# Maternal Mortality in Cheras District Health Office (PKC) Kuala Lumpur, Malaysia: Analysis Data from 2014 to 2021

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*Abstract-*

**Introduction:** The maternal mortality in Malaysia in 2020 was 24.9 maternal deaths per 100.000 live births. In view of the alarming trend of the maternal mortality ratio in Malaysia in 2020 compared to 2019, it is crucial to explore the factors associated with maternal deaths to reduce the maternal death. Hence, this study is aimed to determine the sociodemographic characteristics and the associated factors of MMR in Cheras District Health Office (PKC), Kuala Lumpur. **Methodology:** A cross-sectional using all maternal death reports retrieved from PKC from 2014 to 2021 was conducted. The sociodemographic data and the maternal factors were analysed descriptively. Fisher's Exact Test was performed to determine the significance of associated factors of maternal mortality in the study. **Results:** Out of 18 maternal deaths reported, the majority were aged below 35 years and multiparous. There were 16.7% of mothers who received the tertiary education level. The median household income was RM3250 (USD 770.15). Indirect causes dominated maternal death cases by 66.7%. All the direct causes of death under the PKC are preventable in this study. The eventful antenatal period contributed to 72.2% of cases. However, there was no significant association between the sociodemographic factors and the death category of the maternal death cases. **Conclusion**: Despite no significant associated factors found in the study; we should not ignore the eventful antenatal factors. Therefore, a continuous effort for health promotion and health education among pregnant women remains vital. Further exploration of the perception and awareness of maternal health risk factors and maternal behaviour is necessary to address the gap in maternal mortality cases.

*Index Terms*- Maternal Mortality; Associated Factors; Cheras District Health Office Malaysia; Analysis Data

## I. INTRODUCTION

Maternal death is defined as 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 [1]. Based on this definition, the identification of a maternal death based on the cause of the death is recorded as either direct or indirect maternal death cause. Direct maternal death refers to death related to obstetric complications. Whereas, indirect maternal death refers to the death due to the existing diseases [2]. The measurement of maternal mortality only considers the maternal death occurring up to 42 days postpartum and do not involve late maternal death beyond 42 days postpartum for international reporting and the calculation of maternal mortality ratios and rates. The measure of the number of maternal deaths in a population reflects the risk of mortality associated with a single pregnancy or a single birth and the fertility level in the population [2].

The maternal mortality ratio in Malaysia in 2020 was 24.9 maternal deaths per 100.000 live births, increasing in trend from 21.1 maternal deaths per 100,000 live births in 2019 [3]. Most maternal deaths were preventable. Hence, it is crucial to explore the factors associated with maternal deaths to reduce the maternal mortality in Malaysia [4]. This is also in line with the sustainable development goal (SDG) number 3, related to maternal health, i.e., ensuring healthy lives and promoting well-being for all ages. The aim is to end the global

preventable maternal mortality by reducing it to less than 70 per 100000 live births by 2030 [5]. The indicators set to achieve this target were maternal mortality and the proportion of births attended by skilled health personnel [5].

Identifying the factors that contribute to severe maternal morbidity allows for a better understanding of the problem and the development of an effective prevention approach. This refers to primary prevention by screening or prevention at the institutional, provider, and client levels, to prevent death or severe morbidity from a disorder [6]. Based on the literature, there are several contributing variables for maternal morbidity have been identified. This includes employment status [7], low household income [7], a previous history of abortion [7], multiple births [8], and limited antenatal care [7]. Age, race, educational level, co-existing medical conditions, parity, gestational period, mode of birth, previous cesarean section, and pre-pregnancy body mass index all yielded mixed results [7, 8].

