ADVERSE BIRTH OUTCOMES AMONG ORANG ASLI IN KELANTAN FOR YEARS 2018 – 2020: THE PROPORTIONS AND ASSOCIATED MATERNAL FACTORS

By

DR ERWAN ERSHAD AHMAD KHAN

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LIST OF SYMBOLS

%	Percent
≥	More than and equal to
<	Less than

LIST OF ABBREVIATIONS

ABO	Adverse birth outcomes
AdjOR	Adjusted Odds Ratio
CI	confidence interval
IUGR	Intra uterine growth restriction
JAKOA	Jabatan Kemajuan Orang Asli
Kg	Kilogram
LBW	Low birth weight
MOH	Ministry of Health
OR	Odds Ratio
ROC	Receiving Operating Curve
SGA	Small for gestation age
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

ABSTRAK

HASIL KELAHIRAN YANG BURUK DALAM KALANGAN ORANG ASLI DI KELANTAN SELAMA TAHUN 2018 – 2020: PERKADARAN DAN FAKTOR IBU YANG BERKAITAN

Hasil kelahiran yang buruk merujuk kepada kejadian serius yang berlaku pada bayi semasa kelahiran mereka dan berpotensi untuk mempengaruhi kesihatan mereka di kemudian hari dan juga kesihatan ibu. Hasil kelahiran yang buruk termasuk berat badan bayi yang ringan semasa lahir, kelahiran pramatang, kematian janin dalam kandungan, kematian awal bayi baru lahir dan bayi besar. Kajian semakan rekod menggunakan data sekunder ini bertujuan untuk mengukur perkadaran hasil kelahiran yang buruk dan faktor ibu yang berkaitan dengan bayi Orang Asli dengan berat badan yang ringan semasa lahir di Kelantan selama tahun 2018 - 2020. Kajian ini menggunakan data daripada daftar kelahiran, daftar kematian dan rekod kehamilan. Persampelan rawak berstrata berkadar dilakukan untuk memilih 327 sampel dari lima pusat antenatal yang terlibat dengan penjagaan Orang Asli di Kelantan. Analisis regresi logistik berganda digunakan untuk menentukan faktor ibu yang berkaitan dengan bayi Orang Asli dengan berat badan yang ringan semasa lahir. Perkadaran hasil kelahiran yang buruk adalah seperti berikut: berat badan bayi yang ringan semasa lahir adalah pada 16.2%, kelahiran pramatang pada 7.3%, kematian janin dalam kandungan pada 0.6%, kematian awal bayi baru lahir pada 0.6% dan

bayi besar pada 0.9%. Sejumlah 26.6% daripada ibu dengan kandungan pertama, 20.8% daripada ibu dengan anemia sewaktu kehamilan dan 41.7% daripada ibu dengan tekanan darah tinggi mendapat anak dengan berat badan bayi yang ringan semasa lahir. Faktor ibu yang berkaitan dengan berat badan bayi yang ringan semasa lahir termasuk ibu dengan kandungan pertama (AdjOR: 2.88, 95% CI: 1.44, 5.78), anemia sewaktu kehamilan (AdjOR: 2.33, 95% CI: 1.18, 4.61) dan tekanan darah tinggi (AdjOR: 4.21 95% CI: 1.23, 14.44). Kesimpulannya, hasil kelahiran yang buruk terutamanya berat badan bayi yang ringan semasa lahir dalam kalangan Orang Asli di Kelantan adalah lebih tinggi daripada populasi umum dan setanding dengan kumpulan-kumpulan penduduk asli dari tempat lain di dunia. Langkah-langkah pencegahan yang jelas terhadap berat badan bayi yang ringan semasa lahir dan faktor penentunya, serta pengembangan strategi praktikal dan fokus harus diambil oleh pihak berkepentingan untuk mengurangkan perkadaran berat badan bayi yang ringan semasa lahir dalam kalangan Orang Asli.

Kata kunci: hasil kelahiran yang buruk, berat badan bayi yang ringan semasa lahir, kelahiran pramatang, kematian janin dalam kandungan, kematian awal bayi baru lahir, bayi besar, faktor ibu yang berkaitan

ABSTRACT

ADVERSE BIRTH OUTCOMES AMONG ORANG ASLI IN KELANTAN FOR YEARS 2018 – 2020: THE PROPORTIONS AND ASSOCIATED MATERNAL FACTORS

Adverse birth outcomes refer to serious events that occurred to infants accompanying their birth and has the potential to impact their later life as well as the mothers. Adverse birth outcome includes low birth weight, preterm birth, stillbirth, early neonatal death and macrosomia. This secondary data record review study aimed to measure the proportions of adverse birth outcomes and maternal factors associated with low birth weight among Orang Asli infants in Kelantan for years 2018 - 2020. This study utilised data from the birth registry, death registry and antenatal records. Proportionate stratified random sampling was done to select 327 samples from five antenatal centres involved with Orang Asli. Multiple logistic regression analysis was used to determine maternal factors associated with low birth weight among Orang Asli infants. The proportions of adverse birth outcomes were as follows: low birth weight is at 16.2%, preterm birth at 7.3%, stillbirth at 0.6%, early neonatal death at 0.6% and macrosomia at 0.9%. A total of 26.6% of primiparous mothers, 20.8% of mothers with anaemia in pregnancy and 41.7% of mothers with hypertension had low birth weight infants. Maternal factors associated with low birth weight infants include primiparity (AdjOR: 2.88, 95% CI: 1.44, 5.78), anaemia in pregnancy

