COVID-19 Vaccine Acceptability Among Pregnant Women at a Primary Health Care Facility in Durban, South Africa

A. M. Hoque, S. Buckus, M. Hoque, M. E. Hoque, and G. Van Hal

ABSTRACT

A vaccine represents the most promising strategy for combatting the COVID-19 pandemic through primary prevention. No study has been reported on the acceptability of the COVID-19 vaccine in South Africa (SA) and in the region. The objective of this study was to determine the acceptance of a COVID-19 vaccine among pregnant women. A cross-sectional, descriptive study was conducted at the Kwadabeka Community Health Center (KCHC), Durban. Logistic regression analysis was performed to determine the factors for vaccine acceptability among pregnant women. About two-thirds of pregnant women (63.3%) may accept COVID-19 vaccination once it becomes available in SA. Participants who were <22 years of age were 72% less likely (OR=0.28, CI: 0.13 -0.62) to accept the vaccine, compared to those who were >39 years old. Women with 0-1 parity were 4.3 times more likely (OR=4.3, CI: 1.98-9.48) to accept the vaccine than those with four or more parity. Single pregnant women were less likely (OR=0.23, CI: 0.10- 0.51) to accept the vaccine than those living with their partners. Employed pregnant women had four times more chances of accepting the vaccine (OR= 4.2, CI: 2.28-7.75) than unemployed pregnant women. It was also found that having a positive attitude towards vaccination increased the chance of accepting the vaccine by four times (OR=4.05, CI: 1.89-8.69). Our study found a 63.3% acceptance of a COVID-19 vaccine, but there were noticeable demographic, knowledge, attitude and practice disparities observed in vaccine acceptance among pregnant women. Before a COVID-19 vaccine is introduced to SA, public health officials and policymakers must prioritize effective COVID-19 vaccine-acceptance messages and mass education for all South Africans, especially for the most vulnerable.

Keywords: Kwadabeka Community Health center, Durban, Pregnant women, COVID-19 vaccine.

Published Online: October 30, 2020

ISSN: 2593-8339

DOI: 10.24018/ejmed.2020.2.5.493

A. M. Hoque *

Kwadabeka Community Health Centre,
Durban, South Africa.
(e-mail: mhoque75@gmail.com)

S. Buckus

Kwadabeka Community Health Centre,
Durban, South Africa.

M. Hoque

South African College of Applied
Psychology, Durban, South Africa.

M. E. Hoque

Management College of Southern
Africa, Durban, South Africa.

G. Van Hal

University of Antwerp, Antwerp,
Belgium.

**Corresponding Author*

I. INTRODUCTION

The current 2019 coronavirus disease, known as COVID-19, caused by a severe acute respiratory syndrome called coronavirus-2 (SARS-CoV-2) is currently a global pandemic causing a major threat to people worldwide. Recent reports have raised concerns of negative outcomes in pregnancy such as preterm birth, neonatal pneumonia, vertical transmission of COVID-19 to the fetus and postpartum infections to mothers [1]-[8]. An effective vaccine that represents the most promising strategy for combatting the COVID-19 pandemic of such magnitude through vaccination as primary prevention is constrained by the demand of time. The present interventions of a non-specific nature, such as social distancing, personal hygiene and quarantine, may slow down the spread of the virus and flatten the epidemic curve [9]. The COVID-19 epidemic may not stop unless herd immunity is established within the population. Such a situation is usually

gained by community infection or vaccination. Therefore, high vaccination coverage is required to gain herd immunity and thus stop the COVID-19 pandemic. The development and deployment of a vaccine are therefore one of the most promising strategies in this crisis.

The current intervention of the COVID-19 pandemic involves the aggressive implementation of containment, suppression, and mitigation strategies which are not yet highly effective as cases are increasing day by day in SA. Such an approach encompasses the enforcement of a variety of public health measures, including hand hygiene and respiratory etiquette, disinfection, case identification, isolation of sick people, tracing and quarantine of contacts, and unprecedented mass community restrictions which led to an economic crisis and negative psychological impact on people, including pregnant women [10]-[13].

