

# Weighted analysis of prevalence and risk factors of hepatitis B infection among antenatal mothers in Ipoh

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## ABSTRACT

**Introduction:** Several strategies have been developed to reduce hepatitis B infections. These include antenatal screening, universal immunisation of newborns and immunoglobulin therapy for babies who are at risk. Antenatal screening for hepatitis B is not routinely performed, but all newborns in Malaysia are immunised against hepatitis B. We assessed the prevalence of hepatitis B and the factors associated with it among antenatal mothers in Ipoh. This information is useful in decision-making for future hepatitis B screening programmes for antenatal mothers, allowing for immunoglobulin therapies for newborns if their mother's hepatitis B virus (HBV) status is known.

**Methods:** A cross-sectional study of 1,105 antenatal mothers who attended government health clinics in Ipoh was conducted between July 2008 and October 2008. The participants were asked to complete a self-administered questionnaire, and their hepatitis B surface antigen status was ascertained.

**Results:** A total of 7,172 registered births and 97 HBV carriers were included in the weighted analysis. It revealed that none of the high-risk behaviours explored was significantly associated with HBV infection. Multivariate analysis showed age 35 years and above, multigravida (having two or more pregnancies), a positive history of blood transfusion and a family history of HBV to be significant factors associated with HBV infections.

**Conclusion:** The weighted prevalence of HBV infection among antenatal mothers in Ipoh was 1.35 percent. A risk-based screening programme related to past medical and family history may be useful since these two factors are associated with HBV infection.

**Keywords:** antenatal screening, hepatitis B, prevalence, risk factors, weighted analysis

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## INTRODUCTION

The World Health Organization (WHO) has reported that there were more than two billion carriers and 350 million chronic carriers of the hepatitis B virus (HBV) worldwide in 2002.<sup>(1)</sup> The Malaysian Liver Foundation noted that in 1998, there were about 1.1 million people with chronic HBV infection in Malaysia.<sup>(2)</sup> In endemic areas like East Asia, Southeast Asia, the Pacific Isles and Africa, the commonest mode of infection is vertical transmission from mother to child.<sup>(3)</sup> If no preventive actions are taken, the risk of vertical HBV transmission is as high as 90%.<sup>(4)</sup> A study by Wonke et al also found that about 80%–90% of HBV carrier mothers would infect their newborns.<sup>(5)</sup>

Viral transmission during delivery is evident because of the direct relationship between hepatitis B surface antigen (HBsAg) titre in the mother's blood and the incidence of antigenaemia in the newborn.<sup>(6)</sup> There is also a strong correlation between the presence of hepatitis B e-antigen (HBeAg) in the mother's blood and HBsAg in the newborn. All newborns of HBeAg carrier mothers will become chronic HBV carriers in the future.<sup>(4,6)</sup> A national universal immunisation programme for newborns was implemented in Taiwan in 1984. This programme succeeded in reducing the prevalence of HBV among children below the age of 15 years, from 9.8% in 1984 to 1.3% in 1994.<sup>(7)</sup> The success of this antenatal screening programme also contributed to the decrease in the prevalence rate of HBV. Taiwanese mothers who are identified as HBsAg or HBeAg carriers now have their babies immunised and administered with immunoglobulin treatment immediately after birth.<sup>(8)</sup> The risk of chronic HBV infection for these babies has reduced from 90% to 10%–15%.<sup>(9)</sup>

The prevalence of HBV infection in Malaysia is 4.7%.<sup>(2)</sup> A descriptive study investigating the prevalence of HBV infection among antenatal mothers was conducted by the Hospital Tengku Ampuan Rahimah Kelang in 1987. This study assessed the specific hepatitis B viral markers as well as age, ethnicity and locality differences among antenatal mothers who were found to be HBV carriers. The study involved 2,000 healthy

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**Table I. The number of registered births, study participants and weights by ethnicity at the selected clinics in 2007.**

Ethnicity	No. of registered births	No. of study participants	Weight*
Malay	3,124	678	4.6
Chinese	2,758	171	16.1
Indian	1,073	197	5.4
Others	238	59	4.0
Total	7,193	1,105	6.5

\*The weight was calculated by dividing the number of registered births by the number of study participants.

asymptomatic antenatal mothers attending both rural and urban antenatal clinics in coastal Selangor. The results showed a prevalence of 3.9% of HBV carriers in the study population.<sup>(10)</sup> Our study aimed to determine the prevalence of HBV and to specifically examine the association of sociodemographic and reproductive factors, family and medical history, as well as high-risk behaviours with hepatitis B infection among antenatal mothers in Ipoh.