Pregnancy-related death can be classified into preventable and non-preventable deaths during the maternal mortality meeting at the District, State and National Health Office level [9]. Preventable death is divided into two components i.e., preventable deaths with medical factors and preventable deaths with non-medical factors. Preventable death with medical factors refers to the deaths with the presence of modifiable medical factors (clinical or non-clinical factors) such as failure to diagnose, failure to appreciate severity, delayed referral, treatment, inadequate treatment etc. While preventable deaths with non-medical factors refer to deaths with the presence of non-medical factors (patient/family or socio-political). The shortfalls will be identified from the potentially preventable deaths for the remedial measures. This is important to facilitate the prevention of other maternal death in the future. This may include public health policies or interventions encompassing social, patient and family factors [9]. On the other hand, no remedial measures may be done following non-preventable deaths such as amniotic fluid embolisms etc [9].

Many efforts have been made by the Ministry of Health (MOH) Malaysia to tackle the issue of maternal mortality. However, it has been challenging to reduce maternal mortality. One of the said efforts is the meticulous auditing of maternal deaths using the confidential enquiry into maternal deaths (CEMD) [10]. This effort has been initiated in 1991, which allowed for the improvement in healthcare services based on the remedial factors identified in the audit. Besides, it provides evidence-based information to support the MOH budget requests for services that need improvements, such as the provision of communication systems, provision of equipment for hemoglobin estimation for effective management of anemia in pregnancy, provision of health education and many more others. Moreover, CEMD has improved maternal death reporting by encouraging active capture of maternal deaths through health clinics, district health offices, and state health offices [11].

This study was conducted to determine the sociodemographic characteristics and the associated factors of maternal mortality during antenatal, intrapartum and postpartum the maternal death cases in Cheras District Health Office (PKC), Kuala Lumpur Malaysia.

## II.        MATERIAL AND METHODS

*Underlying Data and Study Design*

A cross-sectional study was conducted using secondary data from The Maternal Death Report retrieved from Cheras District Health Office, Kuala Lumpur from 2014 and 2021.

*Study population, Sampling Method, Inclusion and Exclusion criteria*

The study was carried out at the Family Health Unit, Cheras District Health Office. Universal sampling was used whereby all the maternal deaths cases resulting from any conditions/ issues related to abortions, during pregnancies, labour, and puerperium from 2014 to 2021 reported to Cheras District Health Office were included in the analysis.

The inclusion criteria for the study were maternal mortality cases according to WHO definition; maternal mortality cases under Cheras District Health Office; maternal mortality caused by any conditions or problems associated with the termination of pregnancy or abortions, during pregnancies or its management, during labour or its management and puerperium (within 42 days post-partum) and maternal mortality cases reported under Cheras District Health Office from 2014 to 2021. The exclusion criteria from the study were maternal mortality cases with incomplete reports, and maternal death caused by a road traffic accident. The final cause of death for each case was decided during the maternal mortality meeting at the district level.

*Variables*

Variables included in this study were sociodemographic (age, nationality, ethnicity, marital status, education level, employment status, household income), pregnancy status (gravida/parity, period of gestation, past obstetric history, current antenatal history, current intrapartum history, current postpartum history, latest antenatal colour code, mode of delivery, fetal outcome) past medical and surgical history, Death status (year of death, place of death, cause of death, phase of death, category of death, preventability) and shortfalls of the case.

The death category is classified into direct, indirect and fortuitous death. Direct maternal death is defined as death due to obstetric haemorrhage or hypertensive disorders in pregnancy. For example, those due to anaesthesia or caesarean section complications are classified as direct maternal deaths [1, 2]. Indirect maternal death is defined as those maternal deaths "resulting from previous existing disease or disease that developed during pregnancy and not due to direct obstetric causes but were aggravated by the physiologic effects of pregnancy". For example, deaths due to aggravation (by pregnancy) of an existing cardiac or renal disease are indirect maternal deaths [3]. Fortuitous maternal deaths occur from causes unrelated to the pregnancy and include violent deaths and suicide [4].

The latest antenatal colour code refers to the last colour code given to the patient before death based on the severity of the risk factors. There are four colours used: red, yellow, green, and white. Red code signifies a life-threatening condition, and the patient requires immediate hospital referral and admission. A yellow code indicates that the patient requires antenatal monitoring by a doctor. Green code suggests that complications may develop in these patients and hence requires monitoring by a senior nurse. White code indicates that patients are at no or low risk and can be monitored by the community nurse or midwife [5].