(AdjOR: 2.33, 95% CI: 1.18, 4.61) and hypertension (AdjOR: 4.21 95% CI: 1.23, 14.44). In conclusion, the proportions of adverse birth outcomes especially low birth weight among Orang Asli in Kelantan is higher than the general population and comparable to other indigenous groups from other parts of the world. Explicit preventive measures against low birth weight and its determining factors and the development of practical and focused strategies should be adopted by the stakeholders to reduce the proportions of low birth weight among Orang Asli.

Keywords: adverse birth outcome, low birth weight, preterm birth, stillbirth, early neonatal death, maternal factors associated

CHAPTER 1

INTRODUCTION

1.1 Orang Asli in Malaysia

There are more than 370 million indigenous people scattered over 70 countries worldwide (United Nations, 2019). In peninsular Malaysia, Orang Asli (OA) are regarded as the indigenous people. They are mainly divided into three main tribes – Senoi, Negrito and Proto-Malay and can be further classified into eighteen sub-tribes (Masron *et al.*, 2013). It was estimated that there were around 180,000 Orang Asli in Malaysia with approximately half of the population were located on the east coast of peninsular Malaysia (Husin, 2018). Logistically, they can be divided into two main categories, those who reside at the peripheries of towns and those who are in the inland (Tuan Abdul Aziz *et al.*, 2016). Most of the community members mainly engage in fishing, together with the cultivation of food for their consumption (Masron *et al.*, 2013). Some of them still lead a nomadic life while majority of the community have settled in designated areas (Masron *et al.*, 2013). They utilized the river as the main source of drinking water, food source, washing and transportation (Masron *et al.*, 2013). While national poverty and hardcore poverty rates were 7.5% and 1.4% in 2006, 33.53% and 15.4% of Orang Asli were classified as poor and hardcore poor, respectively (UNDP, 2010). Poverty among Orang Asli has been associated with poorer health outcomes such as malnourishment and a deterioration in physical and mental health (Kiah Hui, 2020).

In Kelantan, there are three main sub-tribes of Orang Asli. The Temiar sub-tribe live close to the Kelantan-Pahang border and make up most of the population while the Batek sub-tribe mainly live close to the Kelantan-Terengganu border. Another sub-tribe of Orang Asli that resides in Kelantan is of the Jahai sub-tribe that mainly lives at Jeli, which is close to the Kelantan-Perak border. Most of them have settled in permanent areas that include both peripheries of the towns as well as the inland.

1.2 Health of the Orang Asli

In general, the Orang Asli population has a lower health status compared to other ethnic groups in Malaysia (Lin Khor and Shariff, 2008). The life expectancy of Orang Asli is around 53 years, lower than the national average of 73 years (Masron *et al.*, 2013). Perinatal mortality rate which derived from numbers of stillbirth and early neonatal death of Orang Asli was reported at 25.7 per 1000 population, higher than the national perinatal mortality rate of 8.1 per 1000 population (Singh HSS, 2008). The proportions of low birth weight among Orang Asli at 20.5% was also higher than the national average of around 6% (S. Kaur *et al.*, 2019; Murtaza *et al.*, 2018). A lack of trust in modern medicine, adherence to traditional believes in the supernatural model of health and lack of access to modern medical facilities were postulated as the main reasons for the lower health status of Orang Asli (Tuan Abdul Aziz *et al.*, 2016). Other factors such as socio-economic disadvantages, genetic vulnerability, resource alienation and political oppression were also found to be associated with low quality of life among Orang Asli (Durie, 2003). As a result of poor hygiene due to environmental and socioeconomic determinants such as scarcity of water, low level of education and low household monthly income, the members of

the population were also exposed to infectious diseases such as soil-transmitted helminths, intestinal parasitic infections and malaria (Aini *et al.*, 2007; G. Kaur, 2009; Y. A. L. Lim *et al.*, 2009; Najwa Zakaria and Sakdiah Minhat, 2020; United Nations University, 2018).

Significant challenges remain in delivering universal health care for the Orang Asli mainly due to logistic reasons. In Kelantan particularly, the Orang Asli Mobile teams were established in an attempt to reach the population and deliver appropriate health care including outpatient services, maternal and child health clinics as well as communicable and non-communicable diseases follow-up. For instance, the mobile team of Gua Musang district is responsible to visit Orang Asli posts such as Pos Balar, Pos Gob and Pos Belatim. They will usually travel long hours on rough terrains to reach these posts. Each post consists of a cluster of Orang Asli villages. The team will usually involve medical officers, assistant medical officers, pharmacists, nurses, attendants and drivers. Other than the mobile team, over the years, more health clinics have been established near the Orang Asli community. These clinics will reduce the burden of the mobile team as the periphery of the town population can now come directly to the clinic. For example, *Klinik Kesihatan Pos Brooke* was recently established in 2020 to cater to the need of the Temiar sub-tribe at Pos Brooke.