## METHODS

A cross-sectional study was conducted in 1,105 antenatal mothers who attended government health clinics in Ipoh between July 1, 2008 and October 31, 2008. Ipoh, the capital of Perak, is the third largest city in Peninsular Malaysia, with a population of more than 600,000. Health services are provided by both the public and private health sectors. During the study period, all antenatal mothers who registered in all the seven public health clinics in Ipoh and who had provided written consent to participate in this study completed a self-administered questionnaire on their sociodemographic profile, reproductive, medical and surgical history, as well as their history pertaining to HBV infection and high-risk behaviours. The questionnaires were in Bahasa Malaysia, English and Chinese.

In addition to the routine antenatal blood investigation, 2 ml of blood was taken for the HBV test. All the blood samples were sent to the Makmal Kesihatan Awam (Public Health Laboratory) in Jelapang for assessment of the HBsAg status. HBsAg was analysed using the microparticle enzyme immunoassay (MEIA) method (Abbott Laboratories, Abbott Park, IL, USA). The test was repeated for 58 blood samples due to insufficient blood or lysis during transportation. The laboratory test results and answers to the questionnaires were categorised, coded and analysed using the Statistical

**Table II. The weighted sociodemographic and reproductive profiles of antenatal mothers attending public health clinics in Ipoh (n = 7,172).**

Factor	No. (%)
<b>Sociodemographic characteristics</b>	
Age (yrs)	
< 35	6,232 (86.9)
≥ 35	939 (13.1)
Ethnicity	
Malay	3,119 (43.5)
Chinese	2,753 (38.4)
Indian	1,064 (14.8)
Others	236 (3.3)
Nationality	
Malaysian	6,931 (96.6)
Others	240 (3.4)
Occupation	
Employed	4,173 (58.2)
Housewife	2,998 (41.8)
<b>Reproductive factors</b>	
Gravida	
Primigravida	2,762 (38.5)
Two or more	4,410 (61.5)
Parity	
Nulliparous	3,271 (45.6)
One or more	3,900 (54.4)
Number of abortions	
None	5,555 (77.5)
One or more	1,617 (22.5)

Package for the Social Sciences version 15.0 (SPSS Inc, Chicago, IL, USA).

To better reflect the government health services workload, a weighted analysis was conducted on the data using the number of registered births by ethnicity in the seven government clinics in Ipoh for 2007 as weights (Table I). For example, each Malay respondent in our study represented 4.6 Malay mothers who were users of the government health clinics in Ipoh. Thus, in the weighted analysis, using weights rounded up to one decimal place, there were 7,172 mothers. The results of both the descriptive and analytical analyses of the data were presented, specifically determining the risk factors by comparing the prevalence of HBV carriers by the risk factors explored. Statistical analysis using chi-square test and multivariate logistic regression analysis were conducted to identify the significant risk factors. In our analysis, a p-value < 0.05 and a 95% confidence interval that did not include 1 were considered to be statistically significant. This study was approved by the Universiti Kebangsaan Malaysia Ethics Committee (FF-067-2008) and the Malaysian National Institute of Health Research Committee, Ministry of Health (NMRR-08-863-2018).

