ORIGINAL ARTICLE

TRENDS AND ESTIMATION OF HEPATITIS B INFECTION CASES IN MALAYSIA, 2003–2030

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ABSTRACT

Hepatitis B virus (HBV) infection is an upcoming public health problem in Malaysia. This study analysed the trend of Hepatitis B (HB) cases from 2003 to 2012 and project the cases for an 18-year period (2013–2030). Based on the national data of annual reported cases and the Malaysian population projections (2010–2040), trend/regression lines were fitted to analyse the trend and estimated HB incidence. The number of HB cases decreased for six consecutive years and began to increase from 2010 onwards. During the 10-year period (2003–2012), the highest number of HB cases was reported in Sabah, followed by Pahang and Wilayah Persekutuan; the lowest was reported in Perlis. The exponential curve shows a decrease of HB cases by an average of 6.3%. However, the polynomial curve shows fluctuations in the trend, with a higher degree of R-square (0.8655). Most states appear to be at moderate vulnerability to HBV infection (Kedah, Perak, Negeri Sembilan, Terengganu, Sabah, and Sarawak), except for Melaka, Wilayah Persekutuan, and Selangor, which were at high risk of HB incidences. Overall, the estimated HB cases indicate that the number of cases and the incidence rates will increase in the future in all states, except for Penang. As the estimated HB cases and incidence rates show an increasing pattern, the government should strengthen their strategies in the management of HB and take preventive measures such as educating the public through awareness programmes, conducting compulsory blood screening, and sustaining the Expanded Programme on Immunization effectively.

Keyword
Hepatitis B, infection estimation, trends, Hepatitis B cases, incidence rate

INTRODUCTION

The World Health Organization (WHO) estimated that two billion individuals have been infected by Hepatitis B virus (HBV)—360 millions are chronically infected—and 600 000 individuals die each year due to liver cirrhosis or hepatocellular carcinoma[1]. HBV infection is an upcoming public health problem in developing countries such as Malaysia[2] and is very common in Asian counties[3, 4, 5]. In Malaysia, it is estimated that one million individuals are chronically infected with HBV[6]. HBV infection is one of main causes of liver cirrhosis in Malaysia[2]. The ratio of infection between Malaysian males and femalesis 2:1[7]and 3:1[6]. The prevalence of HBV infection is the highest among the Chinese, followed by the Malays and the Indians.[2, 3]

According to the WHO, there are two transmission routes to HBV infection[1]. The first route is vertical transmission, such as through childbirth and from family members to a child in the early childhood. The second route is horizontal transmission, such as through sexual contact, occupational exposure, tattooing, and the use of infected needless. Approximately1.4 million Hepatitis B (HB) patients in Malaysia are Chinese infected through vertical transmission[8], and one in every 20 suffers from chronic liver disease caused by HB[9].

The Ministry of Health recorded that 5% of Malaysian are infected by HBV, and more than 80% of the HB patients are between 25 and 55 years of age[10]. With the HB vaccination programme introduced in Malaysia in 1989, consisting of three-dose schedules, the infection rate has been successfully reduced to 0.3%, exceeding the WHO's target of 1%[10].

The HB surface antigen (HBsAg) marker in Malaysian population is higher compared with those of other countries with larger populations. Some studies categorised Malaysia as having low or intermediate endemicity of HB[11,12] but other studies indicate that the HBsAg prevalence in Malaysia is considered high[13,14].

Although China has a larger population compared with Malaysia, the latter has a higher HBsAg prevalence (3–5%) compared with China (4.6%) [14].This is perhaps a result of HB vaccination that has been successfully integrated into routine infant immunisation in China[15,16].

HBV infection is ranked at third place for three consecutive years as the principal cause of death in public hospitals in Malaysia (Health Fact 2010,

2011, 2012). In Malaysia, the six main vaccine-preventable diseases are HB, measles, diphtheria, tetanus, tetanus neonatorum, and whooping cough. However, only HB is categorised as a serious and a silent killer by the WHO; this is because the symptoms can be detected only after 30 to 60 days of infection, whereas in the other diseases, symptoms are apparent once infection has set in. Besides, prolonged infection may lead to chronic disease, and eventually, liver cancer.

