Hesitancy Towards COVID- 19 Booster Vaccine and its Associated Factors Among Geriatric Patients in a Tertiary Hospital in Region 1

Valerie Nadugo Tumaliuan, MD

Background: The COVID-19 pandemic significantly impacted global health, especially among older adults at higher risk for severe illness. Despite the benefits of vaccination, booster vaccine hesitancy posed a barrier to optimal protection in the elderly population.

Objective: This study aimed to identify factors associated with COVID-19 booster vaccine hesitancy among geriatric patients at the Family Medicine Outpatient Clinic of Region 1 Medical Center.

Methods: An analytic, cross-sectional study was conducted with 183 geriatric patients aged 60 and above who had received the primary COVID-19 vaccine series. Data were collected using a 25-item questionnaire addressing sociodemographic information, medical history, COVID-19 knowledge, and vaccine attitudes. Statistical analyses, including chi-square tests and logistic regression, identified factors influencing booster vaccine hesitancy.

Results: The majority of participants were between the ages of 60-69 (66.7%, n=122) and predominantly female (69.4%, n=127). High hesitancy rates were notably observed among elderly females (75.6%), individuals with lower educational attainment (79.7%), and single individuals (93.3%). Other significant factors included hypertension (76.5%) and the absence of prior influenza (81.5%) or pneumococcal (75.9%) vaccinations.

Conclusion: These findings highlight the critical need for targeted educational efforts to mitigate COVID-19 vaccine hesitancy within specific subgroups, particularly elderly females, those with lower education levels, and individuals with certain health conditions. By implementing personalized outreach and emphasizing the advantages of vaccination, stakeholders can enhance vaccine uptake and improve health outcomes for this vulnerable segment of the population.

Key words: Vaccine hesitancy, public health, COVID-19 vaccines, elderly population

BACKGROUND

COVID-19, caused by the SARS-CoV-2 virus, has triggered a global health crisis, resulting in 753 million infections and 6.8 million deaths worldwide[1]. This pandemic has disproportionately affected older adults, who are at higher risk for severe symptoms and complications when infected[2]. In the Philippines, there have been 4.07 million COVID-19 cases and 65,779 deaths as of January 2023[3,4]. The economic, educational and social burdens of COVID-19 are immense, with the elderly population experiencing the highest fatality rates among all age groups. Additionally, co-infections of SARS-COV-2 with endemic diseases in Asia further complicate the public health landscape[5].

Recent studies emphasize the critical role of vaccination in mitigating the spread and severity of COVID-19. One research established a significant link between high vaccination rates and reduced COVID-19 incidence and severity[6]. Despite the rapid development and emergency approval of vaccines, which has fueled public concern over their safety and efficacy[7]. Another challenge is in dispelling negative perceptions about vaccines[8]. The multifactorial nature of vaccine hesitancy involves sociodemographic, health-related, and personal factors. In the Philippines, while 66% of the population is fully vaccinated,

_____
Department of Family and Community Medicine, Region 1 Medical Center

hesitancy remains a challenge, particularly with booster doses, as seen in Pangasinan where only 32.5% of eligible seniors received the first booster dose[,4,7].

Current research identifies vaccine hesitancy as a persistent issue, particularly among older adults[9]. However, it often lacks detailed analysis of specific populations, such as the Filipino elderly. This study addresses this gap by focusing on the factors influencing COVID-19 booster vaccine hesitancy among geriatric patients in the Philippines. By understanding these factors, healthcare providers can develop targeted interventions to improve vaccination rates, thereby reducing the vulnerability of the elderly to severe COVID-19 outcomes. The results of this study may provide crucial insights for healthcare workers to design strategies that address vaccine hesitancy and increase booster uptake among the geriatric population. This study aimed to determine factors associated with COVID-19 booster vaccine hesitancy among geriatric patients in the Family Medicine Outpatient Clinic in Region 1 Medical Center.

METHODS

Study Design

This study utilized a analytic, cross-sectional study design. Geriatric patients aged 60 and above were recruited from the Family Medicine Outpatient Clinic at Region 1 Medical Center (R1MC) in Dagupan City, Pangasinan, Philippines. The recruitment process involved purposive sampling, and data were collected through a 25-item modified questionnaire. The questionnaire, adapted from a local study[7], covered sociodemographic data, medical history, COVID-19 pandemic-related information, and COVID-19 vaccine-related information.