Apart from mobile team and health clinics, intradepartmental cooperation between the Ministry of Health and other government sectors are also necessary to cater for health needs of the Orang Asli. The medical evacuation (Medevac) team, usually provided by the Fire and Rescue Department, helps in transferring emergency cases to nearby hospitals using air transport. For instance, recently, it was

reported that three pregnant Orang Asli women were transferred from their village to Gua Musang Hospital via Medevac (Aimuni, 2021). Other than that, the Department of Orang Asli Development (JAKOA), is also responsible for providing necessary supports to the Ministry of Health with regards to Orang Asli health care.

1.3 Study background

Pregnancy and adverse birth outcomes are some of the issues that must be addressed with regards to Orang Asli due to the susceptibility of the population. A total of 25% of teenage pregnancies in peninsular Malaysia were contributed by Orang Asli (Maimunah *et al.*, 2012). The infant mortality rate among Orang Asli was reported to be three times higher compared to the general population (Singh HSS, 2008). When comparing the proportions of low birth weight cases in Malaysia, minority groups (other than Malay, Chinese or Indian) had the highest prevalence compared to the general population and this could reflect on Orang Asli as well (Jai *et al.*, 2016).

There is no standard definition by the WHO on adverse birth outcomes. A study published on the WHO bulletin on adverse birth outcomes suggested stillbirth, preterm delivery and low birth weight as the parameters for the condition (Watson-Jones *et al.*, 2007). Therefore, adverse birth outcomes can be referred to collection of serious events that occurred to infants accompanying their birth and had the potential to impact their later life as well as the mothers' health. Selection of adverse birth outcomes varies from literatures depending on the area of interest but the majority focused on low birth weight, preterm birth and perinatal mortality as those outcomes are more commonly observed and had the potential to impact infants' later life as well as their mothers (Brown *et al.*, 2016; Gibberd *et al.*, 2019; Graham *et al.*, 2007;

Kildea *et al.*, 2013; Sheppard *et al.*, 2017; Steenkamp *et al.*, 2017; Wenman *et al.*, 2004; Whish-Wilson *et al.*, 2016).

Adverse birth outcomes that are regularly monitored by the WHO at the global level include low birth weight, preterm birth and perinatal mortality. Low birth weight was reported as more common in developing countries and contributed to a range of poor health outcomes (World Health Organization, 2004). Apart from that, it was estimated that over 15 million babies were born prematurely every year worldwide (Blencowe *et al.,* 2012). Over 1 million children die each year due to complications of preterm birth and survivors are at risk of facing a lifetime of disabilities, including learning, visual and hearing problems (Kinney *et al.*, 2012). In addition to that, 2.6 million cases of stillbirth reported globally with the majority of them from developing countries (World Health Organization, 2016). WHO also reported that 2.4 million infants died in the first month of life with 75% of cases were reported occurred during the first week of life (World Health Organization, 2020b).

The impacts of adverse birth outcomes could be devastating to both mothers and infants. Prematurity and low birth weight were found to be among the major determinants of undernutrition among the Orang Asli children (Khor and Shariff, 2019). Low birth weight has also been reported to be associated with stunting among Orang Asli children (Murtaza *et al.,* 2018). The effects of stunting as a result of low birth weight in children could continue into their adulthood and cause obesity with deficiency of vitamins or minerals resulting in the double burden of the disease (World Health Organization, 2020a).

In the event of death such as perinatal mortality, mothers especially those below 20 years old were more likely to be stress while coping with the loss (Human

et al., 2014). Stillbirth, miscarriage and termination of pregnancy were also found to be significantly associated with attempted suicide among the mothers. Apart from psychological issues, women with stillbirth were also found to be 14 times more likely than women with live birth to go into shock or experience sepsis, 13 times more likely to have acute kidney failure and 10 times more likely to suffer cardiac complications, including heart attack (Erin, 2019). Therefore, it is important to focus on adverse birth outcomes as they can contribute to significant health impacts on both mothers and infants.

1.4 Problem Statement and Study Rationale

As discussed earlier, adverse birth outcomes had been associated with unfavourable maternal and child outcomes (Human *et al.*, 2014; Khor and Shariff, 2019; Murtaza *et al.*, 2018). Therefore, sufficient data need to be obtained for further improvement of preventive measures. Every Orang Asli woman needs to be properly evaluated and stratified accordingly so that, adverse birth outcomes can be minimalized, leading to a healthier generation.

Focusing on the factors associated with low birth weight is important not only due to the impacts but also due to the fact that it is one of the most commonly reported adverse birth outcomes among the indigenous (Kildea *et al.*, 2013). The proportion of low birth weight was also reported to be higher among Orang Asli compared to the general population (Jai *et al.*, 2016; Murtaza *et al.*, 2018). However, the previously available data is out of date and in need of revision. Furthermore, understanding the associated factors will help in formulating proper management plans for the targeted population.

As most of the studies among Orang Asli have focused on malnutrition, there are limited published studies that discussed pregnancy-related issues of the population. There is a limited number of studies that discuss adverse birth outcomes among the Orang Asli population. Therefore, it is important to establish the evidence to inform policy related to the health of the Orang Asli.