In Malaysia perspective, the important should give to foresee its future and current impact of Hepatitis B infection impact on health system. This paper analyses the trend of HBV infection cases from 2003 to 2012, and estimates infection cases for the next 18-year period (2013–2030).

METHODOLOGY

This study analysed data from the annual reported HB cases extracted from annual health fact sheets published by the Ministry of Health, Malaysia, and the population projection (2010–2040) published by the Department of Statistics, Malaysia. Trend/regression lines were fitted to investigate the trend to estimate HB cases. The findings of the study are presented in tabular and graphical format.

RESULTS

Trends of HB incidence: national level

The exponential curve in Figure 1 shows an average decrease in HB incidence at 6.3% per year, with a lower degree of R-square (0.1264). However, the polynomial curve shows that from 2004 to 2009, the growth rate experienced a gradual decline, followed by a drastic increase from 2010 onwards, with a higher degree of R-square (0.8655).

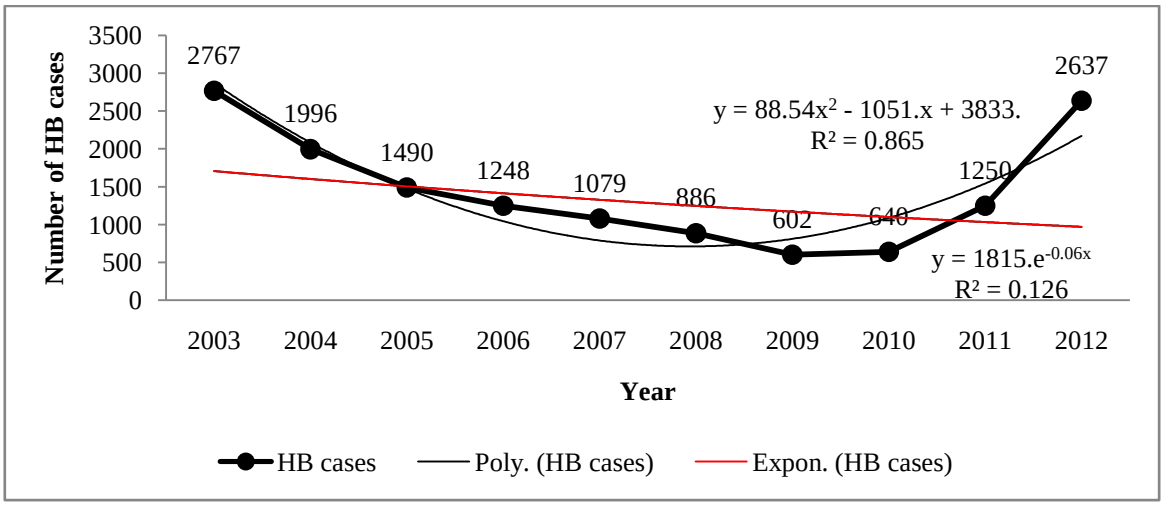

Figure 1: Reported Hepatitis B cases in Malaysia (2003–2013)

Figure 1 shows the number of reported HB cases and the trend of HB incidences in Malaysia from 2003 and 2012. In 2003, the number of HB cases was 2767. The figures decreased drastically to 1490 in 2005 and to 640 in 2010. However, the number of HB cases increased to 1250 in 2011, and it continued to increase to 2637 in 2012. From this trend, we can predict that HB will become one of the many upcoming health issues in the future.

Trends of HB incidence: State level

Figure 2 shows that the highest number of HB cases in the past ten years was reported in Sabah (4494), followed by Pahang (1990) and Wilayah Persekutuan (1348). The states with the least number of HB cases were Perlis (33), followed by Negeri Sembilan (128) and Kedah (201).

