424 (100)	181 (41.0)	95 (30.8)	
Ever injected heroin?										
Yes	0 (0)	0 (0)	20 (12.7)	17 (10.5)	<0.001	0 (0)	0 (0)	51 (11.5)	29 (9.4)	<0.001
Missing	100 (100)	113 (100)	38 (24.1)	35 (21.6)		495 (100)	424 (100)	181 (41.0)	95 (30.8)	

Notes:

Data provided as n (%) unless otherwise noted

a: Accessibility/Remoteness Index of Australia is a remoteness measurement tool that provides a quantifiable index of remoteness in relation to service provision

b: For those who have ever injected

Hepatitis B prevalence and risk factors

Anti-HBc and HBsAg prevalence for Indigenous and non-Indigenous participants across survey years is presented in Figure 1. For non-Indigenous entrants, there was a slight decline in anti-HBc prevalence across survey years, from 17.8% (95%CI,14.1%–22.0%) in 2004 to 14.2% (95%CI, 9.5%–20.2%) in 2013. However, this variation was not significant (*P*=0 .717). For Indigenous prison entrants, the decline in anti-HBc prevalence was more pronounced from 28.9% (95%CI, 19.7%–39.8%) in 2004 and 39.6% (95%CI, 30.2%–49.6%) in 2007 to 21.2% (95%CI, 14.5%–29.4%) in 2010 and 13.5% (95%CI, 7.2%–22.6%) in 2013 (Figure 1). Anti-HBc prevalence was significantly higher among Indigenous than non-Indigenous participants in 2004 (*P*=0.026), in 2007 (*P*<0.001), and in 2010 (*P*=0.002). In 2013, anti-HBc prevalence was not significantly higher among non-Indigenous than Indigenous participants (*P*=0.888). The prevalence of HBsAg for Indigenous was 5.2% (1.8%–11.9%) in 2004, 5.2% (2.0%–11.0%) in 2007, 2.1% (0.6%–5.5%) in 2010 and 3.6% (0.7%–11.0%) in 2013. For non-Indigenous entrants, HBsAg prevalence was 2.5% (1.2%–4.4%) in 2004, 1.5% (0.6%–3.2%) in 2007, 1.4% (0.5%–3.0%) in 2010 and 2.9% (0.8%–7.6%) in 2013 (Figure 1). HBsAg prevalence for Indigenous and non-Indigenous participants did not vary significantly across years. Due to the small number of events, no multivariate analysis was conducted for HBsAg.

When stratified by injecting status, anti-HBc prevalence among Indigenous participants who had never injected drugs was higher than for non-Indigenous participants who had never injected drugs across all survey years. However, statistical significance was reached only for survey years 2007 and 2010 (11.5% *vs.* 9.1% in 2004, *P*=0.693; 30.6% *vs.* 6.1% in 2007, *P*<0.001; 25.8% *vs.*14.0% in 2010, *P*=0.036; and 14.3% *vs.* 11.1% in 2013, *P*=0.687).

Factors associated with anti-HBc among Indigenous and non-Indigenous participants through separate multivariate analyses are presented in Table 2. The risk of anti-HBc positivity was higher among those aged ≥30 years compared to those aged <30 years in Indigenous (aOR, 2.7; 95%CI, 1.6–4.5) and non-Indigenous (aOR, 2.7; 95%CI, 1.6–4.5) participants. Factors protective for anti-HBc that were unique to Indigenous participants included entering prison for the first time (aOR, 0.34; 95%CI, 0.2–0.8) and entering prison in 2013 compared to entering in 2004 (aOR, 0.39; 95%CI, 0.16–0.9). The latter finding

indicates a statistically significant difference between anti-HBc prevalence for Indigenous participants between 2004 and 2013. A history of injecting drug use was found to be an HBV risk factor unique to non-Indigenous participants (aOR, 2.54; 95%CI, 1.8–3.6).

