

Postpartum Death in Malaysia 2013 - 2019 A Case Control Study

Faiz Daud (✉ faizdaud@ppukm.ukm.edu.my)

Universiti Kebangsaan Malaysia <https://orcid.org/0000-0003-1405-5179>

Nor Izyani Bahari

Universiti Kebangsaan Malaysia Faculty of Medicine: Pusat Perubatan Universiti Kebangsaan Malaysia

Norfazilah Ahmad

Universiti Kebangsaan Malaysia Faculty of Medicine: Pusat Perubatan Universiti Kebangsaan Malaysia

Siti Harirotul Hamrok Asis

Kementerian Kesihatan Malaysia

Research article

Keywords: Postpartum, Death, Mortality, Associated Factors

Posted Date: September 28th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-78721/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Information regarding factors associated with postpartum death enhances the understanding of the root cause of the problem; hence, facilitate the formation of effective remedial measure. Literatures on postpartum death in Malaysia are limited despite the increasing trend of mortality in the state of Selangor. This study aimed to determine the associated factors with postpartum death in Malaysia.

Method: A case-control was conducted using data from the Selangor State Health Department. All 114 postpartum death cases that were notified to the health department from 2013 to 2016 were selected. Controls (ratio case 1: control 4) were mothers who survived six weeks of postpartum within the same year range and selected via simple random sampling. A set of datasheets was used to gather information on; i) socio-demographic characteristics, ii) past medical/surgical history and iii) obstetrics history. Analyses were conducted using IBM Statistical Product and Service Solution Statistics Version 25.

Results: The odds of postpartum deaths were almost three times higher among the non-Malaysian citizen (aOR 2.78, 95% CI: 1.35-5.72). The presence of medical/ surgical problems was associated with a 3-fold increase in the odds of postpartum death (aOR 3.22, 95% CI: 1.85-5.61). The odds of death were nine times higher for those who delivered in non-health facilities (home/en-route) (aOR 9.13,95% CI: 2.05-40.77) than those delivered in health facilities. Women who attended antenatal care at government health facilities and practised family planning had low odds for postpartum deaths [(aOR 0.35, 95% CI: 0.20-0.64) and (aOR 0.46, 95% CI: 0.25-0.85), respectively.

Conclusions: Postpartum deaths could be prevented reduce by ensuring adequate health service delivery to the non-citizen, enhanced medical care on underlying medical/surgical illness and restrict delivery in non-health facilities. This reduction can be achieved by promoting attendance to antenatal care in government health facilities and practicing family planning. Future health programme aimed to curb this death should be designed with emphasis on education to these target group as early as pre-pregnancy and throughout the antenatal period.

Introduction

The terms “postpartum period” and “postnatal period” are often used interchangeably but sometimes separately, when “postpartum” refers to issues pertaining to the mother and “postnatal” refers to those concerning the baby (1). The postnatal period begins immediately after the birth of the baby and extends up to six weeks (42 days) after birth (1). This crucial period is to optimize maternal health after delivery. Home visit is one of the intervention to assess the wellbeing of mothers and babies, to provide education and support, to encourage breastfeeding or to provide practical support (2). Nevertheless, postpartum practices and beliefs are practiced throughout the world (3) , including among Malaysian. Asian postpartum practices aim to restore the balance of the new mother, as the delivery process is considered to make the mother weak and vulnerable (3). However, the community should be educated that taboos

and traditions are not a substitute for medical care and consultation (3). Therefore, people should be educated to seek timely medical aid (3). Delay or failure in seeking medical treatment during postpartum period may result in maternal morbidity and mortality.

Retrospectively, a statistic in Malaysia showed a significant reduction in the Maternal Mortality Ratio (MMR) between the years 1950 and the year 2000. However, the MMR remains relatively static from the year 2000 till 2014, with 24.4/100,000 live births and 22.3 / 100 000 live births, respectively (4). On the other hand, Selangor has a high maternal mortality death, and relatively high maternal mortality ratio (MMR) compared to the other state in Malaysia from 2012-2014. MMR in Selangor was the highest in 1995 (40 per 100,000 live births) and dropped to 22 per 100,000 live births in 2014 (5).

Additionally, ASEAN countries such as Myanmar and Indonesia (East Java Province) showed higher MMR compared to Malaysia, which is 282 per 100 000 live births in 2014 (6) and 89.6 per 100 000 livebirth in 2015, respectively (7)

Even though the global MMR in 2017 representing a 38% reduction since 2000 (8), much effort is needed to achieve the Sustainable Development Goal (SDGs), aimed to reduce global maternal mortality ratio (MMR) to below 70 per 100 000 live birth by 2030.

Literature on postpartum death in Selangor was limited, hence, we were unable to ascertain the associated factors related to postpartum death. Therefore, this study aims to identify the socio-demographic characteristic, determine the trend and the major causes of death that contribute to postpartum death, and analyse the associated risk factors for postpartum death in Selangor.

Methods

Study Location

Selangor is one of the fourteen states of Malaysia. It is the west coast of peninsular Malaysia and is bordered by Perak to the North, Pahang to the East, Negeri Sembilan to the south and the Strait of Malacca to the West (9). Selangor is divided into nine districts. Petaling is the most central and urban with Gombak, Klang, and Sepang. Up north are the quaint district of Sabak Bernam, Kuala Selangor and Hulu Selangor whereas further south is Kuala Langat and Hulu Langat. In 2019, the estimation of the total population in Selangor was 6.53 million (10).

Study Design and Sample Size Measurement

It is a case-control study. The aim is to determine the association of risk factors and postpartum death. The sample size calculated using Epi Info 7(11). The following assumptions: 95% confidence, 80% power, ratio of control to case 4:1 and 20% contingency for non-responses used. It gave a total sample size of 114 cases and 456 controls. Therefore, the total sample size is 570 samples.

Selection of Case

Selangor State Maternal Death Technical Committee uses the World Health Organization International Classification of Disease definition of maternal death "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from unintentional or incidental causes (8). All maternal death in Selangor were identified through the mandatory notification to the Selangor State Health Department. Death of any phase of pregnancy, include antenatal, intrapartum or puerperium on review of the death certification, must be reported by District Health Officer to Selangor State Technical Committee and subsequently to Development Division of Family Health, Ministry of Health within 24 hours from the time of death. All cases of maternal death must be investigated thoroughly at the district level and subsequently reviewed by state committee expert, which define the cause of death, death classification and remedial action that need to be implemented.

This study employs secondary data on postpartum deaths occurring between 2013 and 2019, collected through a database compiled by Selangor State Maternal Death Technical Committee in Selangor State Health Department. A case of postpartum death defined as a woman who died during the puerperium, which is death within 42 days after delivery. The study populations involve the case of postpartum death that permanently residing in all nine districts in Selangor includes, Petaling, Gombak, Klang, Sepang, Sabak Bernam, Kuala Selangor, Hulu Selangor, Kuala Langat and Hulu Langat for six months before death, regardless the place of death. Deceased include Malaysian citizenship, the indigenous group of Sabah, Sarawak and Peninsular Malaysia, Legal Immigrant includes United Nation High Commissioners Refugees (UNHCR) with a valid passport and Illegal Immigrant without a valid passport.

There are a total of 184 of postpartum maternal death cases in these nine districts in Selangor from the year 2013 to 2019. The desired samples size that needed in this study is 114 case (obtained from a calculation using Epi Info). The cases were selected using stratified random sampling (or Proportionate Stratification), and we use districts as strata. We first multiply the desired sample size (n) by the proportion of units in each stratum. As a result, we need to select 13 cases from Gombak, 21 cases from Hulu Langat, 6 cases from Hulu Selangor, 25 cases from Klang, 8 cases from Kuala Langat, 5 cases from Kuala Selangor 30 cases from Petaling, 2 cases from Sabak Bernam and 4 cases from Sepang, the sum of 114 cases in total. The cases extracted from the Selangor State Maternal Mortality database using simple random sampling in IBM Statistical Product and Service Solution Statistics Version 25 (SPSS 25).

