ORIGINAL ARTICLE

Knowledge and Perceptions of COVID-19 Vaccines amongst Pregnant Women of Karachi: A Comparative Cross-Sectional Study

Sohail Lakhani[1], Sadia Batool[1], Muhammad Jawad Yousfani[1]

1. Aga Khan University, Karachi, Pakistan.

ABSTRACT

Objective: The current study aimed to understand the knowledge, attitude, and perceptions of COVID-19 vaccinations amongst both the vaccinated and unvaccinated pregnant women of Karachi, Pakistan.
Materials and Methods: A descriptive cross-sectional study design was employed whereby pregnant women were enrolled based on a strict eligibility criterion from a government and a private tertiary-care hospital of Karachi using purposive sampling. The study was conducted between June and August 2021. Descriptive statistical analysis was performed on the acquired data using STATA software (version 17.0).
Results: A total of 222 unvaccinated and 231 vaccinated pregnant women were enrolled in the study. A relatively larger proportion of unvaccinated women lack formal education (37.8%) compared to vaccinated women (17.3%). A mere 3.6% of unvaccinated women are employed, whereas among vaccinated women, employment rate was 17.7% with the difference being statistically significant (p-value <0.001). Nearly half of the unvaccinated women (47.7%) reported not knowing how effective the vaccine is, compared to only 13.9% of vaccinated women, a statistically significant difference (p-value of <0.001). The predominant reason for vaccine hesitancy among these women is the fear of side effects on both the mother and child's health, with a significant 68.5% affirming this concern.
Conclusion: To address vaccine hesitancy among pregnant women in Pakistan, establishing trust and implementing targeted awareness campaigns is crucial. This will be the key steps in acceptance of vaccines and reaching herd immunity at a faster pace

Corresponding Author

Dr. Sohail Lakhani
Aga Khan University
sohail.lakhani2@aku.edu

INTRODUCTION

Vaccine hesitancy has emerged as a global concern that involves doubting or delaying vaccination process by recipients when it is crucial with respect to time and herd immunity. This phenomenon is impacted by multiple factors including past negative medical care encounters, individual wellbeing convictions, fear of needles and influence from medical care experts. Furthermore, the perception regarding vaccine hazards, trust in medical services frameworks and cultural standards play a significant role in exaggerating hesitancy. The consideration of philosophical beliefs further complicates matters. Vaccine hesitancy can lead to uninterrupted spread of preventable diseases, along with expanded repercussions including prolonged hospitalizations and eventual morbidity and mortality. To mitigate the risk of the issue effectively it is important to focus on arranging public health awareness campaigns, improve communication channels and trust building drives to protect health.[1,2]

A similar reluctance was observed in the phase of COVID-19 vaccinations. Acceptance rates of COVID 19 vaccines varied, ranging from 37.6%, in the population to 86.1% among students. Several factors influenced people's decision to accept or refuse the vaccine, including ethnicity, employment status, religious beliefs, political ideology, income, age and prior vaccination history. Gender disparities along with education levels and religiosity were associated with acceptance rates for vaccines. Age of the recipient also had an impact on vaccine hesitancy notably when younger individuals displayed massive willingness to receive vaccines. Some common reasons for vaccine refusal included concerns about safety doubts regarding vaccine effectiveness, lack of trust in the healthcare system and a perception that COVID-19 was not severe enough.[3]

In December 2020, FDA approved the emergent COVID-19 vaccine for emergency use, which was a significant step forward against the virus. However, they faced a hurdle when it became apparent that one third of the U.S. Population had reservations or outright refused to receive the COVID-19 vaccine even though many of them were at a higher risk of severe illness. This hesitancy towards getting vaccinated not only jeopardized the efforts to achieve herd immunity but also posed risks to public health and the economy. Peoples concerns about safety related to the COVID-19 vaccine played a massive role in influencing their willingness to get vaccinated.[4]

In middle-income countries, researchers utilized the Child Health and Nutrition Research Initiative (CHNRI) method during the COVID-19 pandemic, identifying top priorities such as overcoming vaccine access obstacles, addressing hesitancy, improving healthcare availability, and mitigating the pandemic's impact, emphasizing the crucial role of collaboration and the urgent need for healthcare system strengthening.[5]