Setting

The study was conducted at Region 1 Medical Center (R1MC) in Dagupan City, Pangasinan, Philippines, a tertiary government hospital with a 600-bed capacity that offers a wide range of medical inpatient and outpatient services. Recruitment started in March 2023 and data collection was completed by June 2023. Patients were recruited as they came to the facility for consultation.

Study Participants

Inclusion criteria were geriatric patients aged 60 and above who had completed the primary series of the COVID-19 vaccine and were seen in the Family Medicine Outpatient Clinic at R1MC from March to June 2023. Exclusion criteria included patients not registered for consultation under the Family Medicine Outpatient Clinic, those who refused to participate, and those who had not completed the primary series of the COVID-19 vaccine. Participants signed an informed consent form, which detailed the study's purpose, risks and benefits, confidentiality provisions, and the voluntary nature of participation.

Variables and Data Collection

The primary variables included sociodemographic characteristics, medical history, COVID-19 knowledge, primary sources of COVID-19 information, and COVID-19 vaccine-related information. The outcome variable was booster vaccine hesitancy. Data were collected using a modified 25-item questionnaire structured into four sections: sociodemographic data (5 questions), medical history (8 questions), COVID-19 pandemic-related information (5 questions), and COVID-19 vaccine-related information (7 questions). The questionnaire was translated to Filipino (Tagalog) and validated by the Institutional Review Board. As this was a cross-sectional study, there was no follow-up period. The primary investigator collected the completed questionnaires from each participant, checked for completeness, and anonymized the data for analysis.

Statistical Analysis

The study aimed to investigate factors influencing booster vaccine hesitancy. Nominal data were summarized as frequencies and percentages, while continuous data were summarized as mean $\pm$ standard deviation (SD) or median and interquartile range, depending on the normality of the distribution. Group comparisons were performed using chi-square tests for categorical variables and independent t-tests for continuous variables. Logistic regression was used to identify factors influencing booster vaccine hesitancy. All statistical analyses were performed using Microsoft Excel 2018 for Windows, and a p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study adhered to ethical standards, ensuring respect for autonomy and data privacy. Written informed consent was obtained from all participants, explaining the study's purpose, risks, and benefits. The study maintained strict confidentiality of the participants' data, and no personal identifiers were included. The research was approved by the Institutional Review Board (IRB) of the Family and Community Medicine Department, ensuring that all ethical guidelines were followed. Participants were informed of their right to withdraw at any time without penalty, and the primary investigator had no conflicts of interest or financial disclosures to report.

RESULTS

Participants' Sociodemographic Characteristics and Medical History

A total of 183 participants were included in this study, of which 127 (69.4%) were females and 56 (30.6%) were males. Participants were older adults 60-86 years (mean $\pm$ SD age: 67 $\pm$). Most participants were married (68.3%) and have reached high school (48.6%). Almost all of the participants reported no allergy to food (98.4%) and none reported any allergy to drugs. Twenty- nine percent of the participants

received Influenza vaccine at least once while 11.5% of the participants received pneumococcal vaccine at least once.

The analysis of baseline characteristics associated with COVID-19 booster vaccine hesitancy revealed several significant findings. Age emerged as a significant predictor, with individuals aged 80 years and older exhibiting the highest hesitancy rate (90%) compared to younger age groups. Gender also played a crucial role, with females demonstrating a substantially higher hesitancy rate (75.6%) compared to males (69.6%). Education level showed a clear association, as individuals with a Bachelor's degree or higher displayed a significantly lower hesitancy rate (60%) compared to those with lower educational attainment. Marital status was another notable factor, with single individuals exhibiting the highest hesitancy rate (93.3%) among various marital statuses. (Table 1)

Health-related characteristics further elucidated the complexity of vaccine hesitancy. Body mass index (BMI) was significantly associated with hesitancy, with individuals falling within the 18.5-22.9 range displaying the highest hesitancy rate (79%) among the well-represented groups. The presence of food or drug allergies starkly influenced hesitancy, with individuals without these allergies showing no hesitancy. Vaccination history played a pivotal role, as individuals with no history of receiving influenza or pneumococcal vaccines exhibited significantly higher hesitancy rates. Among underlying diseases, hypertension, respiratory disease, and diabetes were strongly associated with booster vaccine hesitancy, indicating the multifaceted nature of hesitancy drivers. It is important to note that underrepresented groups across the various variables have been excluded to maintain the integrity of analysis.

The study analyzed COVID-19 booster vaccine hesitancy among 183 elderly participants, finding that 73.8% were hesitant. Hesitancy was highest among participants aged 80+ (90%), females (75.6%), those with elementary education or below (79.7%), and single

Table 1. Baseline characteristics associated with COVID-19 booster vaccine hesitancy.