Vaccine development has begun in several research centers and pharmaceutical companies in different countries as soon

as the SARS-CoV-2 was identified as the causative agent and the first genome sequence was published. It is believed that several effective vaccines will be available for use soon worldwide [14]. However, the mere availability of a vaccine will not guarantee the uptake. For example, a vaccine against influenza A H1N1 was offered before, or at the onset of the second epidemic wave, but vaccination rates were found to be lower than expected, with a population coverage ranging from 0.4 to 59% across 22 countries in 2009 [15]. The low uptake of an effective and available vaccination for high-risk infections has been defined as a “pandemic public health paradox”, to which vaccine hesitancy group explained as “the reluctance or refusal to vaccinate despite the availability of vaccines” significantly contribute [16]. It is also reported that while the hesitancy level and reasons for vaccine acceptance may vary by the vaccine itself, geographic location, the health system, accessibility and availability can also be driven by emotional, cultural, social, and political factors as much as by cognitive factors [17].

It is known that the vaccine demand in low- and middle-income countries (LMICs) is less well-studied and there may be different considerations from the population compared to high-income countries [18]. LMICs may have less capacity to introduce new vaccines and may need to deal with populations which have hesitant belief [19]. Some studies have been conducted and found a poor uptake on new vaccines against emerging and re-emerging infectious diseases in Southeast Asia, such as for Dengue fever [20-22], Zika [23] and Ebola [24]. Factors contributing to vaccination acceptance usually included personal risk perceptions, vaccination attitudes or motivation, information sources, access and demographic variables, as well as social influences and practical factors [25].

A recent study from Indonesia on the acceptance of the COVID-19 vaccine found that 93.3% of the respondents would accept a vaccine if it is 95% effective, but the acceptance decreased to 67.0% for a vaccine with 50% effectiveness [26]. Factors associated with the acceptance of the vaccine were its effectiveness, being healthcare workers and having a higher perceived risk of COVID-19 infection and if the vaccine is offered for free [26]. A web-based study recently conducted in Saudi Arabia found that 64.7% showed interest in accepting the COVID-19 vaccine if it became available. However, the willingness to accept the vaccine varied among different age groups, marital status, the participants' education level and type of employment [27]. A study from China found a 72.5% acceptance rate of the vaccine in the general population. Vaccine safety and social contacts' decisions were the most important predictors [25], [28].

In SA, the vaccine acceptance rate is poor. A study conducted among private health insurance members during 2015 found that only 5.0% received the influenza vaccine [29]. Priority risk groups such as pregnant women, older adults, and those with a medical condition, were significantly more likely to be vaccinated, as they were members belonging to insurance schemes that offered a specific influenza vaccine benefit. A similar finding was reported from a Primary Health Care (PHC) setting over a four-year period where the mean annual influenza vaccine coverage among patients was 4.5% [30]. However, no study has been

reported on COVID-19 vaccine acceptance in SA and especially on pregnant women as a known vulnerable population. Therefore, the objective of this study was to determine the rate and factors for the acceptance of a COVID-19 vaccine among pregnant women.

II. MATERIALS AND METHOD

A. Study design

A cross-sectional descriptive study was conducted at the Kwadabeka Community Health Center (KCHC), Durban during the period 4 September to 3 October 2020. This was part of a larger study that also assessed the knowledge, attitudes and practices of pregnant women during COVID-19 and the psychological impact of COVID-19 on pregnant women.

B. Settings and subjects

The KCHC is situated in the community of Kwadabeka with a residence of almost 130,000 black population. Most of the residents live in formal and (mainly) informal dwellings and they have a cultural tie with the rural indigenous people of the KwaZulu-Natal (KZN) and Eastern Cape Provinces. Most of these residences are reliant on public health facilities at the KCHC as it provides free of cost services. There are over 20,000 headcounts at the out-patient department (OPD) and of them, about 400 are antenatal attendees at the KCHC every month. The KCHC provides a comprehensive free Primary Health Care (PHC) service package together with maternal and antenatal care package based on national guidelines [31].

C. Sample size

The sample size was determined using the Epi Info 7 software. As there were no similar studies related to coronavirus vaccine acceptance among pregnant women, the calculations assumed that the probability of accepting the vaccine was 50.0%, at 95% confidence interval, the limit of precision of 5%, with a design effect of 1.0.

