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Clinico-demographic profile of women with Severe Maternal Outcomes during COVID 19 pandemic at a tertiary hospital in eastern Nepal

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Abstract

Background: Severe Maternal Outcomes reflect the status of existing health care system. COVID-19 pandemic affected the healthcare delivery system and led to an increased maternal morbidity and mortality. This study aimed to assess the clinico-demographic profile of women with severe maternal outcome at B. P. Koirala Institute of Health Sciences (BPKIHS).

Methods: A retrospective descriptive study was conducted at BPKIHS. Medical records of all women with severe maternal outcomes (maternal mortality and maternal near-miss) over the period of six months following lockdown (03/24/2020 - 09/24/2020), were reviewed. Maternal near-miss cases were identified as per 'a specific intervention-based criteria' defined by World Health Organization (WHO). The demographic and clinical variables of interest were recorded and analyzed.

Results: There were 97 cases of severe maternal outcomes; 18 maternal mortalities and 79 maternal near-miss. Severe Maternal Outcome incidence ratio (SMOR) was 22.61/1000 live births, Maternal Near-Miss incidence ratio (MNMR) was 18.4/1000 live births and the Maternal Mortality Ratio (MMR) was 419 per 100,000 live births. The mean age was 27.93 ± 7.67 years. Major causes of severe maternal outcomes were obstetric hemorrhage (48.45%), sepsis (18.56%) and hypertensive disorders (16.49%). The leading cause of mortality was sepsis (27.78%) followed by hypertension and obstetric hemorrhage. COVID-19 infection was responsible for 5.56% of maternal mortality.

Conclusions: Severe maternal outcome ratio and maternal mortality remained high during COVID-19 pandemic. Obstetric hemorrhage, sepsis, and hypertensive disorders are the leading causes of adverse maternal outcomes with COVID-19 affecting the outcome both directly and indirectly.

Keywords: COVID-19; maternal morbidity; maternal mortality; near miss, sepsis

Declarations

Ethics approval and consent to participate: The study was conducted with prior ethical approval from Institutional Review Committee of BPKIHS (IRC/ 2070/ 020)

Consent for publication: Not applicable.

Availability of data and materials: The full data set supporting this research is available with the corresponding author and will be available upon request by the readers.

Competing interest: None

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BACKGROUND

Severe maternal outcome (SMO) includes all maternal deaths and maternal near-miss (MNM) cases [1]. Evaluation of SMO gives an idea about the quality of obstetric care, identifies lacunae and creates opportunity for improvement. [2]. Obstetric hemorrhage, hypertension, and sepsis are the leading causes for SMO [3, 4]. Inadequate antenatal care, delay in recognizing danger signs or seeking care, lack of essential drugs, blood and blood products, are all associated with such outcomes [3].

Coronavirus disease (COVID-19) pandemic affected maternal health both directly and indirectly. Because of altered immunity, pregnant women were likely to have severe symptoms [5]. Various pregnancy complications like pre-eclampsia, gestational hypertension, intrauterine growth restriction, preterm birth were reported to be associated with COVID-19 infection [6, 7]. In addition, with the start of pandemic, due to its novelty and highly contagious nature, the fear of infection during hospital visits led to reduced antenatal visits, screening of pregnancy related complications and institutional deliveries [8]. The lockdown implemented by the Government of Nepal caused restrictions on transport and closure of outpatient departments in many hospitals [9]. Hospitals were restricted in capacity providing both routine and COVID-19 health services. This affected women's access to safe delivery causing delays in reaching health facility and in receiving quality care upon arrival. COVID-19 infection to pregnant women as well as disruptions in maternal health services due to lockdown, both contributed to worsened maternal and perinatal outcomes with significant increase in maternal deaths [6, 10-12]. This study aimed to calculate the indicators of SMO and to study their demographic and clinical profile during COVID-19 lockdown at BPKIHS. The findings reflect the status of maternal health services at the institute may serve as guidance for improvement of care in future.