Discussion

Overall, exposure to HBV across survey years 2004, 2007 and 2010 was higher among Indigenous participants compared to non-Indigenous participants, and higher among those with a history of injecting drugs compared to non-injectors. Among participants who had never injected drugs, Indigenous prison entrants had higher anti-HBc prevalence than non-Indigenous prison entrants across survey years (although this difference was only statistically significant for years 2007 and 2010). This may reflect the higher rates of vertical transmission from mother to child among the Indigenous population. Factors specific to Indigenous populations that may promote vertical transmission include lower community immunity levels arising from poor vaccination coverage, lack of access to health services related to geography, and poor utilisation of pre- and post-natal care.[9,14] A higher anti-HBc prevalence could also indicate inconsistent vaccination coverage of the Indigenous people most at risk of entering prison. This highlights the need for targeted vaccination programs for high-risk, hard-to-reach populations in the community, combined with screening and immunisation upon entry to prison.

Australia introduced a universal infant vaccination program in 2000 and an adolescent program began in 1997, which ended in 2014 (due to the assumption that those who were adolescents in 2014 should have been vaccinated in the infant vaccination program that had commenced in 2000). In 2015, the National HBV mapping project estimated vaccination rates of 92.3% Australia-wide; however, no distinction between Indigenous and non-Indigenous Australians is reported.[15] A study comparing hepatitis B surface antigen (HBsAg) prevalence between Indigenous and non-Indigenous Australians before and after the year 2000 found Indigenous rates to be significantly higher than non-Indigenous people. However, the difference had declined.[8] National notification data from 2003–2014 has shown a decline in newly acquired HBV diagnosis among people under 30 years of age, which is consistent with the decrease in HBV prevalence reported in this study.[12]

HBV infection risk was found to be higher among those aged 30 years or older in both Indigenous and non-Indigenous participants. This could be partly because older-aged prison entrants fall outside the age brackets that were captured in HBV infant vaccination programs and have had a longer period of time to be exposed to the virus. Protective factors specific to Indigenous prison entrants were entering prison the first time and entering in 2013, the latter indicating a statistically significant decrease in anti-HBc

Figure 1: Anti-HBc and HBsAg prevalence among prison entrants by Indigenous status and survey year.

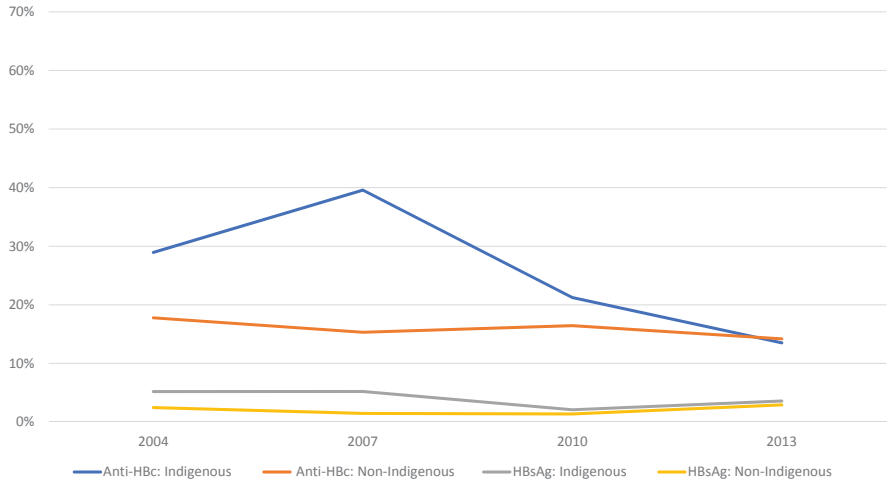

Table 2. Multivariate analysis of risk factors for anti-HBc among prison entrants.

