MATERNAL DEATH CAUSED BY COVID-19 IN BANJARNEGARA DISTRICT, CENTRAL JAVA PROVINCE, INDONESIA

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Abstract. Banjarnegara District in Central Java Province is one of the five districts with the highest rates of maternal death attributable to COVID-19. The current COVID-19 pandemic has become one additional cause that increased maternal death. Therefore, this study aimed to examine the determinants of maternal mortality due to COVID-19 in the Banjarnegara District. The study design was cross-sectional, and the activities included collection of maternal mortality data at the Banjarnegara District Health Office and conducting interviews with Public Health Center midwives. There were 24 maternal deaths caused by COVID-19 infections in 2021 with some during pregnancy, on childbirth and at postpartum. The result of this study showed that most of maternal death occurred in reproductive age (20-35 years old). Most of the deaths had no obstetric complication. Thirty-seven percent or 9 of the 24 deaths were at a gestation age of less than 29 weeks. Most of the 24 maternal deaths due to COVID-19 occurred in hospitals (83.33%); mostly died during pregnant (66.66%) with 29.17% post-partum and 4.17% died in labor. This study revealed that a delay in referring to health services due to being late in making decisions in the family that other causes of maternal death. The other non-medical factors in mortality included low economic and factors of belief and religion. For this reason, efforts are needed to reduce cases of maternal mortality with an innovative program for pregnant women, namely the assistance of one mother with one cadre to build a community alert system in dealing with emergencies related to pregnancy and childbirth.

Keywords: COVID-19, maternal mortality, Banjarnegara, Central Java

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INTRODUCTION

The World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus as a pandemic on 12 March 2020 (WHO, 2020). The pandemic became an event threatening public health and causing common cold to severe acute respiratory syndrome (Li *et al*, 2020). COVID-19 can affect anyone regardless of age, comorbid conditions, and gender, including pregnant women (Christyani and Padang, 2020). Typical symptoms include fever >38°C, shortness of breath, coughing, diarrhea, fatigue, muscle aches or pains, and other respiratory tract symptoms. According to Association of Obstetrics and Gynecology Indonesia (2020), mild symptoms occur in some cases without fever. Furthermore, there are 4,655 confirmed cases in Indonesia, with 144,06 deaths (COVID-19 Task Force, 2021).

The results of epidemiological study publications on COVID-19 in pregnancy are still limited, and this virus is a big challenge faced in reducing maternal mortality. As a result, there are restrictions on activities, including health services for pregnant women that are afraid of visiting health facilities for fear of infection (Setyawan and Purmono, 2020). Meanwhile, social distancing results in uncertain changes, both physiologically and psychologically, hence a special way is needed to meet their needs (Pradana *et al*, 2020). A study in Brazil reported that there were 13,858 cases of maternal death and 1,396 of them were caused by COVID-19 infection. Differences in the ratio of maternal deaths varied between cities. Cities with limited resources and low socioeconomic status show higher rates of maternal mortality due to COVID-19 (Andreucci and Knobel, 2021; Siqueira *et al*, 2021). Another study showed that age was significantly associated with maternal mortality due to COVID-19 infection with relative risk (RR) of 1.08 ($p<0.0001$). Other risk factors for death are diabetes, hypertension, obesity, and chronic kidney disease. Comorbid mothers and poverty are independent predictors of mortality in pregnant women with COVID-19 (Torres-Torres *et al*, 2021). Banjarnegara District has the lowest health development index score in

Central Java Province (Central Java Provincial Health Office, 2020). During 2017-2019, the maternal mortality rate in Banjarnegara District was ranked fifth in Central Java Province (Central Java Provincial Health Office, 2020).

The maternal mortality rate in 2017 reached 137.66/100,000 live births, decreased to 58.8/100,000 in 2018, and increased again in 2019 to 139.83/100,000 (Banjarnegara District Health Office, 2021; Central Java Provincial Health Office, 2019). The coverage of first-time pregnancy, being examined by a health worker and fourth-time examination at a health service were respectively 95.00%, 98.00% and 85.00-88.00% (Central Java Provincial Health Office, 2020).