METHODS

This was a single center retrospective descriptive study conducted at B. P. Koirala Institute of Health Sciences, Dharan, Nepal, a tertiary care hospital in Eastern Nepal that acts as a referral center for this region. The institute was designated as a level III hospital for COVID -19 management, taking care of patients needing high dependency and intensive care management as well as management of pregnant women with COVID-19 while continuing its regular health care services.

The study was conducted after ethical approval from Institutional Review Committee (IRC/2070/020) and permission to review the patient case records was obtained from the hospital director. Medical records of all women who had had severe maternal outcomes over the period of six months; after Nepal government announced lockdown (03/24/2020 - 09/23/2020), were reviewed. This period was considered because that was the time when the Nepal Government had declared nationwide lockdown in multiple steps and most of the health care facilities were not providing routine health services. Severe maternal outcomes included maternal near miss and maternal mortality. For the identification of MNM, "specific intervention-based criteria" proposed by WHO was adopted [2]. According to the criteria, a woman was identified as near miss if any one of the following criteria was fulfilled. a) Use of continuous vasoactive drugs, b) Intubation and ventilation for >60 minutes not related to anesthesia c) Hysterectomy following infection or hemorrhage d) Dialysis for acute renal failure e) Transfusion of more than five units red cell f) Cardio-pulmonary resuscitation (CPR).

The total number of admissions, total deliveries; admissions to intensive care units were recorded from the daily census of the department. The medical records of all women admitted to the different wards of the department of Obstetrics and Gynecology as well as other departments with obstetric conditions were reviewed. Women who met the criteria for near miss according to "WHO specific intervention-based criteria" were included in the study. Similarly, all cases of maternal mortality; women expired in the hospital during the course of treatment as well as brought dead were included in the study. Variables studied were:

Demographic and baseline variables: Age, residence, ethnicity, referral, timing of presentation

Obstetric characteristics: Gravida, parity, period of gestation, type of pregnancy, antenatal care, fate of pregnancy, mode of delivery if delivered.

Clinical variables: GCS, pulse rate, blood pressure, organ dysfunction, duration of hospital stay

Outcome variables: Near miss, criteria for near miss, maternal mortality, cause of mortality

The variables of interest were recorded in the preformed proforma from the case record files. The data were then entered in Micrsoft Excel spreadsheet. Statistical analysis was done using SPSS version 11.5. Descriptive statistics was used and the results were presented in tables and bar graphs as frequency and percentage for categorical variables and mean, standard deviation, median, Interquartile Range (IQR) for continuous variables.

The indicators of severe maternal outcome as described by the WHO were calculated [1]. They were; Severe maternal outcome ratio (SMOR): number of women with life-threatening conditions (MNM + MD) per 1000 live births (LB); MNM ratio (MNMR): number of maternal near-miss cases per 1000 live births (MNMR = MNM/ LB); Maternal near-miss mortality ratio (MNM: 1 MD): ratio between maternal near miss cases and maternal deaths. Higher ratios indicate better care; Mortality index (MI): number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage [MI = MD/ (MNM + MD)]. The higher index indicates low quality of care. The Maternal Mortality Ratio (MMR) was calculated as number of maternal deaths per 100 000 live births.

For analysis, following operational definitions were used.
Obstetric Hemorrhage: Ruptured ectopic pregnancy, abortion related bleeding, bleeding due to molar pregnancy, antepartum hemorrhage due to any cause, postpartum hemorrhage
Sepsis: post-abortal sepsis, sepsis during pregnancy, puerperal sepsis.
Hypertensive disorders of pregnancy: chronic HTN, Gestational HTN, pre-eclampsia, Eclampsia.
Hepatic dysfunction: Serum transaminase values more than 1.5 times the normal range
Renal dysfunction: Serum creatinine value more than 0.9 mg/dl.
Coagulopathy: Platelet count less than 100,000/mm3 and/ or INR more than 1.5.

