Maternal death causes before and during COVID-19 pandemic: a descriptive study in Banjarnegara Indonesia

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Abstract

Purpose: Maternal mortality in Indonesia in 2017 was 3rd highest in Southeast Asia. The Banjarnegara District in 2018 was ranked with the third highest maternal mortality rate in Central Java Province. In previous years, the most common cause of maternal death in the district was bleeding, but in 2021 the biggest cause was COVID-19. This study aims to examine cases of maternal mortality by analyzing maternal characteristics, causes, and health service coverage from 2019 to 2021. **Methods:** The design of this study is a descriptive epidemiological study of maternal death cases in Banjarnegara in 2019-2021 using secondary data from the district health office. In-depth interviews with health workers in the public health center and the district health office. **Results:** Maternal death cases in 2019-2021 were 81 cases. COVID-19 will be the leading cause of maternal death during the COVID-19 pandemic in 2021, accounting for 60%. **Conclusion:** Preeclampsia was the leading cause of maternal death before the COVID-19 pandemic, while COVID-19 infection emerged as the primary cause in 2021. Strategic measures are needed to increase access to well-coordinated health services to reduce maternal deaths related to COVID-19 and the other effects of the pandemic.

Keywords: maternal death; Banjarnegara; COVID-19; pandemic

INTRODUCTION

The World Health Organization (WHO) report stated that there were 810 maternal deaths every day in 2017 due to childbirth, most of which occurred in low- and middle-low-income countries [1]. Maternal mortality in Indonesia in 2017 ranks 3rd highest in Southeast Asia, with 117 maternal deaths per 100.000 live births [1].

In 2017 the public health development index of Banjarnegara was ranked the second lowest out of 35 regencies/cities in Central Java Province (0.4927). In 2018 the index was the lowest in Central Java Province. The district maternal mortality rate during the 2017-2019 period was still fluctuating, in 2017 137.66 per 100,000 live birth, decreased to 58.8 per 100,000 live birth, and increased again in 2019 to 139.83 per 100,000 live birth [2].

The coverage of K4 visits ranges from 85 - 88%. K4 coverage has not yet reached the national target of 90% and is the lowest K4 coverage in Central Java Province [3]. The coverage of birth attendance by health workers reaches 98% however, Banjarnegara District ranks third in Central Java Province with the highest number of maternal deaths [4]. Health workers' detection of the risk of pregnant women is an average of 23%, while by the community, it is 13% [2]. The high coverage of K1 and birth attendance by health workers quantitatively, but the number of maternal deaths is still high, and not all health centers in Banjarnegara district provide optimally integrated ANC services and the low risk of early detection of pregnant women and the postpartum period by health workers. In addition, the percentage of pregnant and maternity women who received services according to standards was still below the

target, namely 88.6% and 98.1% [5].

The COVID-19 pandemic, which began at the end of 2019 until now, has added to the challenges in reducing maternal death. Indonesia reported its first COVID-19 infection in early 2020. Several studies reported cases of maternal death due to COVID-19 infection [6,7]. Necessary up-to-date information on cases of maternal death during the COVID-19 pandemic as a reference in making a regional policy.

The assistance program for pregnant women with the One mother one cadre approach is an initiative and innovative program developed by one of the health centers in the district. This concept has been quite successful in being implemented in the district [8].

Although many countries have reported maternal deaths during the COVID-19 pandemic, information on maternal mortality rates in Indonesia before and during the pandemic remains limited. This research aims to provide up-to-date information on cases of maternal death before and during the COVID-19 pandemic in Indonesia. Several previous studies have only described cases of maternal death, this study will explore the causes of maternal death before and during the covid 19 pandemic, the location of maternal death, and the maternal period which is vulnerable to maternal death. This study examines cases of maternal death by analyzing the mother's characteristics, causes, and coverage of health services. The research results are expected to become recommendations and overcome the problem of maternal mortality in the district during the COVID-19 pandemic.

