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Impact of COVID -19 Pandemic on Feto-maternal Outcome: A Single Center Based Study from Central India

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Abstract

Background: Global surge of COVID-19 had put concerns on the maternal and neonatal wellbeing. The present study was aimed to assess the impact of COVID-19 on feto-maternal outcome. ***Method:*** A single-center based retrospective analytical study with pregnancy outcome data of all singleton pregnancy from period 01 Apr 2019 to 31 Mar 2021 was conducted. Comparison was done between pre COVID-19 period and COVID-19 pandemic period. Maternal age, gravida, parity, mode of delivery etc were the parameters analysed. Chi-square/Kruskal Wallis and Mann Whitney U Test were performed with SPSS Ver 20.0 software and p value < 0.05 was considered statistically significant. ***Results:*** The statistics of 421 singleton deliveries during COVID-19 was compared with 554 deliveries a year prior COVID-19. It was observed that caesarean delivery (LSCS) accounted for 51.07%, Low Birth Weight (LBW) proportion was increased slightly, and pre-term deliveries were decreased. Also 22% increase in LSCS and a threefold increase in Intra Uterine Fetal Demise (IUFD) proportion were noted. The odd ratio of caesarean delivery was 2.5 times higher than pre-COVID-19 period. Post LSCS pregnancy accounted 43.12% of all LSCS performed and contributed as a key indication for LSCS. ***Conclusions:*** The research explores the outcome of pregnancies in India during and after the COVID-19 lockdown. The COVID-19 pandemic was found to have influenced various aspects of feto-maternal outcome. Not too many significant negative effects were established on pregnancy outcomes other than high incidence of caesarean delivery.

Keywords: ***COVID-19 Pandemic; Feto-maternal outcome; LSCS; Caesarean Delivery; Neonatal outcome.***

Introduction

Humans had dealt with the pandemic SARS-CoV-2 infection (COVID-19), which have a tremendous socio-economic, geopolitical, and psychological component, as well as a serious global public health issue since its outbreak from December 2019 [1]. Expectant mothers have already been identified as a susceptible populace by the WHO, based on the past findings of a higher risk of stillbirth, premature births, and fetal growth restriction (FGR), as well as inference from prior airway virus epidemics such as SARS, MERS, and influenza [2-4]. Pregnant mothers faced a dual pressure circumstance first on one hand, they are aware that COVID 19 diseases can be fatal, and then on the other, they are unsure whether such infection can be transferred to the foetus and therefore it has unforeseen implications for the pregnancy period, childbirth, and new-born development [1]. Unfortunately, due to safety and efficacy concerns, a vaccine was not accessible until January 2021 and it is still not feasible for pregnant women. The nation's economic abrupt downturn caused a national panic that was triggered by insecurities, concerns, and unforeseen economic woes. This chaotic situation has influenced the stress level of mother and resulted in unfavourable pregnancy environment condition. It might have impeded the fetal maturation and /or might have protracted trans-generational repercussions in form of adverse health outcomes among children later down the line. As a result, it's reasonable to predict that a severe stressor, such as the present COVID 19 epidemic, might have an adverse influence on feto-maternal outcome in many forms.

Certain publications on the impact of COVID 19 on pregnancy, prenatal progression, and births look into the possible implications of the disease on expectant mothers, foetuses, and neonates [5-7]. Typically, the matter of fact that the possibility of COVID period seems to have a negative impact on pregnancy outcomes as depicted in few studies [8-10]. Interestingly, some research indicated the reverse, with no evidence of negative impacts of COVID lockdowns on pregnancy outcomes [6,11-13].

Until now, the influence of COVID-19 on feto-maternal outcome in non-infected mothers or as whole on antenatal care, has not been extensively studied and published. The present single

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centre hospital based study focused on the pregnancy outcome in a sub-zonal Armed Forces Hospital of central India during the Covid-19 period. The aim and objective of the study were to access the impact of COVID 19 pandemic on feto-maternal outcome of all pregnant mothers delivered during the study period. Following demographic and clinical parameters of the patients delivered during the study period like age, gravida, parity, period of gestation (POG), mode of delivery, birth weight and other undesirable birth events - were analysed and were compared with the pre COVID -19 yearly data.