Selection of Control

The control defined as women who survived in six weeks of postpartum. Selection of controls involved women who received postnatal care in Kelana Jaya Health Clinic under the district of Petaling. The postpartum cases included the cases that have notified to Petaling District Health Office or Kelana Jaya Health Clinic. It is a secondary data of postpartum alive in Petaling District in 2019. The duration of the postpartum case is limited until 42 days post-delivery. The postpartum mother needs to have a permanent residential address in Selangor for at least six months and also include Malaysian citizenship, the indigenous group of Sabah, Sarawak and Peninsular Malaysia, Legal Immigrant includes United

Nation High Commissioners Refugees (UNHCR) with a valid passport and Illegal Immigrant without a valid passport. We exclude postpartum cases with incomplete information needed for analysis.

There were a total of 2641 of alive postpartum in Kelana Jaya Health Clinic in 2019. The desired samples size that needed in this study is 456 samples (obtained from a calculation using Epi Info). The list of registration number of the postpartum cases in Kelana Jaya Health Clinic retrieved from Postnatal Treatment Record (PNN102) and was key in into the SPSS 25. The desired sample size of 456 selected by using random sampling in SPSS 25. The detail information of each samples extracted from Postnatal Treatment Record (PNN 102), Antenatal Record KIK/1(b)/96 (Amendment 2012) and Tele-Primary Care Record.

Variable

The dependant variable was the postpartum maternal death in Selangor. The independent variables for the analysis were socio-demographic status included citizenship, ethnicity, maternal age, parity and associated risk factors includes maternal with pre-existing medical illness, place of delivery, mode of delivery, place of antenatal care and practice of family planning. This study also will describe the trend of postpartum deaths in Selangor according to the number of cases to years, the cause of death that contribute to postpartum death and the classification.

Statistical Analysis

The data obtained compared and analysed using SPSS version 25. The variables expressed as frequency and percentage while Simple and Multiple Logistic Regression used to compare variables. Level of significance "P" value evaluated, where P value < 0.05 was considered statistically significant.

Results

The Trend of Maternal Mortality Ratio and Postpartum Death in Selangor 2013 to 2019

Socio-demographic characteristics

A total of 570 women (114 cases and 456 controls) participated in this study. Most of the postpartum death (73.7%) were Malaysian citizenship, and most of them were Malays ethnicity (53.5%). The majority were 20 to 34 years old (65.8%), and 60.5% were multiparous (parity 2–4). Similarly, 69.3% had a pre-existing medical or surgical illness and most had antenatal checked up at government health facilities (60.5%). The majority, 89.5% delivered in a health facility (government or private facilities) and most delivered via non-caesarean delivery (57.9%). 80.7% of women among postpartum death were not practising family planning.

Simple Logistic Regression

The result from the Simple Logistic Regression analysis shows age was not statistically significantly associated with postpartum death and therefore, was not examined in the Multiple Logistic Regression. From the Simple Logistic Regression test, non-Malaysian were 68% more likely to experience postpartum death compared to Malaysian (cOR 5.68, 95% CI: 3.21–10.04). Among ethnicity, other groups (consist of immigrants) associated with a 5-fold increase in the odds of postpartum death (cOR 5.08, 95% CI: 2.82–9.16). Primiparous women had a 61% reduction of postpartum death compared to grand-multiparous (cOR 0.39, 95% CI: 0.16–0.91). The presence of pre-existing medical/surgical problem was triple to experience postpartum death (cOR 3.44, 95% CI: 2.10–5.63). The odd death was 17 times higher for those who deliver in non-health facilities (home/en-route) (cOR 17.77, 95% CI: 4.92–64.10) than those who deliver in health facilities (government/private health facilities). Caesarean deliveries were 69% more likely to die from postpartum death (cOR 1.69, 95% CI: 1.11–2.58) compared to non-caesarean delivery. Women who went for antenatal checked up in government health facilities had a 64% reduction in postpartum death (cOR 0.36, 95% CI: 0.21–0.61) compared to those who had an antenatal check-up at private health facilities. Women who practised family planning had a 49% reduction of postpartum death compared to acceptor family planning (cOR 0.51, 95% CI: 0.30–0.89).

Table 1
Characteristic and Simple Logistic Regression Analysis Amongst Case (Postpartum Death) And Control (Postpartum Alive) in Selangor

Characteristic	Case (Postpartum Death) (n = 114) n(%)	Control (Postpartum Alive) (n = 456) n(%)	Crude OR (95% CI OR)	X ² stat. (df)	P value
Citizenship					
Malaysian	84 (73.7)	429 (94.1)	1		
Non-Malaysian	30 (26.3)	27 (5.9)	5.68 (3.21;10.04)	34.18(1)	< 0.001 *
Ethnic					
Malay	61 (53.5)	279 (61.2)	1		
Chinese	12 (10.5)	96 (21.1)	0.57 (0.29– 1.11)	2.75(1)	0.097
India	7 (6.1)	44 (9.6)	0.73 (0.31– 1.69)	0.55(1)	0.460
Indigenous	4 (3.5)	10 (2.2)	1.83(0.55– 6.03)	0.99(1)	0.321
Others	30 (26.3)	27 (5.9)	5.08(2.82– 9.16)	29.25(1)	< 0.001*
Age in years					
less 19 years	2 (1.8)	17 (3.7)	1		
20–34 years	75 (65.8)	332 (72.8)	1.92(0.43– 8.49)	0.74(1)	0.390
35 years or more	37 (32.5)	107 (23.5)	2.94(0.65– 13.33)	1.95(1)	0.162
Parity					
Grand-multiparous (para 5 or above)	9 (7.9)	21 (4.6)	1		
Primiparous (para 1)	36 (31.6)	218 (47.8)	0.39 (0.16– 0.91)	4.76(1)	0.029 *
Multiparous (para 2– 4)	69 (60.5)	217 (47.6)	0.74(0.33– 1.70)	0.50(1)	0.479

Characteristic	Case (Postpartum Death)	Control (Postpartum Alive)	Crude OR (95% CI OR)	X ² stat. (df)	P value
Pre-existing Medical/Surgical Illness					
NO	35 (30.7)	52 (11.4)	1		
YES	79 (69.3)	404 (88.6)	3.44 (2.10– 5.63)	22.81(1)	< 0.001 *
Place of Delivery					
Facilities (government/ privates)	102 (89.5)	453 (99.3)	1		
Non Facilities (Homes/En-routes)	12 (10.5)	3 (0.7)	17.77(4.92– 64.10)	25.89(1)	< 0.001 *
Mode of Delivery					
Non-Caesarean Delivery	66 (57.9)	319 (70)	1		
Caesarean Delivery	48 (42.1)	137 (30)	1.69(1.11– 2.58)	5.87(1)	0.015 *
Place of Antenatal Care					
Private Health Facilities	26 (22.8)	53 (11.6)	1		
No Antenatal Care/ Un-booked	19 (16.7)	7 (1.5)	5.53(2.07– 14.82)	11.58(1)	0.001 *
Government Health Facilities	69 (60.5)	396 (86.8)	0.36(0.21– 0.61)	14.41(1)	< 0.001*
Family Planning					
Acceptor Family Planning	22 (19.3)	50 (11.0)	1		
Non-Acceptor Family Planning	92 (80.7)	406 (89)	0.51(0.30– 0.89)	5.24(1)	0.022 *
☒ Likelihood Ratio (LR) test					
☒ Wald test					
*Significant P-value					

Table 1 shows that citizenship, ethnicity, parity, pre-existing medical/surgical illness, place of delivery, mode of delivery, place of antenatal care and family planning were statistically significant risk factors for postpartum death in Selangor from 2013 to 2019.