In the midst of the vaccine introduction, pregnant women faced heightened risks and worse outcomes from COVID-19, even with milder symptoms. Vaccination was the key during their pregnancy to ensure the safety of both mother and child. A study in a London hospital related to COVID-19 vaccine and pregnant women found that less than one-third of them chose to get vaccinated. In younger, non-white, and economically disadvantaged women, this number was even lower.[6] The hesitancy, among pregnant women in LMIC's, varied between 10-50% depending on where they lived, which population they came from, what was their socio-economic status, education, and what sort of political influence affected them.[7] Despite concerns about safety and effectiveness from one-third of the examined group, most were open to receiving it, if it was made available to them.[8]

A study conducted in Punjab, Pakistan, in January 2022, involved 405 pregnant women. Surprisingly, 56% hadn't received the COVID-19 vaccine, despite their family members got vaccinated. These women were concerned about the factors like efficacy, baby's protection, and COVID-19 risk. Among those unvaccinated, 78% had no intention to get vaccinated. This highlighted huge vaccine hesitancy in pregnant women in Pakistan, emphasizing the need for targeted efforts to build trust in COVID-19 vaccines.[9]

Amidst the prevailing global, regional, and local concerns regarding COVID-19 vaccine hesitancy among pregnant women, it is imperative to understand the perspectives of expectant mothers in Karachi, the largest metropolitan city in Pakistan. Acknowledging the substantial impact of vaccine hesitancy, a meticulous consideration of regional variations is indispensable for the formulation of nuanced policies and strategies for the introduction of novel vaccines. Based on the above considerations and identifying no literature in the city of Karachi, the current study aimed to understand the knowledge, attitude and perceptions of COVID-19 vaccinations amongst both the vaccinated and unvaccinated pregnant women of Karachi, Pakistan while discerningly accounting for diverse socio-demographic factors that may intricately influence their perspectives.

MATERIALS AND METHODS

Study design, setting and sampling technique.
A descriptive cross-sectional study design was employed to evaluate the knowledge and attitude of COVID-19 vaccinated and unvaccinated pregnant women. The study was conducted in a government and a private tertiary-care hospital of Karachi. Purposive sampling, a subtype of non-probability sampling, was adopted to recruit eligible participants. The study was conducted between June and August 2021.

Study Tool
A structured questionnaire was used to assess and inquire about the knowledge and perceptions of pregnant women to COVID-19 vaccinations. In addition to the vaccine related questions, socio-demographic information was also inquired from the participants including their education status, employment status, history of past vaccine complications, parity, husband's education, and employment status. The questionnaire was content validated by subject specialists and pretested before being used for data capturing.

Eligibility Criteria
Women in their third trimester of pregnancy and over 18 years of age were included in the study sample. Women who had trouble communicating or understanding or could not provide informed, voluntary consent were deemed ineligible to participate in the study. Women with active neurological or psychiatric illness were considered as ineligible as existing mental disorder may have confounded the status of mental health. Similarly, women with test anxiety, phobias and social anxiety disorder were also be disregarded as they could deviate the true estimates.

Sample Size
A sample size of 187 was considered to be the minimum sample in each respondent group. The sample size was based on 5% level of significance and 80% power. We anticipated a refusal rate of 10%. The sample size for the study was calculated using the "WHO Sample Size Calculator software version 2.0" to test "the hypothesis for two population proportions (two-sided test)."

Ethical Consideration
Ethical approvals were acquired from the Ethics Review Committee of the Aga Khan University Hospital and the Institution Review Board of the Jinnah Postgraduate Medical Center. Patient privacy and confidentiality were maintained at every stage of the study.

Statistical Analysis
Frequencies and percentages for qualitative variables and, mean and standard deviation for quantitative variables were calculated as part of descriptive analysis. Chi-squared tests were performed to check the differences in proportions of characteristics between vaccinated and unvaccinated pregnant women groups. A p-value of less than 0.05 was considered as significant at all stages of analysis. All analyses were carried out using STATA software (version 17.0).

RESULTS

A total of 250 pregnant women in each group were reached out and amongst them 222 unvaccinated and 231 vaccinated pregnant women were enrolled in the study. The socio-demographic differences amongst COVID-19 vaccinated and unvaccinated pregnant women, with a focus on their educational background, employment status, and reproductive history are summarized in Table 1 below.