RESULTS

There were 5406 admissions in the department of Obstetrics and Gynecology during the study period. Among them, 5141 were admissions for pregnancy and pregnancy-related conditions which included early pregnancy complications, antenatal admissions and postnatal admissions. Out of 4824 antenatal admissions, 41.6% were registered and the rest were unregistered. There were total of 4410 deliveries with 4290 live births during the study period.

There were 79 women identified as MNM and 19 maternal deaths. However, one death was due to head injury following fall injury and was not considered as maternal mortality. Thus, there were 97 women meeting the criteria for identification as severe maternal outcomes constituting 1.89% of total pregnancy related admissions. Severe Maternal Outcome Ratio (SMOR) was 22.61 per 1000 live births and Maternal Near Miss Ratio (MNMR) was 18.41 per 1000 live births. the MNM: Mortality ratio was 4.39: 1 with Mortality index of 18.55%. The Maternal Mortality Ratio (MMR) for six month was 419 /100,000 live births.

The mean age of the women was 27.93 (±7.67) years and 53% of women were from rural areas. Almost two-third of the women belonged to Dalit and disadvantaged ethnic groups. Among all the women, 73.53% were not registered with the institute and 12 (17.65%) did not have a single antenatal visit. Ninety four percent women had singleton pregnancy and 6% had multiple pregnancy. Nearly half (47.42%) women were referred to the institute from other hospital. The baseline demographic and obstetric characteristics of women are summarized in **Table 1.**

Table 1: Baseline Demographic and Obstetric Characteristics of women with SMO

Characteristics		Frequency (%)	Mean (SD)/ Median (IQR)
Age (years)			27.93 (7.67)
Residence	Rural Mountain	2 (2.06)	
	Rural Hill	26 (26.80)	
	Urban Hill	7(7.22)	
	Rural Terai	25 (25.78)	
	Urban Terai	37 (38.14)	
Ethnicity	Dalit	16 (16.49)	
	Disadvantaged Janajati	39 (40.21)	
	Disadvantaged non-dalit Terai Caste Group	16 (16.49)	
	Relatively Advantaged Janajati	7 (7.22)	
	Religious minorities	3 (3.09)	
	Upper Caste Group	16 (16.49)	
Presentation	Early pregnancy	32 (32.99)	
	Antenatal	45 (46.39)	
	Postnatal	20 (20.62)	
Parity	Nullipara	31 (31.96)	
	Multipara	66(68.04)	
POG at presentation (weeks)			30 (14, 37)
Antenatal Care (n=68)	Registered	6 (8.82)	
	Unregistered	50 (73.53)	
	No ANC	12 (17.65)	
Fate of pregnancy	Termination during early pregnancy (Abortion, molar, ectopic pregnancy)	29 (29.90)	
	Vaginal Delivery	25 (25.77)	
	Delivery by Cesarean Section	35 (36.08)	
	Not delivered	8 (8.25)	

Eight women had GCS below 10 at the time of presentation. Thirty-five (36.08%) women had renal dysfunction, 17 (17.53%) each had hepatic dysfunction and coagulopathy. Most women (58.16%) had blood transfusion more than five units as near miss criteria, followed by intubation in 30 (30.61%) and use of vasoactive drugs in 22 (22.45%) women. The median IQR of duration of hospital stay was 7 (5,12) days. However, some women had a hospital stay as long as 60 days. The clinical characteristics of women are summarized in **Table 2.**

Table 2: Clinical characteristics of women with severe maternal outcomes

Clinical Characteristics		Frequency (%) / Median (IQR)
GCS at presentation	15	90 (92.78)
	9-14	5 (5.16)
	8 or below	2 (2.06)
Blood Pressure at presentation	Normal	59 (60.82)
	Hypotension	17 (17.53)
	Hypertension	19 (19.59)
	Not recordable	2 (2.06)
Pulse Rate at presentation	Normal	57 (58.76)
	Tachycardia	39 (40.21)
	Not Recordable	1 (1.03)
Renal Dysfunction		35 (36.08)
Hepatic Dysfunction		17 (17.53)
Coagulopathy		17 (17.53)
Near Miss Criteria	Use of vasoactive drug	22 (22.45)
	Intubation	30 (30.61)
	Hysterectomy	3 (3.06)
	Dialysis	4 (4.08)
	Blood Transfusion	57 (58.16)
	CPR	14 (14.29)
Median Hospital Stay (days)		7 (5, 12)