Multiple Logistic Regression

This analysis produced five significant factors associated with postpartum death. The significant variables confirmed by the log-likelihood ratio (LR) test. From the analysis, we found that the odds of postpartum death were almost three times higher among non-Malaysian women (aOR 2.78, 95% CI: 1.35–5.724) than Malaysian women. The presence of pre-existing medical or surgical problems was associated with a 3-fold increase in the odds of postpartum death (aOR 3.22, 95% CI: 1.85–5.61). The odds of death were nine times higher for those who delivered in non-health facilities (home/en-route) (aOR 9.13, 95% CI: 2.05–40.77) than those who delivered in health facilities. Women who went for antenatal checked up in government health facilities had a 65% reduction in postpartum death (cOR 0.35, 95% CI: 0.20–0.64) compared to those had an antenatal check-up at private health facilities. Women who practised family planning had a 54% reduction of postpartum death compared to non- acceptor of family planning (aOR 0.46, 95% CI: 0.25–0.85).

Table 2
Significant Determinant Factors of Postpartum Death in Selangor, 2013 to 2019 (Multiple Logistic Regression)

Characteristic	Adjusted OR (95% CI OR)	X ² stat. (df)	P value
Citizenship			
Malaysian	1		
Non-Malaysian	2.78 (1.35–5.72)	7.16(1)	0.006 *
Parity			
Grand-multiparous (para 5 or above)	1		
Primiparous (para 1)	0.50(0.18–1.36)	1.86(1)	0.172
Multiparous (para 2–4)	0.82 (0.31–2.17)	0.16 (1)	0.690
Pre-existing Medical/Surgical Illness			
NO	1		
YES	3.22 (1.85–5.61)	16.30(1)	< 0.001 *
Place of Delivery			
Facilities (government/ privates)	1		
Non-Facilities (homes/En-routes)	9.13(2.05–40.77)	9.42(1)	0.002 *
Mode of Delivery			
Non-Caesarean Delivery	1		
Caesarean Delivery	1.58(0.98–2.56)	3.43(1)	0.064
Place of Antenatal Care			
Private Health Facilities	1		
No Antenatal Care/Un-booked	2.74(0.85–8.87)	2.82(1)	0.093
Government Health Facilities	0.35(0.20–0.64)	11.96(1)	0.001 *
Family Planning			
Acceptor Family Planning	1		
Non-Acceptor Family Planning	0.46(0.25–0.85)	5.81(1)	0.016 *
☒ Likelihood Ratio (LR) test			
☒ Wald test			
*Significant <i>P</i> -value			

Table 2 shows eight potential variables have been analysed in the Multiple Logistic Regression by using Backward Stepwise 1^a procedure

Discussion

Postpartum death was significantly associated with non-Malaysian citizenship, pre-existing medical illness, place of delivery, place of antenatal care and practice of family planning. Despite the implementation of 'The Strategies to Reduce Maternal Mortality in 2017 in Selangor State Health Department, the number of postpartum death progressively increasing in trend. Therefore, the identification of significant factors associated with postpartum death in this study will enlighten the State Health Department as well as Malaysia Ministry of Health to re-strategize the effort to reduce postpartum death in future.

In Malaysia, Ministry of Health (MOH) has reported that maternal death in postpartum period remain the highest phase of death and has increased from 59.1% in 2009 to 64.6% in 2011 (4). In addition, more than 50% of death occurred during the postpartum phase between 2012–2014 (13). It is consistent with findings from other studies. The study conduct in Nigeria in 2019 revealed that 55.6% of maternal death occurred during the postpartum period (14) whereas a study done by Halim et. Al in Bangladesh showed that 78.8% of maternal death occurred in the postnatal period (15). Additionally, a study done in the United Kingdom revealed that 66.7% of postpartum death was preventable death (16) whereas preventable postpartum death in Selangor accounted for 54.9%.

As Selangor is a rapidly developing urban area, Selangor has become a focal point for the immigrant to fulfil the jobs opportunities in various aspects. It is consistent with our result where the odds of postpartum death were almost three times higher among non-Malaysian citizenship (immigrant) (aOR 2.78,95% CI: 1.35–5.724) than Malaysian women. Immigrant women basically have a strong believe on traditional birth attendant. These women believe unregulated birth worker provides the best of both worlds which is support for physiological and birth care. It makes them feel safe as they believe that the traditional attendant has knowledge and skill to handle complication during delivery. This is a wrong perception because they are not trained to perform clinical and medical tasks therefore would not know how to handle complications (17) and eventually may lead to death. The findings in our study were in accordance with the study conducted in Spain that show an excess risk of maternal death (cOR 2.19, 95% CI: 1.68–2.85) among immigrant women in their country (18). The scenario was even worst in the USA, where the majority was immigrant with racial and ethnic disparities exist for multiple adverse obstetric outcomes and types of obstetric care (19). Similarly to the findings of the meta-analysis showed that migrant women in Western European countries have a doubled risk of dying during or after pregnancy when compared with indigenous born women, corresponding to additional risk of 9 maternal deaths per 100,000 deliveries among migrant women per year (20).

The major causes of postpartum death within the study period in Selangor was due to Associated Medical Condition, which accounted for 21.7% of all the total postpartum deaths. In Malaysia, between 2012–2014, Associated Medical Conditions continues to be the leading cause of maternal death (4.6 per 100 000 LB) followed by postpartum haemorrhage (3.9 per 100 000 LB) and pulmonary embolism (2.6 per 100 000 LB) (13). Among the deaths caused by an associated medical condition, half of the deaths caused by cardiac diseases (13). This finding is in accordance with our findings that showed the presence of medical or surgical condition was associated with a 3-fold increase in the odds of postpartum death in Selangor. This finding is similar to the study conducted in the United Kingdom, where the odds of maternal mortality is seven times higher in cases with the pre-existing medical condition compared to the control group (21). Additionally, Godefay et al. reported that 88% of maternal death in Northern Ethiopia had a pre-existing medical condition (22) and study conduct by Nair et al. in the United Kingdom found that the odds of maternal death was six times higher in women with pre-existing medical illness (23).

Concerning the pre-existing medical/surgical illness, this finding reflects the gaps in service delivery of pre-pregnancy care and family planning. All women should be aware of the importance of being healthy optimally before embarking into the pregnancy(13). Thus, this should alert the need to strengthen the program of pre-pregnancy care and family planning in Selangor.

In the present study, delivery at non-health facilities identified to be strongly associated with postpartum death in Selangor. Non-health facilities defined as delivery occur at the home, workplace, on the site of accident or injury and may be en-route to health facilities or brought in dead (BID) (13). In Malaysia, maternal deaths outside health facilities over five years from 2009 to 2014, had shown an increasing trend from 19.7 to 35.7%. Generally, the number of pregnancy-related death outside health facilities was the highest in Selangor, followed by Johor and Sabah for three consecutive years (13). This finding corresponding to study conducted in Guinea (24) revealed that maternal death significantly associated in case of transfer from another hospital (OR 24.60, 95%CI 11.32–53.46). In contrast, Chinkumba et al. reported a study conducted in sub-Saharan Africa; the odds for maternal mortality who deliver in health facilities were two times higher compared to home delivery (25) The reason that might account for this result includes those seeking care at facilities may be complicated cases with a higher risk of mortality and referral-based secondary and tertiary facilities in treating women with more complex conditions.