		Unvaccinated N=222	Vaccinated N=231	p-value
Education	No formal education	84 (37.8%)	40 (17.3%)	<0.001
	Primary education	60 (27.0%)	42 (18.2%)	
	Secondary education	59 (26.6%)	57 (24.7%)	
	Secondary education	2 (0.9%)	0 (0.0%)	
	Bachlor's Or above	17 (7.7%)	92 (39.8%)	
Education of Husband	Bachlor's Or above	28 (12.6%)	92 (39.8%)	<0.001
	No formal education	59 (26.6%)	44 (19.0%)	
	Primary education	52 (23.4%)	30 (13.0%)	
	Secondary education	83 (37.4%)	65 (28.1%)	
Employment Status	Employed	8 (3.6%)	41 (17.7%)	<0.001
	Unemployed/House wife	214 (96.4%)	190 (82.3%)	
Employment Status of Husband	Employed	213 (95.9%)	226 (97.8%)	0.25
	Unemployed	9 (4.1%)	5 (2.2%)	
Any history of complications due to any past vaccinations	No	217 (97.7%)	228 (98.7%)	0.44
	Yes	5 (2.3%)	3 (1.3%)	
Is this first pregnancy	No	152 (68.5%)	148 (64.1%)	0.32
	Yes	70 (31.5%)	83 (35.9%)	

Table 1: Socio demographic details of COVID-19 unvaccinated and vaccinated pregnant women

As evident, a statistically significant difference (p-value <0.001) emerges in the educational background between the two groups. A relatively larger proportion of

unvaccinated women lack formal education (37.8%) compared to vaccinated women (17.3%). On the contrary, the percentage of vaccinated women with a bachelor's degree or higher is significantly greater (39.8%) than that of unvaccinated women (7.7%), reinforcing the trend that higher education correlates with higher vaccination rates. This educational divide extends to the spouses of the women surveyed. Husbands of unvaccinated women are more likely to have no formal education, while a greater percentage of husbands of vaccinated women hold a bachelor's degree or above. The statistical significance of this difference (p-value <0.001) corresponds with the pattern observed among the women themselves, suggesting that household education level may be a factor in vaccination decisions.

Employment status further explains the disparity between the two comparing groups. A mere 3.6% of unvaccinated women are employed, whereas among vaccinated women, employment rate is 17.7% with the difference being statistically significant (p-value <0.001). This suggests that employment, potentially linked to greater social exposure and access to healthcare information, may influence vaccination status. However, the majority of women in both groups are not employed, indicating that employment is not a universal characteristic of vaccinated

		Unvaccinated	Vaccinated	p-value
		N=222	N=231	
How effective is the COVID-19 vaccination in preventing a COVID-19 infection?	Don't know	106 (47.7%)	32 (13.9%)	<0.001
	Not effective	22 (9.9%)	15 (6.5%)	
	Not very effective	14 (6.3%)	12 (5.2%)	
	Somewhat effective	56 (25.2%)	90 (39.0%)	
	Very effective	24 (10.8%)	82 (35.5%)	
Do you think it is safe for pregnant women to get the COVID-19 vaccine?	Don't know	110 (49.5%)	43 (18.6%)	<0.001
	No	68 (30.6%)	46 (19.9%)	
	Yes	44 (19.8%)	142 (61.5%)	
Do you think it is safe for a woman to get the COVID-19 vaccine if she is trying to get pregnant?	Don't know	144 (64.9%)	82 (35.5%)	<0.001
	No	42 (18.9%)	34 (14.7%)	
	Yes	36 (16.2%)	115 (49.8%)	

Table 2: Perceptions of COVID-19 vaccine effectiveness and safety among unvaccinated and vaccinated pregnant women

women. In contrast, the employment status of husbands does not significantly differ between the two groups, suggesting that the husband's employment status may not be a significant factor in the vaccination status of pregnant

women.

It is also worth mentioning that no significant differences were observed between the two groups regarding complications from past vaccinations or whether it is their first pregnancy. This indicates that personal or immediate past experiences with vaccinations and pregnancy status do not significantly influence the decision to receive a COVID-19 vaccine.

The findings in table 2 presents perceptions of COVID-19 vaccine effectiveness and safety among unvaccinated and vaccinated pregnant women, with a focus on their beliefs about the vaccine's ability to prevent COVID-19 infection and its safety for pregnant women or those trying to become pregnant.