**Table III. The difference in weighted prevalence of hepatitis B virus (HBV) carriers by sociodemographics, reproductive factors, medical and family history and the high-risk behaviours of antenatal mothers who attended public health clinics (n = 7,172).**

Factor	Total no.	No. (%)		p-value
		HBV positive	HBV negative	
<b>Sociodemographic factor</b>				
Age (yrs)				0.029
< 35	6,232	92 (1.5)	6,140 (98.5)	
≥ 35	940	5 (0.5)	935 (99.5)	
Ethnicity				0.011
Malay	3,119	55 (1.8)	3,064 (98.2)	
Chinese	2,753	32 (1.2)	2,721 (98.8)	
Indian	1,063	5 (0.5)	1,058 (99.5)	
Others	237	4 (1.7)	233 (98.3)	
Nationality				0.885
Malaysian	6,932	93 (1.3)	6,839 (98.7)	
Others	240	4 (1.7)	236 (98.3)	
Occupation				0.541
Employed	4,173	53 (1.3)	4,120 (98.7)	
Housewife	2,999	44 (1.5)	2,955 (98.5)	
<b>Reproductive factor</b>				
Gravida				< 0.005
Primigravida	2,762	18 (0.7)	2,744 (99.3)	
Two or more	4,410	79 (1.8)	4,331 (98.2)	
Parity				0.331
Nulliparous	3,271	39 (1.2)	3,232 (98.8)	
One or more	3,901	58 (1.5)	3,843 (98.5)	
Abortion				0.542
None	5,555	78 (1.4)	5,477 (98.6)	
One or more	1,617	19 (1.2)	1,598 (98.8)	
Age at 1st pregnancy (yrs)*				0.158
< 18	330	5 (1.5)	325 (98.5)	
18–34	6,437	92 (1.4)	6,345 (98.6)	
≥ 35	253	-	253 (100.0)	
Age at 1st sexual intercourse (yrs)†				0.593
< 18	259	5 (1.9)	254 (98.1)	
≥ 18	6,211	83 (1.3)	6,128 (98.7)	
<b>Medical and family history</b>				
Confirmed HBV cases				< 0.005
Yes	93	46 (49.5)	47 (50.5)	
No	7,079	51 (0.7)	7,028 (99.3)	
History of jaundice				< 0.005
Yes	198	9 (4.5)	189 (95.5)	
No	6,974	88 (1.3)	6,886 (98.7)	
Contact with jaundice patients				0.032
Yes	577	14 (2.4)	563 (97.6)	
No	6,595	83 (1.3)	6,512 (98.7)	
History of blood transfusion				< 0.005
Yes	287	16 (5.6)	271 (94.4)	
No	6,885	81 (1.2)	6,804 (98.8)	
History of surgery				0.101
Yes	1,562	14 (0.9)	1,548 (99.1)	
No	5,610	83 (1.5)	5,527 (98.5)	
History of dental procedure				0.648
Yes	3,265	41 (1.3)	3,224 (98.7)	
No	3,907	55 (1.4)	3,852 (98.6)	
Positive family history				< 0.005
Yes	308	46 (14.9)	262 (85.1)	
No	6,864	51 (0.7)	6,813 (99.3)	
Acupuncture				0.058
Yes	253	-	253 (100.0)	
No	6,919	97 (1.4)	6,822 (98.6)	
Ear piercing				0.960
Yes	5,011	68 (1.4)	4,943 (98.6)	
No	2,161	29 (1.3)	2,132 (98.7)	
Body piercing				0.745
Yes	814	10 (1.2)	804 (98.8)	
No	6,358	87 (1.4)	6,271 (98.6)	

Table III. (continued).

Factor	Total no.	No. (%)		p-value
		HBV positive	HBV negative	
Tattooing				0.088
Yes	273	-	273 (100.0)	
No	6,899	97 (1.4)	6,802 (98.6)	
Drug abuse				0.452
Yes	41	-	41 (100.0)	
No	7,131	97 (1.4)	7,034 (98.6)	
Sharing needles				-
Yes	0	0 (0)	0 (0)	
No	7,172	97 (1.4)	7,075 (98.6)	
Multiple partners				0.114
Yes	178	-	178 (100.0)	
No	6,994	97 (1.4)	6,897 (98.6)	
Anal sex				0.535
Yes	28	-	28 (100.0)	
No	7,144	97 (1.4)	7,047 (98.6)	
Induced abortion				0.071
Yes	298	-	298 (100)	
No	6,874	97 (1.4)	6,777 (98.6)	

\* Data is missing for 152 respondents.