The World Health Organization (WHO) envisions a world where every pregnant woman and new born receives quality care throughout the pregnancy, childbirth and the postnatal period. Within the continuum of reproductive health care, antenatal care (ANC) provides a platform for critical health-care functions, including health promotion, screening, diagnosis and disease prevention (26). A study conducted in developing countries revealed the utilisation of antenatal care and skilled delivery service has significantly and negatively associated with MMR (27) Similarly, our study revealed that women who received antenatal care in government facilities were less likely experiencing postpartum death compared to those received in private facilities. Correspondingly to the study conducted in the United Kingdom, the odd of death was 23 times higher for women who have inadequate use of antenatal care (21). Besides, our study also in agreement with the study conducted in Nigeria, the likelihood of death was 68% lower

for mothers who booked for antenatal care (28) while in Zambia, the likelihood of experiencing maternal death was 94% less among women who completed their scheduled antenatal care visits than for those who did not (29)

The finding of our study observed women who practice family planning were less likely experiencing postpartum death compared to those who did not practice family planning. Despite contraceptive service more accessible in all health clinic or community clinic in Selangor, high-risk women in the reproductive age group tend to refuse to utilise the service for many reasons. A study conducted in Northern Ethiopia found that women who did not practice family planning before the last pregnancy was three times higher to experience maternal death compared to those who practised (22). Ahmed et al. report that without contraceptive use, the number of maternal deaths would have been 1.8 times higher than with contraceptive use, which means that contraceptive use averted 44.3% of maternal deaths in worldwide (30). Universal access to high-quality family planning is one of the vital action strategies under the Safe Motherhood Initiative.

Strength and Limitation

This study is the first to analyse data of maternal mortality in the state of Selangor focussing on postpartum death in the study period of 2013 to 2019. The findings of this study could make a baseline analysis for further planning and policies to reduce maternal death in Selangor and Malaysia. However, this study has several limitations. The number of postpartum deaths is small and it may affect the outcome of the analysis. Besides, the selection of control was confined to one district only where it could avoid further bias by collecting data from all districts in Selangor state and preferable to match with the sample of the cases. Moreover, this study should exclude immigrant as it would have posed bias toward the analysis among Malaysian citizenship. In addition, the study should exclude postpartum death that was classified as fortuitous or undetermined.

Conclusions

Risk factors which were significantly associated with postpartum death in Malaysia includes non-Malaysian citizenship, the presence of pre-existing medical or surgical illness, place of delivery, place of antenatal care and family planning practices. Determining associated factors for postpartum death serves as a foundation for the development of an effective preventive strategy for prevention of maternal mortality. It is essential to enhance service delivery of antenatal care to these target group and strive for strict follow-up with emphasis on education. A comprehensive pre-pregnancy health promotion effort which extends into the antenatal period would reduce the incidence of postpartum death.

List Of Abbreviations

WHO, World Health Organization; MMR, Maternal Mortality Ratio; cOR, Crude Odd Ratio; aOR, adjusted Odd Ratio; LR, Likelihood Ratio; CI, Confidence Interval; LB, Live Birth.

Declarations

Ethics Approval and Consent to Participate

The authors would like to thank the Faculty of Medicine, The National University of Malaysia and the Medical Research and Ethics Committee of the Ministry of Health, Malaysia [NMRR-20-305-53046 (IIR)] for granting authorisation research.

Consent for Publication

Not applicable.

Availability of Data and Material

Interested parties may contact faizdaud@ppukm.ukm.edu.my for anonymised data upon receiving a reasonable request.

Competing Interest

The authors declare that they have no competing interests

Funding

This study was supported by The National University of Malaysia via project code: GUP-2019-080. The role of funder is to provide financial assistant for data collection.

Authors' Contribution

FD contributed to the conception and design, critical revision of the manuscript for valuable intellectual content and supervision. NIB contribute in the data collection, analysis, interpretation of data, drafted the manuscript, statistical analysis, administrative, technical or material support. NA and SHH contribute to the acquisition data and revision of the graphical content. All authors read and approved the final manuscript.

Acknowledgements:

We also would like express gratitude to Director of Selangor State Health, Dato' Indera Dr. Sha'ari bin Ngadiman, Petaling District Health Officer and Kelana Jaya Health Clinic for their support throughout the

study.

Authors' Information

¹Department of Community Health, Faculty of Medicine, UKM Medical Centre, Kuala Lumpur, MALAYSIA.

²Selangor State Health Department, Selangor, MALAYSIA

References

1. World Health Organization. WHO Technical Consultation on Postpartum and Postnatal Care 2010. Available from: https://apps.who.int/iris/bitstream/handle/10665/70432/WHO_MPS_10.03_eng.pdf?sequence=1. Accessed 25 June 2020.
2. Naohero Y, Therese D, Shuko N, Rintaro M. Schedules for home visits in the early postpartum period. *Cochrane Database Syst Rev.* 2017(8):1-72.
3. Mun WC, Daud F, Sivaratnam L, Selimin DS. The 'Irrational' Taboos and 'Irrelevant' Traditions Related to Postpartum Women's Health and Well-Being. *J SAINS MALAYSIANA.* 2019;48(5):1055-64.
4. Ministry Of Health Malaysia. REPORT ON THE CONFIDENTIAL ENQUIRIES INTO MATERNAL DEATHS IN MALAYSIA 2009-2011 2015 [Available from: <http://fh.moh.gov.my/v3/index.php/pages/orang-awam/kesihatan-ibu>. Accessed 15 August 2020.
5. Vital Statistik Malaysia. 2016. Available from: http://www.data.gov.my/data/ms_MY/dataset/vital-statistics-malaysia-1056. Accessed 15 May 2020.
6. Oo MEEP. Situation Analysis of Access to Healthcare Services in Myanmar: Overview of Maternal Healthcare 2018 [Available from: <https://www.pic.org.kh/index.php/en/publications/38-2019-research-reports.html>. Accessed 12 June 2020.
7. Prasetyo B, Damayanti H, Pranadyan R, Habibie PH, Romdhoni AC, Islami D. Maternal mortality audit based on district maternal health performance in East Java Province, Indonesia. *Bali Medical Journal.* 2018;7(1):61-7.
8. World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO.; 2019.
9. Selangor Town and Country Planning Department. Selangor State Map 2020. Available from: <https://jpbdselangor.gov.my/en/home/general-information/selangor-map.html>. Accessed 16 May 2020.
10. Selangor at a Glance [Internet]. 2019. Available from: <https://www.dosm.gov.my/v1>. Accessed 16 May 2020.