Regarding the perceived effectiveness of the COVID-19 vaccine in preventing infection, there is a noticeable difference between the unvaccinated and vaccinated groups.

Reason		Unvaccinated
		N=222
Why will you not accept the COVID-19		
Fear of side effects on mother and child's health	No	70 (31.5%)
	Yes	152 (68.5%)
Not sure of effectiveness	No	205 (92.3%)
	Yes	17 (7.7%)
Lack of trust in the vaccine	No	184 (82.9%)
	Yes	38 (17.1%)
Not sure of safety	No	159 (71.6%)
	Yes	63 (28.4%)
Religious belief	No	212 (95.5%)
	Yes	10 (4.5%)
Others	No	108 (48.6%)
	Yes	114 (51.4%)
Whom would you like to consult to make this decision?		
Family members/ Spouse	No	40 (18.0%)
	Yes	182 (82.0%)
Friends	No	216 (97.3%)
	Yes	6 (2.7%)
Health professionals	No	68 (30.6%)
	Yes	154 (69.4%)
Religious leaders	No	216 (97.3%)
	Yes	6 (2.7%)
Community leaders	No	221 (99.5%)
	Yes	1 (0.5%)
Government officials	No	221 (99.5%)
	Yes	1 (0.5%)
Others	No	201 (90.5%)
	Yes	21 (9.5%)

Table 3: Reasons of unvaccinated pregnant women (N=222) to accept the COVID-19 vaccine

Nearly half of the unvaccinated women (47.7%) reported not knowing how effective the vaccine is, compared to only 13.9% of vaccinated women, a statistically significant difference (p-value of <0.001). This suggests a substantial gap in knowledge or confidence about the vaccine's effectiveness among unvaccinated women. On the contrary, a higher percentage of vaccinated women believe the vaccine to be 'somewhat' or 'very effective' (39.0% and 35.5%, respectively), compared to 25.2% and 10.8% of unvaccinated women. This indicates that vaccinated women are more likely to believe in the efficacy of the vaccine, which could be a contributing factor to their decision to get vaccinated.

When it comes to the perceived safety of the COVID-19 vaccine for pregnant women, again, a significant disparity is evident. A larger proportion of unvaccinated women are uncertain about the vaccine's safety (49.5%), while 61.5% of vaccinated women believe it to be safe. The p-value (<0.001) indicates that this difference is statistically significant. This pattern suggests that confidence in the vaccine's safety is associated with the decision to be vaccinated during pregnancy.

The perceptions of vaccine safety for women trying to get pregnant show a similar trend. A majority of unvaccinated women (64.9%) do not know if it is safe for a woman trying to get pregnant to receive the COVID-19 vaccine, compared to 35.5% of vaccinated women. Meanwhile, nearly half of the vaccinated women (49.8%) believe it is safe, which is significantly higher than the 16.2% of unvaccinated women who share this belief, with the difference being statistically significant (p-value <0.001). The Table 3 above depicts the reasons why unvaccinated pregnant women (N=222) are hesitant to accept the COVID-19 vaccine and whom they would prefer to consult when making the decision about vaccination. The predominant reason for vaccine hesitancy among these women is the fear of side effects on both the mother and child's health, with a significant 68.5% affirming this concern. This indicates that the potential risks to maternal and fetal health are a major factor in their decision-making process. Another notable reason, though much less prevalent, is a lack of certainty about the vaccine's effectiveness, with only 7.7% of the women citing this as a concern. This suggests that while effectiveness is a consideration, it is not as significant a barrier as concerns about side effects.

Similarly, a lack of trust in the vaccine is a reason for a minority of the group, with 17.1% expressing this opinion.

This lack of trust could stem from various sources, including misinformation, a general distrust of pharmaceuticals, or a lack of transparent communication from health authorities. Concerns about the safety of the vaccine are also significant, with 28.4% of the women unsure about its safety. This is a critical area where more information and reassurance from trusted health professionals could potentially influence attitudes. Religious beliefs appear to play a minimal role in the decision not to vaccinate, with only 4.5% of the women considering it a factor. This suggests that for the majority, religion does not conflict with the decision to receive the vaccine. When it comes to sources of advice and information that these women would like to consult, family members or spouses are the most influential, with 82% of women looking to them for guidance. This underscores the importance of family dynamics and shared decision-making in healthcare choices within this demographic. Health professionals are also considered a key source of consultation, with 69.4% of the women indicating they would seek advice from them. This reflects a recognition of the expertise of healthcare providers and suggests that medical professionals have a significant opportunity to influence vaccination decisions. On the other hand, friends, religious leaders, community leaders, and government officials are much less influential, with very few women indicating a desire to consult them. This suggests that the decision to vaccinate is seen as a personal or family matter, rather than one that involves wider social circles or authority figures.