The most common cause for severe maternal outcomes was obstetric hemorrhage in 47 women accounting for 48.45% of total cases followed by sepsis in 18 (18.37%) and hypertensive disorders in 16 (16.33%). COVID pneumonia was the cause for severe outcome in two (2.04%) women. The causes of severe maternal outcomes are summarized in Table 3. Out of 47 women with obstetric hemorrhage, the most common condition leading to hemorrhage was ruptured ectopic pregnancy in 13 (27.65%) followed by atonic PPH in 11 (23.40%) and antepartum hemorrhage; abruptio placentae and placenta previa accounting for five (10.63%) cases each. Other causes of hemorrhage were molar pregnancy in 6 (12.76%), incomplete abortion in 5 (10.63%), and ruptured uterus in 2 (4.25%). Out of the 18 cases of sepsis, the most common was puerperal sepsis in 11 (61.11%) followed by post-abortal sepsis in 5 (27.78%). Two women had sepsis during the antenatal period, one of them had secondary bacterial infection of scabies with underlying SLE while in other, urosepsis was suspected **Table 3**.

Table 3: Cause of severe maternal outcomes

Cause	Frequency (%)
Obstetric Hemorrhage	47 (48.45)
Sepsis	18 (18.56)
Hypertensive disorder of Pregnancy	16 (16.49)
Cardiac Disease	6 (6.19)
Metastatic GTD	2 (2.06)
Thromboembolism	2 (2.06)
COVID pneumonia	2 (2.06)
Acute Pulmonary Edema (Anesthesia Related)	1 (1.03)
Sudden Cardiac Arrest	1 (1.03)
CVA	1 (1.03)
Unidentified	1 (1.03)

Obstetric hemorrhage was the major cause on maternal near miss in 44 women accounting for 55.69% of cases followed by sepsis in 13 (16.45%) and hypertensive disorders of pregnancy in 12 (15.18%) cases. Sepsis was the leading cause of maternal mortality accounting for 27.78% of total deaths followed by hypertensive disorder of pregnancy in four (22.22%) and obstetric hemorrhage in three (16.67%) cases. Covid pneumonia was responsible for one (5.56%) maternal mortality. The causes of maternal near miss are reported in **Figure 1** and those of maternal mortality are reported in **Figure 2.**