Methods

Study setting: On January 30, 2020, the Indian government declared India's 1st instance of COVID-19 [14] and India's first COVID-19 fatality was reported on March 12, 2020 [15]. As a preventive step against the COVID-19 pandemic when there were about 500 documented positive coronavirus infections in India, the Government of India imposed a countrywide lockdown for 21 days on March 24, 2020, restricting mobility of the complete 1.38 billion citizens of India [16]. People were not allowed to leave their homes during the lockdown. Except for transportation of critical supplies, fire, police, and emergency services, all modes of transit aviation, and road prohibited. Academic, institutions industrial organizations and hospitality facilities were also put on hold. Food stores, banks and ATMs, petrol pumps, and other necessities as well as their production, were spared [17,18]. On 1st June, a phased relaxation of the unlock measures began, gradually relaxing the restraints. People were, nevertheless, required to maintain social distancing guidelines and wearing masks [19]. India's vaccination campaign began on January 16, 2021 [20]. Vaccination safety signals in pregnant women, on the other hand, have yet to be established. As a result, social distance persists, as does awareness that COVID-19 disorders are still incurable and pose a serious threat.

Study design: The research approach is a single center based retrospective analytical study at a sub-zonal hospital of Indian Armed Forces of central India. Pregnancy outcome data of all singleton pregnancy from period 01 Apr 2019 to 31 Mar 2021, irrespective of SARS-CoV-19 infection status were included in the study. All data were divided in two group, Group A was the data from April 2019 to March 2020 i.e. Pre Covid-19 period and it was compared with the Group B - the data from COVID 19 pandemic period i.e. from April 2020 to March 2021. We concentrated on singleton births because multiple pregnancies are frequently related with preterm delivery and low birth weight baby which might be confounding factor in result. That's why we have excluded all multiple pregnancy form main data analysis. COVID testing and antibody analysis were performed by reverse transcriptase–polymerase chain reaction detection of SARS-CoV-2 nucleic acid using either nasal or nasopharyngeal specimens on pregnant women during hospital admission. COVID-19 infected women had delivered in a specific dedicated hospital ward, where precautionary measures were implemented throughout delivery procedures, as per established protocol. The research was conducted in accordance with the Declaration of Helsinki. In addition, data from the National Family Health Survey (NFHS), has also been obtained to compare and analyse the impact of COVID 19 on parameter of different feto-maternal outcome.

Obstetrical factors, maternal and new-born parameters: Age, gravida, parity, POG, birth weight, mode of delivery were all documented as obstetrical and fetal parameters. The gap between the birth of the child and the last menstruation was used to calculate Period of gestation (POG). Preterm birth was considered as a baby born before 37 weeks (259 days) of pregnancy. All caesarean deliveries were performed due to obstetrical indication only. Birth weight of all new born were classified according to World Health Organization recommendations. Classification of group were as follows - Low birth weight (LBW): 1500–2500 g, a very low birth weight (VLBW): 1000–1500 g, and an extremely low birth weight (ELBW): less than 1000 g.

Statistical analysis: Statistical analyses were carried out using SPSS 26.0 version (SPSS Inc, Chicago, IL) for Windows. Qualitative data were given as actual frequencies and percentages, while continuous data were calculated as mean ± standard deviation (SD) / median with interquartile range (IQR). Chi-Square tests was performed between categorical variables. Mann-Whitney U test/ Kruskal-Wallis test was used depending on nature and normality distribution data. The significance level at p value < 0.05 was used to establish statistical significance.