*Data management*

All data were entered, coded and recoded into Microsoft Excel Sheet before being kept in the researcher's Google Drive with a password protected. Any incomplete data was checked with the original patient report record.

Ethical consideration

Ethical approval for this research was obtained from the Malaysian Research Ethics Committee (MREC) with the ethics reference number NMRR ID-22-00484-PYX (IIR).

Statistical analysis

Data were managed in Microsoft Excel and were analysed using statistical software IBM SPSS Version 26.0. Demographic data and other categorical data were presented in frequencies and percentages. Numerical data, normally distributed, were presented as mean and standard deviation (SD), while median and Interquartile Range (IQR) were presented for numerical data, which was not normally distributed. The association between two categorical data was analyzed using Pearson's Chi-square. In addition, Fisher's exact test was used when the assumptions of Pearson's Chi-square test were not met. The probability value of less than 0.05 (p-value <0.05) was considered statistically significant.

### III.    RESULTS

The trend of maternal mortality under Cheras District Health Office from 2014 to 2021 is shown in Figure 1. The trend of maternal mortality was fluctuated within this study period. There was no mortality in year 2015. However, it was a sudden increase in MMR from 47.7 to 179.8 per 100,00 live births from year 2020 to 2021.



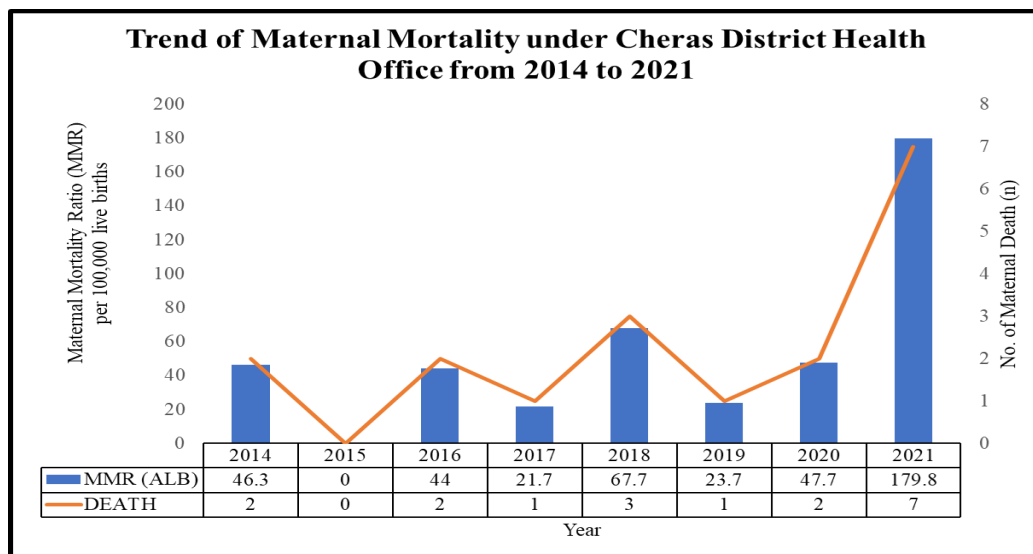| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|
| MMR (ALB) | 46.3 | 0 | 44 | 21.7 | 67.7 | 23.7 | 47.7 | 179.8 |
| DEATH | 2 | 0 | 2 | 1 | 3 | 1 | 2 | 7 |

Figure 1: Trend of the maternal mortality cases under Cheras District Health Office from 2014 to 2021

A total of 18 maternal deaths cases under this nine-year review from 2014 to 2021. 6 (33.3%) was from direct cause and 12 (66.7%) was from an indirect cause. The majority of the maternal death cases aged below 35 years old with a mean age of 30.7 ± 5.56. The nationality was equally distributed. Seventy-two per cent of mothers were multiparous and only 16.7% of mothers have received the tertiary education level. The median household income was RM 3250 (IQR: RM 3225). Twelve cases (66.7%) of maternal death cases under Cheras District Health Office were due to indirect cause of death.