Lastly, in line with the Sustainable Development Goals (SDG) 2030 – Goal 3 Good Health and Well-Being and Goal 10 Reduced Inequalities, with the aspiration of "leaving no one behind", it is crucial to address issues among minorities especially health-related issues so that we can move forward together for the betterment of the nation (United Nations, 2015).

1.5 Research Questions

1. What are the proportions of adverse birth outcomes among Orang Asli women in Kelantan for years 2018 – 2020?
2. What are the characteristics of Orang Asli women in Kelantan for years 2018 – 2020 according to adverse birth outcomes?
3. What are the maternal factors associated with low birth weight among Orang Asli infants in Kelantan for years 2018 – 2020?

1.6 Research Objectives

1.6.1 General Objectives

To measure the proportions of adverse birth outcomes and maternal factors associated with low birth weight Orang Asli infants in Kelantan for years 2018 - 2020.

1.6.2 Specific Objectives

1. To measure the proportions of adverse birth outcomes among Orang Asli women in Kelantan for years 2018 - 2020.
2. To describe the characteristics of Orang Asli women in Kelantan for years 2018 – 2020 according to adverse birth outcomes.
3. To determine the maternal factors associated with low birth weight among Orang Asli infants in Kelantan for years 2018 – 2020.

1.7 Hypotheses

- $H_{A:}$ Orang Asli mothers that are < 20 years old or ≥ 40 years old are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with low booking weight are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with short stature are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with late booking are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with primiparity and grand multiparities are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with anaemia are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with history of adverse birth outcomes are significantly associated with low birth weight infants.

- $H_{A:}$ Orang Asli mothers that were infected with sexually transmitted diseases (STD) such as HIV or Syphilis are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with Diabetes Mellitus are significantly associated with low birth weight infants.
- $H_{A:}$ Orang Asli mothers with hypertension are significantly associated with low birth weight infants.

CHAPTER 2

LITERATURE REVIEW

Literatures were searched using four search engines – PubMed, Scopus, ScienceDirect and Google Scholar using keywords such as adverse birth outcomes, infant outcomes, low birth weight, Orang Asli, antenatal complications, preterm birth, stillbirth, neonatal death, perinatal mortality and macrosomia.

2.1 Low Birth Weight and its Determinants

Low birth weight was reported as the most observed adverse birth outcome. WHO estimated that 15- 20% of all birth worldwide were low birth weight and this accounted for more than 20 million births per year (World Health Organization, 2014). In term of ethnicity, it was reported that indigenous babies had lower mean birthweight compared to non-indigenous babies (Ford *et al.,* 2018). According to Malaysia's National Health and Morbidity Survey (NHMS), 9.7% of children under the age of five were born with low birth weight (Jai *et al.*, 2016). Another study from Malaysia reported the overall prevalence of low birth weight infants was 6.38% with rural women were around five times more likely to deliver low birth weight infants when compared to women from urban areas (S. Kaur *et al.,* 2019). Orang Asli, on the other hand, were found to have the highest prevalence of low birth weight infants with 20.5% (Murtaza *et al.,* 2018). Research on indigenous populations from other parts of the world reported low birth weight as more common among the indigenous compared to non-indigenous. Whish-Wilson *et al.,* (2016) reported that the

prevalence of low birth weight among indigenous of Australia at 6.5% was higher than non-indigenous at 5.4%. In another study from Australia, it was found that the rate of low birth weight among indigenous at 13.2% was higher than their non-indigenous counterpart at 8.2% (Kildea *et al.*, 2013). Inuit of Canada were also reported to have a higher rate of low birth weight at 6.4% compared to the non-aboriginal population at 4.7% (Chen *et al.*, 2015).

Two main aetiologies have been identified as related to low birth weight – prematurity and intra uterine growth restriction (IUGR). Being born before 37 weeks of gestation means a foetus has less time to grow and gain weight in the mother's uterus. Multiple pregnancies, infections and chronic conditions such as Hypertension are among common causes for preterm birth which can lead to low birth weight (World Health Organization, 2018). On top of that, endocrine changes in the uteroplacental environment contributed by hormones from both mother and foetus such as cortisol, oestrogen and progesterone also appear to be the principal factors leading to the development of uterine contractions, resulting in preterm birth (Committee to Study the Prevention of Low Birthweight,1985).

Intra uterine growth restriction (IUGR) has been defined as the rate of foetal growth that is below the normal level of the growth potential with regards to race and gender of the foetus (D. Sharma *et al.*, 2016). Reduced maternal nutrition consumption, maternal systemic diseases such as Hypertension and Diabetes Mellitus, periodontal disorder, improper placental activity that can contribute to an altered uteroplacental blood flow or disturbance of the placental transfer, abruption, infarction, or mal-development of the placenta are all examples of maternal causes that can be linked to inadequate substrate supply to the foetus during development,

thus leading to IUGR (Negrato and Gomes, 2013). Mothers that consume alcohol, tobacco or involves with illicit drugs abuse during pregnancy will also result in the exposure of the foetus to a toxic intrauterine milieu, thus result in IUGR (Ahluwalia *et al.*, 2001). On the other hand, chromosomal anomalies such as gonadal dysgenesis, Edward Syndrome, Turner Syndrome, Down Syndrome and Prader-Willi Syndrome have been identified as several foetal factors that could cause IUGR (Jancevska *et al.*, 2012).