METHODS

This study is a descriptive epidemiological study of maternal death cases in Banjarnegara District before and during the COVID-19 pandemic in 2019-2021. Of the 35 Public Health Centers, 21 Public Health Centers reported cases of maternal death that were included in this study. The population in this study were all mothers who were reported to have died during pregnancy, childbirth, and the postpartum period, which were not due to accidents in Banjarnegara District based on their identity cards (KTP) 81 cases of maternal deaths occurred before and during COVID-19 pandemic.

Data collection was carried out through secondary data from the District Health Office and Public Health Centers that reported cases of maternal death. In addition, data collection was carried out through in-depth interviews with health center staff, especially midwives and the District Health Office. Data collection was carried out from February to December 2021. The data taken is retrospective data from 2019 -2021. The

variables in this study were maternal characteristics, including age, parity, education, frequency of ANC, the medical cause of death, COVID-19 infection(based on a positive result on an antigen or PCR test), period of maternal death, and place of death.

Other variables, which are indirect causes such as geographical, sociocultural, and economic factors, are obtained from the results of interviews. Our research has received ethical approval from the health research ethic-committee of the Indonesian Ministry of Health Research and Development Agency No: LB.02.01/2/ KE.281/2021.

RESULTS

Cases of maternal mortality in Banjarnegara District are spread over several sub-district health centers. Figure 1 shows the distribution of maternal death cases in Banjarnegara District for 2019-2021 based on health center catchment areas. Maternal deaths occur in the western and southern regions of the district. Over a period of 3 years, 21 public health centers reported cases of maternal deaths, and three public health centers reported cases of more than two maternal deaths. During the COVID-19 pandemic, 16 public health centers reported maternal death due to COVID-19 infection. The Public health center that reported the most cases of maternal death due to COVID-19 was the Rakit 1 Public Health Center, with 3 cases reported.
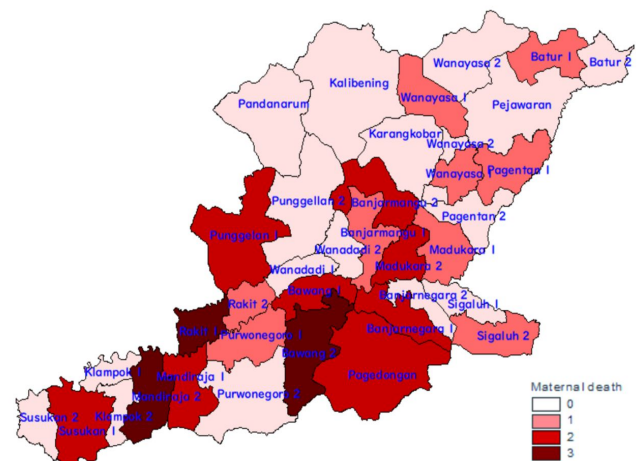

Figure 1. The distribution of maternal death cases in Banjarnegara District for 2019-2021 based on the area of the health center.

Table 1 shows maternal deaths in the last three years were dominated by the ages of 20-34 years, However, there were still maternal deaths at a young age (under 20 years). Maternal education was dominated by secondary education. Based on parity, most maternal deaths were multiparas. Pregnant

women with maternal mortality have a frequency of complete ANC. During the COVID-19 pandemic, the most common cause of maternal death was COVID-19 infection. Before the COVID-19 pandemic, preeclampsia was the most common cause of maternal death. In the last three years, the most maternal deaths based on the maternal period were during the postpartum, and during the covid 19 pandemic, the most maternal death occurred during pregnancy. Most deaths occurred in the hospital either before or during the COVID-19 pandemic.