DISCUSSION

Our study reveals that educational attainment and employment status are significant socio-demographic factors differentiating vaccinated from unvaccinated pregnant women. The higher prevalence of education and employment in the vaccinated group may reflect broader access to information and healthcare resources, potentially facilitating a more favorable attitude towards vaccination. Out study also reveals that vaccinated women are more likely to believe in the vaccine's effectiveness and safety for both current and prospective pregnancies. In contrast, a considerable number of unvaccinated women lack information or are uncertain about these aspects, which may influence their decision against vaccination. These findings highlight the potential impact of information and belief systems on vaccine uptake and suggest that increasing

awareness and confidence in the vaccine could influence vaccination rates among pregnant women.

The findings of our study also revealed that the concerns about side effects and safety are the primary reasons for vaccine hesitancy among the unvaccinated pregnant women. The decision-making process is heavily influenced by family and health professionals, indicating that efforts to increase vaccination rates in this group may be most effective if they involve educating and engaging with these influential parties to address concerns about health risks and vaccine trustworthiness.

It is evident from the literature that public health demands that a multi-faceted solution be adopted in addressing of the vaccine hesitancy.[1,2] This requires increased awareness and honest communication with all stakeholders to build trust. Healthcare professionals are regarded as credible sources of information that's why it also includes training healthcare providers, on how to overcome vaccine hesitancy as well as developing educational programs aimed at this objective. These trainings and programs help in building trust and preparedness to solve it.[10,11] Specific interventions need to be implemented towards the populations that show low willingness to get vaccinated.[3]

It has been observed that vaccine hesitancy among pregnant women was attributed to myths, religion, and safety issues.[12,7] Lack of education and exposure to the outside world was the root cause of believing the myths as evident from the findings of our study. Women relied on healthcare providers and social media to provide factual information about the vaccines.[13,12] The importance of clear communication was highlighted especially among expectant mothers who needed reliable information about the vaccination process.[15,6] Thus, it is suggestive that there is need of implying partnership between healthcare and public health authorities.[16] Given high level of vaccine hesitancy among pregnant women in Pakistan, it clearly is necessary that the trust be created between the pregnant women and medical staffers, while targeted awareness raising measures should also be implemented. Misinformation concerning vaccination should be addressed in such a way that it increases vaccine acceptance specifically for urban areas where hesitance is more apparent. Therefore, it is vital to implement an all-encompassing framework that takes into account the different elements involved in covering populations with vaccines for community safety.[9,17] Strengths of this study include its comprehensive assessment of COVID-19 vaccine knowledge and attitudes among pregnant women,

the inclusion of both vaccinated and unvaccinated participants, a sufficiently sized sample, ethical considerations, and the use of a validated questionnaire. However, limitations include its cross-sectional design, potential selection bias from purposive sampling, social desirability bias in self-reported data, limited generalizability, lack of longitudinal data, and the absence of qualitative insights. Despite these limitations, the study provides valuable insights into vaccine hesitancy among pregnant women in Karachi, Pakistan, which can inform targeted interventions and further research in this area. As a way forward, there is a need to conduct longitudinal studies to track changes in pregnant women's attitudes toward vaccines, qualitative research to delve deeper into their concerns, tailored information campaigns addressing specific hesitancy reasons, healthcare provider training, community engagement with leaders and influencers, psychological support, policy advocacy, ongoing monitoring, and global sharing of best practices. Research on vaccine safety during pregnancy should continue, and empowerment programs for pregnant women should be developed. Addressing vaccine hesitancy is a multifaceted process that requires collaboration and adaptation to effectively reach and educate pregnant women in Karachi, Pakistan, and beyond.

CONCLUSION

To address vaccine hesitancy among pregnant women in Pakistan, establishing trust and implementing targeted awareness campaigns is crucial. This will be the key steps in acceptance of vaccines and reaching herd immunity at a faster pace.