	Overall		Indigenous		Non-Indigenous	
	aOR (95% CI)	*P* value	aOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Ethnicity						
Non-Indigenous	1		-	-	-	-
Indigenous	1.91 (1.41–2.59)	<0.001	-	-	-	-
Survey Year						
2004	1		1			
2007	1.00 (0.71–1.42)	0.992	1.59 (0.80–3.13)	0.185	0.791 (0.52–1.20)	0.268
2010	0.94 (0.63–1.36)	0.750	0.76 (0.37–1.54)	0.447	0.97 (0.63–1.50)	0.885
2013	0.57 (0.36–0.90)	0.016	0.39 (0.16–0.92)	0.032	0.70 (0.41–1.20)	0.198
Age						
<30	1		1		1	
≥ 30 years	2.80 (2.10–3.73)	<0.001	2.67 (1.60–4.48)	<0.001	2.87 (2.02–4.06)	<0.001
ARIA						
Highly Accessible	1		1		1	
Not Highly Accessible	1.01 (1.00–1.02)	0.002	1.01 (1.00–1.02)	0.040	1.01(1.00–1.02)	0.045
Prior imprisonment						
Yes	1		1		1	
No	0.62 (0.44–0.89)	0.010	0.34 (0.15–0.79)	0.012	*0.74 (0.49–1.10)*	*0.136*
Ever injected drugs						
No	1		1		1	
Yes	1.90 (1.41–2.56)	<0.001	*1.23 (0.72–2.12)*	*0.448*	2.54 (1.80–3.59)	<0.001
Tattoos						
No	1		1		1	
Yes	*1.01 (1.00–1.04)*	*0.360*	*1.01 (0.99–1.02)*	*0.338*	*1.00 (0.98–1.03)*	*0.724*
Body Piercings						
No	1		1		1	
Yes	1.02 (1.00–1.04)	0.035	1.60 (0.95–2.68)	0.077	1.02 (1.00–1.04)	0.032

Notes:

aOR = Adjusted odds ratio; CI = Confidence interval.

For those variables that did not remain significant in the adjusted model, the odds ratios are shown in italic. These variables were not included in the final model, but their adjusted odds ratios were obtained by adding and removing each insignificant variable to the final model.

prevalence between the survey years 2004 to 2013. As specific risk behaviours among Indigenous prison entrants were not identified, this indicates that these behaviours are not a key risk factor for anti-HBc positivity and vertical or sexual transmission may be implicated. Associated risk factors specific to non-Indigenous prison entrants were a history of injecting drug use – a practice known to increase the risk of HBV exposure.

Limitations of the study include the relatively small sample of Indigenous participants for each state/territory and possible seasonal effects due to different data collection periods across survey years. Regarding the latter, there are no Australian studies on seasonal variations in the demographics or viral hepatitis status of those entering prison. One US study found no significant trends in anti-HBc and HBsAg prevalence over two years among individuals entering prison.[16] Anti-HBc as a marker of exposure cannot be used to directly determine acute or chronic HBV infection. A combination of serologic markers should be used to identify whether the individual has acute or chronic HBV infection.[17]

In the absence of a national BBV monitoring mechanism, or national screening policy for prison entrants, the NPEBBVS provides unique ongoing insights into BBV prevalence and risk behaviours in this highly marginalised population. The prison setting provides an opportunity to offer HBV vaccination and treatment in those who have missed out on mainstream vaccination and treatment programs.[18] Further to this, the prison setting provides the opportunity for the initiation of treatment for HBV. World Health Organization guidelines state that treatment requires close monitoring and follow-up with a clinician who has expertise in HBV infection. This would likely require follow-up post release back into the community.[19] There is a lack of studies describing successful programs linking HBV treatment in prisons and following release. Further research on HBV among prisoners and the wider Indigenous populations is needed to understand vaccine coverage rates and provide evidence to support targeted programs to improve this coverage.

Barriers associated with vaccinating against HBV, testing and contact tracing include stigma and poor HBV knowledge by healthcare professionals, which can result in inadequate pre- and post-testing counselling and insufficient contact tracing. Furthermore, the issues surrounding disclosure of injecting drug status and discrimination are known barriers to establishing a diagnosis of HBV.[20]

Conclusion

This study demonstrates that HBV prevalence across most survey years was higher among Indigenous prison entrants compared to non-Indigenous entrants. A significant reduction in HBV prevalence between the years 2004 and 2013 was found for Indigenous entrants. Additionally, the study highlights the similarities and differences in associated HBV risk and protective factors between Indigenous and non-Indigenous entrants. Consideration of these similarities and differences is required in policy responses.

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