Results

There were total 982 patients admitted and delivered at our hospital during the period from Apr 2019 to March 2021. Total seven patients were of twin pregnancy and excluded from the study as per exclusion criteria fixed for the study. Total 554 patients were delivered during the pre-COVID period i.e from 01 April 2019 to 31 Mar 2020 (Group A) and 421 deliveries have occurred during the COVID- 19 pandemic period i.e 01 Apr 2020 to 31 Mar 2021 (Group B). Major distribution of study population is depicted in **Figure: 1**. Out of 421 patients tested for SARS –CoV-2 RT PCR test, only 13 cases were tested positive and all cases were either asymptomatic or mild symptomatic which did not require any specialized / intensive management. The incidence of COVID -19 positive cases in our institution were 3.09% i.e. about 3 cases per 100 deliveries. A further subset analysis was carried out to find out the impact of COVID-19 on antenatal care and same is compared with the subset of pre COVID data. The mean, 95 % CI, median, range, first & third quartile and interquartile range (IQR) in each group for maternal age, maternal Hb gm%, Period of gestation (POG) and new-born birth weight were derived and depicted in **Table: 1**. Statistical significance (p value) was assessed using non parametric Mann-Whitney U test as all the quantitative data stated above as it showed non normal distribution on Kolmogorov Smirnov test as well as on Shapiro Wilk test. Exhaustive frequency distribution of maternal age, gravida, parity, period of gestation, mode of delivery, new-born gender and birthweight of two group and level of significance (P value) is depicted in **Table: 2**.

In subset analysis we found that the majority of the pregnant are belong to age group of 25-29 year age group (47.27 % vs 46.93%) among both the group. During COVID time approx. ≈ 3% (39.67% ~ 36.82%) increase in prim gravida lady was noticed. Proportion of primipara lady were found to be highest among both the group. Our study yield that the significant increase in post term delivery patient during COVID pandemic period (2.61%). The no of male child born in group is higher than that of female, which was statistically insignificant. During COVID time, it was observed that there was statistically significant increase in caesarean delivery rate of approximately 22 % (51.06% vs 29.42) and statistically non-significant increase (3 times approx.) in IUFD percentage among two groups (1.66 % vs 0.54%). A chi-square test or Kruskal-Wallis test was performed to examine the relation between the year wise assessment and maternal age range, gravida, parity, period of gestation, mode of delivery, new-born gender, birth status and new-born weight. The p valves as obtained after using the test stated

above found to be < 0.05 for period of gestation, mode of delivery and birth weight of NBB. Hence, it is evident form the study that the difference between POG at delivery, delivery mode and new-born birth weight among two groups (Group- A & Group-B) is statistically significant.

On further analysis of indication of caesarean and instrumental deliveries it was noticed that in instrumental deliveries - forceps deliveries were carried out for 3 cases of fetal distress and prolonged labour was the reason for use of vacuum in case of 4 deliveries (**Figure: 2**). Post LSCS pregnancy accounted 43.12% (163 out of 378) of all LSCS performed totally and contributed as a major indication for caesarean delivery / LSCS. The odd of caesarean delivery were was 2.5 times higher than that of pre COVID time. The calculated Odd ratio was 2.50, 95% CI 1.97 – 3.05 which is statistically significant. Odd ratio of other parameters with confidence level and significance were depicted in **Table: 3**.

Table I. [Intergroup comparison of maternal age, Haemoglobin, Period of gestation (POG) and new-born baby birthweight with p-value]

Nomenclature			Maternal Age (years)	Maternal Hb gm%	POG (days)	NBB birth weight (kg)
April 2020 - March 2021	n		421	421	421	421
	Mean		26.79	11.2	270.29	2.88
	95% CI	Lower	26.42	11.06	268.94	2.84
		Upper	27.16	11.34	271.64	2.93
	Median		27	11.20	272	2.90
	Range		19 – 41 (22)	7.00-14.40 (7.40)	192-302 (110)	1.30-4.30 (3.00)
	Interquartile range, (Q1 - Q3)		5 (24-29)	2.10 (10.20 – 12.30)	14 (261 -275)	0.6 (2.60-3.20)
April 2019 - March 2020	n		554	554	554	554
	Mean		26.25	11.19	267.3	2.92
	95% CI	Lower	25.94	11.09	266.29	2.88
		Upper	26.55	11.23	268.12	2.96
	Median		26	11.20	268	2.95
	Range		19 -40 (21)	7.90-14.50 (6.60)	189-294 (105)	0.85 -4.27 (3.42)
	Interquartile range, (Q1 - Q3)		4 (24-28)	1.60 (10.40 -12.00)	14 (265 -279)	0.6 (2.62 -3.22)
p value (using Mann-Whitney U test)			0.015	0.542	0.001	0.109

