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Prevalence of hypertension in pregnancy and its associated sociodemographic factors among mothers aged 15–49 years old in Malaysia

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Abstract

Background Hypertensive disorders of pregnancy (HDP) pose a substantial public health concern, ranking among the primary contributors to maternal and perinatal morbidity and mortality, impacting around 5–10% of pregnancies. This study aimed to determine the prevalence of HDP and its associated factors among mothers aged 15–49 who recently gave birth within the last two years, throughout Malaysia, informing effective public health and primary care interventions.

Methods This study was a part of the national survey on maternal and child health (MCH) also known as the National Health and Morbidity Survey (NHMS) 2022: MCH. This was a cross-sectional study using two stage stratified random sampling design. Data of mothers aged 15–49 years old who recently gave birth within the last two years were selected in this study. This survey utilised a set of structured validated questionnaires administered via face-to-face interviews (using a mobile device). Multiple logistic regression analysis was employed to identify the associated factors for hypertension.

Results Among 6 335 participants recruited for this study with an estimated population of 782, 550, the prevalence of HDP among Malaysian mothers aged 15–49 years old who recently gave birth within the last two years was 6.5% (95% CI: 5.76, 7.37). Multiple logistic regression showed that maternal age and ethnicity were significantly associated with hypertension. Advanced maternal age had higher odds of hypertension, with an aOR of 2.18 (95% CI = 1.75, 2.71). In addition, Other Bumiputera had higher odds of hypertension (aOR = 2.71, 95% CI = 1.25, 5.87).

Conclusion This study reveals the prevalence of HDP among Malaysian women with children under 2 years old, emphasizing advanced maternal age (above 35) and ethnicity as notable risk factors. It improves understanding of the epidemiology of HDP in Malaysia, offering valuable insights for the development of effective public health strategies and clinical interventions that can help with the control of HDP.

Keywords Hypertensive disorders of pregnancy, High-risk, Prevalence

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Text box 1. Contributions to the literature

- Hypertensive disorders of pregnancy (HDP) impact around 5–10% of pregnancies, which poses a substantial public health concern on morbidity and mortality of perinatal and postnatal mothers.
- This study identified several sociodemographic factors associated with HDP in Malaysia, including advanced maternal age and Other Bumiputera ethnic backgrounds. These findings emphasize the importance of implementing comprehensive screening and preventive measures for at-risk populations.
- By utilizing a national survey approach and employing multivariable analysis, this research enhances our understanding of the epidemiology of HDP in Malaysia, offering valuable insights for healthcare policymakers and practitioners to improve maternal and perinatal health outcomes.

Introduction

Hypertensive disorder of pregnancy (HDP) is a collective terminology that defines the onset of hypertension at any point of pregnancy. Namely, HDP can be classified as gestational hypertension for the onset after 20 weeks of gestation or chronic hypertension for the onset before 20 weeks of gestation, which eventually can progress to pre-eclampsia and eclampsia [1]. Globally, HDP represents a significant public health challenge with far-reaching implications for maternal and child health, affecting approximately 5–10% of all pregnancies [2]. Additionally, HDP has been established as one of the leading causes of maternal and perinatal morbidity and mortality.

According to the 2019 Global Burden of Disease study, the global incidence of HDP was reported to be 18.1 million, leading to 27.8 thousand deaths due to its complications in 2019 [3]. Regionally, there exists a direct correlation between the prevalence of HDP with sociodemographic status and human development indices, indicating the disparity of HDP incidence in regions with lower income such as sub-Saharan Africa and South Asia [1–3]. In Southeast Asia, the incidence of HDP was reported to be 1.5 million mothers, with reported maternal deaths approximating 2.5 thousand [3]. In Malaysia, according to the previous National Health and Morbidity Survey 2016, the prevalence of HDP was recorded to be 5.8% [4]. Taken together, the burden and impact of HDP are significantly evident, often worsened by limited access to healthcare, inadequate prenatal care, and lack of awareness [4, 5].