11. Prevention CfDCA. Epi Info 7- StaCalc: Statistic Calculators 2019 [Available from: <https://www.cdc.gov/epiinfo/user-guide/statcalc/statcalcandopenepi.html>StatCalc: Statistical Calculators.
12. Malaysia DoS. Vital Statistics 2019 2019 [Available from: https://www.dosm.gov.my/v1_/.
13. Ministry of Health Malaysia. REPORT ON THE CONFIDENTIAL ENQUIRIES INTO MATERNAL DEATHS IN MALAYSIA 2012 – 2014 2019 [Available from: <http://fh.moh.gov.my/v3/index.php/pages/orang-awam/kesihatan-ibu>.
14. Sageer R, Kongnyuy E, Adebimpe WO, Omosehin O, Ogunsola EA, Sanni B. Causes and contributory factors of maternal mortality: evidence from maternal and perinatal death surveillance and response in Ogun state, Southwest Nigeria. *BMC Pregnancy and Childbirth*. 2019;19(1):63-70.
15. Halim A, Utz B, Biswas A, Rahman F, Van Den Broek. Cause of and contributing factors to maternal deaths; a cross-sectional study using verbal autopsy in four districts in Bangladesh. *BJOG*. 2014;121:86-94.
16. Ai-ris YC, Molina RL. Maternal mortality in the United States: updates on trends, causes, and solutions. *J NeoReviews*. 2019;20(10):e561-e74.
17. Ahmad N, Nor SFS, Daud F. Understanding Myths in Pregnancy and Childbirth and the Potential Adverse Consequences: A Systematic Review. *The Malaysian Journal of Medical Sciences: MJMS* 2019;26(4):17-27.
18. Blagoeva Atanasova V, Arevalo-Serrano J, Antolin Alvarado E, García-Tizón Larroca S. Maternal mortality in Spain and its association with country of origin: cross-sectional study during the period 1999–2015. *BMC Public Health*. 2018;18(1):1171-9.
19. Grobman WA, Bailit JL, Rice MM, Wapner RJ, Reddy UM, Varner MW, et al. Racial and ethnic disparities in maternal morbidity and obstetric care. *Obstet Gynecol*. 2015;125(6):1460-7.
20. Pedersen GS, Grøntved A, Mortensen LH, Andersen A-MN, Rich-Edwards J. Maternal Mortality Among Migrants in Western Europe: A Meta-Analysis. *Maternal and Child Health Journal*. 2014;18(7):1628-38.
21. McCall SJ, Nair M, Knight M. Factors associated with maternal mortality at advanced maternal age: a population-based case-control study. *BJOG : an international journal of obstetrics and gynaecology*. 2017;124(8):1225-33.
22. Godefay H, Byass P, Graham WJ, Kinsman J, Mulugeta A. Risk Factors for Maternal Mortality in Rural Tigray, Northern Ethiopia: A Case-Control Study. *PLOS ONE*. 2015;10(12):e0144975.
23. Nair M, Knight M, Kurinczuk JJ. Risk factors and newborn outcomes associated with maternal deaths in the UK from 2009 to 2013: a national case-control study. *BJOG : an international journal of obstetrics and gynaecology*. 2016;123(10):1654-62.
24. Diallo A, Michalek IM, Bah IK, Diallo IA, Sy T, Roth-Kleiner M, et al. Maternal mortality risk indicators: Case-control study at a referral hospital in Guinea. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2020;251:254-7.

25. Chinkhumba J, De Allegri M, Muula AS, Robberstad B. Maternal and perinatal mortality by place of delivery in sub-Saharan Africa: a meta-analysis of population-based cohort studies. BMC Public Health. 2014;14(1):1014-22.
26. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience: World Health Organization; 2016 [Available from: <https://www.who.int/reproductivehealth/news/antenatal-care/en/>].
27. Girum T, Wasie A. Correlates of maternal mortality in developing countries: an ecological study in 82 countries. Maternal Health, Neonatology and Perinatology. 2017;3(1):19-24.
28. Ntoimo LF, Okonofua FE, Ogu RN, Galadanci HS, Gana M, Okike ON, et al. Prevalence and risk factors for maternal mortality in referral hospitals in Nigeria: a multicenter study. Int J Womens Health. 2018;10:69-76.
29. Moyo N, Makasa M, Chola M, Musonda P. Access factors linked to maternal deaths in Lundazi district, Eastern Province of Zambia: a case control study analysing maternal death reviews. BMC Pregnancy and Childbirth. 2018;18(1):101-9.
30. Ahmed S, Li Q, Liu L, Tsui AO. Maternal deaths averted by contraceptive use: an analysis of 172 countries. The Lancet. 2012;380(9837):111-25.

Figures

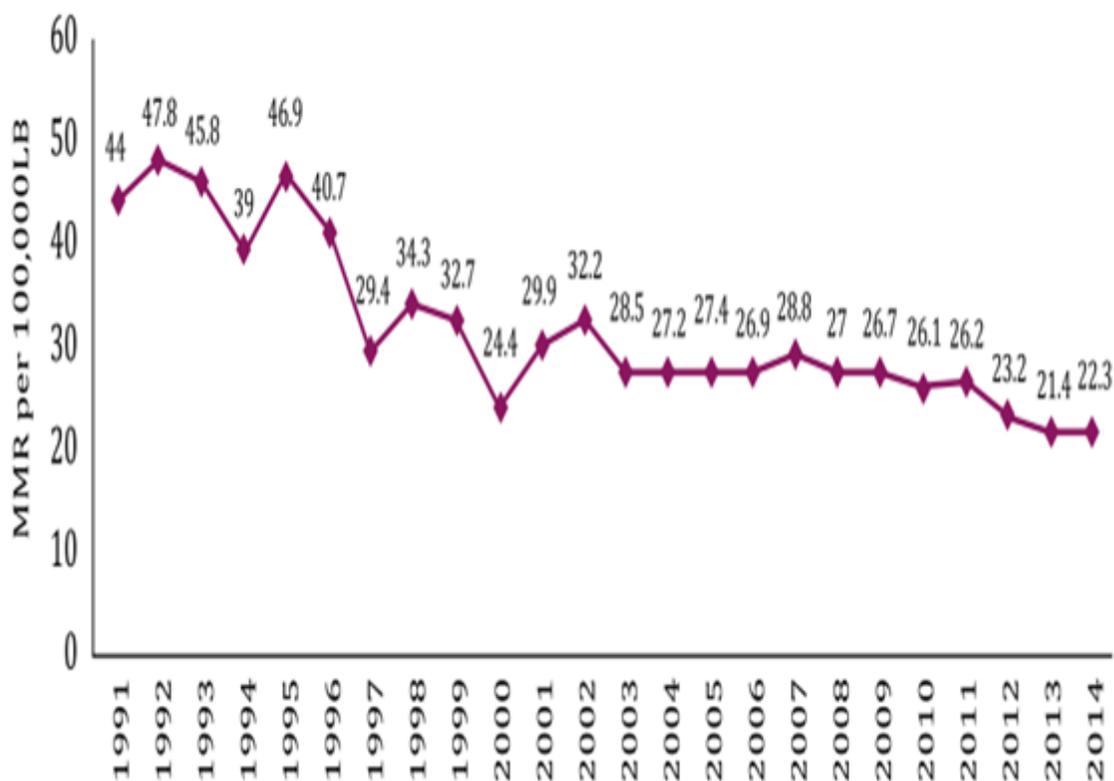


Figure 1

A statistic in Malaysia showed a significant reduction in the Maternal Mortality Ratio (MMR) between the years 1950 and the year 2000. However, the MMR remains relatively static from the year 2000 till 2014, with 24.4/100,000 live births and 22.3 / 100 0000 live births, respectively.