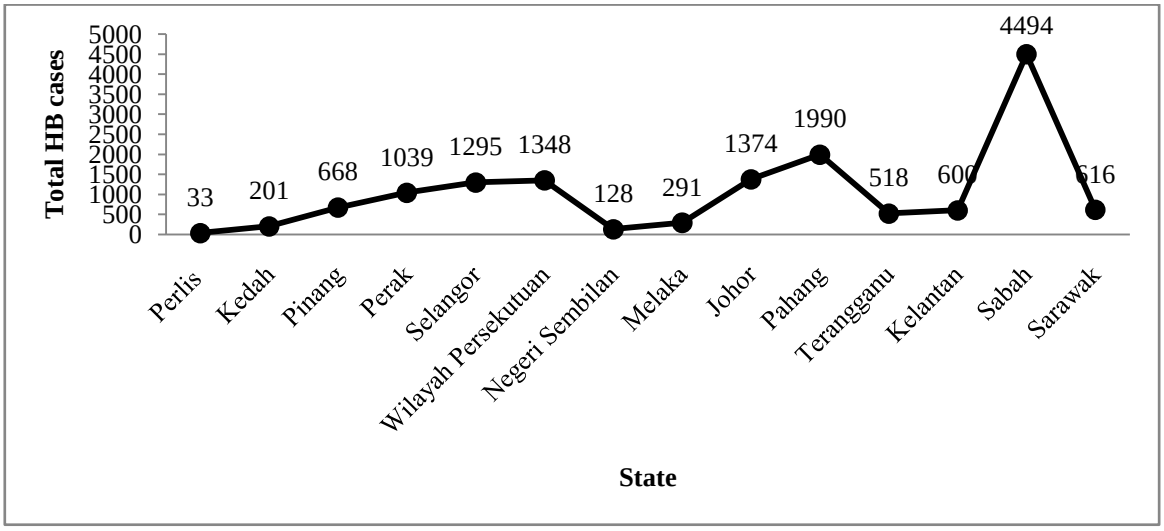

Figure 2: Reported Hepatitis B cases in each state in Malaysia (2003-2012)

Estimates at national level

Based on the computed trend equations from 2003 to 2012, HB cases was projected using a polynomial regression, which take into consideration the 2010-2040 population projection by the Department of Statistics, Malaysia (Figure 3).