Table 1. Characteristics of mothers in maternal death in Banjarnegara District in 2019-2021 (n=81)

Variable	%
Maternal age	
<20 Years	2,5
20-34 Years	69,1
≥35 Years	28,4
Maternal education	
Elementary School	27,2
Junior High School	38,3
Senior High School and College	34,6
Parity	
Primipara	12,3
Multipara	87,7
Frequency of ANC	
Complete (>4 times)	93,8
Never/ Incomplete (<4 times)	6,2
Causes of maternal death	
Hemorrhage	12,3
Hypertension/ Pre Eclampsia	13,6
Cardiovascular Disease	7,4
Infection	2,5
COVID-19	32,1
Other	32,1
Maternal period	
Prenatal	40,7
Intrapartum	4,9
Postpartum	54,3
Place of maternal death	
Hospital	86,4
Public Health Center/Clinic/Midwife Independent Practice	6,2
Not a health facility	7,4
Total	100

Source: Banjarnegara Health Office secondary data

Table 2 shows maternal death cases in Banjarnegara in the last three years. Maternal death is increasing yearly, especially in 2021, dominated by the main cause of COVID-19 infection. Preeclampsia was previously the most common cause of maternal death, but during the COVID-19 pandemic (2020-2021), COVID-19 infection emerged as the leading cause of maternal mortality. Maternal deaths caused by COVID-19 infection have started to be reported since 2020 and peaked in July - August 2021. Maternal death during the COVID-19 pandemic has doubled from before the COVID-19 pandemic.

Table 2. Causes of maternal death in Banjarnegara District before and during the COVID-19 pandemic

Causes	Year			Total
	Before Pandemic	During Pandemic		
	2019	2020	2021	
Hemorrhage	5	2	3	10
Cardiovascular Disease	2	3	1	6
Hypertension/ Pre Eclampsia	7	4	0	11
Infection	1	1	0	2
COVID-19	0	2	24	26
Other	7	7	12	26
Total	22	19	40	81

Table 3 shows that most maternal deaths in Banjarnegara District in the last three years were other causes such as cancer, lupus, and other diseases accompanying pregnancy and COVID-19 infection. Most maternal deaths due to COVID-19 infection occur during pregnancy. Most maternal death due to other causes occurs during the postpartum period.

Table 3. Causes of maternal death based on the maternal period in Banjarnegara District in 2019-2021

Causes	Maternal Period		
	Pregnancy	Intra partum	Post partum
Hemorrhage	0	2	8
Cardiovascular disease	3	0	3
Hypertension/ Pre-eclampsia	3	1	7
Infection	0	0	2
COVID-19	18	0	8
Other	9	1	16
Total	33	4	44

Table 4 shows that most of the maternal deaths occurred in the hospital. Most maternal deaths in hospitals were due to other causes, such as cancer, lupus, diabetes, and other comorbidities, and the second most common cause was due to COVID-19 infection.

Access to health services is quite easy for the community to reach. The number of health service facilities is 4 General Hospitals, where 2 are Comprehensive Obstetrics and Neonatal Services Hospitals; 35 Public Health Centers, where 13 Public Health Centers have Comprehensive Obstetrics and Neonatal Services; 39 auxiliary community health service centers, 1578 integrated service post, 1 Regional Health Laboratory, 66 pharmacies dan 17 Clinics.

Table 4. Causes of death based on places of maternal death, Banjarnegara District in 2019-2021

Causes	Place of maternal death		
	Hospital	Public health center/clinic/ midwife independent practice	Not health facility
Hemorrhage	9	1	0
Cardiovascular disease	3	1	2
Pre-eclampsia	7	2	2
Infection	1	0	1
COVID-19	24	1	1
Other	26	0	0
Total	70	5	6

Related factors of maternal death are not only due to medical causes but also other indirect factors such as economic and socio-cultural factors. There are still delays in deciding to seek care at health facilities. Decision-making is more dominant in the husband, the head of the family. This condition is exacerbated by people who don't believe in COVID-19 and are afraid to visit health facilities.