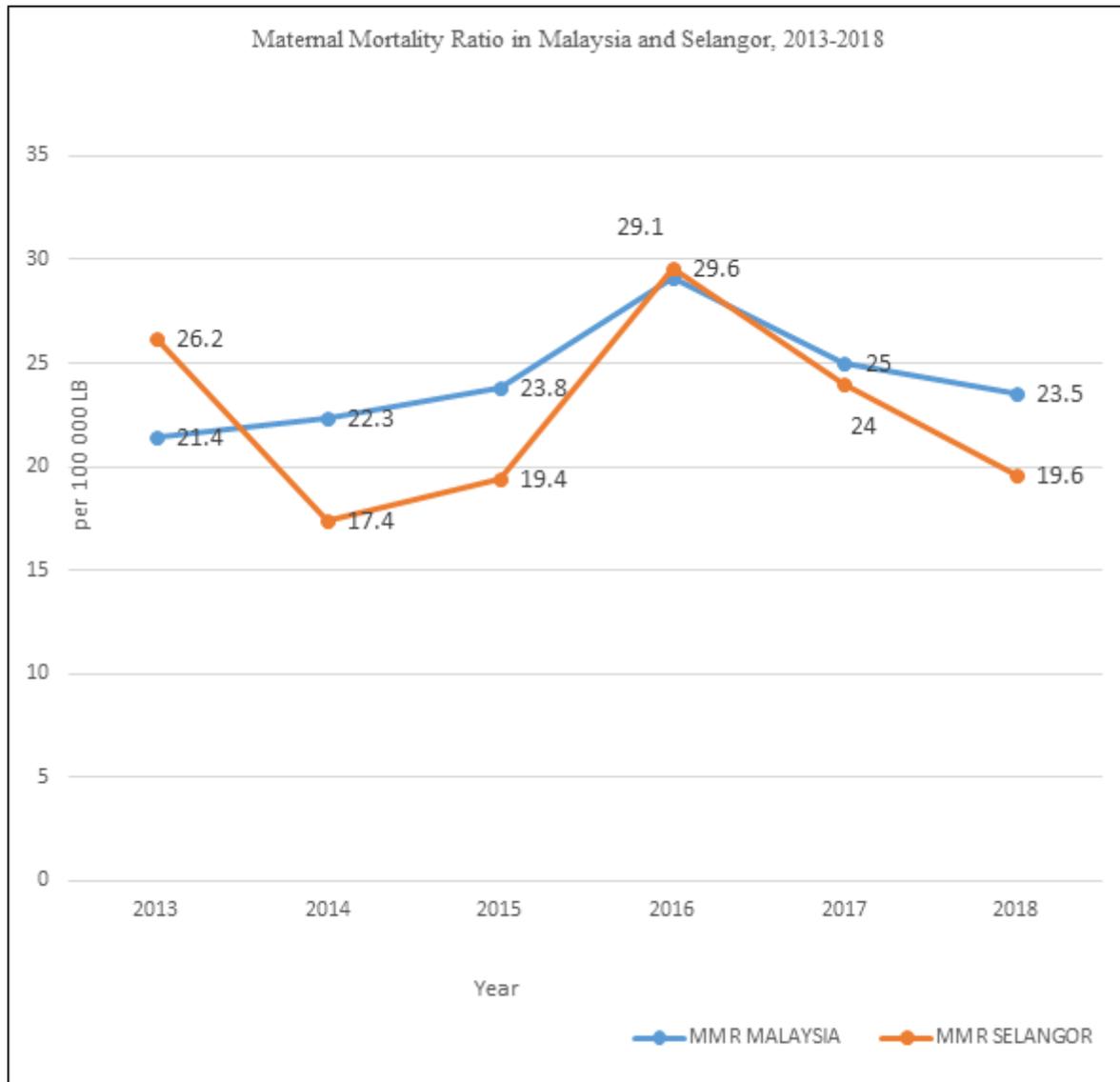


Figure 2

During the study period (2013-2019), Maternal Mortality Ratio (MMR) in Selangor shows an increasing trend from the year 2014 to 2016. The trend started to decline until the year 2018.

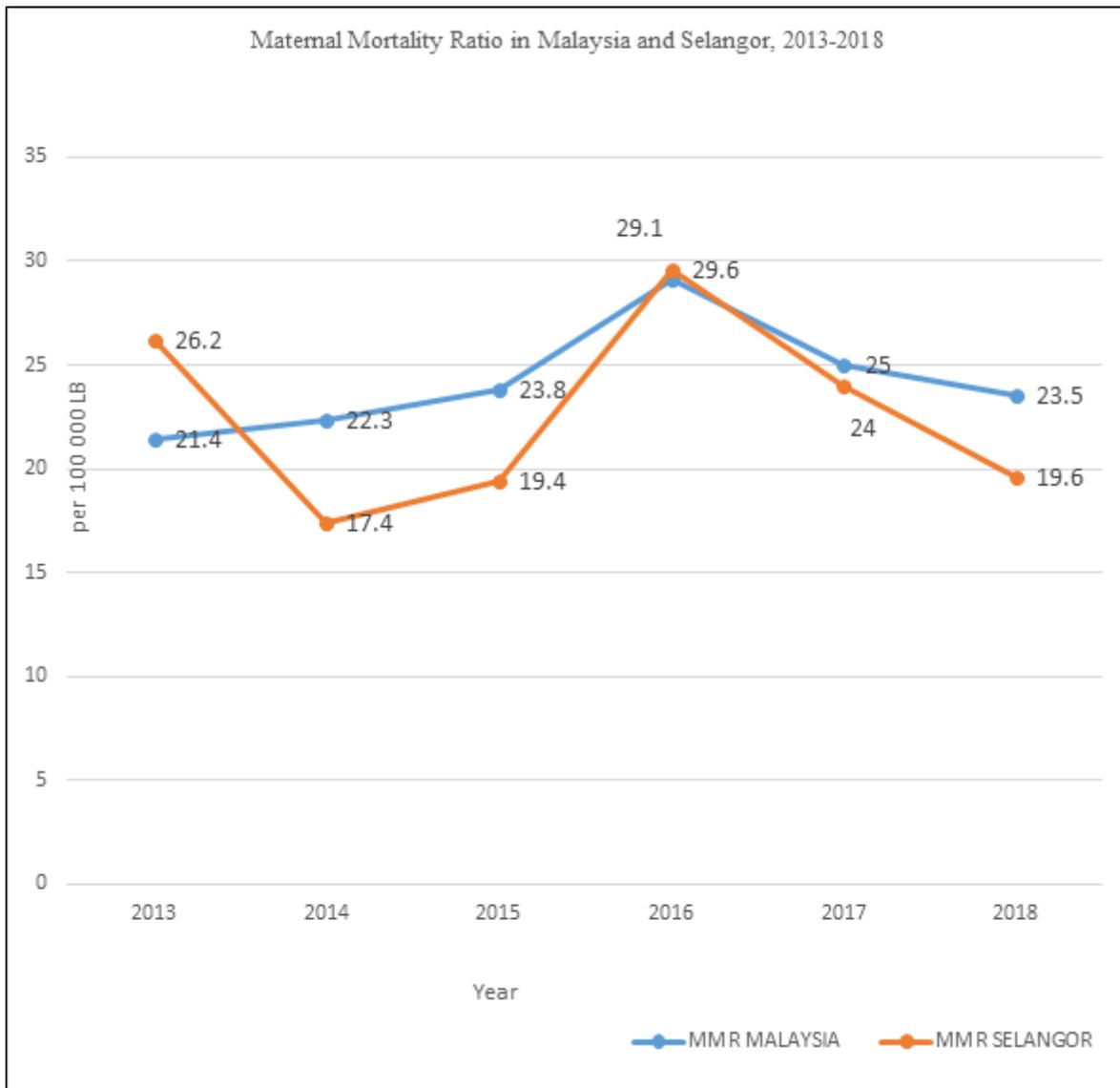
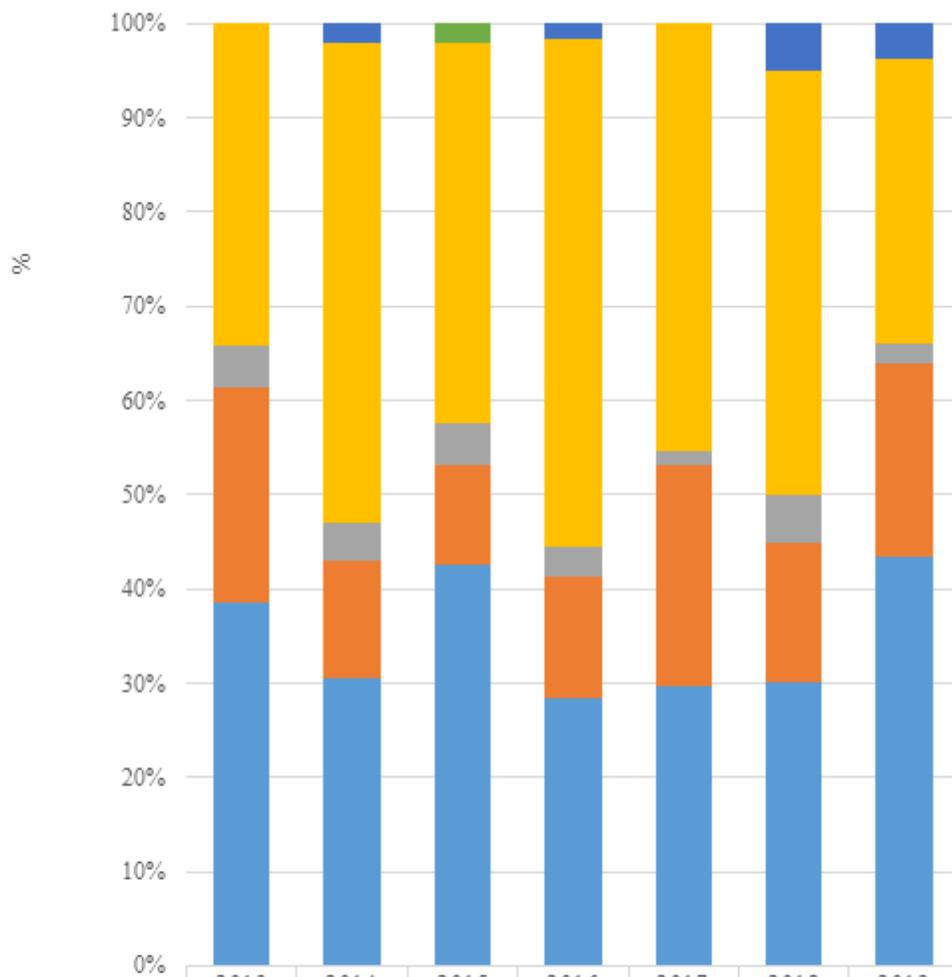