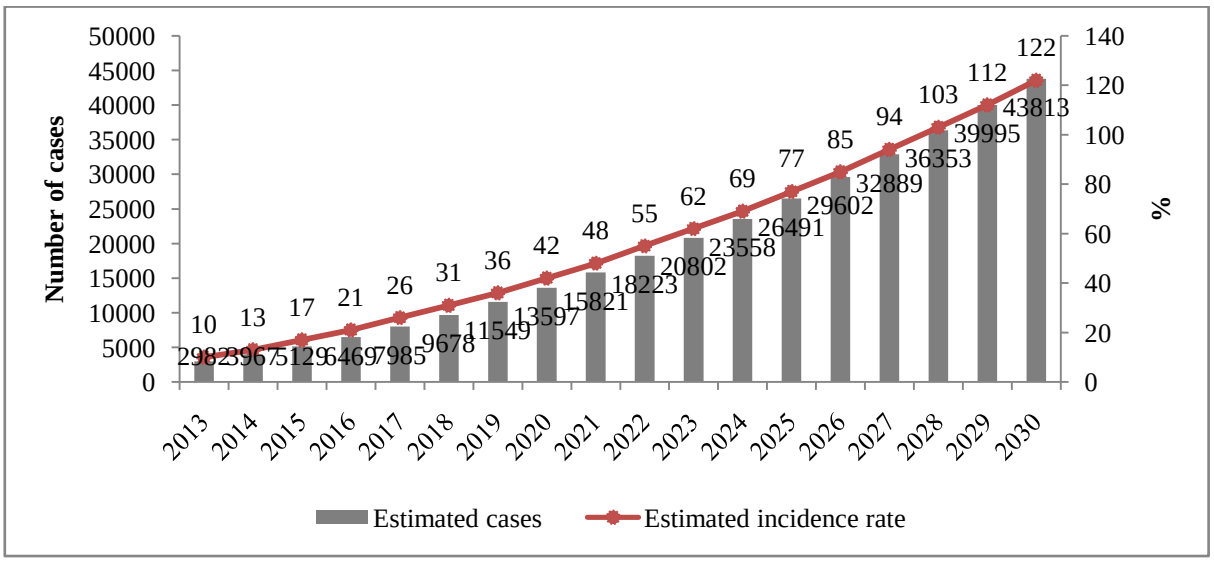

Figure 3: Projection of Hepatitis B cases and incidence rate

This incident rate projection is based on per 100 000 populations. The estimated HB cases and incidence rate show increasing pattern in the future (Figure 3). The exponential curve shows an average increase in the HB incidence at 15.77% per year, with a higher degree of R-square (0.8689) (Figure 4).

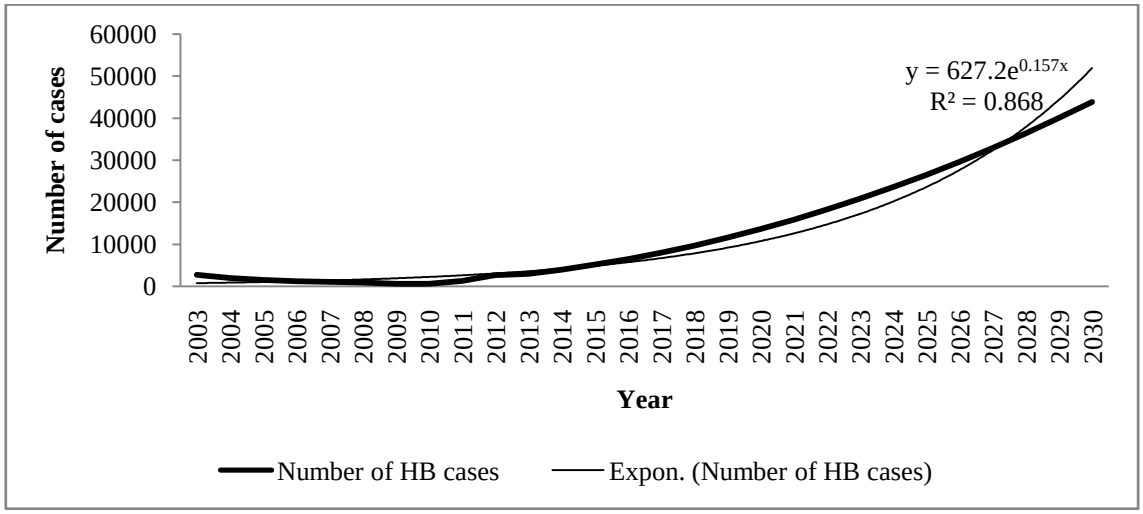

Figure 4: Actual and estimated Hepatitis B cases

Estimates at state level

At the state level, the estimated HB cases show different level of increases. The polynomial regression used to estimate the HB cases are shown in Table 1.

The overall projection of Hepatitis B cases in Malaysia shows that Sabah tops the list with the highest number of cases by 2030, with approximately 16 050 cases, followed by Wilayah Persekutuan, with 8877 cases. Other states are projected to have less than 5000 cases between 2013 and 2030. Based on the HB cases was projected using a polynomial regression, exponential regression used to see the goodness of fit of estimated figures using R square (Table 3).