† Data is missing for 702 respondents.

## RESULTS

A total of 1,105 antenatal mothers participated in this study and 16 were found to be HBV carriers. The overall prevalence of HBV infection among antenatal mothers in Ipoh was 1.45%. Based on the weighted analysis, the number of respondents and carriers was 7,172 and 97, respectively, thus yielding a prevalence rate of 1.35%. Table II shows the sociodemographic and reproductive profiles of the antenatal mothers in Ipoh. The majority of the respondents were Malaysian (96.7%), Malay (43.5%), aged <35 years (86.9%) and employed (58.2%). Among these, 38.5% were primigravida, 54.4% had one or more live births and 22.5% reported having had at least one abortion.

Table III shows the weighted prevalence of HBV carriers among antenatal mothers according to their sociodemographics, reproductive, medical and family histories, as well as high-risk behaviours. Among the 6,232 mothers aged < 35 years, the prevalence of HBV carriers was 1.5% compared to 0.5% among the 940 mothers aged > 35 years. The prevalence of HBV carriers by ethnicity was 1.8% among the Malays and 1.7% among other racial groups, with a lower prevalence among the Chinese (1.2%) and Indians (0.5%). The differences in prevalence by age and ethnicity were statistically significant, with a p-value of 0.029 and 0.011, respectively.

In contrast, the differences in prevalence of HBV carriers by nationality and occupation were not statistically significant. With regard to the reproductive history, the prevalence of HBV carriers was higher

among mothers who had two or more pregnancies, one or more live births and one or more abortions, as well as mothers who had early sexual intercourse and had their first pregnancy before the age of 18 years. However, the differences in prevalence were only statistically significant among those who had two or more pregnancies (1.8%) compared to the primigravida (0.7%) (p-value < 0.005).

The prevalence of HBV carriers among antenatal mothers who reported to be confirmed HBV cases was 49.5%, and the prevalence of mothers who had a family member who is an HBV carrier was 14.9%. Among the antenatal mothers with a history of jaundice and contact with a jaundiced patient, the prevalence of HBV carriers was 4.5% and 2.4%, respectively. The prevalence of HBV carriers among mothers with a history of blood transfusion was 5.6%. The differences in prevalence for the above factors were statistically significant. Antenatal mothers with a history of surgery and dental procedure had an HBV prevalence of 0.9% and 1.3%, respectively, but the differences in prevalence were not statistically significant. With regard to respondents with high-risk behaviours, the prevalence of HBV among mothers who had pierced their ears and other parts of their body was 1.4% and 1.2%, respectively. However, none of these behaviours was significantly associated with a higher prevalence of HBV carrier status.

Table IV shows the results of multivariate analysis, which included only factors that were statistically significant on crude analysis (Table III). The multivariate model included the age group, gravida, contact with

**Table IV. Multivariate analysis for risk factors of hepatitis B infection (HBV).**

Risk factor	Beta	SE	p-value	OR	95% CI
<b>Demographic factors</b>					
Age (yrs)					
< 35*					
≥ 35	1.504	0.491	0.002	4.5	1.7–11.8
<b>Reproductive factors</b>					
Gravida					
Primigravida*					
Two or more	0.992	0.274	< 0.005	2.7	1.6–4.6
<b>Medical and family history</b>					
History of jaundice					
No*					
Yes	0.768	0.477	0.108	2.2	0.8–5.5
Contact with jaundiced patient					
No*					
Yes	-0.415	0.389	0.286	0.7	0.3–1.4
History of blood transfusion					
No*					
Yes	1.218	0.319	< 0.005	3.4	1.8–6.3
Family members with HBV					
No*					
Yes	3.088	0.224	< 0.005	21.9	14.1–34.1
High-risk behaviours					
None	-	-	-	-	-