Table 1 shows the sociodemographic of maternal death. It is shown that there was no significant association between the sociodemographic factors and the death category of the maternal death cases.

Table 1: Sociodemographic of the maternal death cases

| Sociodemographic Factors | Total (N=18) | Death Category (cause) | | p-value[a] |
| | | Direct (N=6) | Indirect (N=12) | |
|---|---|---|---|---|
| Age Group: | | | | |
| Maternal Age ≥35 | 7 (38.9%) | 4 (66.7%) | 3 (25.0%) | 0.117 |
| Maternal Age <35 | 11 (61.1%) | 2 (33.3%) | 9 (75.0%) | |
| Nationality: | | | | |
| Malaysian | 9 (50.0%) | 3 (50.0%) | 6 (50.0%) | 1.000 |
| Non-Malaysian | 9 (50.0%) | 3 (50.0%) | 6 (50.0%) | |
| Ethnicity: | | | | |
| Malay | 7 (38.9%) | 1 (16.7%) | 6 (50.0%) | 0.880 |
| Chinese | 2 (11.1%) | 2 (33.3%) | 0 (0.0%) | |
| Indian and Others | 9 (50.0%) | 3 (50.0%) | 6 (50.0%) | |
| Marital Status: | | | | |
| Married | 14 (77.8%) | 4 (66.7%) | 10 (83.3%) | 0.806 |
| Not Married | 4 (22.2%) | 2 (33.3%) | 2 (16.7%) | |
| Parity: | | | | |
| Primigravida | 5 (27.8%) | 2 (33.3%) | 3 (25.0%) | 0.561 |
| Multipara | 13 (72.2%) | 4 (66.7%) | 9 (75.0%) | |
| Education Level: | | | | |
| Primary education | 2 (11.1%) | 1 (16.7%) | 1 (8.3%) | 0.570 |
| Secondary education | 6 (33.3%) | 3 (50.0%) | 3 (25.0%) | |
| Tertiary education | 3 (16.7%) | 0 (0.0%) | 3 (25.0%) | |
| Others/Unknown | 7 (38.9%) | 2 (33.3%) | 5 (41.7%) | |
| Employment Status: | | | | |
| Employed | 9 (50.0%) | 4 (66.7%) | 5 (41.7%) | 0.310 |
| Unemployed/Unknown | 9 (50.0%) | 2 (33.3%) | 7 (58.3%) | |
| Household Income: | | | | |
| Income equal or less RM2500 | 5 (27.8%) | 3 (50.0%) | 2 (16.7%) | 0.453 |
| Income more than RM2500 | 8 (44.4%) | 2 (33.3%) | 6 (50.0%) | |
| Unknown | 5 (27.8%) | 1 (16.7%) | 4 (33.3%) | |

[a]Fisher Exact Test, statistical significance difference at $p<0.05$

Table 2 shows the preventability of pregnancy-related factors and death categories. The majority of the pregnancy-related factor was preventable (88.9%). However, there was no association between the cause of death category and the preventability (p=0.431)

Table 2: Preventability of the maternal death cases following death category from 2014 to 2021

| Pregnancy-related factor | Total (N=18), n(%) | Death Category | | p-value[a] |
| | | Direct (N=6), n(%) | Indirect (N=12), n(%) | |
|---|---|---|---|---|
| Preventability: | | | | |
| Preventable | 16 (88.9%) | 6 (100.0%) | 10 (83.3%) | 0.431 |
| Unpreventable | 2 (11.1%) | 0 (0.0%) | 2 (16.7%) | |

ᵃFisher Exact Test, statistical significance difference at p<0.05

Table 3 shows the factors associated with maternal death following the phase of pregnancy. The majority of the maternal death cases (72.2%) were eventful during their antenatal period. Those eventful cases contributed most to the indirect cause of maternal death. 50% of maternal death happened in a government hospital with a specialist. However, overall, there is no significant association between the pregnancy-related factor and the death category of the maternal death cases.