Table 1: Polynomial regression at the state level, 2003-2012

State	Polynomial regression	R^2
Perlis	$y = 0.0682x^2 - 0.7682x + 4.9$	0.0344
Kedah	$y = 1.0568x^2 - 11.292x + 41.517$	0.8693
Penang	$y = -1.1212x^2 + 4.9879x + 82.533$	0.6649
Perak	$y = 6.0227x^2 - 93.262x + 384.97$	0.8483
Selangor	$y = 9.303x^2 - 91.794x + 276.2$	0.8081
Wilayah Persekutuan	$y = 18.011x^2 - 208.21x + 586.52$	0.8679
NegeriSembilan	$y = 0.7462x^2 - 5.5659x + 14.683$	0.7134
Melaka	$y = 5.1326x^2 - 52.913x + 122.52$	0.7567
Johor	$y = 9.5x^2 - 120.73x + 435.67$	0.7976
Pahang	$y = 1.3258x^2 - 21.383x + 265.57$	0.2803
Terengganu	$y = 3.9015x^2 - 47.474x + 162.7$	0.8967
Kelantan	$y = 0.4886x^2 - 7.5326x + 82.617$	0.0839
Sabah	$y = 32.436x^2 - 381.37x + 1298.2$	0.6747
Sarawak	$y = 1.6742x^2 - 14.102x + 74.7$	0.5476

Table 3: Exponential regression at the state level, 2003-2030

State	Exponential regression	R^2
Kedah	$y = 9.0231e^{0.1546x}$	0.9248
Perak	$y = 32.673e^{0.153x}$	0.6864
Selangor	$y = 49.068e^{0.1785x}$	0.9049
WP	$y = 35.268e^{0.2158x}$	0.8288
NS	$y = 4.5861e^{0.1803x}$	0.9548
Melaka	$y = 4.0191e^{0.262x}$	0.7713
Johor	$y = 53.935e^{0.1637x}$	0.8307
Pahang	$y = 139.91e^{0.0495x}$	0.7408
Terengganu	$y = 19.465e^{0.1716x}$	0.8244
Kelantan	$y = 37.553e^{0.061x}$	0.6609
Sabah	$y = 161.88e^{0.1731x}$	0.8106
Sarawak	$y = 29.691e^{0.1315x}$	0.9424

Abbreviation: WP, Wilayah Persekutuan; NS, Negeri Sembilan

The exponentialcurve for Kedah indicates an average increase in HB incidence at 15.46% per year, with a higher degree of R-square (0.9248). Although the numbers of actual reported cases are below 40 in the last ten years, the HB incidence is projected to increase sharply to 550 cases between 2017 and 2030. Similarly, the average HB incidence in Perak demonstrates an almost identical trend at 15.3% increase, with a lower degree of R-square (0.6864). The projected figure for Selangor shows an even more worrying trend of 17.85% increase in the average HB incidence, with a higher level of R-square (0.9049), making Selangor the third most vulnerable state after Melaka and Wilayah Persekutuan. Melaka is projected to be the most vulnerable state, with 26.2% increase and an R-square of 0.7713. Despite having a low number of reported cases prior to 2011, the projected HB incidence in Melaka shows a ten-fold increase to 2665 cases by 2030. Similar to this, the average HB incidence in Wilayah Persekutuan is projected to increase 21.58%, with an R-square of 0.8288. The number of cases is projected to increase three-fold to 8877 cases during the same observation period. Kelantan and Pahang appear to be less vulnerable at 6.1% and 4.9% increases and R-squares of 0.6609 and 0.7408, respectively. The projected number of cases in Kelantan increases at a slower rate, from 59 cases in 2013 to 255 cases by 2030; whereas in Pahang, a decrease is apparent between 2011 and 2023. Other states (Kedah, Perak, Negeri Sembilan, Terengganu Sabah, and Sarawak) appear to have almost identical and moderate increases in the HB incidence at between 13.1% and 18%. Most of the states appear to be at moderate vulnerability except for Melaka, Wilayah Persekutuan, and Selangor, where the risks of HB incidence are higher than in other states.