D. Participant selection and data collection

The sample of pregnant women was recruited from those who attended the antenatal clinic during the study period. All patients, including pregnant women attending the KCHC during this pandemic, are screened for COVID-19 symptoms and if found positive are isolated for further care. Every pregnant woman that attended the antenatal clinic as part of out-patient services during the study period was asked to participate. Those pregnant women having symptoms of COVID-19 were excluded from the study. A written invitation with the aim and objectives were explained to participants (in English and/or isiZulu) while they were waiting for an antenatal consultation with the midwives. The participants were assured that they would not be discriminated against regarding their antenatal consultation should they refuse to participate. Data were collected using a structured questionnaire by the two trained social workers who are familiar with social science studies. Universal precaution measures were adopted during the data collection. A two-page questionnaire was developed based on women's demographics, knowledge, attitudes and practice on COVID-

19 infection and a question on the acceptance of a COVID-19 vaccine once it became available in SA. The questionnaire was both in English and local language isiZulu. Both field workers were conversant in the local languages of isiZulu and English.

E. Questionnaire

The knowledge questions were posed on six specific symptoms of COVID-19 with yes or no answers: cough, sore throat, body pain, fever, difficulty in breathing and tiredness. Also, there were seven true or false questions. The true or false questions were: the virus survives for days outside the body in the open air, the virus survives for days outside the body on a plastic surface, most people who get COVID-19 become very ill, smokers who get COVID-19 are more likely to get ill than non-smokers, you can have the virus without any symptoms, children get less ill from the virus than adults and only elderly people die from COVID-19. The attitudes of the respondents were measured by five questions with yes or no answers: you may get infected by COVID-19, anyone in their family may get infected, the COVID-19 epidemic is a serious infection, the KCHC will be able to handle the COVID-19 pandemic in the region and the government has provided sufficient information on the COVID-19 pandemic. The six practice questions consisted of: do you cover your mouth when you sneeze or cough, do you use a face mask when you go to public places, do you keep a distance of 1-2 meters in public places, do you wash or sanitize your hands once you enter your house coming from outside, would you visit your family or friends during the COVID-19 epidemic and, would you visit a person who is diagnosed and isolated for a COVID-19 infection?

F. Measurements

The knowledge, attitudes and practices score of COVID-19 infection were measured by using a score of one (1) for the correct and zero (0) for incorrect answers or positive (1) and negative (0) statements. Total knowledge, attitudes and practices score were measured by adding the scores for the correct answers or on positive statements.

G. Data analysis

Data were captured using the Microsoft Excel programme, coded, then transported and analyzed using SPSS version 22. Descriptive statistics such as mean with standard deviation (SD) for continuous variables and frequency distribution for categorical variables were undertaken. Chi-square test and binary logistic regression were carried out to identify the factors for COVID-19 vaccine acceptability. P-values <0.05 were considered statistically significant.

H. Ethical consideration

Ethical approval was obtained from a Health Ethics Review Board (reference no. 06/2020). Permission was obtained from KCHC management team. The anonymity and confidentiality of the respondents were always maintained. Participation in the study was voluntary. Respondents could discontinue participating in the study anytime if they wished to without any harm. The study questionnaire contained a consent section that stated the purpose, nature and objectives of the study, and declaration of confidentiality and anonymity.

III. RESULTS

A total of 346 pregnant women participated in this study. About two-thirds (63.3%) of the pregnant women reported that they would accept the COVID-19 vaccine as soon as the vaccine becomes available. It was found that most of the pregnant women (81.2%) were between the ages of 20 to 29 years and the mean age of the respondents was 26.71 years (SD=6.81). More than two-thirds of the pregnant women were single (71.4%), and 52% unemployed. The mean gestational age was 23.77 (SD= 6.83) weeks and the mean parity was one (SD= 1.01). More than half (52%) were reported to be unemployed and 56.7% had matric and post-matric education.

TABLE I: ASSOCIATION OF DEMOGRAPHIC VARIABLES WITH ACCEPTANCE OF COVID-19 VACCINE

		Will accept vaccine (n=346)		Chi-squared value	P-value
		No (%)	Yes (%)		
Age	15 to 22 years	16.8	83.2	24.67	0.025
	23 to 30 years	47.1	52.9		
	31 to 38 years	42.5	57.5		
	Over 38 years	31.6	68.4		
Gestational age	Up to 13 weeks	26.2	73.8	3.92	0.141
	14 to 27 weeks	38.5	61.5		
	28 weeks and over	40.2	59.8		
Parity	0 and 1	40.1	59.9	6.89	0.032
	2 and 3	24.7	75.3		
	4 and more	50.0	50.0		
Marital Status	Single	29.1	70.9	21.71	0.000
	Married	58.3	41.7		
	Other	51.3	48.7		
Highest level of education	No education	50.0	50.0	27.90	0.000
	Up to grade 11	48.8	51.2		
	Matric	37.3	62.7		
	Higher education	13.0	87.0		
Employment Status	Employed	53.7	46.3	38.95	0.000
	Unemployed	21.3	78.7		