The study also found the eventful antenatal factors which contributed to the direct death include gestational diabetes mellitus, maternal obesity, primigravida, uncontrolled hypertension and default follow up. On the other hand, the most common factor that contributed to the indirect maternal death was unbooked pregnancy followed by the advanced maternal age and COVID-19 infection. During intrapartum, eclampsia was shown to be related the direct maternal death while delay in seeking health care facilities contributed to indirect maternal death. During the postpartum period, postpartum haemorrhage contributed to the direct cause of maternal death while infection, intracranial haemorrhage and heart problem contributed to the indirect cause of maternal death.

Table 3: Association between Phases of Pregnancy and Death category from 2014 to 2021

| Pregnancy-related factor | Death Category | | | p-valueᵃ |
| --- | --- | --- | --- | --- |
| | Total (N=18), n(%) | Direct (N=6), n(%) | Indirect (N=12), n(%) | |
| Antenatal Factors: | | | | |
| Eventful | 13 (72.2%) | 5 (83.3%) | 8 (66.7%) | 0.439 |
| Uneventful | 5 (27.8%) | 1 (16.7%) | 4 (33.3%) | |
| Intrapartum Factors: | | | | |
| Eventful | 2 (11.1%) | 1 (16.7%) | 1 (8.3%) | 0.569 |
| Uneventful | 16 (88.9%) | 5 (83.3%) | 11 (91.7%) | |
| Postpartum Factors: | | | | |
| Eventful | 7 (38.9%) | 1 (16.7%) | 6 (50.0%) | 0.199 |
| Uneventful | 11 (61.1%) | 5 (83.3%) | 6 (50.0%) | |
| Antenatal Colour Coding: | | | | |
| White | 1 (5.6%) | 1 (16.7%) | 0 (0.0%) | 0.320 |
| Green | 5 (27.8%) | 1 (16.7%) | 4 (33.3%) | |
| Yellow | 1 (5.6%) | 1 (16.7%) | 0 (0.0%) | |
| Red | 1 (5.6%) | 0 (0.0%) | 1 (8.3%) | |
| Not applicable (private hospital) | 6 (33.3%) | 3 (50.0%) | 3 (25.0%) | |
| Unbooked/Unknown | 4 (22.1%) | 0 (0.0%) | 4 (33.3%) | |
| Place of delivery: | | | | |
| Government hospital with specialist | 9 (50.0%) | 2 (33.3%) | 7 (58.3%) | 0.509 |
| Private hospital with O&G specialist | 2 (11.1%) | 2 (33.3%) | 0 (0.0%) | |
| Not applicable | 5 (27.8%) | 1 (16.7%) | 4 (33.3%) | |
| Others | 2 (11.1%) | 1 (16.7%) | 1 (8.3%) | |

ᵃFisher Exact Test, statistical significance difference at p<0.05

The causes of maternal mortality in Cheras District Health Office from 2014 to 2021 are shown in Table 4. Sepsis indirectly due to other diseases accounted for 75% of the total indirect cause or 50.0% of the all-maternal mortality.

Table 4: Causes of maternal death cases from 2014 to 2021

| Type of causes | Causes | No. of maternal mortality |
| --- | --- | --- |
| Direct (n=6) | Haemorrhage (n=3) | |
| | -   Postpartum haemorrhage | 3 |
| | Hypertensive disease in pregnancy (n=3) | |
| | -   Massive Intracranial bleed secondary to eclampsia | 2 |
| | -   Disseminated intravascular coagulation (DIVC) secondary to eclampsia | 1 |
| Indirect | Acute Coronary Syndrome | 1 |
| | Sepsis due to (n=9): | |

| (n=12) | - Pneumonia | 3 |
| | - COVID-19 | 3 |
| | - Group A Streptococcal Toxic Shock Liked Syndrome Secondary to Extensive Bullous Cellulitis | 1 |
| | - Septicemia | 1 |
| | - Multiple organ failure secondary to mixed septic and cardiogenic shock with underlying hyperthyroidism precipitated by ruptured left ectopic pregnancy | 1 |
| | Asphyxia | |
| | - Airway obstruction secondary to massive bleeding post-operation for necrotising fasciitis | 1 |
| | Unknown cause | 1 |
| | **TOTAL** | **18** |