Some other factors had been identified to be linked with low birth weight. Maternal age is one of them. Both spectrum of age, very young mother which is also defined as teenage pregnancy and advanced maternal age of more than 35 years old were reported to be associated with low birth weight infants. Abebe *et al.*, (2020) reported that adolescent women have a significantly higher risk of preterm birth and low birth weight. Advance maternal age was also reported as a predictor for preterm birth which could lead to low birth weight (Londero *et al.*, 2019). With regards to the indigenous, it was reported that mothers aged 12 - 19 years old were associated with low birth weight (Dowell *et al.*, 2019).

Being a first-time mother was associated with a significantly increased risk of low birth weight or small for gestational age birth, according to a systematic review of forty-one studies, whereas grand multiparity and great grand multiparity were not associated with an increased risk of pregnancy outcomes (Shah, 2010). A similar conclusion was made among the aborigines of Australia's east coast, where primiparous women were linked to lower birth weight babies when compared to multiparous moms (Comino *et al.*, 2012). It was theorized that this group of primiparous mothers' lack of understanding towards the necessity of antenatal care

had predisposed them to complications such as low birth weight infants (J. Kaur and Kaur, 2012). Furthermore, it was assumed that altered angiogenesis, insulin resistance, and immunological maladaptation in primiparous mothers caused serious obstetric complications such as preeclampsia, which finally led to unfavourable delivery outcomes such as low birth weight infants (Dekker *et al.*, 1998; Luo *et al.*, 2007; Xiong *et al.*, 2002).

The nutritional status of the mothers, it its most basic form, is reflected by their weight and height is also an important factor associated with low birth weight. Wong *et al.,* (2015) reported that 12.9% of Orang Asli adults as underweight. A total of 15.9% of Orang Asli mothers were reported as short stature with a height of less than 145cm (Murtaza *et al.*, 2018). These findings could impact the birth outcome as underweight women were at increased risk of having low birth weight infants in both developed and developing countries (Han *et al.*, 2011). Short stature mothers, on the other hand, were reported at increased risk for small gestational age and preterm birth (Kozuki *et al.*, 2015).

Being a late booker is another established risk factor for low birth weight. It is defined as booking later than 12 weeks of gestation (Norhayati *et al.*, 2016). Am and Hj, (2011) reported 26.9% of Orang Asli women as not knowing that they need to have their first antenatal check-up done in the first three months of pregnancy. This could be disastrous as complications of delivery such as preterm birth and low birth weight were significantly associated with late booking (Floridia *et al.*, 2014). Other than that, women with bad obstetric history were also found to be at risk of having adverse birth outcomes including low birth weight (Tsegaye and Kassa, 2018).

Anaemia is another issue that must be addressed when it comes to Orang Asli due to the prevalence of the disease among the population and the impact of the situation on the birth outcome. A total of 25.6% of Orang Asli women were reported to be anaemic during booking (Jeganathan and Karalasingam, 2017). This could be catastrophic as pregnant women with anaemia were significantly associated with low birth weight, preterm birth, perinatal mortality and neonatal mortality (Rahman *et al.*, 2016). It had been hypothesized that reduced haemoglobin levels will induce shifts in placental angiogenesis, reducing the supply of oxygen to the foetus and theoretically inducing intrauterine growth restriction and low birth weight (Stangret *et al.*, 2017).

Sexually transmitted diseases such as Syphilis and HIV were also have been reported occurring in the Orang Asli communities and these could lead to low birth weight infants as well. An HIV-infected woman had a higher risk of stillbirth, preterm birth, low birth weight and small gestation age infant (Li *et al.*, 2020). In addition to that, adverse pregnancy outcomes including low birth weight were also seen among 16.3% of women with treated syphilis and 33.8% among women with untreated syphilis (Liu *et al.*, 2019).

As the burden of non-communicable diseases such as Diabetes Mellitus and Hypertension were reported to be increasing among the Orang Asli population, it is important to evaluate those conditions with regards to the pregnancy outcomes. A total of 53.3% of Orang Asli at Kampung Ulu Tual, Kuala Lipis were reported to have abnormal capillary sugar (Shalihin *et al.*, 2019). This is alarming as uncontrolled blood sugar can lead to many obstetric outcomes such as foetal loss, preterm birth, congenital malformations and macrosomia (Negrato *et al.*, 2012). Hypertension, on the other hand, was found to be associated with low birth weight,

preterm delivery, perinatal death, small for gestational age and birth asphyxia (Berhe *et al.*, 2019). Elevated maternal blood pressure during pregnancy is influential in causing delivery of low birth weight infants, regardless of maternal ethnicity (Fang *et al.*, 1999; Xiong *et al.*, 2002). Hypertension disorders in pregnancy could result in decreased uteroplacental perfusion, resulting in complications such as preeclampsia (Beck and Peeters, 1998; Mustafa *et al.*, 2012). Reduced placental blood flow will then result in decreased foetal development, with an increased risk of intrauterine growth restriction and low birth weight (Misra, 1996).