Results showed that 43% of the pregnant women scored 50% or more on the knowledge-related questions with a mean knowledge score of 3.48 (SD=1.36) from a total score of 13. Very few of the participants knew about the viral survival outside the body and on a plastic surface (6.6% and 8.7% respectively). However, 99% of the participants knew about the symptoms of a COVID-19 infection (one or more symptoms) and 77% knew that not only elderly people die from COVID-19 (Table II). The attitude of the respondents was low as the mean score was 1.77 (SD=1.12) of the total score of 5. About two-thirds of the respondents (63%) felt that the COVID-19 epidemic is a serious infection, (63%) and 50% reported that anyone in their family may get infected with the virus. The preventive practices of pregnant women were found to be favourable as the mean practice score was 4.7 (SD=.97) from a total score of 6. Most of the respondents stated that they would not visit a COVID-19 positive patient (94%), would not visit other family or friends during the COVID-19 pandemic (92%), and wash or sanitize hands coming indoors from outside (93%).

TABLE II: KNOWLEDGE, ATTITUDE AND PRACTICE OF 346 PREGNANT WOMEN ON COVID-19

Knowledge (n=346)	Frequency	Percent
Knowledge on symptoms		
Cough	156	45.1
Sore throat	175	50.6
Body pain	86	24.9
Fever	84	24.6
Difficulty breathing	238	68.8
Tiredness	30	8.7
Knowledge on the viral survival outside the body 7 days	23	6.6
The virus survives for days outside the body on a plastic surface ≥ 3 days	30	8.7
Most people who get COVID19 will get very ill	95	27.5
Smokers who get COVID-19 are more likely to get ill than non-smokers	145	41.9
You can have the virus without any symptoms	143	41.3
On average, children get less ill from the virus than adults	186	53.8
Not only elderly people die from COVID-19	265	76.6
Mean knowledge (SD)	3.48 (1.36)	43.5
Attitude		
I may get infected by COVID-19	10	2.9
Anyone in my family may get infected	173	50
COVID-19 epidemic is a serious infection	218	63
This clinic will be able to handle COVID-19 pandemic	12	3.5
The government has provided enough information regarding COVID-19	154	44.5
Mean attitude (SD)	1.77 (1.12)	30
Practice		
I cover mouth when sneeze or cough (n=346)	168	48.6
I use a face mask in public places (n=346)	262	75.7
I maintain social distance of 1-2 meters (n=346)	229	66.2
I wash or sanitize hands coming home from outside (n=346)	322	93.1
I will not visit family or friends during lockdown (n=346)	318	91.9
I will not visit a COVID-19 positive patient (n=346)	326	94.2
Mean Practice score (SD)	4.7 (0.97)	78.3

Bivariate analysis showed that the age of the pregnant women, parity, marital status, level of education, and employment status were significantly associated with vaccine acceptability ($p < 0.05$). For example, the rate of vaccine acceptability (83%) was higher among younger pregnant women (age younger or equal to 22 years) than among older pregnant women ($p < 0.05$). The respondents with 2-3 previous pregnancies had a higher vaccine acceptance rate of 75.3% compared to other groups ($p < 0.05$). Single pregnant women had significantly higher (70.9%) vaccine acceptance rate compared to those who were married or living together ($p < 0.05$). The vaccine acceptance rate among higher educated pregnant women was significantly higher with 87% ($p < 0.05$), compared to those who had no education. Unemployed mothers were more accepting (78.7%) of the vaccine than employed respondents (21.3%) ($p < 0.05$). The chi-squared test of association showed that knowledge and attitudes towards COVID-19 were significantly associated with

vaccine acceptability ($p < 0.05$) but practice was not associated with vaccine acceptability ($p > 0.05$) (Table III).