Therefore, this study examined the determinants related to maternal mortality due to COVID-19 in Banjarnegara District, Central Java Province. The results provide recommendation for overcoming the problem of maternal death due to COVID-19 in Banjarnegara District. This study might also add evidence on the risk factors related to COVID-19 among pregnant women, which can be useful not necessarily only to the study location but also to other similar districts in Indonesia.

MATERIALS AND METHODS

This study was conducted by using a cross-sectional design in 16 Public Health Center (PHCs) reporting cases of maternal death due to COVID-19 infection in Banjarnegara District in 2021. The primary purpose of this study was to provide detailed characteristics of those maternal deaths. The dependent variable in this study was maternal deaths that occurred during pregnancy, childbirth, and postpartum. Independent variables in this study were characteristics of maternal, *ie*, age of maternal, level of education, frequency of antenatal care, type of comorbid, time of period death occurs, place of death, gestational age, and type of birth. In quantitative method, we conducted a descriptive analysis of the characteristics of the maternal death due to COVID-19 infection. In

qualitative method, we conducted interviews with health workers such as midwifes and health program management officers. The purpose of qualitative study was to provide information about the accessibility to health services, the barrier of maternal health services during the COVID-19 pandemic, challenges in implementing vaccination for pregnant women, and innovation programs in existing maternal and child health services.

Ethical approval was obtained from the Health Research and Development Agency with reference number: LB.02.01/2/KE.281/2021. Licensing and study coordination were also conducted with the local government of Banjarnegara District at the PHC and Health Office.

RESULTS

There were 41 maternal mortalities in Banjarnegara District in 2021. The largest cause of death was COVID-19 (58.56%) while other causes summed up at 41.44% (Banjarnegara District Health Office, 2022).

The mortality of pregnant women due to COVID-19 in 2021 were spread in 16 Public Health Center in the West and South areas of Banjarnegara District. The health centers that reported the most mortality was Rakit 1, consisting of 3 people, while other health centers reported only 1 to 2 cases. Table 1, shows that 75.00% mortality of pregnant women due to COVID-19 are in the productive age of 20-35 years, while the remaining 25.00% are above 35 years. As for the education level, 41.00% and 50.00% of those who died were junior high and high school, respectively. Three-fourth (75.00%) of mother had ANC for 4 times or more. Only 12.34% of pregnant women who died of COVID-19 had comorbidities, namely diabetes melitus (DM), Congestive heart failure (CHF), and severe pre-eclampsia. Gestational age at termination of pregnancy was as follows: first trimester 4.17%, second trimester 33.33% and third trimester 62.50%, it can be assumed that pregnant women who died in the postpartum period had terminated their pregnancies first.

Table 1
Characteristics of maternal mortality due to COVID-19 in Banjarnegara District (2021) (N = 24 except the method of labor and delivery)

Characteristic	Frequency *n* (%)
Age	
<20 years	0 (0.00)
20-35 years	18 (75.00)
>35 years	6 (25.00)
Level of education	
Primary school	2 (8.33)
Junior high school	10 (41.67)
High school and college	12 (50.00)
Antenatal care visit (ANC)	
<4 times	6 (25.00)
≥4 times	18 (75.00)
Availability of comorbidity	
Diabetes mellitus (DM)	1 (4.17)
Congestive heart failure (CHF)	1 (4.17)
Severe pre-eclampsia (SPE)	1 (4.17)
No comorbidity/complication	21 (87.66)
Gestational age	
First trimester (0-12 weeks)	1 (4.17)
Second trimester (13-28 weeks)	8 (33.33)
Third Trimester (29-40 weeks)	15 (62.50)
Time of death	
During pregnant	16 (66.66)
In labor	1 (4.17)
Postpartum	7 (29.17)

Table 1 (cont)

Characteristic	Frequency *n* (%)
Place of death	
Hospital	20 (83.33)
Public Health Center	1 (4.17)
House	0 (0.00)
No data available	3 (12.50)
Method of labor and delivery (N = 8)	
Per vagina (normal)	2 (25.00)
Per vagina (with vacuum)	1 (12.50)
Caesarean section	5 (62.50)

Source: Banjarnegara District Health Office (2022)
COVID-19: Coronavirus disease 2019

Of 24 mothers who were confirmed dead with COVID-19 during 2021, 16 (66.66%) died during pregnancy, 1 (4.17%) died in labor and 7 (29.17%) post-partum. Out of 8 mothers who were able to make it to the labor room, two of them (25.00%) underwent a vaginal delivery, while one (12.50%) had a vacuum-assisted vaginal delivery. The remaining five mothers (62.50%) underwent a cesarean section for the delivery of their babies. Maternal deaths that occur during the postpartum period are likely to have undergone delivery either by caesarean section or vaginally.