## IV.    DISCUSSION

From 2000 to 2017, there was a 38% reduction in the global MMR or from 342 deaths to 211 deaths per 100,00 population where 94% of all maternal deaths occur in low- and middle-income countries [1]. The trends of maternal mortality were almost the same in Malaysia from 2014 to 2020 [6]. However, during the COVID-19 pandemic, the increase in maternal deaths was not unexpected in the US [7]. It was the same in this study where the increase in maternal deaths from 47.7 to 179.8 per 100,00 live births from the year 2020 to 2021.

An increase the number of maternal mortality, Clark [7] concluded is due to limited access to prenatal care, lack of support and an increase in stress before and after birth. In resource-poor nations, maternal mortality has been attributed to "3 delays": delay in deciding to seek care, delay in reaching care in time and delay in receiving adequate treatment [8]. Therefore, action and policy are needed to be taken at every level in making widespread, structural improvements in health coverage that can create greater access to women's care.

The average age of maternal death in this study was $30.7 \pm 5.56$ which was almost comparable with a study by Sageer, Kongnyuy [9] where the average age of maternal death was $30.8 \pm 5.7$ years in Ogun State, Nigeria in a two-year study (2015 and 2016). Half of the cases (50.0%) were non-Malaysian. This group prefers to have antenatal follow up at private health facilities, whereby there is no proper documentation and scheduled visit given to them [10]. In addition, their low socioeconomic status, poor health literacy, poor social support and the legal issue among undocumented foreigners and their negative perception of being caught if they seek treatment in government health facilities, aggravated the risk of maternal death among the population [10].

For the target of intervention [11], the classification into direct and indirect deaths was introduced in the ICD-9 revision in 1975. However, in ICD-10, the classification of maternal death is classified into four [12] which are the direct cause, indirect death, coincidental (fortuitous) death and unspecified maternal death. The importance of the classification is to focus on the quality of obstetric care for health-related conditions in previously healthy women [13]. A study by Ngonzi, Tornes [14] found that direct causes of mortality accounted for 77.7 % while indirect causes contributed 22.3 % in a study at Tertiary University Teaching Hospital in Uganda. A systematic review done by Say, Chou [15] found about 73% of all maternal deaths between 2003 and 2009 were due to direct causes and 27.5% were accounted for by the indirect cause. In this study, there was no difference in the characteristics of the direct and indirect causes of maternal death. This is attributed to the small sample size.

In UK and Ireland, thrombosis and thromboembolism are the leading cause of direct maternal death during and up to six weeks after the end of pregnancy [16]. In this study, postpartum hemorrhage (PPH) contributed to 50% of direct causes and 16.7% of all cases. maternal mortality. There were two cases of massive intracranial bleeding and one case of disseminated intravascular coagulation (DIVC) secondary due to eclampsia. A study by Sageer, Kongnyuy [9] found hemorrhage and pre-eclampsia contributed to 43.4% and 36.9% of maternal deaths in Nigeria, respectively. It was contributed by inadequate human resources for health, delay in seeking care, inadequate equipment, lack of ambulance transportation and delay in referral services. Ngonzi, Tornes [14] found 21.6% of maternal death was due to obstetric haemorrhage and 14.4% due to hypertensive disorders in pregnancy