Characteristics	Baseline (n=183)		Acceptance (n=48)		Hesitancy (n=135)		Hesitancy Rate	X^2	p-value
	n	%	n	%	n	%	%		
Age								73.85	< .00001
60-69 years	122	66.7	33	68.8	89	65.9	73		
70-79 years	51	27.9	14	29.2	37	27.4	72.6		
80+ years	10	5.5	1	2.1	9	6.7	**90**		
Gender								32.32	< .00001
Male	56	30.6	17	35.4	39	28.9	69.6		
Female	127	69.4	31	64.6	96	71.1	**75.6**		
Education								50.08	< .00001
Elementary or below	74	40.4	15	31.3	59	43.7	**79.7**		
High School	89	48.6	21	43.8	68	50.4	76.4		
Bachelor's degree or higher	20	10.9	8	16.7	12	8.9	60		
Marital status								13.13	.004358
Single	15	8.2	1	2.1	14	10.4	**93.3**		
Married	125	68.3	40	83.3	85	63.0	68.0		
Widowed	36	19.7	6	12.5	30	22.2	83.3		
Separated	7	3.8	1	2.1	6	4.4	85.7		
BMI (kg/m²)								10.79	0.029041
<18.5	19	10.4	6	12.5	13	9.6	68.4		
18.5-22.9	81	44.3	17	35.4	64	47.4	**79**		
23-24.9	56	30.6	16	33.3	40	29.6	71.4		
25-30	26	14.2	9	18.8	17	12.6	65.4		
>30	1	0.5	0	0.0	*1	0.7	*100		
Food Allergy								109.60	< .00001
No	180	98.4	48	100.0	132	97.8	73.3		
Yes	3	1.6	0	0.0	*3	2.2	*100		
Drug Allergy								112.18	< .00001
No	183	100	48	100.0	135	100	73.8		
Yes	0	0	0	0.0	0	0.0	*N/A		
Vaccination History									
Influenza Vac.								90.86	< .00001
No	129	70.5	24	50.0	106	78.5	**81.5**		
Yes	53	29	24	50.0	29	21.5	54.7		
Pneumococcal Vac.								102.78	< .00001
No	160	87.4	39	81.3	123	91.1	**75.9**		
Yes	21	11.5	9	18.8	12	8.9	57.1		
Underlying Disease								51.91	< .00001
Hypertension	81	61.4	19	39.6	62	45.9	**76.5**		
Diabetes	41	31.1	11	22.9	25	18.5	69.4		
Renal Disease	4	3	0	0.0	*4	3.0	*100		
Respiratory Disease	14	10.6	4	8.3	10	7.4	71.4		
Cardiovascular Disease	8	6.1	4	8.3	4	3.0	50		
*Underrepresented									

individuals (93.3%). Participants with a BMI of 18.5-22.9 showed the highest hesitancy (79%) among well-represented groups, and those with hypertension (76.5%), respiratory disease (71.4%), and diabetes (69.4%) were also more hesitant. A lack of previous influenza and pneumococcal vaccinations was strongly associated with higher hesitancy rates (81.5% and 75.9%, respectively).

The logistic regression analysis for COVID-19 booster vaccine hesitancy identified several significant factors. Age showed that individuals aged 80+ had a lower odds ratio (OR) of hesitancy (OR: 0.625) compared to younger age groups. Gender did not show a significant difference, with an OR of 5.466 for females but a wide confidence interval (CI: 0.701). Educational level demonstrated that those with a Bachelor's degree or higher were significantly less hesitant (OR: 0.363, p=0.040). Marital status and BMI did not show significant associations. Vaccination history revealed that those who had previously received an influenza vaccine were significantly less hesitant (OR: 10.970, p=0.008), while the pneumococcal vaccine showed no significant impact. Among underlying diseases, hypertension was notably associated with increased hesitancy (OR: 3.945), while other diseases showed no significant effect.

The analysis of COVID-19 pandemic and vaccine-related factors associated with COVID-19 booster vaccine hesitancy revealed several significant associations. Poor knowledge about COVID-19 was significantly associated with higher hesitancy rates (86.5%, p<0.0001). The presence of a COVID-19 patient in the neighborhood was associated with lower hesitancy rates (50%, p=0.002), compared to neighborhoods with no known cases (74.9%). Knowing someone who had been infected or had died from COVID-19 was also found to have significant association, with those knowing infected individuals and those knowing deceased individuals showing lower hesitancy rates (64.8% and 67.6%, respectively; both p<0.0001). The influence of vaccine manufacturer on the decision to vaccinate was not significantly different between the two groups (p=0.92).