The clinical signs of HDP can be characterised by high blood pressure, protein in urine and oedema during pregnancy [6, 7]. The implications of HDP not only pose immediate risks to the mother and foetus during pregnancy but also have long-term implications for their health. Previous studies have shown that HDP, especially pre-eclampsia, increases the risk of stroke, cardiovascular diseases, chronic hypertension end-stage renal disease (ESRD) in later life for mothers [8]. Moreover, the offspring is at risk of low birth weight, preterm birth and developmental issues in later life [8].

Understanding the prevalence of HDP and the factors associated with it, is crucial for developing effective public health strategies and clinical interventions. This includes identifying at-risk populations and optimizing prenatal care to prevent and manage HDP. This study, therefore, aims to investigate the prevalence of HDP among mothers aged 15 to 49 years who recently gave birth within the last two years from the NHMS 2022 dataset. By focusing on this population, the study aims to contribute valuable insights into the epidemiology of HDP and the factors associated with it. The findings of this study are expected to inform healthcare policies, the formulation of programs and practices to improve maternal and child health outcomes in Malaysia.

Methodology

Study design

This study utilized secondary data from the second national survey on maternal and child health (MCH) also known as the NHMS 2022: MCH, employing a two-stage stratified random sampling method. Stratification was based on states and location (urban and rural areas), with Enumeration Blocks (EB) as the Primary Sampling Unit (PSU) and Living Quarters (LQs) within selected EBs as the Second Sampling Unit (SSU). All household members within the chosen LQs were part of the study. The inclusion criteria included mothers aged 15–49 with children under two years old falling within this age range who have children under two years old [9]. Exclusion criteria included those that data is not completed in the survey, those with medical conditions that may confound study objectives or outcomes such as patients with autoimmune disorders, those with multiple pregnancies and previous pregnancy complications, and those unwilling or unable to provide informed consent for participation.

Questionnaire and survey instruments

This NHMS 2022: MCH survey used a set of structured validated questionnaires administered via face-to-face interviews (using a mobile device). Questionnaire in a hardcopy format were prepared as a backup in case of technical problems. The questionnaires were pre-tested in two languages (Malay and English) and a manual consisting of the flow of the questionnaire and definitions of terms was available as a guide for data collectors. There were 3 broad sections in this questionnaire which were sociodemographic details, maternal care (pregnancy comorbidity) and child health. Detailed questionnaire and data collection can be found on NHMS 2022 page 183 until page 199 (https://iku.gov.my/images/

nhms-2022/TRNHMSmch2022.pdf). In this study, we focused on the hypertension in pregnancy module.

Variable definition

Demographic details of participants, including locality, age, ethnicity, citizenship, marital status, educational level, and employment status were collected as independent variables. Maternal age was categorised into <35 and ≥35 years old [10, 11] in univariate and multivariate analysis.

"Other Bumiputera" refers to aboriginal peoples or native inhabitants of Sarawak and Sabah. "Other ethnicity" encompasses individuals who do not belong to any of the recognized ethnic groups in Malaysia.

The dependent variable in the current study is HDP at any onset of the perinatal duration, defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg. This includes occurrences of gestational hypertension and pre-eclampsia within the survey data. Diagnosis of hypertension was verified further by the antenatal health record book.

Statistical analysis

Data analysis was conducted using the SPSS version 26 software (SPSS Inc., US). Weighted results made an important inference for prevalence of HDP among Malaysian population. Weight factor was applied to each individual to adjust for the varying probabilities of selection (design weight), non-response rate, and post-stratification factors which were adjusted for the Malaysian population projection by the Department of Statistics Malaysia (DOSM) in the year 2022.

Categorical variables were presented in number (n) and percentage (%), while continuous variables were presented in either mean ± standard deviation (SD). Simple logistic regression and multiple logistic regression was used to identify factors associated with HDP. In univariate analysis, variables with $p<0.25$ were considered to be significant and were included in the multivariate analysis. Multiple logistic regression was conducted using the Enter method to determine factors associated with HDP. Hosmer-Lemeshow test was used to determine the goodness of fit of the logistic regression model. A p-value lesser than 0.05 was considered significant.