Forward Likelihood Ratio Stepwise Logistic regression analysis was conducted to determine the significant predictors for vaccine acceptability (Table IV). Initially, all the variables that were found significantly associated with vaccine acceptability from the bivariate analysis were included in the analysis. Results showed that participants who were < 22 years of age were 72% less likely ($OR = 0.28$, $CI: 0.13 - 0.62$) to accept a vaccine, compared to those who were > 39 years old. Women with 0 (nil parity) or 1 parity were 4.3 times more likely ($OR = 4.3$, $CI: 1.98 - 9.48$) to accept the vaccine than those with four or more parity. Single pregnant women were less likely ($OR = 0.23$, $CI: 0.10 - 0.51$) to accept the vaccine than those living with their partners.

TABLE III: ASSOCIATION BETWEEN KNOWLEDGE, ATTITUDE AND PRACTICE WITH VACCINE ACCEPTANCE

PRACTICE WITH VACCINE ACCEPTANCE					
		Will accept vaccine?		Chi-squared value	P-value
		No	Yes		
Good knowledge	Yes	5.5%	14.6%	6.65	0.010
	No	94.5%	85.4%		
Good attitude	Yes	10.2%	32.9%	22.23	0.000
	No	89.8%	67.1%		
Good practice	Yes	100%	97.3%	3.54	0.60
	No	-	2.7%		

Employed pregnant women were four times more likely to accept the vaccine ($OR = 4.2$, $CI: 2.28 - 7.75$) than unemployed pregnant women. It was also found that having good attitudes towards COVID-19 increased the chances of accepting a vaccine by four times ($OR = 4.05$, $CI: 1.89 - 8.69$).

TABLE IV: LOGISTIC REGRESSION OUTPUT OF PREGNANT WOMEN ON ACCEPTANCE OF COVID-19 VACCINE

	B	df	Sig	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Category age		3	.013			
Up to 22 years	-1.275	1	.002	.279	.126	.617
23 to 30 years	-.700	1	.179	.497	.179	1.378
31 to 38 years	-1.000	1	.206	.368	.078	1.731
Parity		2	.001			
Parity 0 & 1	1.467	1	.000	4.336	1.983	9.483
Parity 2 & 3	.824	1	.389	2.279	.350	14.852
Marital status		2	.001			
Single	-1.477	1	.000	.228	.102	.509
Married and living together	-.290	1	.520	.748	.309	1.811
Highest level of education		3	.000			
Up to grade 11	-.936	1	.157	.392	.107	1.433
Matric	.053	1	.937	1.054	.286	3.884
Post Matric education	1.245	1	.079	3.474	.866	13.945
Employed	1.437	1	.000	4.208	2.284	7.754
Good attitude	1.401	1	.000	4.059	1.894	8.698
Constant	.533	1	.480	1.704		

- Variable(s) entered on step 1: Employment status
- Variable(s) entered on step 2: Highest level of education.
- Variable(s) entered on step 3: Good attitude.
- Variable(s) entered on step 4: Marital status.
- Variable(s) entered on step 5: Parity.
- Variable(s) entered on step 6: Age.

IV. DISCUSSION

Vaccination programs are only successful when there are high rates of acceptance and coverage. To accomplish this, it is critical to understand South Africans' risk perceptions about COVID-19, the acceptance of a COVID-19 vaccine, and confidence in the health system and media sources, specifically those used to obtain information about the COVID-19 pandemic. This study provides an insight into the demographic variables, level of knowledge, attitudes towards and preventive practices and acceptability of the COVID-19 vaccine among a recognized vulnerable group of pregnant women. This study is unique because it is the first study to describe the acceptability of a COVID-19 vaccine that will protect pregnant mothers from COVID-19 and its associated morbidity and mortality from a PHC facility in SA. The demographic indicators of the pregnant women being single (71.4%), low level of education (half of them had less than matric education) and high unemployment status (52%) with the index pregnancy is indicative of poor socioeconomic conditions.

The acceptance (63.3%) of a COVID-19 vaccine among these pregnant women is considered to be good compared to other findings from the general population in Saudi Arabia (64.7%) and USA (67%) [32], [33]. However, a higher acceptance rate was observed among the general population (72.5%) in China [28]. This rate of acceptance is much higher than the actual overall vaccine coverage for the influenza vaccine in SA [29], [30]. The historical oppression of the SA population and current disparities (rural vs urban, poor vs rich, educated vs uneducated) in health care are always linked to mistrust of the healthcare system among some black South Africans and may result in these differences in health outcomes as found among black Americans in the USA [34]. Supporting this, our study found that rural black pregnant women are less likely to accept a potential COVID-19 vaccine [33]. In addition to this, racial disparities are reported on COVID-19 vaccine acceptance based on education and employment.

