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Long-term impact of childhood hepatitis B vaccination programs on prevalence among Aboriginal and non-Aboriginal women giving birth in Western Australia

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ABSTRACT

Background/Aims: To evaluate the long-term effect of infant and childhood hepatitis B (HBV) vaccination programs among birthing women in Western Australia.
Methods: A cohort of Western Australian women born from 1974 to 1995 was created using Birth Registrations and Electoral Roll records. They were linked to a perinatal register and notifiable diseases register to identify women having respectively their first births between 2000 and 2012 and diagnoses of HBV infections. HBV prevalence was estimated in Aboriginal and non-Aboriginal women, and according to maternal birth year cohorts.
Results: Of 66,073 women, 155 (0.23%) had a linked non-acute HBV notification. HBV prevalence was five times higher in Aboriginal women compared to their non-Aboriginal counterparts (0.92%, 95%CI 0.65–1.18 versus 0.18%, 0.15–0.21). Among Aboriginal women, after adjusting for year of giving birth and region of residence, those born in the targeted infant and school-based vaccination era (maternal year of birth 1988–1995) had an 89% lower risk (adjusted odds ratio [aOR] 0.11, 0.04–0.33) of HBV than those born in the pre-vaccination era (1974–1981). Prevalence also differed between Aboriginal women residing in rural/remote areas compared to those in major cities (aOR 3.06, 1.36–6.88). Among non-Aboriginal women, no significant difference in HBV prevalence was observed by maternal birth cohort ($p = 0.20$) nor by residence ($p = 0.23$), but there were significant differences by ethnicity with a 36-fold higher prevalence (aOR 36.08, 22.66–57.46) in non-Caucasian versus Caucasian women.
Conclusions: A significant decline in HBV prevalence in Aboriginal birthing mothers was observed following the introduction of HBV vaccination programs in Western Australia. There were also considerable disparities in prevalence between women by area of residence and ethnicity. Our findings reflect those observed in women in other Australian jurisdictions. Continued surveillance of HBV prevalence in birthing mothers will provide ongoing estimates of HBV vaccination program impact across Australia and the populations most at risk of chronic HBV.

1. Introduction

Chronic hepatitis B (HBV) infection is a major cause of liver cirrhosis and cancer contributing to a significant burden of disease worldwide [1]. Most cases of chronic infection are acquired early in life, predominantly through maternal transmission [1]. Australia is considered to have low HBV prevalence (<2%), however in Aboriginal and Torres Strait Islander (hereafter referred to as Aboriginal) people [2], some migrant populations [3] and people who inject drugs [4], HBV prevalence is substantially higher.

A vaccine which is 95% effective in preventing HBV has been available since 1982 and since then, various HBV vaccination programs have been implemented across the States and Territories of

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Australia [5]. Early recommendations were for at-risk adults, and infants and young children from ethnic groups with high HBV carriage rates to be targeted for vaccination [5]. In 1990 a universal neonatal hepatitis B vaccination program, where all babies born were given a 3 dose schedule of HBV vaccine starting from birth, was implemented in the Northern Territory (NT) a region where 28% of the population are Aboriginal (compared with 3% nationally [6]). Subsequently, from May 2000, the HBV vaccine was included in Australia's national infant vaccination schedule, with all babies recommended to receive the first dose at birth. In parallel with the national infant program, schools-based catch-up programs were implemented at various grades and time periods across the Australian States and Territories [5].

Screening pregnant women for HBV, and provision of post-exposure prophylaxis to babies born to HBV-positive mothers remains an important element in prevention of transmission of the virus. Since the late 1990s, screening for HBV with hepatitis B surface antigen (HBsAg) has been recommended and conducted as part of routine care for all pregnant women in Australia [7] with over 90% of pregnant women in WA reported as undergoing HBV screening in 2002 [8]. Thus, testing of birthing mothers in Australia provides an opportunity to represent a sentinel population for monitoring chronic HBV prevalence and assessing the impact of HBV prevention programs. Previous analyses using this methodology in two Australian jurisdictions, the NT [2] and New South Wales (NSW) [9], reported decreases in the prevalence of HBV among Aboriginal women giving birth following the introduction of targeted and newborn vaccination programs. However, differences were observed in overall HBV prevalence across the two jurisdictions among both Aboriginal and non-Aboriginal women.