In-depth interviews results

According to the community health center (PHC) officer, pregnant women's access to health care is easy, but there are still delays in referring to health care centers because pregnant women's families are late in making

decisions. In-depth interviews with PHC officers obtained information about the deaths of pregnant women. According to PHC officials, there was an evidence to suggest that families of pregnant women who exhibited COVID-19 symptoms or had positive test for the virus declined to leave healthcare facilities as they were afraid of contracting the infection after being discharged. So they are at risk of transmitting the COVID-19 virus to other families, including pregnant women in the house. Non-medical factors that result in the death of pregnant women include low socioeconomic status. Pregnant women with low economic status or classified as poor getting COVID-19 would have thought of how to pay for the COVID 19 treatment while meeting their daily needs is difficult. Another factor is the role of religious leaders who are still role models in decision-making related to referring pregnant women affected by COVID-19 to health services.

The efforts made by the District Health Office (DHO) in handling referrals for pregnant women have actually been agreed between obstetrician at the hospital and the DHO. According to informant from Banjarnegara District Health Office, obstetric gynecology doctors have already implemented a system of dividing assistance areas. Consequently, PHC and hospitals can gain access to the personal mobile numbers of the obstetricians practicing at the hospital, enabling them to seek assistance during complicated deliveries. PHC midwives are also included in medical emergency training/workshops at each PHC, especially the handling of preeclampsia. According to the Head of Maternal and Child Health, there has been an innovation in pregnant women's services in Banjarnegara District, namely: Sabu Saka /(OPOC) or one pregnant woman, one cadre which aims to prevent 3 late occurrences: 1) Late in deciding to health services, 2) Late to the place of health services, and 3) Late to get health services. Its implementation includes 4 activities: 1) Reminding the schedule of pregnancy check-ups, 2) Monitoring the health of the fetus through fetal movements, 3) Detecting the high risk of pregnant women by cadres, and 4) Commitment of maternity planning

programs in health care facilities). The program has become a regulation and is strengthened by the Regent's Decree on the One Pregnant Woman, One Cadre program.

DISCUSSION

Pregnant women are a vulnerable group that requires special attention in getting their health services, especially during the COVID-19 pandemic. A study shows that pregnancy with the infection can result in severe clinical symptoms, including respiratory failure and requiring ventilatory care; this condition can increase maternal mortality (Alzamora *et al*, 2020). The mortality of pregnant women due to COVID-19 infection in Banjarnegara District is dominated (75.00%) by reproductive age of 20-35 years, a group which have lower risk of maternal death. These results align with study conducted in Latin America which reported 298 (69.1%) maternal deaths linked to COVID-19 infection at the age of 20-35 years, with a median value of 31 years (Maza-Arnedo *et al*, 2022). Maternal deaths due to COVID-19 mostly occur in the reproductive age (20-35 years) quantitatively, but the results of a statistical test of a study show that maternal age is significantly related to cases of maternal death due to COVID-19. Mothers aged 35-39 years and over 40 years had a higher risk of maternal death due to COVID-19 infection compared to those under 35 years of age (Torres-Torres *et al*, 2022). This shows that with increasing age, the risk of maternal death increases. Education levels of pregnant women who died due to infection were mostly secondary school education and high school and above at 41.67% and 50.00%. Study in Brazil also shows that the most educated pregnant women infected with COVID-19 are in secondary education at 47.7% and the least in higher education at 8.1% (Alzamora *et al*, 2020). Education level of pregnant women is an important aspect of preventing maternal mortality. It is directly proportional to the knowledge

and maturity of pregnant women in taking an attitude in undergoing the process of pregnancy (Corneles and Losu, 2015). The application of health protocols to prevent COVID-19 plays an important role in suppressing the infection. Good adherence to the protocol was found in pregnant women with high education of 76.5% (Cletus and Anyike, 2022).