Our study showed that as years of education increase, so does the acceptance of a COVID-19 vaccine. Additionally, employed participants reported a higher rate of acceptance rate of a COVID-19 vaccine. These findings demonstrate that low-income communities, which are disproportionately impacted by COVID-19, may be more susceptible to continued outbreaks, even if a vaccine becomes available [34].

In this study, the level of knowledge about COVID-19 among the participants was poor despite the SA government having embarked on an aggressive media campaign to educate the population on the preventive measures to curtail person-to-person transmission of the disease. This could be attributed to the socio-demographic characteristics of the respondents, as can be found from sub-Saharan African countries, as they are from rural residences, low educational attainment and a high level of unemployment status [35].

Because COVID-19 is an emerging infectious disease, the optimal treatment for infected individuals has not yet been established [36], [37]. However, earlier case reports from developed countries have reported that the outcome of the coronavirus disease in pregnancy is favorable, but these

outcomes are probably achieved with intensive and active management that might be absent in most developing countries due to the poor healthcare systems prevalent in resource-constrained settings in SA [38]. It is important to know that assumption and reported acceptance or intent does not translate into actual behavior. This may be a concern when there is a time difference between the measurement of acceptance of a vaccine and the actual observation of such behavior or intention (which cannot occur until a COVID-19 vaccine is available in SA) [39].

The COVID-19 pandemic is covered on 24-hour news networks and dominates a great deal of online media both internationally and nationally in SA. However, it is not known how much influence it will have on the less educated, unemployed pregnant women who are also less knowledgeable concerning COVID-19. This media coverage may have made the COVID-19 pandemic more salient in daily life for many in different parts of the world. Having a new vaccine during the COVID-19 pandemic may create positivity about this vaccine which could also influence the acceptance rate. Other factors which could also be of influence are the discovery of a definitive pharmacological treatment or drugs which could reduce the duration of morbidity and mortality. Therefore, the planning for a COVID-19 vaccination in SA should be comprehensive with a focus on groups that are at higher risk.

Building confidence in a COVID-19 vaccine is essential because the herd immunity threshold for SARS-CoV-2, the virus causing COVID-19, is estimated to be between 55% and 82% and we found that 63% of our sample would accept the vaccine [40]. As described by the WHO SAGE working group on vaccine hesitancy, following a social marketing approach is recommended to tackle vaccine hesitancy [41]. This approach should be grounded on existing evidence, and include a participatory approach with ongoing community engagement, to understand needs as they develop and change. The existing frameworks for communication and message design should be such that the information should be communicated in a way that resonates with individuals and is relevant, timely, understandable, and provided through proper channels and the messages and messengers that they trust. As was found in the case of other vaccines, communication training of healthcare providers and other stakeholders in the case of immunization is key [42].

Study limitations: Our findings may be influenced by possible selection bias because participants were not randomly selected, or data were not collected from multi-centers which may limit the generalizability of our results. This may have also resulted in an overestimate of the percentage of those who would accept a COVID-19 vaccine. We are unable to check if the participants' responses are true. Another limitation is the effect of a social desirability bias, as participants may respond to questions in a manner that is viewed favorably by others.

V. CONCLUSION

Although our study found a 63.3% acceptance of a COVID-19 vaccine, there were noticeable demographic, knowledge, attitudes and practice disparities observed in

vaccine acceptance among pregnant women. Before a COVID-19 vaccine is introduced to SA, public health managers and policymakers must prioritize effective COVID-19 vaccine-acceptance messages and mass education for all South Africans, especially those who are most vulnerable.

ACKNOWLEDGMENT

We thank all the participants who voluntarily took part in this study and the two social workers (Mrs Kholowane and Mrs Shabane) who assisted in data collection.