Lack of public knowledge of the impact of COVID-19, especially on pregnant women, can harm the fetus and themselves. Other factors, such as culture and traditions within the family, still play a role in the postpartum care process. Postpartum mothers can only consume white rice without added animal proteins and limit water consumption because it is thought to slow wound healing. This condition can reduce the condition of postpartum women who need enough nutrition to restore the body's condition and help with breastfeeding. Other socio-cultural factors were contrary to family planning services, so mothers were found to be at high risk and having birth intervals <2 years and more than five children. Several pregnant women refuse to be vaccinated.

DISCUSSION

According to the World Health Organization (WHO), maternal death is the death of a woman that occurs during pregnancy, childbirth, or 42 days after delivery [1]. Cases of maternal mortality in Banjarnegara are still high in the last three years (2019-2021), with 81 cases reported. This study provides the latest information regarding the causes of maternal deaths amid the COVID-19 pandemic. In line with the WHO report, the maternal mortality rate in several developing countries is still high, including Indonesia.

The cause of the high maternal mortality rate is inadequate facilities and infrastructure, uneven distribution of human resources in maternal services, inappropriate competencies, lack of interprofessional collaboration in health service facilities, lack of patient safety quality standards in the referral system, and unequal access based on local geographical conditions [9,4]. Pregnant, maternity, and postpartum women are at-risk groups that require special attention related to maternal health services. Maternal deaths can be prevented when detecting risk factors earlier [9].

Cases of maternal mortality in Banjarnegara District are dominated by women of reproductive age (20-34 years), namely 69.1%. Baharuddin's research at 11 hospitals in Indonesia also reported that 64% of maternal deaths occurred between the ages of 21 and 35 [10]. Several studies also show the same result that most maternal deaths occur at reproductive age [11,12,13]. Even though they are in a healthy reproductive period, maternal death can occur due to complications during childbirth related to other causative factors such as medical history and other medical factors. Research in China also illustrates the same results, namely the highest number of cases of maternal death aged 20-29 between 1990-2017, but the highest maternal mortality rate was at the age of 40-49 years [14]. Although the prevalence of maternal deaths occurs at the age of 20-34, a significant risk factor for maternal death is age <20. Maternal deaths in hospitals were strongly related to age groups, especially those at high risk <20 years [15]. Therefore prevention of early pregnancy or at the age of <20 years is necessary to prepare for a safe pregnancy.

Cases of maternal death were dominated by junior high school. The results of previous research explained that the more educated a person is, the higher the chance of identifying danger signs in pregnancy. It is estimated that 4.9 times more highly educated women are more likely to know and detect early danger signs in their pregnancy [16].

Most cases of maternal death were in multiparas. A previous study showed a relationship between parity and maternal mortality [17]. Primiparas and multiparas increase the risk of childbirth. Primiparas are associated with unpreparedness and physiological immaturity of the reproductive organs. Multiparas are

associated with the emergence of complications of pregnancy and childbirth [15].

Most cases of maternal death occurred in mothers who made complete ANC visits. This study is opposite to the previous study, which stated that complete ANC examinations and the quality of services decrease the risk of maternal death [18]. Other studies have also revealed that antenatal care that is not regular or <4 times has a risk of 4.57 times the risk of death compared to mothers who regularly perform ANC [19]. One of the goals of antenatal care is to detect complications early in pregnancy so that regular ANC complications can be found quickly and maternal death can be prevented with proper treatment of complications found [20]. A complete ANC visit not only be in number but must also be followed by quality services and comprehensive ANC.

The most dominant maternal mortality occurred during the puerperium. Other research also shows that the most dominant maternal mortality is in the postpartum period [13,21]. The classic triad of causes of maternal death most commonly found in the puerperium includes bleeding, preeclampsia, and comorbidities [22]. In the COVID-19 pandemic, most maternal deaths occurred during pregnancy, similar to a previous study in which pregnant women in the 2nd and 3rd trimesters with COVID-19 infection can experience cardiopulmonary complications and death [6]. The risk of maternal death in pregnancies with COVID-19 infection is 22 times greater than in mothers not infected with COVID-19 [7]. Strategic measures are needed to increase access to well-coordinated health services to reduce COVID-19 related deaths and the other pandemic effects.

Research in Suriname shows that most maternal deaths occur in hospitals (81%) [13]. In line with this study, maternal deaths occurred mostly in hospitals (86.4%). The hospital is the highest referral service facility for cases of maternal complications. Delays in referrals can cause many deaths in the hospital, so the referred mother is already in critical condition. Interprofessional collaboration in maternal services is needed to detect and get the right diagnosis if complications are found during pregnancy, childbirth, and the puerperium.

Causes of maternal before and during the COVID-19 pandemic

The most common cause of maternal death in this study is COVID-19 infection in 2021. Maternal deaths due to COVID-19 infection were discovered in 2020 and peaked from July to August 2021. Before the COVID-19 pandemic, the most common cause of maternal death was preeclampsia before the COVID-19 pandemic.

Previous studies reported severe manifestations of COVID-19 infection in pregnant women, and most severe COVID-19 infections in pregnant women cause death [6,23]. COVID-19 infection during pregnancy is associated with the emergence of a risk of morbidity and mortality in postpartum mothers and babies born [7]. The high risk of severity of COVID-19 infection in pregnant women is related to physiological changes in pregnancy, such as changes in the metabolic system, cardiovascular system, and several other organ systems [24]. The COVID-19 infection triggers a cytokine storm in the body of pregnant women, inhibiting the immune system and worsening the condition of pregnant women [25]. COVID-19 vaccination and prevention of infection in pregnant, maternity, and postpartum women need to be improved to prevent pregnant women from being infected with COVID-19.

The causes of maternal death before the Covid pandemic were dominated by preeclampsia and other causes such as lupus, kidney, and cancer. Previous studies have shown that a history of illness increases the risk of maternal death by around 27.74 times [18]. Special monitoring of pregnant women with a history of pre-pregnancy disease needs to be carried out strictly by various healthcare professionals.

In this study, 13.6% of the causes of maternal death were found to be preeclampsia before the COVID-19 pandemic. Preeclampsia is a major cause of maternal death that affects fetal growth, premature birth, placental abruption, fetal distress, and even fetal death in the womb. In addition to the risks to the fetus during pregnancy, there is growing evidence that preeclampsia has long-term adverse effects on the offspring, such as cardiovascular sequelae, including hypertension and vascular function in children born to mothers with preeclampsia [26].

Postpartum hemorrhage was 12.3%. Postpartum hemorrhage is a major cause of maternal morbidity and mortality worldwide. Pregnant women are considered at risk of labor complications, including postpartum hemorrhage. Therefore, early detection and intervention of postpartum hemorrhage are needed through interprofessional collaboration to save the mother [27]. Postpartum hemorrhage is caused by several factors, namely uterine atony, tearing of the birth canal, retained placenta, remaining placental tissue left in the uterus, abnormalities in the blood clotting process, and uterine rupture [28].

Sunaryo's study in 2019 on the implementation of mentoring one pregnant woman with one cadre in Banjarnegara showed good results. This assistance had a positive effect on reducing maternal mortality in

2020. This program can increase the readiness and maturity of standardized birth planning to minimize factors that cause maternal death [8]. Research in several countries regarding the assistance of pregnant women by doulas (trained women) who continuously provide physical, emotional, and informational assistance to pregnant women during pregnancy, childbirth, and childbirth reduces the number of cesarean deliveries. It reduces maternal anxiety during the delivery process, thereby reducing the incidence of birth complications that impact cases of maternal mortality [29,30].

Assistance to pregnant women from families, cadres, and professional workers is important to increase mothers' motivation and confidence in preparing for safe delivery [31]. Other studies showed that accompanying health cadres to pregnant women affect prenatal care [32]. The one-mother assistance program with one cadre is a good choice to be implemented in the community.

This study provides up-to-date information regarding maternal death in Banjarnegara for the last three years, which can be used as initial information in determining local government policies to reduce maternal mortality, especially during the COVID-19 pandemic, primarily through the one mother and one cadre assistance program. Health officers can apply it in the community through the support of local health facilities. Community health practitioners can empower cadres through this program to reduce maternal mortality cases in the future.

CONCLUSION

The maternal death cases in Banjarnegara were still high during the COVID-19 pandemic. Before the pandemic, preeclampsia was the leading medical cause of maternal mortality, whereas, during the pandemic, COVID-19 infection emerged as the primary cause. Besides, social, economic, and cultural factors indirectly affect maternal mortality. Strategic measures are needed to increase access to well-coordinated health services to reduce maternal deaths related to COVID-19 and the other effects of the pandemic.

REFERENCES

1. WHO. Trends in maternal mortality 2000-2017. WHO. 2017. Available from: [Website]
2. Dinas Kesehatan Kabupaten Banjarnegara. Profil kesehatan Banjarnegara Tahun 2018. Banjarnegara: Dinkes Banjarnegara; 2018.
3. Dinas Kesehatan Provinsi Jawa Tengah. Profil kesehatan Provinsi Jawa Tengah. Jawa Tengah: Dinkes Provinsi Jawa Tengah; 2018.
4. Dinas Kesehatan Provinsi Jawa Tengah. Profil kesehatan Provinsi Jateng Tahun 2019. Jawa Tengah: Dinkes Provinsi Jawa Tengah; 2019.
5. Dinas Kesehatan Kabupaten Banjarnegara. Profil kesehatan Kabupaten Banjarnegara Tahun 2020. Banjarnegara: Dinkes Banjarnegara; 2020.
6. Hantoushzadeh S, Shamshirsaz AA, Aleyasin A, Seferovic MD, Aski SK, Arian SE, Aagaard K, et al. Maternal death due to COVID-19. American Journal of Obstetrics and Gynecology. 2020;223(1):109.e1-109.e16.
7. Villar J, Ariff S, Gunier RB, Thiruvengadam R, Rauch S, Kholin A, et al. Maternal and neonatal morbidity and mortality among pregnant women with and without COVID-19 infection: The INTERCOVID Multinational Cohort Study. JAMA Pediatrics. 2021;175(8):817–26.
8. Sunaryo S, Isnani T, Lestari E, Apriliana S, Zuyina I, Sari R. Implementation of assistance for one pregnant woman one cadre (OPOC) in Banjarnegara District, Central Java Province, Indonesia. African Journal of Reproductive Health. 2022;26(7):83–9.
9. Sriatmi A. Strategi Pendampingan dan penguatan program KIA dalam Penurunan AKI-AKB di era Pandemi, disampaikan dalam penguatan program KIA melalui pemberdayaan masyarakat berbasis lingkungan. Semarang; 2021.
10. Baharuddin M, Amelia D, Suhowatsky S, Kusuma A, Suhargono MH, Eng B. Maternal death reviews: A retrospective case series of 90 hospital-based maternal deaths in 11 hospitals in Indonesia. International Journal of Gynecology & Obstetrics. 2019;144:59–64.
11. Daru J, Zamora J, Fernández-Félix BM, Vogel J, Oladapo OT, Morisaki N, et al. Risk of maternal mortality in women with severe anemia during pregnancy and post partum: a multilevel analysis. Lancet Global Health. 2018;6(5):e548–54.
12. Mohammed AA, Elnour MH, Mohammed EE, Ahmed SA, Abdelfattah AI. Maternal mortality in Kassala State - Eastern Sudan: community-based study using reproductive age mortality survey (RAMOS). BMC Pregnancy and Childbirth. 2011;11:2–7.
13. Kodan LR, Verschueren KJC, van Roosmalen J, Kanhai HHH, Bloemenkamp KWM. Maternal mortality audit in Suriname between 2010 and 2014, a reproductive age mortality survey. BMC Pregnancy and Childbirth. 2017;17(1):1–9.
14. Li C, Jiang M, Huang K, Li J, Xu L. The trends of maternal mortality ratios and cause pattern in 34 Chinese provinces. BMC Public Health. 2022;1–10.