DISCUSSION

Even though HB vaccination for infants in the WHO's Expanded Program of Immunization (EPI) was implemented in Malaysia in 1989 6,17 and resulted in a decrease of the incidence rate in the 1990's, the increase in HB cases observed after 2010 indicates that the EPI alone does not give full protection against the HBV. Furthermore, the level of immunisation is still poor among those who are born after the implementation of EPI and immunised under the programme18. Ng et al.18 reported that 66.14% of the university students who were vaccinated during infancy had no demonstrable immunity at the time of screening. Other studies suggested that the immune protection persists for at least 20 years following primary vaccination with the three doses of recombinant vaccine compared with lesser doses19. These findings suggest that antibody screening may be helpful for HB booster, which is especially indicated to higher risks individuals such as family members of HB patients, transplant or dialysis patients, and health care workers. With the projection of an increasing HB incidence rate, the government should forewarn the public through HB awareness and blood screening programmes.

Table 2 shows that the number of HB cases are projected to increase in all states, except for Penang. The estimated cases for Penang were in negative value, indicating that no cases are projected in the future.

Table 2: Estimated Hepatitis B cases in each state in Malaysia

	Estimated cases												
Year	Kedah	Penang	Perak	Selangor	WP	NS	Melaka	Johor	Pahang	Terengganu	Kelantan	Sabah	Sarawak
2013	45	2	88	392	476	44	162	257	191	113	59	1028	122
2014	58	-19	133	514	682	55	227	355	200	155	63	1393	147
2015	73	-42	190	655	924	68	302	472	212	205	67	1822	174
2016	91	-67	260	814	1202	83	388	607	226	263	73	2316	205
2017	110	-95	341	992	1516	99	484	762	243	328	80	2876	240
2018	131	-125	435	1189	1866	117	590	936	263	402	87	3500	278
2019	155	-157	540	1404	2252	136	706	1129	285	483	96	4189	319
2020	181	-191	658	1638	2674	156	833	1341	310	572	105	4943	363
2021	208	-227	787	1890	3133	178	970	1571	338	669	116	5762	411
2022	238	-266	929	2162	3627	202	1117	1821	368	774	127	6645	462
2023	270	-307	1082	2451	4157	227	1275	2090	401	886	140	7594	517
2024	305	-350	1248	2759	4723	253	1443	2378	437	1007	153	8607	575
2025	341	-396	1426	3086	5326	281	1621	2684	475	1135	168	9685	636
2026	379	-444	1616	3432	5964	311	1809	3010	516	1271	183	10 828	701
2027	420	-494	1818	3796	6638	342	2008	3355	560	1414	200	12 036	769
2028	462	-546	2032	4178	7348	374	2216	3719	606	1566	217	13 309	840
2029	507	-600	2257	4580	8095	408	2436	4101	655	1725	235	14 647	914
2030	554	-657	2495	5000	8877	444	2665	4503	706	1892	255	16 050	992

Abbreviation: WP, Wilayah Persekutuan; NS, Negeri Sembilan

Currently in Malaysia, HB vaccination for adults is considered a luxury: only those who can afford the cost will undergo vaccination. However, most of the population can hardly afford it and remain unvaccinated. HBV infection is mostly prevalent among the age group of 25 to 55 years, which happens to be the economically productive age group. If the individuals in this age group are immunised against the HBV, the number of HB infection can be controlled, and the country will benefit from it. The public should seek proper medical knowledge of HB as a protection against the disease. Adults at risk for HBV infection—such as from sexual or occupational exposure to HBV, injection-drug users, those living in a household with chronic HB patients, developmentally disabled individuals in long-term care facilities, haemodialysis patients, patients with chronic liver disease, traveller to HBV endemic regions, and HIV-positive individuals[20]—should get vaccinated to prevent infection. The government should also consider providing a free HB vaccination programme for the adult population so that the HB incidence can be reduced with vaccination strategies.

CONCLUSION

HB is one of the 26 infectious diseases in Malaysia of which, under the Prevention and Control of Infectious Diseases Act 1988, anyone having knowledge of the detection of such diseases is under a statutory duty to notify the Ministry of Health. Although infectious, this disease can be prevented through vaccination. As the estimated HB cases and incidence rate show an increasing pattern, the government should relook at the preventive measures, emphasizing the understanding of HB disease, its transmission, immunity to HB, and protection by vaccination given to the public.

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