Abbreviation 1: 95% CI: 95% Confidence Interval

Table II. [Comparative breakdown assessment year wise with maternal age, gravida, parity, gestational period, mode of delivery, new-born gender and weight]

Variables		April 2020 - March 2021		April 2019 - March 2020		P value
		Frequency n = 421	Percent	Frequency n = 554	Percent	
Maternal Age	≤ 19	3	0.71	2	0.36	0.071
	20 - 24	122	28.98	188	33.94	
	25 - 29	199	47.27	260	46.93	
	30 - 34	85	20.19	87	15.70	
	35 - 39	10	2.37	16	2.89	
	≥ 40	2	0.48	1	0.18	
Gravida	Primi	167	39.67	204	36.82	0.950
	2	139	33.02	218	39.35	
	3	80	19.00	94	16.97	
	4	23	5.46	30	5.42	
	5	10	2.37	7	1.26	
	6	2	0.48	1	0.18	
Parity	0	189	44.89	241	43.50	0.750
	1	196	46.56	269	48.56	
	2	34	8.07	43	7.76	
	3	2	0.48	1	0.18	
Gestation Period (days)	<196	1	0.24	1	0.18	0.024
	196-223	7	1.67	5	0.91	
	224-258	35	8.31	66	11.91	
	259-294	367	87.17	482	87.00	
	>294	11	2.61	0	0	
Mode of Delivery	Vaginal Delivery	204	48.46	386	69.68	0.001
	Instrumental	2	0.48	5	0.90	
	Caesarean Delivery	215	51.06	163	29.42	
New-born Gender	Female	196	46.56	242	43.68	0.372
	Male	225	53.44	312	56.32	
Birth Status	Live	414	98.34	551	99.46	0.085
	IUFD	7	1.66	3	0.54	

Birth Weight (kg)	< 1.000	0	0	3	0.54	0.021
	<1.500	2	0.47	5	0.90	
	1.500 - 2.500	98	23.28	89	16.07	
	>2.500	321	76.25	457	82.49	

Abbreviation 1: IUFD : INTRA UTERINE FETAL DEMISE.

Table III. [Odd Ratio of different parameter among group]

Nomenclature	ODD Ratio	95% CI		Remark
		Lower	Upper	
Caesarean Delivery	2.50	1.92	3.26	Significant
Vaginal Delivery	0.40	0.31	0.52	Significant
Male Birth	0.89	0.69	1.15	Non-Significant
Still Birth	3.11	0.80	12.08	Non-Significant