Ethical approval

This study was conducted in accordance with the principles outline in the Declaration of Helsinki and Good Clinical Practice. Ethics approval was obtained from the Medical Research and Ethics Committee of the Ministry of Health Malaysia. The study is registered with the National Medical Research Registry as NMRR-20-959-53329.

Result

Sociodemographic

A total of 6,360 mothers (15–49 years old) with latest childbirth within two years participated in this survey. Out of 6,360 mothers, only 6,335 were included in the analysis due to complete responses. Hence, the response rate was 99.6%.

The majority of the respondents were from Kelantan state (8.8%), which corresponded to the highest estimated population, which was 57,955 and most were from urban areas (69.8%). More than half were Malaysian citizens (95.2%), younger age group (<35 years old) (72.1%), and Malay ethnicity (78.7%). Only 1.4% were unmarried. More than half (49.8%) were in secondary education and either unemployed, students, or housewives (58.4%). The sociodemographic profile of the respondent and the estimated total population are shown in Table 1.

Prevalence of hypertension in pregnancy

The overall prevalence of HDP in Malaysia was 6.5%. The highest prevalence of HDP was found at the state of Malacca (9.8%), followed by Sarawak (9.0%) and Perak (8.9%) while the lowest prevalence was found at Pahang (2.6%). 40–44 year old respondents had the highest prevalence of HDP (13.1%), followed by 35–39 (9.1%) and 30–34 (6.5%), while the lowest prevalence is in the group of 20–24 (3.1%). The highest prevalence of HDP was reported among Malaysian citizens (6.7%), rural dwellers (7.4%), maternal age ≥35 years old (10.2%), other Bumiputera ethnicity (9.2%), single or separated or divorced or widow (7.9%), those with secondary school education level (8.1%) and unpaid worker or housewife or not working or student (7.0%). The prevalence of HDP is summarised in Table 2.

Factors associated with HDP

A simple logistic regression showed that maternal age, ethnicity and employment status were significantly associated with HDP at $p<0.25$. Maternal age ≥35 years old (crude OR=2.15; 95% CI=1.74, 2.66; $p<0.001$), other Bumiputera ethnicity (crude OR=2.84; 95% CI=1.33, 6.06; $p=0.007$) were significantly associated with HDP. There were no significant associations between locality, citizenship, marital status, educational level, and employment status with HDP. The results are summarised in Table 3.

Multiple logistic regression analysis showed that maternal age and ethnicity were significantly associated with HDP. Maternal age ≥35 years old had 2.18 times the odds compared to <35 to have HDP (95% CI=1.75, 2.71; $p<0.001$) when adjusted for locality, citizenship, marital status, educational level, and employment status. Moreover, Other Bumiputera ethnicity has 2.71 times the odds compared to Chinese to have HDP (95% CI=1.25, 5.87;

Table 1 Sociodemographic profile of the respondents ($n=6,335$)

Profile		Unweighted Count, *n* (%)	Estimated Population
Overall		6,335 (100)	782,550
State			
	Johor	370 (5.8)	80,734
	Kedah	542 (8.6)	64,271
	Kelantan	560 (8.8)	57,955
	Melaka	468 (7.4)	30,338
	Negeri Sembilan	393 (6.2)	29,214
	Pahang	456 (7.2)	37,797
	Penang	435 (6.9)	43,167
	Perak	469 (7.4)	59,786
	Perlis	474 (7.5)	7,255
	Selangor	394 (6.2)	149,144
	Terengganu	485 (7.7)	38,381
	Sabah & WP Labuan	400 (6.3)	79,980
	Sarawak	466 (7.4)	58,206
	WP Kuala Lumpur & Putrajaya	423 (6.7)	46,320
Locality			
	Urban	4,420 (69.8)	542,948
	Rural	1,915 (30.2)	239,602
Advanced Maternal Age Group (year)			
	Below 35	4,523 (72.1)	554,673
	35 and above	1,754 (27.9)	219,089
Ethnicity			
	Malay	4,946 (78.7)	569,732
	Chinese	235 (3.7)	32,737
	Indian	207 (3.3)	28,343
	Other Bumiputera	617 (9.8)	99,281
	Others	279 (4.4)	44,552
Citizenship Group			
	Malaysian	5,979 (95.2)	726,740
	Permanent resident or non-citizen	301 (4.8)	47,545
Marital Status			
	Single or separated or divorced or widow	86 (1.4)	10,611
	Married or cohabiting	6,193 (98.6)	763,050
Educational Level			
	no formal education	106 (1.7)	16,137
	primary school	327 (5.3)	49,481
	secondary school	3,059 (49.8)	366,824
	tertiary education	2,653 (43.2)	327,014
Employment Status			
	government or semi-government employee	920 (15.0)	107,299
	private employee	1,143 (18.6)	155,446
	employer or self-employed	496 (8.1)	55,362
	unpaid worker or housewife or not working or student	3,594 (58.4)	441,949

$p=0.011$) when adjusted for locality, citizenship, marital status, educational level, and employment status.

Discussion

The current study documented a prevalence of hypertensive disorders in pregnancy (HDP) of 6.5% among women in Malaysia who had their last childbirth within two years of the study. Inferential analysis to explore the factors associated with HDP revealed significant associations of two factors, namely advanced maternal age and ethnicity.

The observed prevalence of HDP in this study (6.5%) is significant as it shows an increasing pattern, exceeding the rates of 4.5% in 2012 and 5.8% in 2016 among Malaysian women, based on data from the Malaysian National Obstetrics Registry and the National Health and Morbidity Survey [4, 12]. Despite the increase in prevalence of HDP, current prevalence in Malaysia is still low compared to other under-developed Asian countries such as Pakistan and India. According to a prospective study conducted in 2019, the prevalence of hypertensive disorders among pregnant women in Pakistan and India were 9.3% and 10.3%, respectively [13]. In the more developed Western countries like the US, the prevalence of HDP was 8.4% [14]. Although the rate was lower compared to Pakistan and India, it was still higher when compared to the rate in Malaysia. Even though the prevalence in Malaysia has not risen drastically, effective efforts must be taken to ensure the early diagnosis and treatment of hypertension during pregnancy to prevent possible complications and reduce mortality of women at risk of HDP.

Maternal age has been established as an important risk factor for HDP as it affects the reproductive process during pregnancy [10]. This is reflected in the current study as the prevalence of HDP was found to be higher among women with advanced maternal age (≥35 years old) compared to younger women. In line with the study results, Rashed et al. (2016) also reported a higher incidence of pregnancy-induced hypertension among women aged≥35 years old compared to younger women aged 20–34 years old (5.2% vs. 0.8%; $p<0.001$). The correlation was also supported in a study where women who were pregnant at 25–29 years old had a lower risk of gestational hypertension than women who aged 35–39 years old (Ye et al., 2014). Adding to the evidence, pregnant women aged<24 years old were observed to be 69% less likely to develop hypertension during pregnancy compared to women aged≥35 years old [15]. These findings support that increasing maternal age leads to gestational complications such as HDP in women [16].

Multiple logistic regression analysis revealed that women of Other Bumiputera ethnicity had higher odds of developing HDP compared to Chinese women (aOR=2.71; $p=0.011$). As supported by evidence in previous literature, certain ethnic or racial groups exhibit advantages related to specific disease burden. In the case

Table 2 Prevalence of HDP among mothers in Malaysia ($n=6,335$)