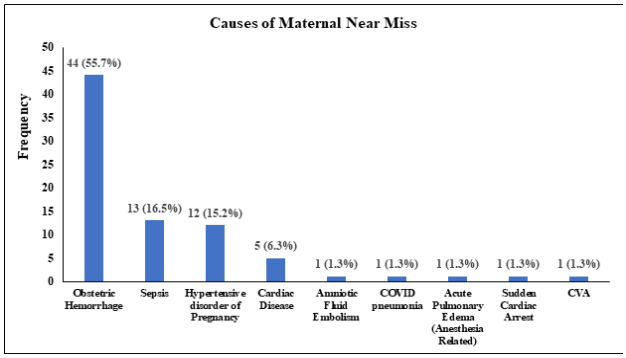

Figure 1: Causes of Maternal Near Miss

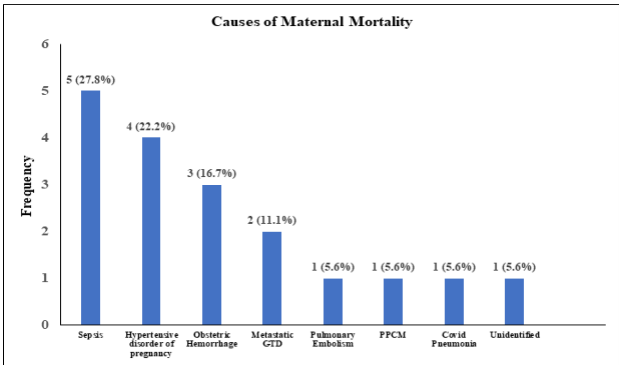

Figure 2: Causes maternal mortality

DISCUSSION

This study reported that the women with severe maternal outcomes constituted 1.89% of total pregnancy-related admissions. The indicators for severe maternal outcomes as well as maternal mortality ratio remained high during the lockdown. Majority of the women were from rural areas, belonged to disadvantaged Janajati group. Obstetric hemorrhage was the major cause of SMO, consequently transfusion of more than five units of blood was the most common near miss criteria met by these women. In contrast to the cause for maternal near miss, sepsis was the leading cause of maternal mortality.

Many published studies reported the significant decrease in hospital admission rate as well as institutional delivery rate during COVID-19 pandemic [10,13,14]. However, during this period the total number of admissions and deliveries did not decrease drastically in the institute as compared to the admission and deliveries in same duration of previous years as per the hospital record. This may be explained by the fact that most of the health care centers providing emergency services were shut down due to lack of personal protective equipment (PPE), human resources and fear of contracting the infection while many hospitals dedicated their services to COVID patients only. Mostly government hospitals and institutions were providing routine health care services as Government of Nepal had provided necessary assistance to those hospitals. However, due to unavailability of the data on total deliveries in the community, the comment cannot be made if institutional deliveries decreased in respect to unattended home deliveries.

The severe maternal outcome indicators were higher as compared to the previous study conducted in the institute in 2015. All the indicators were high; SOMR (22.61 Vs 18.6), MNMR (18.41 Vs 16.6), mortality index (18.55% Vs 8.98%), and MNM: mortality ratio was low(4.39: 1 Vs 10:1) [4]. High mortality index and low MNM: mortality ratio suggested that there were shortcomings in the management of critically ill patients. However, these two studies were carried out at interval of five years. Also, the criteria used for the selection for near-miss cases was also different in these two studies. The indicators were way too higher than those mentioned as reference by WHO [1] as well as those reported in developed countries. A systematic review and meta-analysis performed to analyze the global prevalence of MNMR demonstrated that the global prevalence was 18.67/1000 live births (95% CI: 16.28-21.06) with significant heterogeneity among different regions with prevalence ranging from 3.10/1000 in Europe to 31.88/1000 in the Africa and 16.92/1000live births in Asia [15]. The maternal mortality ratio was very high (419 per 100,000 live births) during the study period compared to the maternal mortality ratio for past five years for the institute, which was 129 per 100,000 live births [16]. The higher rate of mortality during the pandemic may be because of direct COVID infection as well as indirect contribution in the form of delay in reaching proper care due to restrictions in transport and delay in receiving care at health center due to shortage of human resources, PPEs or necessary. Also, the outpatient departments were closed which prevented screening and early management of high-risk cases.

The major cause for the severe maternal outcomes was obstetric hemorrhage which included all women with ruptured ectopic pregnancies, bleeding related to abortion, antepartum hemorrhage, postpartum hemorrhage, ruptured uterus. The entity accounted for 48% of total severe outcomes as well as 55% of total maternal near miss cases. In accordance with this finding, the most common near miss criterion met by women was blood transfusion. Although there were maximum women with obstetric hemorrhage, the main cause of maternal mortality was maternal sepsis. This is in contrast to findings by the previous study where the major cause of mortality was obstetric hemorrhage [16]. This may be because the women who had hemorrhage leading to maternal near miss were managed properly with blood transfusion leading to a favorable outcome. Meanwhile, there were some lacunae in the identification and early initiation of antibiotics in women with sepsis which established sepsis was the primary cause of maternal mortality. Hypertensive disorder was the second most common cause of severe maternal morbidity and mortality. COVID-19 was directly responsible for the adverse outcomes in two percent women and accounted for 5% of total mortality.

The COVID-19 pandemic and lockdown had a negative impact on the delivery of healthcare services. The current study shows that COVID-19 affected the antenatal services as well as safe abortion services (SAS) leading to women presenting with life-threatening conditions. This finding is consistent with other studies which reported reduction in women visiting health facility for abortion services, delayed presentation as well as self-medication at home for this purpose [17, 18]. Lack of proper antenatal care has affected the screening of risk factors like hypertension and anemia as well as lack of antenatal visits in the early trimester has led to delayed diagnosis of conditions like ectopic pregnancy and molar pregnancy. Similar trend was reported in a study by Landrian et al. [19]. As a result of this, those women presented late with hemorrhage severe enough to necessitate intensive intervention. A significant number of women have delays at various levels. The fear of transmission of COVID infection was the underlying

cause for the delay in seeking care for most women and their caregivers. Similarly, restrictions on public vehicles and high expenses to hire private ambulance services were contributory to the delay in reaching proper care. Even when the women reached the health facility, limitations of human resources, proper protective equipment, blood and blood products, and emergency medications at times were all responsible for poor maternal outcomes.

The study highlights the fact that there is a need for improvement in management being provided to women with critical obstetric conditions especially at the time of adverse situations. The residents and senior residents who are primary contact with the patient should be trained to recognize the danger signs and act promptly as well as seek expert suggestions when needed. Regular Near Miss audits should be conducted to identify the good practices that saved the women and shortcomings which led to near miss or mortality. Also, proper management protocol for the humanitarian crisis situations should be formulated within the institution.

The study was limited by its retrospective design; there might be information bias due to discrepancy in maintaining record between different clinicians. In addition, information on contributory factors like literacy, socioeconomic status, the burden faced due to pandemic could not be assessed. Also, the outcomes after the pandemic were not compared to those before the pandemic. Comparison with the indicators before or after the pandemic would have given actual information on the impact of lockdown on the indicators.

CONCLUSIONS

The severe maternal outcome indicators and maternal mortality ratio were very high during COVID-19 pandemic. Obstetric hemorrhage, sepsis, and hypertensive disorders of pregnancy are still the leading causes of adverse maternal outcome. COVID-19 pandemic affected the maternal outcomes by hindering health care delivery to women in addition to direct infection. However, larger, comparative studies will be of help to establish the role of COVID-19 pandemic in maternal health.