\* Reference group

SE: standard error; OR: odds ratio; CI: confidence interval

jaundice patients, and a history of jaundice, blood transfusion and family members with HBV. Although significant based on the crude analysis, ethnicity was not included in the multivariate model as we do not consider differences in ethnicity in providing our health services. The risk of being an HBV carrier was four times higher among older mothers and three times higher among mothers who had two or more pregnancies. Mothers with a positive history of blood transfusion had more than three times the risk of being infected with HBV compared to mothers with no such history. A higher risk of HBV infection was also observed among women whose family members had a history of HBV infection.

## DISCUSSION

Based on the weighted analysis, the prevalence of HBV infection in this study was low, at 1.35%. This prevalence is lower than that found by previous studies; however, it is still within the range reported by Lopez et al.<sup>(11)</sup> Yap's study involving asymptomatic blood donors in the 1990s also found an HBV carrier rate of 2%–10%.<sup>(12)</sup> The HBV rates were also found to differ by ethnicity, and according to the Hospital University Malaya blood donor statistics, the highest HBV carrier rate is found among the Chinese (4%–7%), followed by the Malays (2%–4%) and the Indians (< 1%).<sup>(13)</sup> Contrary to previous studies, this study found that the prevalence of HBV infection among Malays was higher (1.8%) than that among the

Chinese (1.2%). The reason for this may be the changing behaviours of antenatal mothers by ethnicity. Although high-risk behaviours by ethnicity were studied, we did not find that Malay mothers had a higher prevalence of high-risk behaviours compared to mothers from other ethnic groups. However, our study did not include the risk behaviours of the respondent's partner, especially in terms of intravenous drug use. More Malay mothers may be exposed to HBV infection through their partners, and reports have shown a higher rate of intravenous drug use among Malay men compared to other ethnic groups.<sup>(13)</sup> In addition, ethnicity in this study was self-reported, but racially, Malaysians are a more mixed group due to inter-marriages and adoptions. Ethnicity as a risk factor is also less important since patients are not discriminated against based on their ethnicity at our government health facilities.

The risk factors for HBV infection found in this study were also identified by the American Immunisation Action Coalition (IAC).<sup>(14)</sup> Our study found that based on multivariate analysis, older age, gravida two or more, a history of blood transfusion and a history of HBV infection in family members were significant risk factors for HBV infection. However, none of the high-risk behaviours identified by the IAC were found to be significant risk factors for HBV infection in the antenatal mothers in our study; with the exception of ear and body piercings, very few participants reported practising any of

these high-risk behaviours. This low reporting could be due to the poor ability of the instrument to collect data on high-risk behaviours. Some participants may have found the questions too personal and may not have answered them truthfully. However, a greater number of ear and body piercings were reported by our antenatal mothers since as are culturally accepted practices. Taking into account the problems mentioned, risk behaviour-based antenatal screening for HBV may face problems in terms of identifying the target population in such a programme.

The weights used in this study were based on ethnicity and were biased toward the ethnic distribution of babies registered under the government health facilities. The results obtained were not reflective of the general Ipoh population, which has a larger proportion of the Chinese community compared to the other ethnic groups.<sup>(15)</sup> The Chinese community is known to have greater access to private antenatal services because of their greater financial ability. Thus, the result of this study better reflects the magnitude of HBV infection among users of public health services, and this information may be useful in planning screening programmes in the public sector. A study that uses the ethnic distribution of all births registered in Ipoh as weights and that is based on data collected from antenatal mothers attending both public and private clinics would provide a better estimate of the magnitude of HBV infection among antenatal mothers in Ipoh.

In conclusion, the weighted prevalence of hepatitis B infection among pregnant women in Ipoh is 1.35%. Risk factors that are statistically associated with HBV infections are older age, gravida two or more, a positive history of blood transfusion and a family history of HBV infection. A risk-based screening programme related to high-risk behaviours such as body piercing and self-reported drug use may not be effective, since the association between HBV infection and such behaviours was not evident in this study.

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