Variable		Unweighted Count, *n*	Estimated Population	Prevalence (%)	Lower CI (%)	Upper CI (%)
Overall		379	51,017	6.52	5.76	7.37
State						
	Johor	22	4,854	6.01	4.10	8.73
	Kedah	33	3,922	6.10	3.98	9.24
	Kelantan	42	4,482	7.73	5.49	10.80
	Melaka	43	2,976	9.81	7.52	12.70
	Negeri Sembilan	18	1,378	4.72	3.13	7.05
	Pahang	12	970	2.57	1.51	4.33
	Penang	13	1,309	3.03	1.80	5.07
	Perak	42	5,301	8.87	6.59	11.83
	Perlis	15	212	2.92	1.67	5.06
	Selangor	30	11,604	7.78	5.35	11.18
	Terengganu	22	1,753	4.57	2.93	7.06
	Sabah & WP Labuan	25	5,135	6.42	4.39	9.30
	Sarawak	42	5,234	8.99	6.37	12.56
	WP Kuala Lumpur & Putrajaya	20	1,888	4.08	2.54	6.48
Locality						
	Urban	257	33,285	6.13	5.76	7.37
	Rural	122	17,732	7.40	5.76	7.37
Advanced Maternal Age Group (year)						
	Below 35	210	28,488	5.14	5.80	7.43
	35 and above	167	22,313	10.18	5.80	7.43
Ethnicity						
	Malay	293	37,101	6.51	5.62	7.54
	Chinese	8	1,509	4.61	2.14	9.64
	Indian	8	938	3.31	1.53	6.99
	Other Bumiputera	56	9,136	9.20	7.05	11.92
	Others	12	2,118	4.75	2.58	8.61
Citizenship Group						
	Malaysian	362	48,574	6.68	5.88	7.59
	Permanent resident or non-citizen	14	2,147	4.52	2.60	7.73
Marital Status						
	Single or separated or divorced or widow	5	838	7.90	3.05	18.93
	Married or cohabiting	371	49,883	6.54	5.77	7.40
Education Level						
	No formal education	8	1,210	7.50	3.21	16.54
	Primary school	23	3,095	6.26	4.03	9.59
	Secondary school	201	29,864	8.14	6.88	9.60
	Tertiary education	134	15,504	4.74	3.86	5.81
Employment Status						
	Government or semi-government employee	62	6,523	6.08	4.58	8.02
	Private employee	56	8,811	5.67	4.10	7.78
	Employer or self-employed	25	3,386	6.12	3.83	9.63
	Unpaid worker or housewife or not working or student	224	31,047	7.03	6.07	8.12

of HDP, previous studies have reported some ethnic groups experience higher risk of HDP compared to others. Many studies comparing different ethnicities with Caucasian race, has established higher risk of HDP among women of African American and Filipino descent [17], women of African Caribbean origin [18], as well as women of Maori, indigenous Australian, American Indian and native Alaskan origins [19]. From these findings, it is noted

Table 3 Factors associated with HDP among mothers age 15–49 in Malaysia ($n=6,335$)

Characteristic		Simple Logistic Regression			Multiple Logistic Regression		
		Crude OR	95% CI	*p*-value	Adj. OR	95% CI	*p*-value
Locality							
	Urban (ref.)	1	—		1	—	
	Rural	1.10	0.88, 1.38	0.401	0.95	0.75, 1.21	0.693
Advanced Maternal Age (year)							
	Below 35 (ref.)	1	—		1	—	
	35 and above	2.15	1.74, 2.66	**< 0.001**	2.18	1.75, 2.71	**< 0.001**
Ethnicity							
	Chinese (ref.)	1	—		1	—	
	Malay	1.78	0.87, 3.65	0.113	1.74	0.84, 3.58	1.35
	Indian	1.00	0.36, 2.82	0.995	0.93	0.33, 2.63	0.891
	Other Bumiputera	2.84	1.33, 6.06	**0.007**	2.71	1.25, 5.87	**0.011**
	Others	1.28	0.51, 3.19	0.596	0.96	0.23, 4.02	0.954
Citizenship							
	Malaysian (ref.)	1	—		1	—	
	Permanent resident or non-citizen	0.76	0.44, 1.32	0.331	1.03	0.32, 3.36	0.957
Marital Status							
	Single or separated or divorced or widow (ref.)	1	—		1	—	
	Married or cohabiting	1.00	0.40, 2.49	0.995	0.96	0.38, 2.41	0.925
Educational Level							
	no formal education (ref.)	1	—		1	—	
	primary school	1.07	0.44, 2.56	0.886	0.78	0.31, 1.93	0.584
	secondary school	0.98	0.45, 2.14	0.964	0.68	0.29, 1.60	0.374
	tertiary education	0.75	0.34, 1.64	0.464	0.49	0.20, 1.18	0.113
Employment Status							
	government or semi-government employee (ref.)	1	—		1	—	
	private employee	0.71	0.49, 1.04	0.076	0.82	0.56, 1.21	0.327
	employer or self-employed	0.74	0.46, 1.19	0.212	0.72	0.43, 1.20	0.205
	unpaid worker or housewife or not working or student	0.91	0.68, 1.22	0.543	0.88	0.63, 1.23	0.453