Figure 3

There was a total of 184 postpartum deaths identified in Selangor during the study period. 34 (18.5%) postpartum death occurred in 2019, followed by 33(17.9%) cases occurred in 2017 and 27 (14.7%) postpartum death in 2013.

Percentage of Maternal Mortality by Stage of Pregnancy in Selangor, 2013-2019
n=359



Unknown			2.1				
Abortion		2		1.6		5	3.8
Antenatal	34.1	51	40.4	54	45.3	45	30.2
Intrapartum	4.6	4.1	4.3	3.2	1.6	5	2
Immediate postpartum	22.7	12.3	10.6	12.7	23.4	15	20.6
48hr-42 days postpartum	38.6	30.6	42.6	28.5	29.7	30	43.4

Figure 4

Immediate postpartum death (less than 48 hours post-delivery) and late postpartum death (48 hours to 42 days post-delivery) in Selangor was ranged from 41% to 64% out of the total number of maternal death in each year of 2013 till 2019.

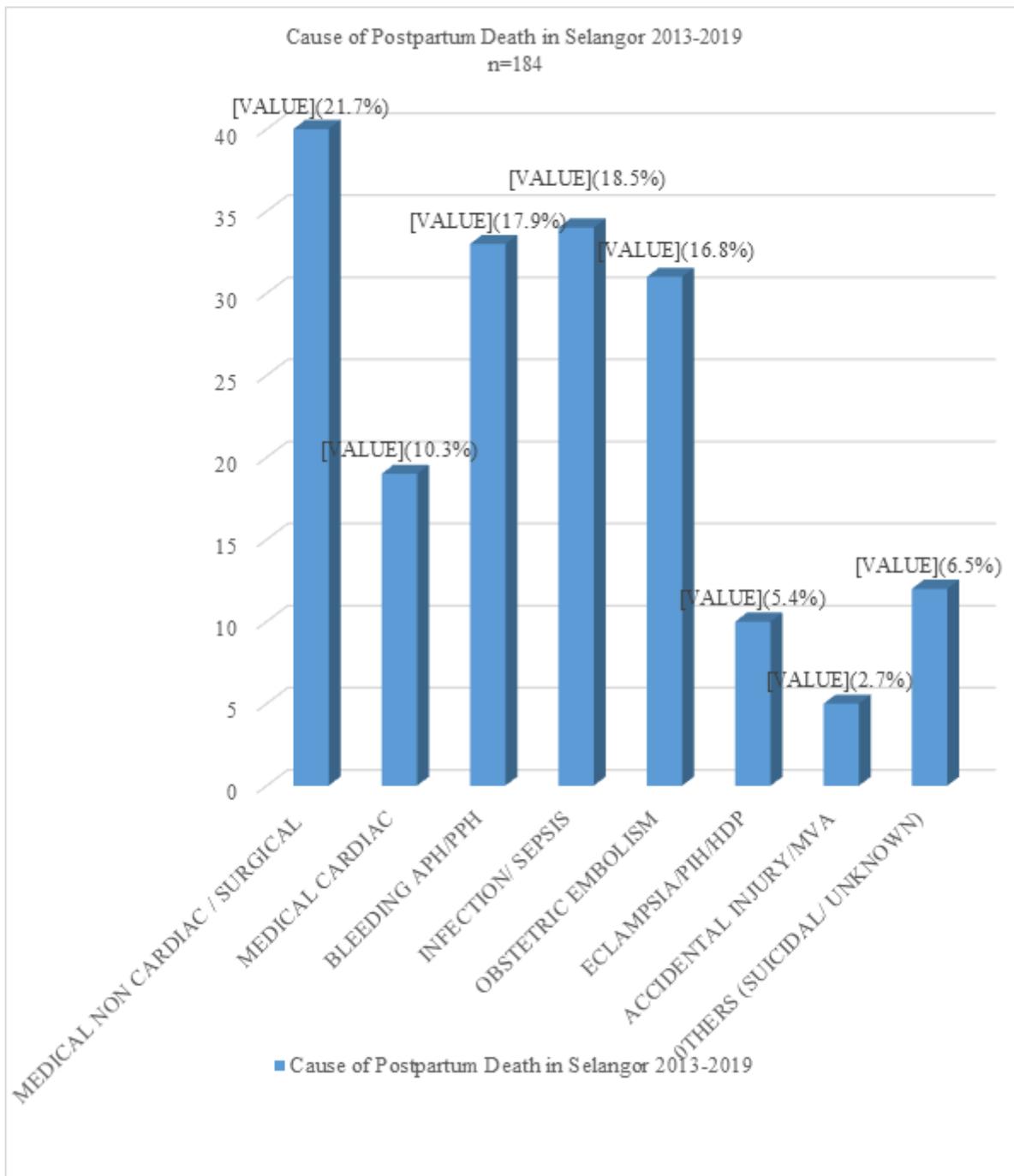


Figure 5

The leading cause of death in the seven years of the study period was medical (non-cardiac) and surgical condition (21.7%), infection and sepsis (18.5%), antepartum and postpartum bleeding (17.9%) and obstetric embolism (16.8%).