Abbreviation 1: 95% CI: 95% Confidence Interval

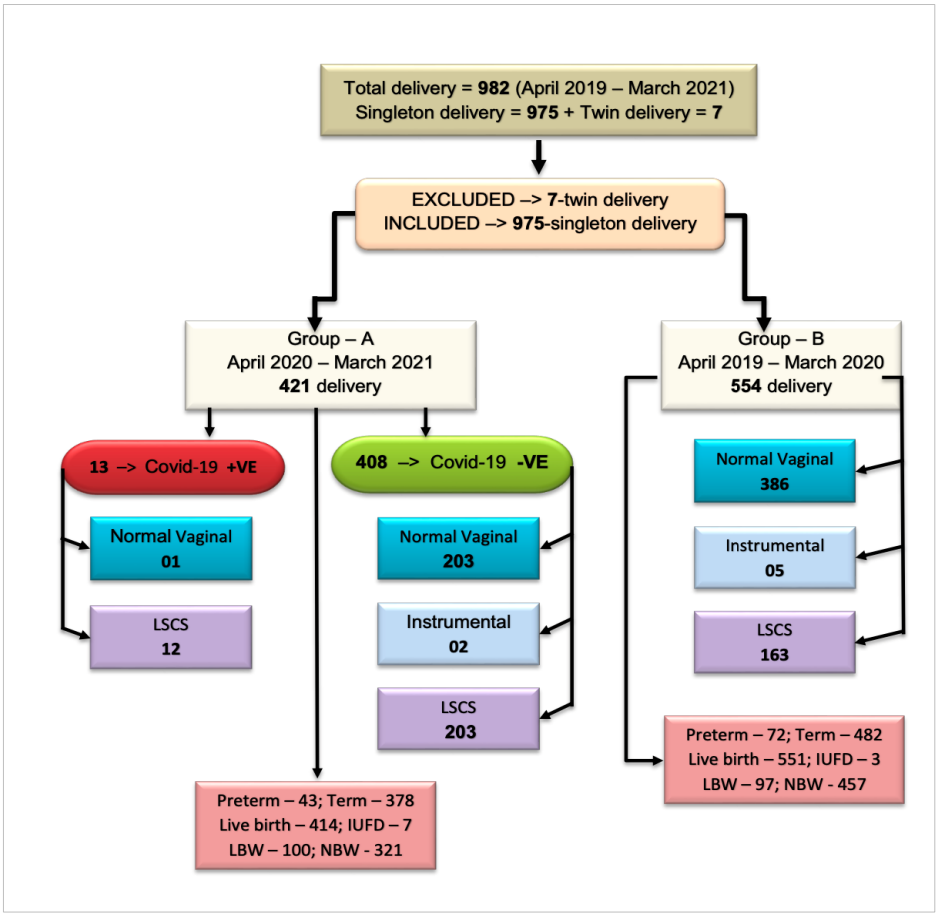

Figure 1: Distribution of Study population

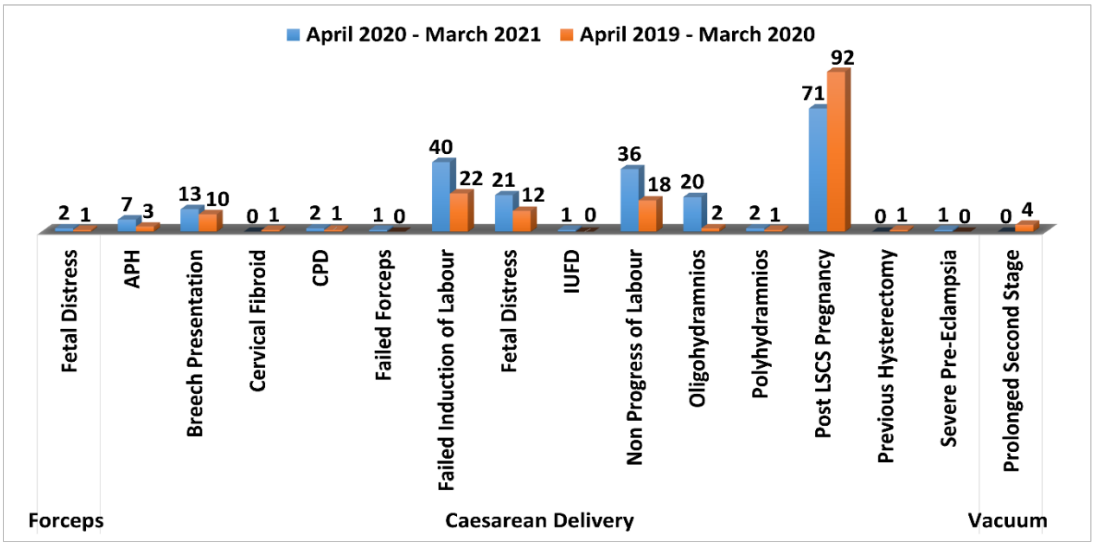

Figure 2: Indication for Instrumental delivery (forceps and vacuum) and Caesarean Delivery

Discussion

The outbreak made its way once the first incidence of coronavirus infection was identified from Wuhan, China, in December 2019. On 30 January 2020, the WHO officially pronounced Coronavirus Infection Disease 2019 (COVID 19) a Global Health Crisis, preceded by a pandemic on 11 March 2020. COVID -19 pandemic seems to be associated with psychological calamity, as well as global level economic meltdown [1]. Pregnancy-related physiological and immunological alterations may increase the likelihood of expectant mothers contracting respiratory viruses like influenza [21]. Expecting mothers are particularly prone to become infected, have much more serious clinical consequences, and can have a higher risk of death than non-pregnant women [22]. The eventual emergence of the COVID-19 pandemic has had a huge impact on expectant women's way of life, raising worries and anxieties, and having a considerable impact on overall patient care [23].