In line with this study, mothers with higher education' deaths due to the COVID-19 infection was few. Maternal mortality due to COVID-19 infection in Banjarnegara is more dominant during pregnancy and postpartum at 66.67% and 29.15%. The previous multinational cohort study also reported 11 cases of maternal death due to the COVID-19 infection, 7 (63.64%) died during pregnancy, 2 (18.18%) died shortly after caesarean section, and 2 (18.18%) experienced symptoms and died 7 days after delivery (Villar *et al*, 2021). In this study, 62.50% of COVID-19 infections in pregnancy occurred in the 3rd trimester. This is similar to a systematic review study and meta-analysis, where the average gestational age in mothers infected was in the 3rd trimester of pregnancy, which was 37.97 weeks (95% confidence interval (CI): 37.59-38.35) (Di Toro *et al*, 2021). This condition indicates the need to supervise vulnerable groups related to the infection prevention protocol, especially pregnant women. In most of the 87.66% of mothers who died without other comorbidities/ complications, only 1 case was found, each with comorbid diabetes mellitus, severe preeclampsia, and heart failure. This is in contrast to the results of Torres-Torres *et al* (2022) who stated that previous/comorbid disease history factors were associated with maternal mortality, including diabetes mellitus absolute risk reduction (aRR) = 2.66 (95% CI: 1.65-4.27)), chronic hypertension (aRR = 1.75 (95% CI: 1.02-3.00)) and obesity (aRR = 2.15 (95% CI: 1.46-3.17). Closer monitoring is needed against pregnant women who have comorbidities with COVID-19 infection to prevent the risk of maternal death. The death can be prevented when risk factors during pregnancy can be identified early (Petersen *et al*, 2019).

Of the 8 pregnant women who gave birth, most gave birth by Caesarean section (62.50%). In the several studies reported in a systematic review and meta-analysis, caesarean section was the most common (385 deliveries or 63.84%) in COVID-19 infected pregnant women (Sarastry *et al*, 2021). Caesarean section is best for mothers with severe infection and emergency conditions. On the other hand, COVID-19 infection with mild symptoms of vaginal delivery is allowed to be performed at the referral hospital and with infection prevention protocol Level 3 (Boelig *et al*, 2020; MOH RI, 2020) where additional measures beyond standard precautions, such as masks, gloves, gowns, goggles, as well as strict adherence to hand hygiene practices, are implemented to prevent the transmission of infectious diseases (WHO, 2020).

Maternal mortality caused by COVID-19 has been found since 2020 and reached its peak in July 2021, together with the peak of delta variant infection in Indonesia. On 15 July 2021, 56,767 new cases were recorded, however complete dose vaccination coverage was still at 5.5% (Dyer, 2021). Pregnant women who were not vaccinated during the delta wave period compared to the pre delta period showed a higher mortality rate and higher disease severity and pregnancy complications in the delta wave period (Birol Ilter *et al*, 2022). Therefore, vaccination of pregnant women is very important to reduce the maternal mortality and severity of COVID-19 infection during pregnancy. The infected pregnant women showed more severe symptoms due to physiological changes in the immune system. The infection has been associated with higher case fatality rates and more severe complications (Wang *et al*, 2021). This condition is also exacerbated by several other factors, including families and pregnant women who do not believe in COVID-19 and are worried about being diagnosed with the virus. The mortality could have been avoided when the community, particularly pregnant women, had been screened at the health facilities. Factors that cause maternal mortality are not only because the person concerned is infected with the COVID-19 virus but there are other factors, for examples,

delays in making decisions in seeking care at health facilities, culture and traditions in the family are still conducted for postpartum care.

Community empowerment is an effort to build, improve, and develop the potential and power for direct participation and involvement. The people are encouraged and motivated to embrace joint responsibility for resolving communal and environmental challenges. It is hoped that one pregnant woman one cadre efforts will increase the scope of services to reduce the mortality rate of pregnant women from the cause of infection, either COVID-19 or others.

In summary, maternal mortality in Banjarnegara District increased from the previous year, and 60% was related to COVID-19 in 2021. The study revealed that the majority (83.33%) of the 24 maternal deaths caused by COVID-19 were reported to have transpired in hospital settings. Among the deceased, the highest proportion was found to be pregnant women (66.66%), while postpartum women accounted for 29.17% of the total deaths. These results underscore the significance of prioritizing the safety and well-being of pregnant and postpartum women in healthcare facilities amid the COVID-19 pandemic. Those mothers who died of COVID-19 in Banjarnegara were mostly high school educated. The other cause of maternal death is a delay in referring to hospital due to being late in making decisions in the family. Efforts to build a community alert system to overcome emergencies related to pregnancy and childbirth include raising awareness about the risk of COVID-19 among pregnant women and their families with the help of community cadres, through implementation of One Pregnant Woman One Cadre Program.