15. Ramazani IB-E, Ntela S-DM, Ahouah M, Ishoso DK, Monique R-T. Maternal mortality study in the Eastern Democratic Republic of the Congo. BMC Pregnancy and Childbirth. 2022;22(1):1–14.

16. Wulandari RD, Laksono AD. Determinants of knowledge of pregnancy danger signs in Indonesia. PLoS One. 2020;15(5):1–11.

17. Respati SH, Sulistyowati S, Nababan R. Analisis faktor determinan kematian ibu di Kabupaten Sukoharjo Jawa Tengah Indonesia. Jurnal Kesehatan Reproduksi. 2019;6(2):52.

18. Aeni N. Faktor risiko kematian ibu. Kesmas National Public Health Journal. 2013;7(10):453.

19. Noor H. Analisis faktor risiko terhadap kematian maternal di Kabupaten Bulukumba Tahun 2007-2009. J Media Kebidanan Poltekkes Makassar. 2010;2:47–55.

20. WHO. WHO recommendations on antenatal care for a positive pregnancy experience. 2016. Available from: [Website]

21. Rochmatin H. Gambaran determinan kematian ibu di Kota Surabaya Tahun 2015-2017. Jurnal Biometrika dan Kependudukan. 2019;7(2):178.

22. Saifudin AB. Buku acuan nasional pelayanan kesehatan maternal dan neonatal. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo; 2006.

23. Alzamora MC, Paredes T, Caceres D, Webb CM, Webb CM, Valdez LM, et al. Severe COVID-19 during pregnancy and possible vertical transmission. American Journal of Perinatology. 2020;37(8):861–5.

24. Narang K, Enninga EAL, Gunaratne MDSK, Ibirogba ER, Trad ATA, Elrefaei A, et al. SARS-CoV-2 infection and COVID-19 during pregnancy: a multidisciplinary review. Mayo Clinic Proceedings. 2020 Aug;95(8):1750–65.

25. Wenling Y, Junchao Q, Zhirong X, Shi O. Pregnancy and COVID-19: management and challenges. Revista du Instituto Medicina Tropical Sao Paulo. 2020;62(August):1–9.

26. Fox R, Kitt J, Leeson P, Aye CYL, Lewandowski AJ. Preeclampsia:risk factors, diagnosis, management, and the cardiovascular impact on the offspring. Journal of Clinical Medicine. 2019;8(10):1–22.

27. Watkins EJ. Postpartum hemorrhage. Official Journal of American Academy Physician Assist. 2020;33:29–33.

28. Wiknyo Sastro, Hanifa; Syaifuddin AB. Ilmu kandungan. Jakarta: Jakarta Yayasan Bina Pustaka Sarwono Prawirohardjo; 2007.

29. Chen C-C, Lee J-F. Effectiveness of the doula program in Northern Taiwan. Tzu Chi Medical Journal. 2020;32(4):373–9.

30. Falconi AM, Bromfield SG, Tang T, Malloy D, Blanco D, Disciglio RNS, et al. Doula care across the maternity care continuum and impact on maternal health: evaluation of doula programs across three states using propensity score matching. eClinicalMedicine. 2022;50.

31. Nguyen HH, Heelan-Fancher L. Female relatives as lay doulas and birth outcomes: a systematic review. The Journal of Perinatal Education. 2022;31(2):111 – 123.

32. Susanti E. Peran kader kesehatan dalam pendampingan ibu hamil resiko tinggi terhadap pemeriksaan kehamilan selama pandemi Covid-19. Jurnal Nursing Update. 2020;11(3):68–75.