REFERENCES

- [1] Donders F, Lonnee-Hoffmann R, Tsiakalos A, et al. ISIDOG recommendations concerning COVID-19 and pregnancy. *Diagnostics* 2020;10(4):243.
- [2] Della Gatta AN, Rizzo R, Pilo G, et al. Coronavirus disease 2019 during pregnancy: A systematic review of reported cases. *Am J Obstet Gynecol* 2020;223(1):36-41.
- [3] Di Mascio D, Khalil A, Saccone G, et al. Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: A systematic review and meta-analysis. *Am J Obstet Gynecol MFM* 2020;2(2):100-107.
- [4] Yang Z, Wang M, Zhu Z, et al. Coronavirus disease 2019 (COVID-19) and pregnancy: A systematic review. *J Matern Fetal Med* 2020; 30:1-4.
- [5] Zimmermann P, Curtis N. COVID-19 in children, pregnancy and neonates: A review of epidemiologic and clinical features. *Pediatr Infect Dis J* 2020;39(6):469-477.
- [6] Cheruiyot I, Henry BM, Lippi G. Is there evidence of intra-uterine vertical transmission potential of COVID-19 infection in samples tested by quantitative RT-PCR? *Eur J Obstet Gynecol Reprod Biol* 2020; 249:100-101.
- [7] Li D, Wang D, Dong J, et al. False-negative results of real-time reverse-transcriptase polymerase chain reaction for severe acute respiratory syndrome coronavirus 2: Role of deep-learning-based CT diagnosis and insights from two cases. *Korean J Radiol* 2020;21(4):505-508.
- [8] Kimberlin DW, Stagno S. Can SARS-CoV-2 infection be acquired in utero? More definitive evidence is needed. *JAMA* 2020;323(18):1788-1789.
- [9] Chen R, Zhang Y, Huang L, et al. Safety and efficacy of different anesthetic regimens for parturients with COVID-19 undergoing Cesarean delivery: A case series of 17 patients. *Can J Anaesth* 2020;67(6):655-663.
- [10] WHO. Mental health and psychosocial considerations during covid-19 outbreak. World Health Organization; 2020. Report No.: WHO/2019-CoV/MentalHealth/2020.1.
- [11] Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *Int J Environ Res Public Health* 2020; 17:1729.
- [12] Rajkumar RP. COVID-19 and mental health: A review of the existing literature. *Asian J Psychiatry*. 2020; 52:102066.
- [13] Sønderkov KM, Dinesen PT, Santini ZI, Østergaard SD. The depressive state of Denmark during the COVID-19 pandemic. *Acta Neuropsychiatr* 2020;1-3.
- [14] Kormann C, Wright R, McKibben B, Thomas L. How long will it take to develop a coronavirus vaccine? *The New Yorker*. 2020. Available at <https://www.newyorker.com/news/news-desk/how-long-will-it-take-to-develop-a-coronavirus-vaccine>. Accessed on 27 August 2020.
- [15] Mereckiene J, Cotter S, Weber JT et al (2012) Influenza A(H1N1) pdm09 vaccination policies and coverage in Europe. *Eurosurveillance* 2012; 17(4):2006-14.
- [16] Reintjes R, Das E, Klemm C, et al. "Pandemic public health paradox": time series analysis of the 2009/10 influenza A/H1N1 epidemiology, media attention, risk perception and public reactions in 5 European countries. *PLoS ONE* 2016; 11(3):151-58.
- [17] MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;14(34):4161-4.
- [18] Nichter M. Vaccinations in the Third World: a consideration of community demand. *Soc Sci Med* 1995; 41:617-32.
- [19] Yufika A, Wagner AL, Nawawi Y, Wahyuniati N, Anwar S, Yusri F, et al. Parents' hesitancy towards vaccination in Indonesia: a cross-sectional study in Indonesia. *Vaccine* 2020; 38:2592-9.
- [20] Harapan H, Anwar S, Setiawan AM, Sasmono RT, et al. Vaccine acceptance and associated factors in Indonesia: a community-based cross-sectional survey in Aceh. *Vaccine* 2016; 34:3670-5.
- [21] Hadisoemarto PF, Castro MC. Public acceptance and willingness-to-pay for a future dengue vaccine: a community-based survey in Bandung, Indonesia. *PLoS Negl Trop Dis* 2013; 7:24-27.
- [22] Yeo HY, Shafie AA. The acceptance and willingness to pay (WTP) for hypothetical dengue vaccine in Penang, Malaysia: a contingent valuation study. *Cost Eff Resour Alloc* 2018;16:60.