In this study, sepsis due to infection contributed 75% of the indirect causes or 50% of maternal death. A study by Ngonzi, Tornes [14] in Uganda found that 8.92% of the most common indirect cause of mortality was due to malaria. There were three cases of maternal mortality due to COVID-19 in this study. It is estimated using the Lives Saved Tool (LiST), that an additional 8.3% to 38.6% of maternal mortality during COVID-19 pandemic per month in low-and middle-income countries [17]. These findings are in line with the current trend of maternal death worldwide, in which there is a change in the trend of maternal deaths from direct obstetric causes to the indirect cause. This indicates that the remedial actions and efforts that have been done, such as strengthening health services, healthcare worker training, quality of care improvement, and continuous CEMD, have shown a positive impact [18, 19]. The audit of maternal deaths via the CEMD appears to be very effective and has been improved from year to year. The CEMD can identify the remedial actions systematically to which the district health organisation and ministry of health will respond accordingly. The pre-pregnancy care services need to be strengthened to minimise unsafe pregnancy among mothers with underlying medical illnesses

Indirect deaths received less intention from health policy. The number of direct cause of death is more in high-income countries and are on the rise in many low- and middle-income countries [20]. However, the incidence of indirect deaths mostly under-reporting and misclassification [20]. Therefore, van den Akker, Nair [13] argue that the classification between direct and indirect has become less meaningful and in some cases it was misleading. Therefore, improving an access to quality maternal healthcare and efforts to decrease unintended pregnancies through family planning is necessary to further reduce the global maternal mortality [21].

## Challenges

This study also showed that the maternal mortality cases during the recent two years have risen significantly compared to the years before the pandemic [22]. The COVID-19 infection contributed to the risk of maternal death due to unsafe deliveries and avoidance of healthcare facilities visits due to the fear of contracting the disease. Besides that, there is also an issue with limited resources (staffing and transportation) at the provider level in contrast to the higher number of COVID-19 cases that need to be managed.

## Recommendation

Proper training of the staff in the data collection is needed to ensure the reliability of the data is protected and provide meaningful data for future analysis. Other than that, the stakeholder collaboration between government and private healthcare facilities should be enhanced in terms of giving health education and promotion to the mothers, especially among the foreigners who seek antenatal care at the private clinics, to increase their awareness of the importance of safe deliveries to prevent maternal death. In addition, continuous health education and health promotion during antenatal follow up in the government health care facilities should be continued. Since indirect maternal death causes dominate the trend of maternal mortality, it gives an insight that pre-pregnancy care services also should be enhanced for all women to ensure a safe pregnancy in the future.

Further study on the knowledge, attitude, practice and awareness of maternal health risk factors can be conducted to determine the gap in the maternal behaviour towards pregnancy safety.

## Limitation

This study used a small sample size as the data only covered maternal death from the Cheras District Health Office. Hence, to improve the power and generalisability of the study, more sample sizes should be recruited by extending the study coverage and time in the future. Despite this, the results still give an insight into the performance of the maternal death prevention programme under the Cheras District Health Office. All data collected were classified as secondary data collected by the allied health personnel from the health clinics in charge. Thus, there is a lack of competency in the data collection, which cause the exclusion of maternal death case due to incomplete data.  Other than that, since the study only compared the maternal death stratified by the death category, we can further analyse comparing the maternal death following the preventability status.

## V. CONCLUSION

Continuous effort for health promotion and health education to pregnant women is vital to enhance women's empowerment in ensuring their good health, especially concerning pregnancy. On the health provider perspective, the findings strengthen the importance of continues preventive measures and remedial actions to be taken in reducing the maternal mortality in particularly in our locality. Future study to explore on the knowledge, attitude, practice and awareness of maternal health risk factor and maternal behavior is necessary in order to address the gap in maternal mortality cases.

## ACKNOWLEDGMENT

## REFERENCES

[1]     World Health Organisation *Maternal Deaths 2022*. 2019.
[2]     World Health Organisation *ICD-10: International Statistical Classification of Diseases and Related-health Problems*. 2004.
[3]     Hirschmann R. *Maternal mortality ratio in Malaysia from 2011 to 2020 (per 100,000 live births) 2022* 2012.
[4]     Malaysian Healthcare Performance Unit, *Malaysian Health at a Glance: 2018*. 2000.
[5]     World Health Organization, *Maternal Health: fact sheet on Sustainable Development Goals (*(SDGsReport No.: WHO*./EURO:2017-2363-42118-58039*. 2017.

[6]     Geller, S.E., S.M. Cox, and S.J. Kilpatrick, *A descriptive model of preventability in maternal morbidity and mortality.* Journal of perinatology, 2006. **26**(2): p. 79-84.
[7]     van Hanegem N, et al., *Severe acute maternal morbidity in asylum seekers: A two-year nationwide cohort study in the Netherlands.* Acta Obstet Gynecol Scand, 2011. **90**(9): p. 1010-1016.
[8]     Lindquist A, Knight M, and Kurinczuk J. J., *Variation in severe maternal morbidity according to socioeconomic position: A UK national case-control study.* BMJ Open, 2013. **3**(6): p. e002742.
[9]     Ministry of Health Malaysia *National Technical Committee Confidential Enquiry into Maternal Death, Malaysia (2019). Guidelines on Classification of Pregnancy Related Into Preventable and Non-Preventable Deaths.* 2019.
[10]    Ravichandran J. and Ravindran J., *Lessons from the confidential enquiry into maternal deaths, Malaysia.* BJOG, 2014. **121**(Suppl 4): p. 47-52.
[11]    Jaafar, S., et al., *Good Practices on Maternal & Child Healths in ASEAN: Confidential Enquiry into Maternal Deaths in Malaysia - reviewing maternal deaths to make motherhood safer*, in *e-Health Bulletin.* 2015.
[12]    Payne, J. and J. Cox *Maternal Mortality.* 2016.
[13]    de Moraes A. P, et al., *Severe maternal morbidity: A case-control study in Maranhao, Brazil.* BMC Reprod Health, 2013. **10**: p. 11.
[14]    Howarth G., *Fortuitous-ambiguously inappropriate to describe maternal death?* BMJ, 2000. **320**(7240): p. 986.
[15]    Ministry of Health Malaysia, *Operation Policy In Obstetrics and Gynaecology Services.* 2010.
[16]    Clark, M. *Increase in Maternal Mortality During COVID Underscores Need for Policy Changes.* 2022.
[17]    UNFPA *Maternal Mortality Update 2002: A Focus on Emergency Obstetric Care.* Maternal United Nations Population Fund, 2003.
[18]    Sageer, R., et al., *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**: p. 63.
[19]    Loganathan T., et al., *Migrant Women's Access to Sexual and Reproductive Health Services in Malaysia: A Qualitative Study.* International journal of environmental research and public health, 2020. **17**(15): p. 5376.
[20]    Cross, S., J.S. Bell, and W.J. Graham, *What you can count it what you target: The implication of maternal death classification for tracking progress towards reducing maternal mortality in developing countries.* Bull WOrld Health Organ, 2010. **88**: p. 147-153.
[21]    World Health Organisation, *The WHO application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-Maternal Mortality (ICD-MM).* 2012.
[22]    van den Akker, T., et al., *Maternal mortality: Direct or Indirect has become irrelevant.* The Lancet Global Health., 2017. **5**(12): p. e1181-e1182.
[23]    Ngonzi, J., et al., *Puerperal sepsis, the leading cause of maternal deaths at a Tertiary University Teaching Hospital in Uganda.* BMC Pregnancy and Childbirth, 2016. **16**: p. 207.
[24]    Say, L., et al., *Global causes of maternal death: a WHO systematic analysis.* The Lancet Global Health., 2014. **2**: p. e323-333.
[25]    HQIP, *Maternal, newborn and infact programme: Saving lives, improving mothers' care 2020 report.* 2021.
[26]    Roberton, T., et al., *Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study.* The Lancet Global Health., 2020. **8**: p. e901-e908.
[27]    van den Akker, T., *Indirect causes of maternal mortality.* Pregnancy Hypertension, 2018. **1**(Suppl 1): p. S14-S15.
[28]    Zureick-Brown S, et al., *Understanding Global Trends in Materna MOrtality.* Int Perspect Sex Reprod Health, 2013. **39**(1): p. 32-41.
[29]    Chmielewska B., et al., *Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis.* The Lancet Global Health. , 2021. **9**(6): p. e759-e72.

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