In the present retrospective study, feto-maternal outcomes were evaluated utilising single hospital-based data for 975 pregnant women and their singleton deliveries between April 2019 and March 2021, which had been subdivided into two group for COVID impact analysis. The hypothesis was assessed that the covid-19 period in India from April 2020 to March 2021 had no negative impacts on mean birth weights of NBB, low birth - weight rates, or preterm delivery among women. The database's comparisons of delivery during the Covid-19 period (April 2020 - March 2021) with the pre-Covid-19 period (April 2019 - March 2020) showed moderately pre-term births decreased and significant increase of gestation period. Previous studies from the United Kingdom [10], Denmark [24], Italy [8], the United States [12] and Israel [11] - all indicated almost no changes or a reduction in comparatively low gestational age. In addition, this study revealed, very low (1000 to 1500 g) and extremely low (<1000 g) birthweight new-borns were lesser in percentage during Covid-19 period which is in concurrence to the findings of an Irish research [25]. However, the total low-birth weight percentage increased from 17.5% to 23.8% and the mean birthweight tend to decrease during the Covid-19 period and tend is found to be similar with other studies [26].

According older statements of the WHO, caesarean delivery rate of 10–15 per 100 live birth is associated with optimum and acceptable maternal and neonatal outcome [27]. One recently published study had also reported that there had been no significant link between maternal and new-born mortality, whenever the caesarean delivery rate surpassed 20%, though the inverse correlation exist up to approx. 20% [27]. India is having one of the higher caesarean delivery rate globally where National Family Health Survey data reveals delivery by caesarean section was 17.2% in 2015-16 and much less incidence of 8.5% in 2005-06 [28]. On the other hand, considerable thought must be waged, since during the Covid-19 outbreak in India, a comparatively extremely high rate of 51.07% caesarean delivery was identified according to this study.

Increasing COVID-19 occurrences inevitably implied more restriction in regular living. Researchers also believed that women may have been forced to stay at home and could have ended up missing more prenatal exams as a result [29]. More research is necessary to understand the actual problems of skipping periodic health check. Furthermore, one study revealed that the lockdown strategy may disrupt women's and foetuses' circadian rhythms, which could have resulted in various negative reproductive consequences including LSCS [30].

There was no information in this study about stress, anxiety, mental health issues and food intake among expectant mothers and their impact on obstetrical outcome throughout the COVID 19 period. The research design did not permit for the evaluation psychological and behavioural parameters, quality of life with feto-maternal outcome in the study participants. The data set is not representative of India itself, and indeed the conclusions really should not be applicable to the entire country due to its population diversity. Despite this, there are some positive aspects to this research, as the study looked at pregnancy outcomes among women of study location in India during the COVID-19 lockdown and afterward.

Conclusions

According to this single center based retrospective study, it was noticed that the COVID- 19 pandemic had contributed certain abrupt change in existing antenatal care. Thereby impacts were noticed on components of feto-maternal outcome which was directly related to previously existing focused / routine antenatal care. The study yielded a significant increase in caesarean delivery rate, gestational period across all high risk / normal pregnancies and mean / median age among subgroups of study population. The present study also concluded a statistically non-significant increase in intrauterine fetal demise rate, and median new born birth weight. Prevalence of low birthweight slightly increased along with decrease in pre-term births during the Covid-19 period. This study was an effort to report the impact of COVID -19 in part of central India. However a multicentre study across pan India would have been better study with external validity.

Declarations

Acknowledgements

Nil

Conflict of interest

Nil

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Nil

Contributors

Dr. Debkalyan Maji, Associate Professor CH (EC) conceived and designed the study, supported the statistical analysis and, analysed the data, and wrote the initial manuscript. Dr. Tarini Singh, Jr Consultant also contributed in designing the study Design, Data analysis, manuscript checking, Dr Parikshit Debnath, Associate Professor contributed to the study design, statistical analysis support, assisted in manuscript preparation

Ethical Clearance

It was obtained from Institute Ethical Review Committee.