- [23] Harapan H, Mudatsir M, Yufika A, Nawawi Y, Wahyuniati N, Anwar S, et al. Community acceptance and willingness-to-pay for a hypothetical Zika vaccine: a cross-sectional study in Indonesia. *Vaccine* 2019; 37:1398-406.
- [24] Mudatsir M, Anwar S, Fajar JK, Yufika A, et al. Willingness-to-pay for a hypothetical Ebola vaccine in Indonesia: a cross-sectional study in Aceh. *Vaccine* 2019; 8:1441.
- [25] WHO. Improving vaccination demand and addressing hesitancy. 16 August 2019 [cited 2020 16 August]; Available from: https://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/
- [26] Harapan H, Wagner AL, Yufika A, Winardi W et al. Acceptance of a COVID-19 Vaccine in Southeast Asia: A Cross-Sectional Study in Indonesia. *Front. Public Health* 2020; 8:381.
- [27] Padhi BK, Almohaithef MA. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: a web-based national survey. *medRxiv*. 2020.
- [28] Fu C, Wei Z, Pei S, Li S, Sun X, Liu P. Acceptance and preference for COVID-19 vaccination in health-care workers (HCWs). *medRxiv*. 2020.
- [29] Geetesh Solankia,b,c, Morna Cornelld, and Ratilal Lalloof. Uptake and cost of influenza vaccines in a private health insured South African population. *South Afr J Infect Dis* 2018; 15:1-4.
- [30] McAnerney JM, Walaza S, Cohen AL, Tempia S, Buys A, Venter M, et al. Effectiveness and knowledge, attitudes and practices of seasonal influenza vaccine in primary healthcare settings in South Africa, 2010-2013. *Influenza and other respiratory viruses* 2015;9(3):143-50.
- [31] [Department of Health. Guidelines for Maternity Care in South Africa: A Manual for Clinics, Community Health Centers and District Hospitals. 4th ed. Pretoria, South Africa: Department of Health; 2016.
- [32] Padhi BK, Mohammed Al-Mohaithef M. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: a web-based national survey *medRxiv* 2020. doi: <https://doi.org/10.1101/2020.05.27.20114413>. Accessed on 17 August 2020.
- [33] Malik AA, SarahAnn M. McFaddena Jad, Elharakea, Saad B. Omera. Determinants of COVID-19 vaccine acceptance in the US. *E Clinical Medicine* 2020;8(57):495.
- [34] Yancy CW. COVID-19 and African Americans. *JAMA* 2020;323(19):1891-2.
- [35] Nwafor J I, Anukwu J K, Anozie B O, A C. Knowledge and practice of preventive measures against COVID-19 infection among pregnant women in a low-resource African setting. *Int J Gynecol Obstet* 2020;1-3.
- [36] PoonLC, Yang H, Kapur A, Melamed N, et al. Global interim guidance on coronavirus disease 2019 (COVID-19) during pregnancy and puerperium from FIGO and allied partners: Information for healthcare professionals. *IJGO* 2020;149(3):273-86.
- [37] Royal college of obstetricians and gynaecologists. Coronavirus (COVID-19) infection in pregnancy information for healthcare professionals. RCOG, London. 2020.
- [38] Yu N, Li W, Kang Q, Xiong Z, Wang S, Lin X, et al. Clinical features and obstetric and neonatal outcomes of pregnant patients with COVID-19 in Wuhan, China: a retrospective, single-centre, descriptive study. *Lancet Infect Dis* 2020;20(5):559-564
- [39] McEachan RRC, Conner M, Taylor NJ, Lawton RJ. Prospective prediction of health related behaviors with the theory of planned behavior: a meta-analysis. *Health Psychol Rev* 2011;5(2):97-144.
- [40] Sanche S, Lin YT, Romero-Severson E, Hengartner N, Ke R. High contagiousness and rapid spread of severe acute respiratory syndrome coronavirus 2. *Emerg Infect Dis* 2020; 26(7):102-109.
- [41] Thomson A, Valle 'e-Tourangeau G, Suggs LS. Strategies to increase vaccine acceptance and uptake: from behavioural insights to context-specific, culturally appropriate, evidence-based communications and interventions. *Vaccine* 2018; 36(44):6457-6458.
- [42] Opel DJ, Mangione-Smith R, Robinson JD et al. The influence of provider communication behaviors on parental vaccine acceptance and visit experience. *Am J Public Health* 2015; 105(10):1998-2004.