The primary source of COVID-19 information varied among participants, with television and radio being the most common source for both acceptance and hesitancy groups, followed by information from friends and relatives. Fewer individuals reported obtaining information from newspapers, social networks, or other websites. (Table 4)

The reasons for hesitancy or refusal of the COVID-19 vaccine among participants were perceived sufficiency of primary doses, underlying medical conditions, and exposure to negative media reports. A smaller proportion cited observing adverse effects from others, previous negative vaccination experiences, and low perceived risk of infection due to limited outdoor activity. (Table 5)

Table 2. Logistic regression results for COVID-19 booster vaccine hesitancy.

Variable	Univariate OR 95% CI	p-value
Age		
60-69 years	**1.837**	**0.625**
70-79 years	**0.132**	
80+ years		
Gender		**0.701**
Male		
Female	**5.466**	
Education		**0.040**
Elementary or below	**1.140**	
High School		
Bachelor's degree or higher	**0.363**	
Marital status	**3.882**	**0.156**
Single		
Married		
Widowed		
Separated		
BMI (kg/m^2)	**1.366**	**0.073**
<18.5		
18.5-22.9		
23-24.9		
25-30		
>30		
Vaccination History		
Influenza Vaccine	**10.970**	**0.008**
No		
Yes		
Pneumococcal Vaccine	**10.307**	**0.895**
No		
Yes		
Underlying Disease		
Hypertension	**3.945**	**0.992**
Diabetes	**1.999**	
Respiratory Disease	**0.744**	
Cardiovascular Disease	**1.006**	

Table 3. COVID-19 pandemic and vaccine-related factors associated with COVID-19 booster vaccine hesitancy

COVID- 19 Pandemic and Vaccine Related Information	Acceptance		Hesitancy		Hesitancy Rate	p-value
	n	%	n	%	%	
How much do you know about COVID- 19?						
No knowledge	0	0	0	0	N/A	**<0.0001**
Little knowledge	5	10.42	32	23.70	**86.5**	
Some knowledge	39	81.25	101	74.81	72.1	
Very knowledgeable	4	8.33	2	1.48	33.3	
Is there a patient with COVID- 19 in your neighborhood?						
No	44	91.67	131	97.04	**74.9**	0.002
Yes	4	8.33	4	2.96	50	
Do you know anyone who has been infected with COVID- 19?						
No	29	60.42	100	74.07	**77.5**	**<0.0001**
Yes	19	39.58	35	25.93	64.8	
Do you know anyone who has died due to COVID- 19?						
No	36	75.00	110	81.48	**75.3**	**<0.0001**
Yes	12	25.00	25	18.52	67.6	
Do you think the manufacturer of the COVID- 19 vaccine influenced your decision to get vaccinated?						
No	40	83.33	113	83.70	73.9	**0.92**
Yes	8	16.67	22	16.30	73.3	

Table 4. Primary source of COVID-19 information.

Primary Source	Acceptance	Hesitancy	n
Television, Radio	46	113	159
Friends, Relatives	15	61	76
Newspaper	6	17	23
Social Network	7	16	23
Others: Website	1	0	1

Table 5. Perceived reasons of hesitancy or refusal of COVID-19 booster vaccine.

Reasons of Hesitancy	n
Primer doses are sufficient	44
Have underlying medical condition	37
Heard or read negative media	36
Observe potential adverse effects from others	27
Bad reaction/experience from previous vaccination	10
Low risk of infection because I rarely go outside	2

DISCUSSION

The demographic profile of participants in this study reflected a predominantly female, older adult population, with a majority being married and having attained at least a high school education. The high prevalence of participants reporting no food or drug allergies suggests a generally healthy cohort, while the relatively low rates of influenza and pneumococcal vaccination highlight potential gaps in preventive healthcare utilization among the study population The findings suggested that while television and radio remain widely utilized sources of COVID-19 information across both acceptance and hesitancy groups, there are notable differences in information-seeking behaviors. Understanding these differences could inform targeted communication strategies to address concerns and misinformation among hesitant individuals, potentially improving vaccine acceptance and public health outcomes[10,11]. Additionally, the limited utilization of newspapers, social networks, and other websites underscores the importance of focusing efforts on channels that have the greatest reach and impact on vaccine-related attitudes and behaviors. The findings highlighted diverse factors contributing to COVID-19 booster vaccine hesitancy or refusal, including concerns about vaccine efficacy and safety, as well as external influences such as media portrayal and personal experiences[10,12]. Addressing these multifaceted reasons through targeted education, communication campaigns, and tailored interventions may help increase vaccine acceptance and uptake, particularly among individuals with underlying medical conditions or concerns about adverse effects. The analysis indicated that higher educational attainment is associated with reduced COVID-19 booster vaccine hesitancy, suggesting that educational interventions could be key in addressing vaccine hesitancy. From a healthcare provider perspective, these findings highlight the importance of understanding the diverse factors influencing vaccine hesitancy to better guide patients through informed decision-making processes[13]. For patients, this means receiving clear, accurate information and reassurance from trusted sources. For the health system, these insights can inform the development of more effective public health campaigns and policies aimed at increasing vaccine uptake and enhancing overall community health outcomes.