References

[1] Bogin B, Varea C. COVID-19, crisis, and emotional stress: A biocultural perspective of their impact on growth and development for the next generation. American Journal of Human Biology. 2020;32(5):e23474.

[2] Wong SF, Chow KM, Leung TN, Ng WF, Ng TK, Shek CC, et al. Pregnancy and perinatal outcomes of women

with severe acute respiratory syndrome. American Journal of Obstetrics & Gynecology. 2004;191(1):292-7.

[3] Li AM, Ng PC. Severe acute respiratory syndrome (SARS) in neonates and children. Arch Dis Child Fetal Neonatal Ed. 2005;90(6):F461-F5.

[4] Shek CC, Ng PC, Fung GP, Cheng FW, Chan PK, Peiris MJ, et al. Infants born to mothers with severe acute respiratory syndrome. Pediatrics. 2003;112(4):e254. Epub 2003/10/03.

[5] Dang D, Wang L, Zhang C, Li Z, Wu H. Potential effects of SARS-CoV-2 infection during pregnancy on fetuses and newborns are worthy of attention. Journal of Obstetrics and Gynaecology Research. 2020;46(10):1951-7.

[6] Been JV, Burgos Ochoa L, Bertens LCM, Schoenmakers S, Steegers EAP, Reiss IKM. Impact of COVID-19 mitigation measures on the incidence of preterm birth: a national quasi-experimental study. Lancet Public Health. 2020;5(11):e604-e11. Epub 2020/10/14.

[7] Sentilhes L, De Marcillac F, Jouffrieau C, Kuhn P, Thuet V, Hansmann Y, et al. Coronavirus disease 2019 in pregnancy was associated with maternal morbidity and preterm birth. American journal of obstetrics and gynecology. 2020;223(6):914.e1-.e15. Epub 2020/06/15.

[8] De Curtis M, Villani L, Polo A. Increase of stillbirth and decrease of late preterm infants during the COVID-19 pandemic lockdown. Archives of Disease in Childhood - Fetal and Neonatal Edition. 2021;106(4):456.

[9] Mor M, Kugler N, Jauniaux E, Betser M, Wiener Y, Cuckle H, et al. Impact of the COVID-19 Pandemic on Excess Perinatal Mortality and Morbidity in Israel. American journal of perinatology. 2021;38(4):398-403. Epub 2020/12/11.

[10] Khalil A, von Dadelszen P, 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.

[11] Meyer R, Bart Y, Tsur A, Yinon Y, Friedrich L, Maixner N, et al. A marked decrease in preterm deliveries during the coronavirus disease 2019 pandemic. American journal of obstetrics and gynecology. 2021;224(2):234-7. Epub 2020/10/15.

[12] Berghella V, Boelig R, Roman A, Burd J, Anderson K. Decreased incidence of preterm birth during coronavirus disease 2019 pandemic. American journal of obstetrics & gynecology MFM. 2020;2(4):100258-. Epub 2020/10/15.

[13] Caniglia EC, Magosi LE, Zash R, Diseko M, Mayondi G, Mabuta J, et al. Modest reduction in adverse birth outcomes following the COVID-19 lockdown. American journal of obstetrics and gynecology. 2021;224(6): 615.e1-.e12.

[14] Andrews MA, Areekal B, Rajesh KR, Krishnan J, Suryakala R, Krishnan B, et al. First confirmed case of COVID-19 infection in India: A case report. Indian J Med Res. 2020;151(5):490-2.

[15] Hindustan Times. India's first coronavirus death is confirmed in Karnataka. 2020 March 12. In. Hindustan Times: India-News. Available at: https://www.hindustantimes.com/india-news/india-s-first-coronavirus-death-in-karnataka-confirmed/story-2ZJ6IuxJ38EiGndBq5pfHO.html. Accessed on 25 June 2021.

[16] Gettleman Jeffrey, Schultz Kai. Modi Orders 3-Week Total Lockdown for All 1.3 Billion Indians. 2020 March 24. In. The New York Times. Available at: https://www.nytimes.com/2020/03/24/world/asia/india-coronavirus lockdown.html. Accessed on 27 June 2021.