References

1. World Health Organization. Evaluating the quality of care for severe pregnancy complications: the WHO near-miss approach for maternal health. Geneva: WHO; 2011.
2. Say L, Souza JP, Pattinson RC. Maternal near miss--towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynecol. 2009;23(3):287-96. https://doi.org/10.1016/j.bpobgyn.2009.01.007. PMID: 19303368.
3. Akpan UB, Asibong U, Omoronyia E, Arogundade K, Agan T, Ekott M. Severe Life-Threatening Pregnancy Complications, "Near Miss" and Maternal Mortality in a Tertiary Hospital in Southern Nigeria: A Retrospective Study. Obstet Gynecol Int. 2020;2020:3697637. https://doi.org/10.1155/2020/3697637. PMID: 32665779.
4. Khadka M, Uprety DK, Rai R. Evaluation of associated risk factors of near miss obstetrics cases at B.P. Koirala Institute of Health Sciences, Dharan, Nepal. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2018;7(2). https://doi.org/10.18203/2320-1770.ijrcog20175931
5. The Royal College of Midwives, Royal College of Obstetricians and Gynecologists. Coronavirus (Covid 19) Infection During Pregnancy. Information for healthcare professionals. Version 10.1. London: RCM and RCOG; 2020.
6. Thakur G, Arora A, Sikka P, Jain V. Impact of covid 19 pandemic on severe maternal outcomes -An observational study from a referral institute of India. Clinical Epidemiology and Global Health. 2022;17:101121. https://doi.org/10.1016/j.cegh.2022.101121
7. Yao Y, Sun L, Luo J, Qi W, Zuo X, Yang Z. The effect of long-term COVID-19 infection on maternal and fetal complications: a retrospective cohort study conducted at a single center in China. Sci Rep. 2024;14(1):17273. https://doi.org/10.1038/s41598-024-68184-2. PMID: 39068277
8. Khalil A, Dadelszen Pv, Draycott T, Ugwumadu A, O'Brien P, Magee L. Change in the Incidence of Stillbirth and Preterm Delivery During the COVID-19 Pandemic. JAMA. 2020: 324(7):705–6. https://doi.org/10.1001/jama.2020.12746. PMID: 32648892.
9. Ministry of Health and Population, Government of Nepal. Report on Health Sector Response to Coronavirus Disease COVID-19. Kathmandu: MOHP, Government of Nepal; 2020. Available at: https://nepalindata.com/media/resources/bulk_file/SitRep%2346_COVID-19_26_03_2020_EN.pdf
10. Chmielewska B, Barratt I, Townsend R, Kalafat E, van der Meulen J, Gurol-Urganci I, et al. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. The Lancet Glob Health. 2021;9(6):e759-e72. https://doi.org/10.1016/s2214-109x(21)00079-6. PMID: 33811827.
11. Poudel A. A 200 percent increase in maternal mortality since the lockdownbegan. The Kathmandu Post. 2020 May 27. Available at: https://kathmandupost.com/national/2020/05/27/a-200-percent-increase-in-maternal-mortality-since-the-lockdown-began
12. Aranda Z, Binde T, Tashman K, Tadikonda A, Mawindo B, Maweu D. Disruptions in maternal health service use during the COVID-19 pandemic in 2020: experiences from 37 health facilities in low-income and middle-income countries. BMJ Glob Health. 2022;7(1):e007247. https://doi.org/10.1136/bmjgh-2021-007247. PMID: 35012970.
13. Singh AK, Jain PK, Singh NP, Kumar S, Bajpai PK, Singh S, et al. Impact of COVID-19 pandemic on maternal and child health services in Uttar Pradesh, India. J Family Med Prim Care. 2021;10(1):509-13. https://doi.org/10.4103/jfmpc.jfmpc_1550_20. PMID: 34017779.
14. Jha D, Adhikari M, Gautam JS, Tinkari BS, Mishra SR, Khatri RB. Effect of COVID-19 on maternal and neonatal services. The Lancet Glob Health. 2021;9(2):e114-e5. https://doi.org/10.1016/s2214-109x(20)30482-4. PMID: 33227253.
15. Abdollahpour S, Heidarian Miri H. The global prevalence of maternal near miss: a systematic review and meta-analysis. Health Promot Perspect. 2019;9(4):255-62. https://doi.org/10.15171/hpp.2019.35. PMID: 31777704.
16. Sitaula S, Basnet T, Agrawal A, Manandhar T, Das D, Shrestha P. Prevalence and risk factors for maternal mortality at a tertiary care centre in Eastern Nepal- retrospective cross sectional study. BMC Pregnancy Childbirth. 2021;21(1):471. https://doi.org/10.1186/s12884-021-03920-4. PMID: 34210273.
17. Qaderi K, Khodavirdilou R, Kalhor M, Behbahani BM, Keshavarz M, Bashtian MH, et al. Abortion services during the COVID-19 pandemic: a systematic review. Reprod Health. 2023;20(1):61. https://doi.org/10.1186/s12978-023-01582-3. PMID: 37055839.
18. Aryal S, Nepal S, Panta SB. Safe abortion services during the COVID -19 pandemic: a cross-sectional study from a tertiary center in Nepal.F1000 Research. 2021;10:112. https://doi.org/10.12688/f1000research.50977.1.
19. Landrian A, Mboya J, Golub G, Moucheraud C, Kepha S, Sudhinaraset M. Effects of the COVID-19 pandemic on antenatal care utilisation in Kenya: a cross-sectional study. BMJ Open. 2022;12(4):e060185. https://doi.org/10.1136/bmjopen-2021-060185. PMID: 35418443.