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CONFLICT OF INTEREST DISCLOSURE

The authors reported no potential conflicts of interest and are solely responsible for the views expressed in this publication.

REFERENCES

Alzamora MC, Paredes T, Caceres D, Webb CM, Valdez LM, La Rosa M. (2020). Severe COVID-19 during pregnancy and possible vertical transmission. *Am J Perinatol* 2020; 37: 861-5.

Andreucci CB, Knobel R. Social determinants of COVID-19-related maternal deaths in Brazil. *Lancet Reg Health Am* 2021; 3: 100104.

Association of Obstetrics and Gynecology Indonesia. Recommendations on handling of corona virus infection (COVID-19) on maternity (pregnancy, labor and postpartum), 2020 [cited 2021 Jun 25]. Available from: URL: https://pogi.or.id/publish/wp-content/uploads/2020/03/Rekomendasi-Penanganan-Infeksi-COVID-19-pada-maternal.pdf [in Indonesian]

Banjarnegara District Health Office. Banjarnegara District Health Profile 2020, 2021 [cited 2022 Aug 27]. Available from: URL : https://dinkesbna.banjarnegarakab.go.id/wp-content/uploads/2021/04/PROFIL-KESEHATAN-KAB.-BANJARNEGARA-TH-2020-1.pdf [in Indonesian]

Banjarnegara District Health Office. Health profile 2021, 2022 [cited 2000 Aug 27]. Available from: URL: https://dinkesbna.banjarnegarakab.go.id/

wp-content/uploads/2022/03/Profil-Banjarnegara-Tahun-2021-1.pdf [in Indonesian]

Birol Ilter P, Prasad S, Mutlu MA, *et al*. Maternal and perinatal outcomes of SARS-CoV-2 infection in unvaccinated pregnancies during Delta and Omicron waves. *Ultrasound Obstet Gynecol* 2022; 60: 96-102.

Boelig RC, Manuck T, Oliver EA, *et al*. Labor and delivery guidance for COVID-19. *Am J Obstet Gynecol MFM*, 2020; 2: 100110.

Central Java Provincial Health Office. Health profile of Central Java Province 2018, 2019 [cited 2022 Jul 20]. Available from: URL: https://dinkesjatengprov.go.id/v2018/dokumen/profil_2018/files/downloads/Profil%20Jateng%202018%20cetak.pdf [in Indonesian]

Central Java Provincial Health Office. Health profile of Central Java Province 2019, 2020 [cited 2022 Jul 20]. Available from URL: https://dinkesjatengprov.go.id/v2018/storage/2020/09/Profil-Jateng-tahun-2019.pdf [in Indonesian]

Christyani F, Padang AF. Vertical transmission of COVID 19 during pregnancy, 2020 [cited 2022 Aug 21]. Available from: URL: https://media.neliti.com/media/publications/401567-transmisi-vertikal-covid-19-selama-keham-79cc55e7.pdf [in Indonesian]

Cletus FC, Anyike TC. Socio-demographic determinants of compliance with COVID-19 protocol among women attending antenatal clinics in Obio/Akpor Local Government Area of Rivers State, 2022 [cited 2022 Aug 10]. Available from: URL: https://fnasjournals.com/index.php/FNAS-JSI/article/view/35/31

Corneles SM, Losu FN. Relationship between education level and knowledge of pregnant women about high risk pregnancies, 2015 [cited 2022 Oct 13]. Available from: URL: https://ejurnal.poltekkes-manado.ac.id/index.php/jidan/article/view/331/297 [in Indonesian]

COVID-19 Task Force. Analysis of Indonesian COVID-19 data (Update as of 26 December 2021), 2021 [2022 Jul 10]. Available from: URL: https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-26-desember-2021 [in Indonesian]

Di Toro F, Gjoka M, Di Lorenzo G, *et al*. Impact of COVID-19 on maternal and neonatal outcomes: a systematic review and meta-analysis. Clin Microbiol *Infect* 2021; 27: 36-46.