2.2 Adverse Birth Outcomes and Associated Maternal Factors

It was estimated that around 15 million babies are born preterm with the rate ranges from 5% to 18% worldwide (World Health Organization, 2018). The rate of preterm birth for aboriginal babies was found to be almost double of the non-aboriginal population at over 14% (Madelaine, 2019). In Malaysia, approximately 500,000 babies were born prematurely every year (Hasmawati, 2020). While limited studies discussed on overall prevalence of preterm birth among Orang Asli, it was found that 33.8% of their babies that were admitted to the neonatal unit in a hospital were born prematurely (Kandasamy and Somasundram, 2007). Maternal factors associated with preterm birth among the indigenous were gestational hypertension and history of previous preterm birth (Heaman *et al.*, 2005). Hypertension can damage the placenta's vasculature, causing the oxytocin receptors to activate abruptly, resulting in preterm labour. Furthermore, elevated blood pressure during pregnancy reduced uteroplacental blood flow, resulting in intrauterine growth restriction and premature birth (Mulualem *et al.*, 2019).

Perinatal mortality that includes stillbirth and early neonatal death continues to remain as one of the major public health issues worldwide especially in the least developed and developing countries. A total of 6.3 million cases were reported annually with 27% of the cases in the least developed countries alone (World Health Organization, 2006a). Minorities like the First Nations of Canada was found to have a higher perinatal mortality rate compared to non-First Nations with a gap of 6.24 per 1000 total births in 2019 (Alberta Health Services, 2020). In Malaysia, perinatal mortality rates for Orang Asli were reported as more than three times of national average – 25.7 per 1000 births for Orang Asli compared to 8.1 per 1000 births for the national average (Singh HSS, 2008). Stillbirth can be divided into macerated or fresh stillbirth. Macerated stillbirth is a stillbirth with pulpy peeling skin indicating that death happened more than 12–24 hours before birth (Cyril Engmann *et al.*, 2009). Fresh stillbirth on the other hand refers to a neonate that died within 12–24 hours before birth and showed no signs of skin disintegration (Cyril Engmann *et al.*, 2009). Maternal infections such as ascending infections from the urinary tract or chronic infections from HIV or Syphilis had been postulated as the possible causative mechanism with regards to stillbirth (Osman *et al.*, 1995; World Health Organization, 2006a). Systemic diseases such as Diabetes Mellitus, thyroid abnormalities, hypertension, systemic lupus erythematosus, cholestasis of the pregnancy, renal disease, sickle-cell disease and other maternal medical conditions also cause stillbirth (American College of Gynaecology, 2009). The causes for early neonatal death are almost similar to stillbirth though most of them are due to infections (C Engmann *et al.*, 2012).

Macrosomia which refers to a neonate with a birth weight of more than 4000g can be due to genetic factors, duration of gestation and presence of Diabetes Mellitus

during pregnancy either gestational or established Diabetes Mellitus (Okun *et al.*, 1997). While very limited studies discussed macrosomia among Orang Asli in Malaysia, it was found that North American Native groups were reported to have higher rates of macrosomia compared to the non-native population (Rodrigues *et al.*, 2000). Maternal diabetes is one of the most serious risks associated with giving birth to a large-for-gestational-age infant. Pregestational and gestational diabetes cause foetal macrosomia in up to 50% of pregnancies complicated by gestational diabetes and 40% of pregnancies complicated by type 1 Diabetes Mellitus (Najafian and Cheraghi, 2012). A longer duration of gestation could also result in larger babies. Other than that, it was also discovered that obese women and those with excessive weight gain during pregnancy were at higher risk to deliver macrosomic babies (Catalano, 2007).

2.3 Impacts of Adverse Birth Outcomes

Adverse birth outcomes can have devastating effects on both neonates and mothers. Low birth weight is associated with foetal and neonatal mortality and morbidity, impaired cognitive performance, and an elevated risk of chronic diseases later in life (World Health Organization, 2014). In contrast to normal weight babies, low birth weight infants are 20 times more likely to develop complications and die (World Health Organization, 2004). It is also commonly associated with stunting in childhood which will eventually result in more complications in later life such as the double burden of malnutrition (Fongar *et al.*, 2019; Utami *et al.*, 2018). Apart from effects to the infants, the parents are also affected by having low birth weight babies especially due to additional costs for medical care (Almond *et al.*, 2005).

Similar to low birth weight, preterm birth will also result in many significant complications. The complexity of health problem arise from preterm birth are proportionate to the timing of the birth – extreme prematurity results in more serious complications than borderline prematurity (Ward and Beachy, 2003). Preterm birth complications result from immature organ systems that are not yet ready to sustain life outside the womb and this reflects on fragility and immaturity of the brain, lungs, immune system, kidneys, skin, eyes, and gastrointestinal system (Institute of Medicine (US) Committee on Understanding Premature Birth and Assuring Healthy Outcomes, 2007). On top of that, preterm babies are more likely than full-term infants to die during the neonatal phase (first 28 days) and infancy (first year), and mortality rates rise proportionally as gestational age or birth weight decreases (Allen *et al.*, 2000).