Authors Contribution
SL: has conceived and designed the analysis by collecting data, contributed data and analysis tools, performed the analysis, Wrote the paper. SB and JY: have played a vital role in writing the paper as well.

Funding
No funding received.

Institutional ethical board approval
Ethical approvals were acquired from the Ethics Review Committee of the Aga Khan University Hospital (AKU CMO) and the Institution Review Board of the Jinnah Postgraduate Medical Center.

Conflict of interest

The author reports no conflict of interest.

REFERENCES

1. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J. Vaccine hesitancy: an overview. Hum Vaccin Immunother. 2013;9(8):1763-73.

2. McClure CC, Cataldi JR, O'Leary ST. Vaccine Hesitancy: Where We Are and Where We Are Going. Clin Ther. 2017;39(8):1550-62.

3. Troiano G, Nardi A. Vaccine hesitancy in the era of COVID-19. Public Health. 2021;194:245-51.

4. Kricorian K, Civen R, Equils O. COVID-19 vaccine hesitancy: misinformation and perceptions of vaccine safety. Hum Vaccin Immunother. 2022;18(1):1950504.

5. Polašek O, Wazny K, Adeloye D, Song P, Chan KY, Bojude DA, et al. Research priorities to reduce the impact of COVID-19 in low- and middle-income countries. J Glob Health. 2022;12:09003.

6. Blakeway H, Prasad S, Kalafat E, Heath PT, Ladhani SN, Le Doare K, et al. COVID-19 vaccination during pregnancy: coverage and safety. Am J Obstet Gynecol. 2022;226(2):236.e1-.e14.

7. Ransing R, Kukreti P, Raghuveer P, Puri M, Paranjape AD, Patil S, et al. A brief psycho-social intervention for COVID-19 vaccine hesitancy among perinatal women in low-and middle-income countries: Need of the hour. Asian J Psychiatr. 2022;67:102929.

8. Goldenberg RL, Naqvi S, Saleem S, McClure E. Variability in COVID-19 vaccination rates in pregnant women: Vaccine hesitancy or supply limitations? Bjog. 2022;129(12):2095-6.

9. Mustafa ZU, Bashir S, Shahid A, Raees I, Salman M, Merchant HA, et al. COVID-19 Vaccine Hesitancy among Pregnant Women Attending Antenatal Clinics in Pakistan: A Multicentric, Prospective, Survey-Based Study. Viruses. 2022;14(11).

10. Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. Vaccine. 2016;34(52):6700-6.

11. Solís Arce JS, Warren SS, Meriggi NF, Scacco A, McMurry N, Voors M, et al. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. Nat Med. 2021;27(8):1385-94.

12. Simmons LA, Whipps MDM, Phipps JE, Satish NS, Swamy GK. Understanding COVID-19 vaccine uptake during pregnancy: 'Hesitance', knowledge, and evidence-based decision-making. Vaccine. 2022;40(19):2755-60.

13. Yasmin F, Asghar W, Babar MS, Khan H, Ahmad S, Hameed Z, et al. Acceptance Rates and Beliefs toward COVID-19 Vaccination among the General Population of Pakistan: A Cross-Sectional Survey. Am J Trop Med Hyg. 2021;105(5):1230-9.

14. Ma M, Raza SH, Yousaf M, Zaman U, Jin Q. Investigating the Psychological, Social, Cultural, and Religious Predictors of COVID-19 Vaccine Uptake Intention in Digital Age: A Media Dependency Theory Perspective. Vaccines (Basel). 2023;11(8).

15. Wang PH, Lee WL, Yang ST, Tsui KH, Chang CC, Lee FK. The impact of COVID-19 in pregnancy: Part II. Vaccination to pregnant women. J Chin Med Assoc. 2021;84(10):903-10.

16. Ransing R, Raghuveer P, Mhamunkar A, Kukreti P, Puri M, Patil S, et al. COVID-19 vaccine confidence project for perinatal women (CCPP)-Development of a stepped-care model to address COVID-19 vaccine hesitancy in low and middle-income countries. Front Public Health. 2022;10:1100046.

17. Marzo RR, Shrestha R, Sapkota B, Acharya S, Shrestha N, Pokharel M, et al. Perception towards vaccine effectiveness in controlling COVID-19 spread in rural and urban communities: A global survey. Front Public Health. 2022;10:958668.

★★★★★