[17] Press Information Bureau, Government of India. PM calls for complete lockdown of entire nation for 21 days. 2020 March 24. Available at:https://pib.gov.in/PressReleseDetail.aspx?PRID=1608009. Accessed on 25 June 2021.

[18] Ministry of Home Affairs, Government of India. Guidelines on the measures to be taken by Ministries/ Departments of Government of India, State/Union Territory Governments and State/ Union Territory Authorities for containment of covid-19 Epidemic in the Country. 2020 March 24. Available at: https://www.mha.gov.in/sites/default/files/Guidelines.pdf . Accessed on 25 June 2021.

[19] Sharma N, Ghosh D. "Unlock1": Malls, Restaurants, Places of Worship to Reopen June 8. 2020 May 30. In. NDTV. Available at: https://www.ndtv.com/india-news/lockdown-extended-till-june- 30-malls-restaurants-can-reopen-from-june-8-except-in-containment-zones-2237910. Accessed on 25 June 2021.

[20] Deccan Herald. Covid-19 vaccination starts in India: 10 things to know. 2021 January 16. In. Deccan Herald. Available at: https://www.deccanherald.com/national/covid-19-vaccination-starts-in-india-10-things-to-know-939626.html. Accessed on 25 June 2021.

[21] Jamieson DJ, Honein MA, Rasmussen SA, Williams JL, Swerdlow DL, Biggerstaff MS, et al. H1N1 2009 influenza virus infection during pregnancy in the USA. Lancet (London, England). 2009;374(9688):451-8. Epub 2009/08/01.

[22] Donders F, Lonnée-Hoffmann R, Tsiakalos A, Mendling W, Martinez de Oliveira J, Judlin P, et al. ISIDOG Recommendations Concerning COVID-19 and Pregnancy. Diagnostics (Basel). 2020;10(4):243.

[23] Tang K, Gaoshan J, Ahonsi B, Ali M, Bonet M, Broutet N, et al. Sexual and reproductive health (SRH): a key issue in the emergency response to the coronavirus disease (COVID- 19) outbreak. Reproductive health. 2020;17(1):59. Epub 2020/04/25.

[24] Hedermann G, Hedley PL, Bækvad-Hansen M, Hjalgrim H, Rostgaard K, Poorisrisak P, et al. Danish premature birth rates during the COVID-19 lockdown. Arch Dis Child Fetal Neonatal Ed. 2021;106(1):93-5. Epub 2020/08/14.

[25] Philip RK, Purtill H, Reidy E, Daly M, Imcha M, McGrath D, et al. Unprecedented reduction in births of very low birthweight (VLBW) and extremely low birthweight (ELBW) infants during the COVID-19 lockdown in Ireland: a 'natural experiment' allowing analysis of data from the prior two decades. BMJ Glob Health. 2020;5(9).

[26] Zografaki I, Papamichail D, Panagiotopoulos T. Adverse effect of the financial crisis in Greece on perinatal factors. European journal of public health. 2018;28(6):1116-21. Epub 2018/05/23.

[27] Molina G, Weiser TG, Lipsitz SR, Esquivel MM, Uribe-Leitz T, Azad T, et al. Relationship Between Cesarean Delivery Rate and Maternal and Neonatal Mortality. Jama. 2015;314(21):2263-70. Epub 2015/12/02.

[28] International Institute for Population Sciences. National Family Health Survey (NFHS-4) 2015- 16: India Fact Sheet. [Internet]. Available at http://rchiips.org/nfhs/pdf/NFHS4/India.pdf. Accessed on 26 Jun 2021.

[29] Graham WJ, Afolabi B, Benova L, Campbell OMR, Filippi V, Nakimuli A, et al. Protecting hard-won gains for mothers and newborns in low-income and middle-income countries in the face of COVID-19: call for a service safety net. BMJ Glob Health. 2020;5(6):e002754.

[30] Bagchi S, Sabir H, Müller A, Reiter RJ. Effects of altered photoperiod due to COVID-19 lockdown on pregnant women and their fetuses. Chronobiology International. 2020;37(7):961-73.