Perinatal mortality (stillbirth or early neonatal death) will means the end of the story for the neonates. However, it can still impact the psychology of the mothers. According to studies, parents who have experienced a perinatal loss are more likely to experience depressive symptoms, guilt, excessive grief, and feelings of loss of control (Badenhorst and Hughes, 2007; Beutel *et al.*, 1996; Fottrell *et al.*, 2010). It was also found that mothers who have lost their babies by stillbirth or neonatal death are 7-9 times more likely to be depressed than women who have a live infant (Vance *et al.*, 1991).

Macrosomia also greatly affects foetus and mothers. Due to obstructed labour, macrosomic neonates will usually be at risk for birth asphyxia, shoulder dystocia, hypoglycaemia and birth trauma such as fractures and nerve injuries (Said and Manji, 2016). Maternal complications, on the other hand, involve a prolonged

first stage of labour, a prolonged second stage of labour, instrumental delivery, failed instrumental delivery, emergency caesarean section, post-partum haemorrhage and obstetric anal sphincter injury (Beta *et al.*, 2019).

2.4 Maternal and Child Health Issues of Orang Asli

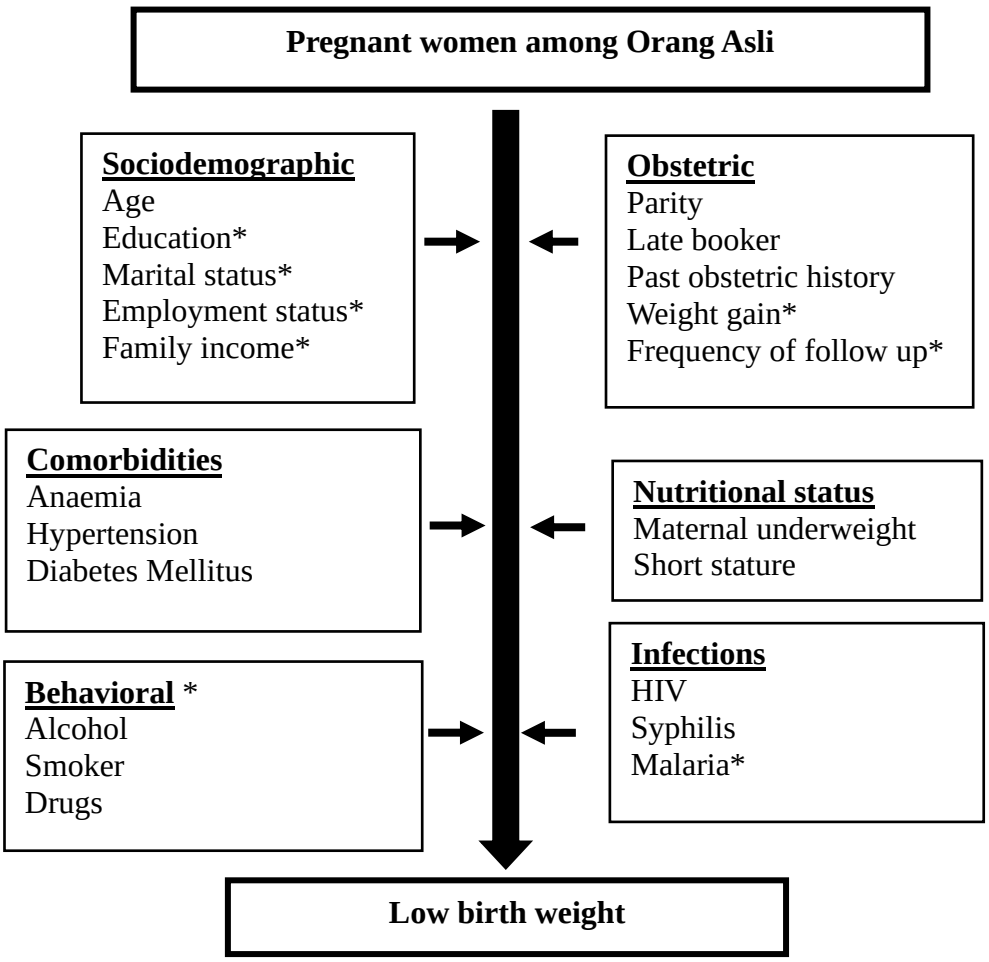
A total of 25% of teenage pregnancies in peninsular Malaysia were contributed by Orang Asli (Maimunah *et al.*, 2012). The proportions of late antenatal booking and home delivery were high among Orang Asli women and associated with their approach to antenatal care (UNDP, 2015). It was reported that around 70% of Orang Asli women had a history of home delivery and 44.2% had experienced at least one high-risk pregnancy before (Am and Hj, 2011). Familiarity and the strong influence of traditional health practices have been postulated as the main reasons for their preference for home delivery (UNDP, 2015). In relation to booking status, it was reported that up to 36% of Orang Asli women came late for their first antenatal check-up (H. Lim and Chee, 1998). In another remote part of Malaysia, just around half of pregnant Orang Asli women arrived for their first antenatal appointment in the first trimester (Am and Hj, 2011). Despite their modest size, the Orang Asli proved to be a group that merited additional evaluation if ethnic group-specific ratios were explored (UNDP, 2015). This is primarily because Orang Asli patients were only admitted to hospitals when they had serious obstetric complications that necessitated intervention (Sivalingam and Looi, 1999).