Dyer O. Covid-19: Indonesia becomes Asia's new pandemic epicentre as delta variant spreads. *BMJ* 2021; 374: n1815.

Ministry of Health Republic of Indonesia (MOH RI). Guidelines for antenatal, delivery, postpartum, and newborn care in the new adaptation era, 2020 [cited 2022 Oct 12]. Available from: URL: https://covid19.go.id/storage/app/media/Materi%20Edukasi/2020/Oktober/revisi-2-a5-pedoman-pelayanan-antenatal-persalinan-nifas-dan-bbl-di-era-adaptasi-kebiasaan-baru.pdf [in Indonesian]

Li Q, Guan X, Wu P, *et al*. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 2020; 382: 1199-207.

Maza-Arnedo F, Paternina-Caicedo A, Sosa CG, *et al*. Maternal mortality linked to COVID-19 in Latin America: results from a multi-country collaborative database of 447 deaths. *Lancet Reg Health Am* 2022; 12: 100269.

Petersen EE, Davis NL, Goodman D, *et al*. Vital signs: Pregnancy-related Deaths, United States, 2011-2015, and strategies for prevention, 13 States, 2013-2017, 2019 [cited 2022 Jul 19]. Available from: URL: https://www.cdc.gov/mmwr/volumes/68/wr/mm6818e1.htm?s_cid=mm6818e1_w

Pradana AA, Casman, Nur'aini. The effect of social distancing policy on

the COVID-19 outbreaks against vulnerable groups in Indonesia, 2020 [cited 2022 Jul 10]. Available from: URL: https://jurnal.ugm.ac.id/jkki/article/view/55575/27986 [in Indonesian]

Sarastry R, Layarta C, Aladini U, Pramono BA. Delivery routes in pregnancy with COVID-19 and the risk of intrapartum vertical transmission: a meta-analysis, 2021 [cited 2022 Aug 03]. Available from: URL: https://mji.ui.ac.id/journal/index.php/mji/article/view/4779/2106

Setyawan A, Purmano FA. Socialization of increased knowledge of pregnant women and toddlers in independent monitoring in the era of COVID-19 pandemic in Ngesrep Village, Semarang, 2020 [cited 2022 Jul 18]. Available from: URL: https://proceedings.undip.ac.id/index.php/semnasppm2019/article/view/395/250 [in Indonesian]

Siqueira TS, Silva JRS, Souza MDR, *et al*. Spatial clusters, social determinants of health and risk of maternal mortality by COVID-19 in Brazil: a national population-based ecological study. *Lancet Reg Health Am* 2021; 3: 100076.

Torres-Torres J, Martinez-Portilla RJ, Espino-Y-Sosa S, *et al*. Comorbidity, poverty and social vulnerability as risk factors for mortality in pregnant women with confirmed SARS-CoV-2 infection: analysis of 13 062 positive pregnancies including 176 maternal deaths in Mexico. *Ultrasound Obstet Gynecol* 2022; 59: 76-82.

Torres-Torres J, Martinez-Portilla RJ, Espino-Y-Sosa S, *et al*. Co-morbidities and social determinants in pregnant women with COVID-19 infection: analysis of 11,031 pregnancies including 138 deaths. *Ultrasound Obstet Gynecol* 2021; 58 (Suppl 1): 32.

Villar J, Ariff S, Gunier RB, T, *et al*. Maternal and neonatal morbidity and mortality among pregnant women with and without COVID-19 infection: the INTERCOVID Multinational Cohort Study. *JAMA Pediatr* 2021; 175: 817-26.

Wang CL, Liu YY, Wu CH, Wang CY, Wang CH, Long CY. Impact of COVID-19 on pregnancy. *Int J Med Sci* 2021; 18: 763-7.

World Health Organization (WHO). WHO announces COVID-19 outbreak a pandemic, 2020 [cited 2022 Oct 14]. Available from: URL: https://reliefweb.int/report/world/who-announces-covid-19-outbreak-pandemic

World Health Organization (WHO). Rational use of personal protective equipment for COVID-19 and considerations during severe shortages, 2020 [cited 2022 Aug 10]. Available from: URL: https://www.who.int/publications/i/item/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages