**Jurnal Berkala**
# EPIDEMIOLOGI
*PERIODIC EPIDEMIOLOGY JOURNAL*

*ORIGINAL ARTICLE*

# MATERNAL MORTALITY IN GROBOGAN DURING COVID-19 PANDEMIC 2020-2021

*Kondisi Kematian Ibu di Kabupaten Grobogan Selama Pandemi COVID-19 Tahun 2020-2021*

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## ARTICLE INFO

## ABSTRACT

**Background:** Maternal mortality is one of the health statuses that is considered global. Central Java Province has the highest maternal mortality rate in Indonesia, and one of the regencies with a high MMR (Maternal Mortality Rate) is Grobogan. **Purpose:** This research wants to describe maternal mortality in Grobogan in 2020-2021. In further research, we can determine the relationship between risk factors that cause maternal death and use them to develop program decisions to reduce maternal mortality in Grobogan. **Methods:** This study used a descriptive-quantitative study using Maternal and Infant Mortality data from the Health Office of Grobogan in 2020-2021 and analyzed averages and proportions. **Results:** This study showed that 103 mothers died, 69% mothers at the age of 20-35 years, 46.60% mothers had Junior High School, 8% were in the Purwodadi 2 area, 73% with gestational age >28 weeks, 52% had 2-3 parity, 87.38% of mothers never abortion, 57% of mothers died during the puerperium, and 39% caused by being infected of COVID-19. **Conclusion:** Maternal mortality in Grobogan Regency during the 2020-2021 COVID-19 pandemic, most of the causes of death were due to COVID-19 infection, which mainly occurred in mothers aged 20-35 years, last educated at junior high school, at gestational age >28 weeks, parity 2-3, more common in mothers who have never had a history of abortion, and is currently experiencing the puerperium. This maternal death occurred in 28 of the 30 Puskesmas in Grobogan.

***ABSTRAK***

***Latar Belakang:*** *Kematian ibu merupakan salah satu status kesehatan yang dianggap global. Provinsi Jawa Tengah memiliki angka kematian ibu tertinggi di Indonesia, dan salah satu kabupaten dengan AKI (Angka Kematian Ibu) yang tinggi adalah Kabupaten Grobogan.* ***Tujuan:*** *Mendeskripsikan angka kematian ibu di Grobogan tahun 2020-2021. Pada penelitian selanjutnya, dapat diketahui hubungan antara faktor-faktor risiko penyebab kematian ibu dan menggunakannya untuk mengembangkan keputusan program penurunan angka kematian ibu di Grobogan.* ***Metode:*** *Penelitian ini menggunakan penelitian deskriptif-kuantitatif dengan menggunakan data Kematian Ibu dan Bayi dari Dinas Kesehatan Grobogan Tahun 2020-2021 dan dianalisis rata-rata dan proporsinya.* ***Hasil:*** *Penelitian ini menunjukkan 103 ibu meninggal, 69% ibu pada usia 20 tahun. -35 tahun, 46,60% ibu SLTP, 8% berada di wilayah Purwodadi 2, 73% dengan usia kehamilan >28 minggu, 52% memiliki paritas 2-3, 87,38% ibu tidak pernah aborsi, 57% ibu meninggal masa nifas, dan 39% disebabkan karena terinfeksi COVID-19.* ***Kesimpulan:*** *Kematian ibu di Kabupaten Grobogan pada masa pandemi COVID-19 2020-2021, sebagian besar penyebab kematian karena infeksi COVID-19, yang terutama terjadi pada ibu berusia 20-35 tahun, pendidikan terakhir di SMP, di usia kehamilan >28 minggu, paritas 2-3, lebih sering terjadi pada ibu yang tidak pernah memiliki riwayat abortus, dan sedang mengalami masa nifas. Kematian ibu ini terjadi di 28 dari 30 Puskesmas di Grobogan.*

## INTRODUCTION

According to the WHO definition, maternal death is death during pregnancy or within 42 days after pregnancy, due to all related causes such as bleeding, infection after childbirth, high blood pressure, complications of childbirth, unsafe abortion, or disease (both during pregnancy and treatment), but not caused by an accident or injury (WHO, 2019). Therefore, the maternal mortality rate is one indicator used to assess a country's health status. The SDGs (Standard Development Goals) include it in point 3: a healthy and prosperous life with 13 targets.

The SDGs target concerning maternal and child health is to reduce the maternal mortality rate to 70 per 100,000 live births, the newborn mortality rate to reach 12 per 1,000 live births, and the under-five mortality rate to reach 25 per 1,000 live births in 2030 (Bappenas dan UNICEF, 2017). Based on the 2010 Inter-Census Population Survey (SUPAS) results, Indonesia's MMR (Maternal Mortality Rate) was 305 per 100,000 live births. However, in 2012 based on the Indonesian Demographic Health Survey (IDHS) results, the MMR in Indonesia reached 359 per 100,000 live births, which is a fluctuating increase and is still very high compared to the ministry of health target (Kementrian Kesehatan Republik Indonesia, 2021).

Meanwhile, in 2020, the maternal mortality rate has increased, one of which can be caused by disease factors (Kementrian Kesehatan Republik Indonesia, 2021). In 2020, WHO announced a global COVID-19 pandemic and became the attention of the whole world, one of them in Indonesia. Based on COVID-19 task force data as of March 1, 2022, the number of confirmed cases was 5,589,176, with 148,660 deaths, including pregnant women. Based on data from POGI (Indonesian Obstetrics and Gynecology Association), 536 pregnant women were COVID-19 infected, of which 52 percent were asymptomatic or OTG until April 2021. Meanwhile, based on data from the Directorate of Family Health as of September 14, 2021, 1,086 mothers died with positive PCR/antigen swab results (Rokom, 2021).

Some provinces have the highest MMR in Indonesia, and one of them is Central Java Province. In 2020, Central Java was in the third most significant position, namely 530 mothers

who died (Kementrian Kesehatan Republik Indonesia, 2021). This number has increased from 2019, with 416 mothers dying. It is a concern for the regional government of Central Java Province to continue to strive to reduce MMR in Central Java Province, which is in Grobogan. Grobogan is one of the districts with a high MMR in Central Java Province, second place after Brebes. Based on the Health profile of Grobogan, the maternal mortality rate is still fluctuating from 2016 to 2020. In those five years, cases have increased from 127 to 146 per 100,000 live births (Widodo et al., 2021). Based on reports of maternal deaths due to COVID-19 in Grobogan, from January 2020 to December 2021, there were 103 maternal deaths. The number of maternal deaths is large compared to other districts, such as Banyumas, where the number of maternal deaths due to COVID-19 is 33 people.

Based on the WHO Application of ICD-10 to deaths during pregnancy, childbirth, and the puerperium: ICD-MM categorizes maternal deaths subdivided into two groups: (1) Direct obstetric deaths, which are those resulting from the pregnancy state obstetric complications (pregnancy, labor, and the puerperium), from interventions, omissions, incorrect treatment, or from events chain resulting from any of the above. (2) Indirect obstetric deaths result from previous existing disease or disease that developed during pregnancy and was not because of direct obstetric causes but as aggravated by physiologic effects of pregnancy (WHO, 2012). Based on these categories related to direct and indirect factors causing maternal death and the available data on maternal and neonatal mortality at the Grobogan District Health Office, the researchers used several variables, such as socio-demographic (mother's age and last education), gestational age, parity, abortion experience, causes of maternal death, and maternal condition at death. The researcher considers this variable important to be included in the study because the variable can be directly related to maternal death (maternal condition at death). In contrast, other variables are due to substantive reasons (indirect factors that can cause maternal death, such as socio-demographic, gestational age, parity, abortion experience, and causes of maternal death). Previous research supports the variables used, which states that mothers with pregnancy complications (OR 12.19), childbirth complications (OR 9.94), and disease history (OR 27.73) together contributed to

64.30% of maternal deaths in the Pati district in 2011 (Aeni, 2013).

Another study that looked at the maternal mortality determinants in Bondowoso Regency with a cross-sectional design resulted that the determinants of maternal mortality were complications (OR 2.50 95%CI 1.41 – 3.62) determined by antenatal visits (OR -1.01 95%CI -1.94 – 0.09) and pregnancy risk factors (OR 1.90 95%CI 1.01 – 2.78). Maternal education determined antenatal visits (OR 0.54 95% CI 0.09 – 0.10), while completeness of antenatal care determined pregnancy risk factors (OR -1.09 95%CI -1.99 – -0.19) and mother's education (OR -0.47 95%CI - 0.85–0.07) (Fransiska, Respati, & Mudigdo, 2017). Based on the follow-up study of the 2010 Indonesian population census, the highest risk of maternal death found was with age <15 years, most occurred in post-partum mothers (56%), and most maternal deaths occurred (57.7%) in hospitals and 31.4% occurred at home (Afifah et al., 2016).

This study is an adaptation study of previous research conducted by Nimas Puspitasari and Mateus, which describes maternal mortality in Grobogan in general in 2016-2018. Based on this study, maternal mortality in Grobogan in 2018 increased by 152.25 per 100,000 live births, predominantly occurring at the age of 20-35 years (77.90%), with mothers graduating from elementary school (42.90%), dominantly occurring in post-partum mothers (66.20%). The cause of death is mostly hypertension (39%). At the same time, in 2020, there was a pandemic that changed the conditions of life on various lines, one of which was health, so this study describes maternal mortality in Grobogan during a pandemic from 2020 to 2021. In addition, Grobogan is the location of this research because it is the area with the second highest maternal mortality rate in Central Java and the ninth highest COVID-19 case in Central Java. Researchers hope that in future research, we can determine the relationship between risk factors that cause maternal death so we can use them as material in making program decisions to reduce maternal mortality in Grobogan, especially in the current pandemic situation.

**METHODS**

A descriptive-quantitative study was conducted based on January 2020 to August 2021 maternal mortality data in Grobogan District

Health Office. Maternal and neonatal mortality data contained the obtained data. This research has obtained the ethical clearance of FKM UI No. 128/UN2.F10.D11/PPM.00.02/2022. This research study population was all mothers who died in Grobogan from January 2020 to October 2021, with as many as 103 people. The variables in this study, namely socio-demographic (mother's age and last education), gestational age, parity, abortion experience, causes of maternal death, and maternal condition at death obtained from data on maternal and child mortality in Grobogan in 2020-2021. The data was a record of the public health centers collected by the Grobogan District Health Office on maternal deaths during 2020-2021.

We analyzed maternal and infant mortality data in Grobogan in 2020-2021. Researchers cleaned the data beforehand so we could analyze it. The variables to be analyzed were socio-demographic (mother's age and last education), gestational age, parity, abortion experience, causes of maternal death, and maternal condition at death. First, the researcher presents the analyzed variables in averages and proportions. Then several variables will also be presented in categories, such as maternal age, gestational age, and parity. Furthermore, the tabular form will present the results of the analysis. Researchers conducted the analysis and presentation to produce a picture of maternal mortality in Grobogan in 2020-2021. Maternal age was categorized into <20 years, 20-35 years, and >35 years according to the category of maternal age at risk, maternal gestational age was categorized into <15 weeks, 15-28 weeks, and >28 weeks, and parity categorized into 1 and 4, and 2-3.

## RESULTS

The number of maternal deaths in Grobogan in 2020-2021 was 103, and the cases fluctuated from January 2020 to October 2021. Nationally, the peak of COVID-19 cases occurred in July and began to incline in August 2021, but most deaths occurred in July and peaked in August. In Grobogan, the highest number of deaths occurred in June-July 2021, with 42 mothers who died. Of the 103 mothers who died, the average age was 30.56 ± SD 6.95 years, whereas most of the mothers who died were aged 29 and 32 years, eight people (8%). The youngest maternal age was 18 years old, which was four people (4%). If the maternal age was categorized based on the category of the ministry of health, most of the mothers who died were at low risk for complications and death, namely 20-35 years (71.84%), as shown in Table 1.

Based on education level, in Grobogan, most of the pregnant women who died had low education, only up to junior high school (46.60%), and even one person did not attend school. Meanwhile, the average gestational age of mothers who died was 31.90 ± SD 7.45 weeks. Most of the gestational age of mothers who died were at an age prone to pregnancy complications and death, namely the age group >28 weeks (73%). Grobogan has 30 public health centers, and maternal deaths are across 28 health centers, with the highest proportion being Purwodadi 2, namely eight deaths (8%), Pulokulon 1, and Godong 1, each with seven deaths (7%). Almost all public health centers are in rural areas, and only one occurs in urban areas, namely Purwodadi 1, as shown in Table 1.

Based on parity, mothers with parity 2-3 times more (52%) compared to mothers who have experienced giving birth ≤1 and ≥4 times (48%). 13 mothers had previously experienced an abortion, two mothers had experienced an abortion two times (1.94%), and 11 mothers had experienced an abortion once (10.68%). However, more mothers never had an abortion (87.38%). Most of the mothers who died occurred during childbirth (57%), and 38 people (37%) women died during pregnancy, as shown in Table 1. Out of 60 people for mothers whose birth attendants were known, as many as 88% of mothers were assisted by doctors, and midwives assisted 12%. Most mothers who gave birth and post-partum gave birth at the hospital (93%).

**Table 1**
Demographics and Conditions of Maternal Mortality

| Variable | Total (n) | % |
|---|---|---|
| **Age (years)** | | |
| <20 | 5 | 4.85 |
| 20 – 35 | 74 | 71.84 |
| >35 | 24 | 23.30 |
| **Education (level)** | | |
| Not go to school | 1 | 0.97 |
| Elementary school | 13 | 12.62 |
| Junior high school | 48 | 46.60 |
| Senior high school | 31 | 30.09 |
| Higher education | 10 | 9.71 |
| **Public Health Center (area)** | | |
| Purwodadi 2 | 8 | 8 |
| Godong 1 | 7 | 7 |
| Pulokulon 1 | 7 | 7 |
| Toroh 1 | 5 | 5 |
| Tanggungharjo | 5 | 5 |
| Purwodadi 1 | 5 | 5 |
| Wirosari 1 | 5 | 5 |
| Pulokulon 2 | 5 | 5 |
| Kradenan 2 | 5 | 5 |
| Ngaringan | 4 | 4 |
| Brati | 4 | 4 |
| Penawangan 2 | 4 | 4 |
| Klambu | 4 | 4 |
| Geyer 1 | 4 | 4 |
| Tawangharjo | 3 | 3 |
| Kedungjati | 3 | 3 |
| Tegowanu | 3 | 3 |
| Toroh 2 | 3 | 3 |
| Grobogan | 3 | 3 |
| Gubug 2 | 2 | 2 |
| Karang Rayung 1 | 2 | 2 |
| Gubug 1 | 2 | 2 |
| Godong 2 | 2 | 2 |
| Wirosari 2 | 2 | 2 |
| Karang Rayung 2 | 2 | 2 |
| Gabus 2 | 2 | 2 |
| Penawangan 1 | 1 | 1 |
| Kradenan 1 | 1 | 1 |
| **Parity (times)** | | |
| ≤1 and ≥4 | 50 | 48 |
| 2 – 3 | 53 | 52 |

*(Continued)*

**Table 1**
*(Continued)*

| Variable | Total (n) | % |
|---|---|---|
| **Abortus (times)** | | |
| Never | 90 | 87,38 |
| 1 | 11 | 10,68 |
| 2 | 2 | 1,94 |
| **Pregnant Womens Condition at Death** | | |
| Maternity | 6 | 6 |
| Pregnant | 38 | 37 |
| Post-partum | 59 | 57 |
| **Causes of Pregnant Women Die** | | |
| COVID-19 | 36 | 39 |
| COVID-19 + Comorbid | 21 | 23 |
| Hypertension | 18 | 20 |
| Hypertension + comorbid | 4 | 4 |
| Circulatory system disorders | 3 | 3 |
| Bleeding | 2 | 2 |
| Eclampsia | 1 | 1 |
| Hepatic Shock | 1 | 1 |
| Amniotic fluid embolism | 1 | 1 |
| Asthma | 1 | 1 |
| Hypovolemic shock | 1 | 1 |
| Kidney stone surgery | 1 | 1 |
| Metabolic Disorder | 1 | 1 |
| Severe pneumonia | 1 | 1 |

In Grobogan 2020-2021, out of 92 mothers whose cause of death is known. More mothers died due to only COVID-19 disease (39%). The rest were because of other causes such as hypertension, circulatory system disorders, bleeding, eclampsia, hepatic shock, amniotic fluid embolism, asthma, hypovolemic shock, kidney stone surgery, metabolic disorders, and severe pneumonia (Table 1). In that month, the graph of maternal mortality in Grobogan is linear, with a graph of fluctuations in new cases and deaths every month of COVID-19 in Indonesia. Of which 38 people (37%) mothers died from COVID-19, 4 of whom had comorbidities, namely severe pre-eclampsia, eclampsia, HbSAg+, type II diabetes mellitus, and early post-partum hemorrhage because of placental retention.

**DISCUSSION**

Research with a systematic review and meta-analysis globally supports the increasing condition of maternal mortality during the pandemic in Grobogan that the condition of the maternal and

fetal during the pandemic have worsened with an increase in maternal mortality, stillbirth, ruptured ectopic pregnancy, and maternal depression (Chmielewska et al., 2021). This condition also occurred in Brazil, where the maternal mortality rate increased by 20% in 2020 (Francisco, Lacerda, & Rodrigues, 2021). All patient groups have a high risk of developing severe cases of COVID-19. However, the population of pregnant women (including pregnant and post-partum women) has a higher risk of death (OR 2.60 95% CI 2.28-2.97) compared to other groups, namely non-maternal women and men in 2021 (Gonçalves, Franco, & Rodrigues, 2021).

According to the Ministry of Health, the maternal age of 20-35 years is the age that is ready for pregnant women because it is the age of the mother who is physically and mentally mature so that the pregnancy process can run optimally. In comparison, the age <20 and >35 years are the age at risk for pregnant women. Because there can be many complications, such as abortion, statistically, pregnant women aged <20 years have 7,79 times died caused by abortion, and pregnant women aged >35 years have 5.95 times to died caused by abortion and statistically significant (Yokoe et al., 2019). Other studies support that the mortality rate in COVID-19 patients is high in older individuals and patients with at least one comorbidity (Karimi, Makvandi, Vahedian-Azimi, Sathyapalan, & Sahebkar, 2021). In another study in Canada that mothers aged <20 years and >24 years were increasingly at risk for severe mortality and morbidity, whereas mothers aged 35-39 years were 1.31 times at risk for severe mortality and morbidity compared to mothers aged 20-24 years, and mothers aged 45 years are at risk of 2,69 times (Aoyama et al., 2019).

Mothers with higher education can improve prevention by early detection of pregnancy complications or can immediately access appropriate health services after signs and symptoms of complications appear (Yadav, Sahni, Kumar, Bala, & Kalotra, 2021). A mother's education can also improve a woman's cognitive skills, economic status, and autonomy, influence decisions to conduct fertility practices, use of health services, to maternal morbidity(Weitzman, 2017). Other studies in China also support the results of these studies, which show that a person's knowledge is related to his level of education and will affect susceptibility to disease. Meanwhile, if we conducted a health education intervention, it would be more effective if it is given to groups with lower education to increase their ability to prevent exposure to disease (Zhong et al., 2020).

Studies conducted in Belgium and France support this study, that pregnant women diagnosed with COVID-19 at the gestational age ≥20 weeks showed severe symptoms and laboratory results compared to women who were not pregnant (Badr et al., 2020). As for the results of another study in Bengkulu City, mothers with pregnancies >28 weeks were more at risk of experiencing anxiety so that they could experience eclampsia, premature birth, or an impact on death (Asmariyah, Novianti, & Suriyati, 2021). Based on previous research, the maternal mortality ratio in the community with a parity of 4 during 2010-2015 was 14.20% higher than that of mothers who had never given birth after adjusting for other variables (Aryanty et al., 2021). Parity is one of the factors that can determine the fate of the mother and fetus, both during pregnancy and childbirth. Parity 1 is at risk because the mother does not yet have physical or psychological readiness to give birth and has 1.68 times greater anxiety than mothers with multiparity parity status (Mortazavi, Mehrabadi, & KiaeeTabar, 2021).

The case in North Macedonia showed progressive clinical deterioration in post-partum mothers even though they had gotten aggressive supportive care. It can happen because post-partum mothers with COVID-19 are more at risk of giving an inflammatory response to the mother by giving birth by cesarean delivery and increasing the risk of multiorgan system failure (Sivevski et al., 2020). The conditions in Surabaya are in line with the results of this study that the majority of maternal deaths occurred during the puerperium 66.97%, and the least occurred during childbirth, namely 16.51% (Rochmatin, 2019). It can happen because the puerperium is a period that requires care for both mother and baby so as not to cause complications and even death (Puspitasari & Adi, 2021), and infection during the puerperium is 13% greater experienced by mothers with cesarean section (Susilawati & Kasron, 2019). These complications, especially infection, can cause maternal death due to germs that spread into the bloodstream (septicemia). It can be an extensive cellular injury with ischemia, mitochondrial dysfunction, apoptosis, immunosuppression, organ dysfunction, and even death, especially if they do not get early treatment to control the complications (Escobar, Echavarría, Zambrano, Ramos, & Kusanovic, 2020).

Abortion is also one of the critical points to consider regarding maternal mortality. In Grobogan, abortion was another cause of maternal mortality in 2019 (Dinas Kesehatan Provinsi Jawa Tengah, 2019). The proportion of abortions in mothers who died in Grobogan in 2020-2021 was 12.62%. Two mothers (1.94%) had experienced an abortion twice, and 11 (10.7%) mothers had experienced an abortion one time. Abortion often causes complications, such as bleeding, infection, perforation, and shock (Cunningham, 2014), and infection is the leading maternal mortality cause in Indonesia (Kementrian Kesehatan Republik Indonesia, 2021). Other causes include hypertension with comorbidities, circulatory system disorders, bleeding, eclampsia, hepatic shock, amniotic fluid embolism, asthma, hypovolemic shock, kidney stone surgery, metabolic disorders, and severe pneumonia. It can be why in 2020, the SARS-CoV-2 virus began to enter Indonesia and continues to mutate until now. Pregnant women have a higher risk of serious illness, morbidity, and even mortality than the general population if infected with COVID-19. Pregnant women with COVID-19 have reported the side effects on the fetus in the form of preterm delivery (Central Board of the Indonesian Obstetrics and Gynecology Association, 2020). In a study in China, as many as 50% of pregnant women reported undergoing intensive care in the ICU, 33% needed ventilator assistance, and 25% died  (Liu et al., 2020).

## CONCLUSION

Maternal mortality in Grobogan during the 2020-2021 COVID-19 pandemic, most of the causes of death were due to COVID-19 infection. It mainly occurred in mothers aged 20-35 years, last educated at junior high school, at gestational age >28 weeks, parity 2-3, and is more common in mothers who have never had a history of abortion and are currently experiencing the puerperium. This maternal death occurred in 28 of the 30 Puskesmas in Grobogan.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this study.

## AUTHOR CONTRIBUTIONS

All authors declare that we are participating actively in this study and article writing and are partly responsible for the content of the writing, including preparation and writing of concepts, designs, analysis, or revision of the article. NH: Conceptualization, Writing-Original Draft preparation, Data curation and analysis, Editing, and Visualization. MK: Reviewing, Editing, and Supervision.

## ACKNOWLEDGMENTS

## REFERENCES

Aeni, N. (2013). Faktor risiko kematian ibu. *Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*, *7*(10), 453–459.

Afifah, T., Tejayanti, T., Saptarini, I., Rizkianti, A., Usman, Y., Senewe, F. P., & Pangaribuan, L. (2016). Maternal death in Indonesia: follow-up study of the 2010 Indonesia population census. *Indonesian Journal of Reproductive Health*, *7*(1), 1–13.

Aoyama, K., Pinto, R., Ray, J. G., Hill, A. D., Scales, D. C., Lapinsky, S. E., … Fowler, R. A. (2019). Association of maternal age with severe maternal morbidity and mortality in Canada. *JAMA Network Open*, *2*(8), e199875–e199875.

Aryanty, R. I., Romadlona, N., Besral, B., Panggabean, E. D. P., Utomo, B., Makalew, R., & Magnani, R. J. (2021). Contraceptive use and maternal mortality in Indonesia: a community-level ecological analysis. *Reproductive Health*, *18*(1), 1–9.

Asmariyah, A., Novianti, N., & Suriyati, S. (2021). Tingkat kecemasan ibu hamil pada masa pandemi COVID-19 di Kota Bengkulu. *Journal Of Midwifery*, *9*(1), 1–8.

Badr, D. A., Mattern, J., Carlin, A., Cordier, A.-G., Maillart, E., El Hachem, L., … Damoisel, C. (2020). Are clinical outcomes worse for pregnant women at≥ 20 weeks' gestation infected with coronavirus disease 2019? A multicenter case-control study with propensity score matching. *American Journal of Obstetrics & Gynecology*, *223*(5), 764–768.

Bappenas dan UNICEF. (2017). *Laporan baseline SDG tentang anak-anak di Indonesia.* Jakarta. Retrieved from https://www.unicef.org/indonesia/id/laporan/laporan-baseline-sdg-tentang-anak-anak-di-indonesia

Central Board of the Indonesian Obstetrics and Gynecology Association. (2020). *Rekomendasi penanganan infeksi virus corona (COVID-19) pada maternal (hamil, bersalin dan nifas).* Surabaya. Retrieved from https://pogi.or.id/publish/wp-content/uploads/2020/03/Rekomendasi-Penanganan-Infeksi-COVID-19-pada-maternal.pdf

Chmielewska, B., Barratt, I., Townsend, R., Kalafat, E., van der Meulen, J., Gurol-Urganci, I., … Thangaratinam, S. (2021). Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. *The Lancet Global Health*, *9*(6), e759–e772.

Cunningham, F. G. (2014). *Williams obstetrics* (24th ed.). New York: Graw Hill Education Medical.

Dinas Kesehatan Provinsi Jawa Tengah. (2019). Profil Kesehatan Provinsi Jateng Tahun 2019. In *Dinas Kesehatan Provinsi Jawa Tengah* (Vol. 3511351).

Escobar, M. F., Echavarría, M. P., Zambrano, M. A., Ramos, I., & Kusanovic, J. P. (2020). Maternal sepsis. *American Journal of Obstetrics & Gynecology MFM*, *2*(3), 100149.

Francisco, R. P. V., Lacerda, L., & Rodrigues, A. S. (2021). Obstetric Observatory BRAZIL-COVID-19: 1031 maternal deaths because of COVID-19 and the unequal access to health care services. *Clinics*, Vol. 76. SciELO Brasil.

Fransiska, R. D., Respati, S. H., & Mudigdo, A. (2017). Analysis of maternal mortality determinants in Bondowoso District, East Java. *Journal of Maternal and Child Health*, *2*(1), 76–88.

Gonçalves, B. M. M., Franco, R. P. V, & Rodrigues, A. S. (2021). Maternal mortality associated with COVID-19 in Brazil in 2020 and 2021: Comparison with non-pregnant women and men. *Plos One*, *16*(12), e0261492.

Karimi, L., Makvandi, S., Vahedian-Azimi, A., Sathyapalan, T., & Sahebkar, A. (2021). Effect of COVID-19 on mortality of pregnant and postpartum women: a systematic review and meta-analysis. *Journal of Pregnancy*, *2021*.

Kementrian Kesehatan Republik Indonesia. (2021). *Profil kesehatan Indonesia tahun 2020* (B. Hardhana, F. Sibuea, & W. Widiantini, Eds.). Jakarta: Kementerian Kesehatan Republik Indonesia.

Liu, D., Li, L., Wu, X., Zheng, D., Wang, J., Liang, B., … Zheng, C. (2020). Pregnancy and perinatal outcomes of women with COVID-19 pneumonia: a preliminary analysis. *Available at SSRN 3548758*.

Mortazavi, F., Mehrabadi, M., & KiaeeTabar, R. (2021). Pregnant women's well-being and worry during the COVID-19 pandemic: a cross-sectional study. *BMC Pregnancy and Childbirth*, *21*(1), 1–11.

Puspitasari, N., & Adi, M. S. (2021). Gambaran Kejadian Kematian Ibu di Kabupaten Grobogan, Jawa Tengah Tahun 2016-2018. *Jurnal Penelitian Kesehatan" SUARA FORIKES"(Journal of Health Research" Forikes Voice")*, *12*, 203–207.

Rochmatin, H. (2019). Gambaran Determinan Kematian Ibu di Kota Surabaya Tahun 2015-2017. *Jurnal Biometrika Dan Kependudukan*, *7*(2), 178.

Rokom. (2021). Kemenkes perkuat upaya penyelamatan ibu dan bayi. Retrieved from https://sehatnegeriku.kemkes.go.id/baca/umum/20210914/3738491/kemenkes-perkuat-upaya-penyelamatan-ibu-dan-bayi/

Sivevski, A., Karadzova, D., Davceva, N., Aleksioska-Papestiev, I., Kadriu, R., Velickovic, I., … Baysinger, C. L. (2020). Post Partum Death in a Patient Diagnosed With COVID-19. *Frontiers in Global Women's Health*, *1*, 567810.

Susilawati, & Kasron. (2019). Identification of the Puerperium Infection characteristics. *Jurnal Kebidanan*, *9*(2), 153–159.

Weitzman, A. (2017). The effects of women's education on maternal health: Evidence from Peru. *Social Science & Medicine*, *180*, 1–9.

WHO. (2012). *The WHO application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM*. World Health Organization.

WHO. (2019). *Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division*.

Widodo, S., Rauf, A., Hartuti, M., Martanto, E.,

Maryana, D. N., Aziza, R. I., … Utomo, D. W. N. (2021). *Profil kesehatan Kabupaten Grobogan*. Purwodadi.

Yadav, A. K., Sahni, B., Kumar, D., Bala, K., & Kalotra, A. (2021). Effect of women's and partners' education on maternal health-care services utilization in five empowered action group States of India: An analysis of 13,443 women of reproductive age. *International Journal of Applied and Basic Medical Research*, *11*(4), 231.

Yokoe, R., Rowe, R., Choudhury, S. S., Rani, A., Zahir, F., & Nair, M. (2019). Unsafe abortion and abortion-related death among 1.8 million women in India. *BMJ Global Health*, *4*(3), e001491.

Zhong, B. L., Luo, W., Li, H. M., Zhang, Q. Q., Liu, X. G., Li, W. T., & Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among chinese residents during the rapid rise period of the COVID-19 outbreak: A quick online cross-sectional survey. *International Journal of Biological Sciences*, *16*(10), 1745–1752. https://doi.org/10.7150/ijbs.45221