With regards to the nutritional status among Orang Asli households, it was found that the prevalence of significant underweight, stunting and wasting were 45.3%, 51.6% and 7.8% respectively (Zalilah and Tham, 2002). Prematurity and low birth weight were discovered to be two of the most important indicators of

undernutrition among Orang Asli children (Khor and Shariff, 2019). Stunting has also been linked to low birth weight in Orang Asli children (Murtaza *et al.*, 2018). Stunting because of low birth weight may persist throughout adulthood, leading to obesity and vitamin or mineral deficiencies, resulting in the double burden of disease (World Health Organization, 2020a). The prevalence of anaemia in pregnancy among Orang Asli women was 25.6% (Jeganathan and Karalasingam, 2017). This is most likely due to a poorer socioeconomic background, which leads to inadequate nutritional consumption and insufficient body iron reserves (UNDP, 2015).

Orang Asli infant death rates were found to be as high as 51.7 per 1000 live births, compared to the national infant death rate of 8.9 per 1000 live births (Masron *et al.*, 2013). The ethnic category 'other Malaysian,' which consisted primarily of Orang Asli, Bumiputera Sabah, and Bumiputera Sarawak infants, had the highest death rate (Lan and Ismail, 2008).

2.5 Conceptual framework



***** Factors that will not be studied

Figure 2.1. Maternal factors associated with low birth weight Orang Asli infants in Kelantan for years 2018-2020.

This conceptual framework shows associations between possible maternal factors and low birth weight among the Orang Asli population. Maternal weight gain throughout pregnancy was excluded as anticipating defaulters and incomplete follow up. Most of the sociodemographic characteristics were not evaluated due to the anticipation of a homogenous population and limitation of data. This will be applied to behavioural aspects as well as it was not documented in the records.

CHAPTER 3

METHODOLOGY

3.1 Research design

Secondary Data Record Review Study

3.2 Study area

Kelantan

3.3 Study duration

October 2020 – August 2021

3.4 Study Population

3.4.1 Reference population

All pregnant Orang Asli women in Kelantan.

3.4.2 Source population

All pregnant Orang Asli women in Kelantan, already delivered in Kelantan and followed up with government health facilities in Kelantan for years 2018 – 2020.

3.4.3 Sampling frame

All pregnant Orang Asli women in Kelantan, already delivered in Kelantan, followed up with government health facilities In Kelantan for years 2018 - 2020 and fulfilled the study criteria.

3.5 Study criteria

Exclusion

- Incomplete data of 20% or more.
- Multiple pregnancies

3.6 Sample size estimation

The sample size was calculated to estimate the proportions of adverse birth outcomes among Orang Asli women in Kelantan. A sample size of 317 was estimated to be adequate to address specific objective 1, including an allowance of an additional 10% probability of data entry error (95% confidence, Zα = 1.96 and the precision, = 0.05). Probability of having adverse birth outcomes were set as 0.25 (Graham *et al.*, 2007).

Single proportion formula for objective 1:

$$n = \left(\frac{Z_{\alpha}}{\Delta} \right)^2 * P(1 - P) \qquad \frac{1.96}{0.05}^2 \text{ x } 0.25\ (1\text{-}0.25)$$

Therefore, the sample size calculated for objective 1 is **317**.

No sample size calculation is required for objective 2 as it is only a description of characteristics of Orang Asli women according to the adverse birth outcomes.

The sample size calculation to determine objective 3 – maternal factors associated with low birth weight among Orang Asli infants was done using PS software (dichotomous – two proportions formula) as shown (Table 2). Conventionally, the power of the study is set at 80% with α=0.05. The ratio of low birth weight to non-low birth weight, m was set at 3. The sample size was calculated including an allowance of an additional 10% probability of data entry error.

Table 3.1. Calculations of sample size for factors associated with low birth weight among Orang Asli infants in Kelantan for years 2018 – 2020.

FACTORS/ VARIABLES	**Po**	**P1**	**m**	**N (nx4) + 10%***	**LITERATURE REVIEW**
Teenage pregnancy	0.88	0.70	3	216	(Dowell *et al.*, 2019)
Advance maternal age	0.84	0.65	3	224	(Dowell *et al.*, 2019)
Short stature	0.15	0.35	3	198	(Bhaskar *et al.*, 2015)
Anaemia	0.65	0.40	3	176	(S. R. Sharma *et al.*, 2015)

P0 = Proportion of deliveries with birth weight > 2.5kg
P1 = Estimated Proportion of deliveries with low birth weight
Power of study = 80%
α = 0.05, m = 3
*10% possibility of data entry error

Therefore, the biggest sample size for this study is 317.

3.7 Sampling method and subject recruitment

There are 254 government clinics (*Klinik Kesihatan* and *Klinik Desa*) in Kelantan that provide maternal and child health services. However, only five clinics that are involved with Orang Asli namely Orang Asli Mobile Team, *Klinik Kesihatan Aring, Klinik Kesihatan Post Brooke, Klinik Kesihatan Jeli* and *Klinik Kesihatan Manek*