* Enter method was applied for multiple logistic regression analysis. Multivariate regression model was adjusted for locality, citizenship, marital status, educational level, and employment status. Hosmer Lemeshow test: $p=0.525$; Classification table: 94.1% correctly classified

that women at a higher risk of HDP represent community with lower socioeconomic status often associated with poorer education, household income and medical insurance status, thus limiting their accessibility to medical facility. Limited accessibility to medical facility might delay the diagnosis of HDP and its subsequent treatment [20]. In the context of current study, women of Other Bumiputera ethnicity might belong to communities with lower socioeconomic status, who often reside in rural areas that have limited access to medical facilities, as opposed to Chinese women who represent a community with higher socioeconomic status having access to more sophisticated medical resources [21]. Such a contraint results in the late diagnosis of HDP and poorer prognosis in Other Bumiputera women compared to Chinese women.

Limitation and recommendation

One of the main limitations of this study is that it focuses primarily on the association of sociodemographic factors with the prevalence of HDP among women who had their latest childbirth within two years. Other important factors, including medical factors such as history of comorbidities (gestational diabetes and gestational hypertension), gravida and obstetric characteristics (multiple pregnancy) as well as behavioural factors such as dietary pattern before and/or during pregnancy, smoking status, alcohol consumption and obesity were not investigated due to the nature of the data. All of these factors had long been established as important risk factors for the development of HDP [10, 20, 22–24]. In addition to patient-related factors, future research should also focus on the biochemical aspect of HDP, such as investigating the changes in the expression levels of molecular biomarkers associated with HDP such as placental growth factor.

While it is acknowledged that the sole focus on sociodemographic factors concerning HDP among women who recently gave birth poses a limitation on the study outcome, narrowing the scope to explore the disease relationship with sociodemographic factors does come with its own merits. In the field of social determinants of health, health equity and socioeconomic status play a crucial role in influencing health outcomes,

and understanding its impact is fundamental for public health strategies. The simplicity of scrutinizing sociodemographic data to reveal relevant and actionable results galvanizes targeted interventions for high-risk women, especially when resources may be limited.

Conclusion

Our study provides a population-based prevalence of HDP among women aged 15–49 years old with children under 2 years old in Malaysia. Advanced maternal age, specifically those above 35 years old, emerges as a risk factor for the development of hypertension among women in this study. Additionally, it is noteworthy that individuals of other Bumiputera ethnicity exhibit higher odds of developing HDP.

Abbreviations

DBP	Diastolic blood pressure
EB	Enumeration Blocks
ESRD	End-stage renal disease
HDP	Hypertensive disorder of pregnancy
LQs	Living Quarters
NHMS	2022: MCH National Health and Mortality Survey 2022: Maternal and Child Health
PlGF	Placental growth factor
PSU	Primary Sampling Unit
SBP	Systolic blood pressure
SD	Standard deviation
SSU	Second Sampling Unit

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Author contributions

KKYR, MABS, WKS, PSKT and MFBMY conceived and performed experiments, analysed the data and wrote the manuscript. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval

Ethics approval was requested and obtained from the Medical Research and Ethics Committee of the Ministry of Health Malaysia. The study is registered with the National Medical Research Registry as NMRR-20-959-53329.

Competing interests

The authors declare no competing interests.

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