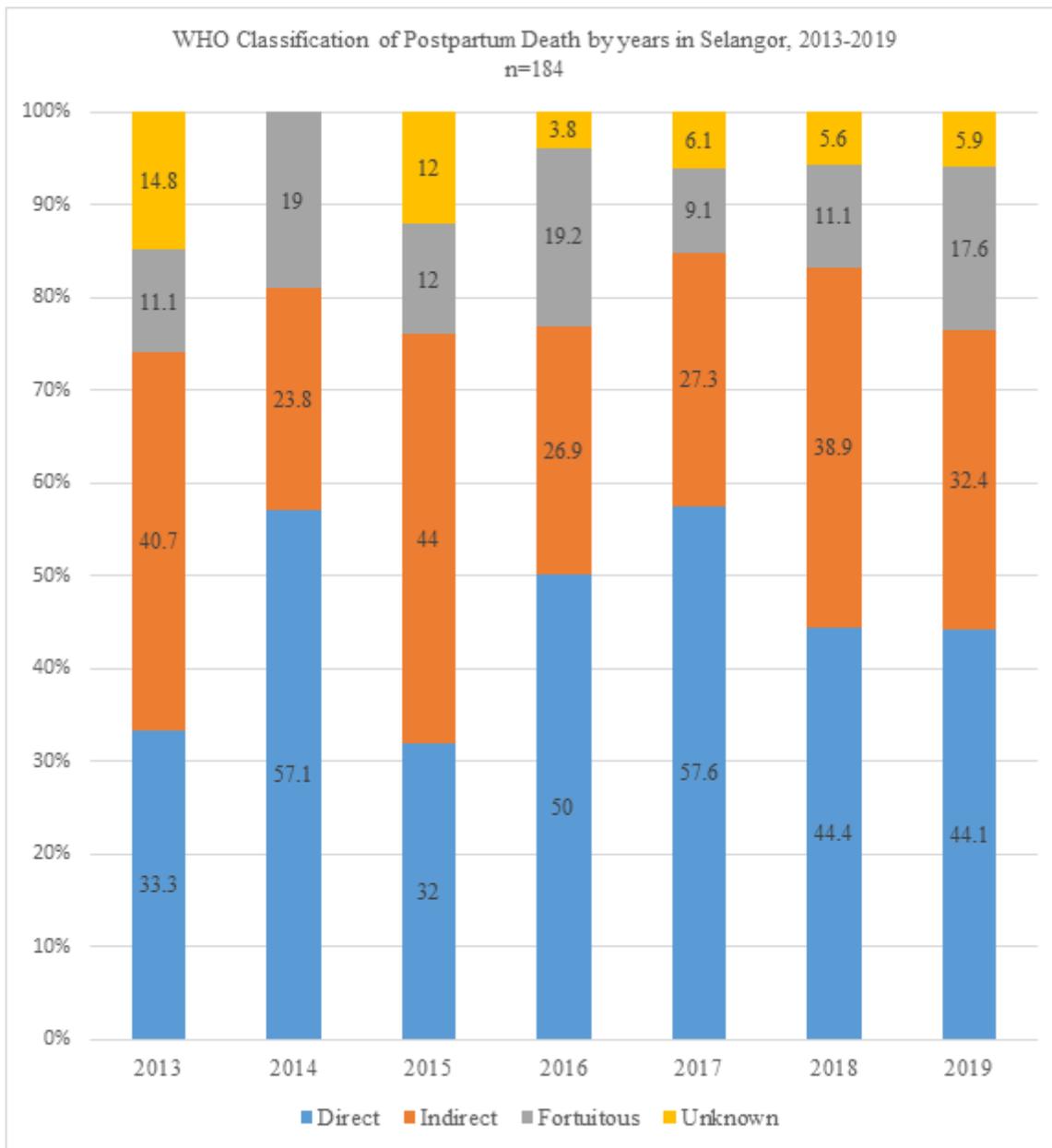


Figure 6

Direct postpartum death ranges from 32% to 57.6% of all postpartum deaths in Selangor between 2013 to 2019. The highest percentage of direct postpartum death was in 2017, accounted for 57.6% compared to indirect death (27.3%).

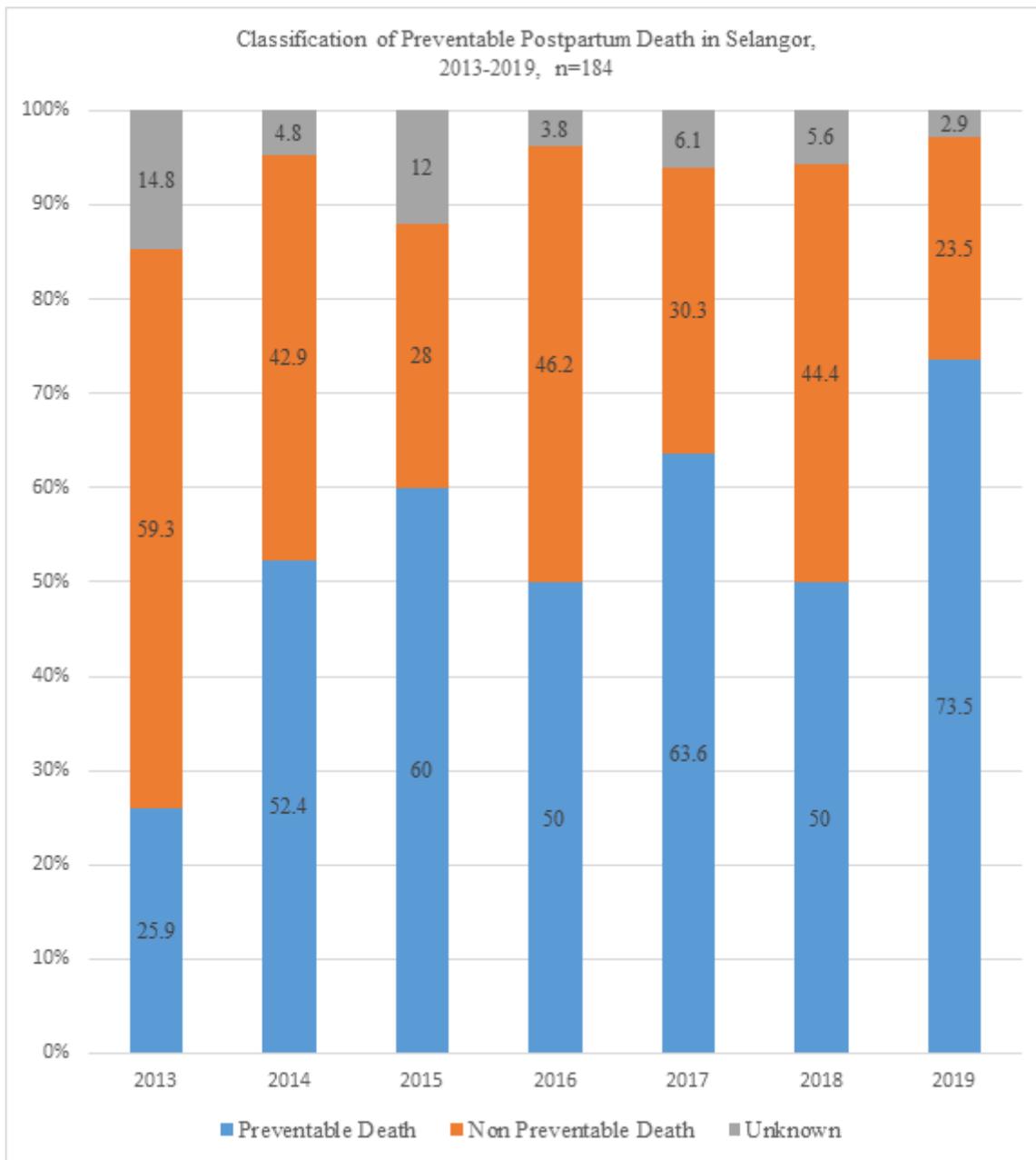


Figure 7

Preventable postpartum death in Selangor was a range between 25.9% to 73.5% from 2013 to 2019. The highest percentage for preventable postpartum death was in 2019, 73.5% compared to non-preventable death, 23.5%

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklistcasecontrol.doc21092020.doc](#)