To provide a more complete picture of the ongoing impact of the HBV vaccination programs, and assess the need for additional programs to target high risk populations in Australia, we assessed the impact of HBV vaccination programs in Western Australia (WA) on the prevalence of HBV infection among mothers giving birth in the State and compared this with the two earlier studies in the NT and NSW [2,9].

2. Methods

2.1. Data linkage and study population

This study was conducted using population-based record linkage in Western Australia (WA) (population 2.6 million) [10]. The WA Data Linkage Branch has created and maintained probabilistic linkages between core health datasets using personal identifiers such as name, date of birth, address, and sex. Linkage accuracy using this process is high with an error rate estimated at 0.11% [11].

A cohort comprising all women in WA with year of birth between 1974 and 1995 was determined by selecting any women appearing in either the WA Registry of Births (which contains all birth registrations in WA from 1974 onwards) or the 2014 WA Electoral Commission enrolments database. For women in this cohort, linked data was extracted from two health datasets. The WA Midwives Notification System is a statutory database which receives information from birth attendants about all births attended in the state of WA where the infant has a gestational age of 20 weeks or more, a birthweight of 400 g or more, or if gestational age is unknown. Data reported for each birth include maternal year of birth, date of giving birth, maternal postcode of residence, ethnicity and birth details such as parity. The WA Notifiable Infectious Diseases Database contains a record of all notifiable conditions reported to the WA Department of Health under statute including HBV. Both acute and non-acute (unspecified) infections detected by laboratory testing are recorded according to strict case definitions [12] and the date of notification is also recorded.

All women in the cohort resident in WA and who gave birth to their first child (i.e. parity null) between 1st January 2000 and 31st December 2012, as determined from the Midwives Notification System, were included.

2.2. Statistical analysis

A woman was defined as having chronic HBV infection at the time of delivery of her first child if she had at least one linked notification of HBV prior to the birthing date. Women whose HBV notification prior to birthing was classified as acute were excluded from the analysis.

The HBV prevalence in birthing women was calculated overall and stratified by Aboriginality as determined from the Indigenous Status Flag created by the WA Data Linkage Branch [13]. HBV prevalence was then examined according to maternal year of birth classified into three categories based on the likelihood of the mother being included in an HBV vaccination program; (i) pre-HBV vaccine (1974–1981), (ii) HBV vaccine available and recommend for at-risk adults (1982–1987), or (iii) targeted infant and school-based catch-up HBV vaccination programs (1988–1995), (see Appendix for details). No women in our cohort were born during the universal newborn vaccination program which commenced in May 2000. Chi-square tests were used to examine trends in HBV prevalence across maternal birth year categories.

Logistic regression was used to investigate the association between maternal birth year categories and HBV infection adjusted for other characteristics. These included health area of residence determined from the mother's residential postcode reported in the Midwives Notification System and classified as metropolitan, regional or remote; year of giving birth (per 5 year increase from 2000 to 2012), maternal ethnicity for non-Aboriginal women (Caucasian, other). Additional adjustments were made for maternal socioeconomic status based on maternal postcode classified according to the index of relative socioeconomic disadvantage (high, middle, low) [14], and maternal smoking (no, yes).

HBV prevalence in Aboriginal women by maternal year of birth was then compared between the WA cohort, and published data from similar cohorts in the NT and NSW. All analyses were performed using SAS version 9.4 (SAS Institute Inc, Cary, North Carolina).

2.3. Ethical approval

This study was approved by the Government of WA Department of Health Human Research Ethics Committee (Ref. #2012/73) and the WA Aboriginal Health Ethics Committee (Ref. 470).

3. Results

A total of 66,086 women in the study cohort gave birth to their first child between 1st January 2000 and 31st December 2012 in WA. Thirteen women had a notification of acute HBV prior to giving birth and were excluded leaving 66,073 women in the analysis. Of these women 7% (4907) were Aboriginal, with a younger age at the time of giving birth compared to their non-Aboriginal counterparts (mean age 19.1 years compared to 26.5 years, $p < 0.0001$) and a higher proportion resident in regional or remote WA (64% vs. 22%, $p < 0.0001$).

Among the 66,073 women, 155 linked to a non-acute HBV notification dated prior to giving birth giving an estimated prevalence of chronic HBV of 0.23%, 95%CI 0.20–0.27. Prevalence was substan-