Similar findings have been reported by previous studies which found that higher educational levels were associated with lower vaccine hesitancy, emphasizing the role of education in health-related decision-making[14,15]. This aligns with our finding that educational attainment significantly reduces COVID-19 booster vaccine hesitancy. Conversely, misinformation and distrust in government and health authorities were significant barriers to vaccine acceptance, which differs from our findings where the type of vaccine manufacturer did not significantly influence hesitancy[16]. This discrepancy could be attributed to varying levels of trust in health systems and authorities across different populations and cultural contexts.

This study has several limitations that should be acknowledged. The cross-sectional design limits the ability to establish causality between the identified factors and vaccine hesitancy. The use of purposive sampling may introduce selection bias, as the sample may not be fully representative of the general elderly population. Additionally, self-reported data on medical history and vaccination status are subject to recall bias. Despite these limitations, the findings provide valuable insights into factors influencing COVID-19 booster vaccine hesitancy among the elderly, highlighting the need for targeted educational campaigns and communication strategies to enhance vaccine acceptance. Future research should consider longitudinal studies to better understand causative factors and address potential biases more comprehensively.

CONCLUSION AND RECOMMENDATION

This study aimed to identify factors associated with COVID-19 booster vaccine hesitancy among elderly patients, concluding that a range of sociodemographic and health-related factors significantly influence hesitancy. Among the 183 elderly participants aged 60-86 years, predominantly female (69.4%) and married (68.3%), higher hesitancy rates were observed among those aged 80 years and older, females, individuals with lower educational attainment, and single participants. Health conditions such as hypertension, respiratory disease, and diabetes also contributed to hesitancy. Furthermore, participants with little knowledge about COVID-19 and those without a history of receiving influenza or pneumococcal vaccines showed higher hesitancy. These findings underscore the complexity of vaccine hesitancy among the elderly and highlight the need for tailored interventions to address these diverse factors.

To effectively combat COVID-19 booster vaccine hesitancy among the elderly, a multifaceted approach is necessary. Increasing educational efforts focused on older adults, particularly those with lower educational attainment, and providing clear, accurate information about vaccine safety and efficacy is crucial. Personalized communication strategies that consider the patient's age, gender, educational background, and health status should be adopted by healthcare providers to address individual concerns more effectively and build trust. Promoting a culture of vaccination by highlighting the benefits of routine vaccines such as influenza and pneumococcal vaccines can help establish trust and acceptance for COVID-19 boosters. Leveraging trusted information sources like television and radio to disseminate vaccine-related information and developing specific interventions for individuals with chronic health conditions are essential. These strategies should be generalizable to other similar settings, but further research is needed to validate these results in different regions and healthcare environments. Longitudinal studies and the exploration of specific communication strategies' impact on vaccine uptake across various demographic groups could result to a more effective public health campaigns globally.

REFERENCES

1. WHO Coronavirus (COVID-19) Dashboard. With Vaccination Data. 2023 [cited 2023 Jan 31]. Available from: https://covid19.who.int/

2. Yusuf F, Fahriani M, Mamada SS, Frediansyah A, Abubakar A, Maghfirah D, et al. Global prevalence of prolonged gastrointestinal symptoms in COVID-19 survivors and potential pathogenesis: A systematic review and meta-analysis. F1000Research. 2021;10:301. doi: 10.12688/f1000research.52216.1

3. Department of Health. COVID-19 Tracker. 2023 [cited 2023 Jan 31]. Available from: https://doh.gov.ph/covid19tracker

4. Austria H. Pangasinan Hits 75% Vaccination. Philippine News Agency. 2022 Aug 10 [cited 2022 Aug 10]. Available from: https://www.pna.gov.ph/articles/1169717?fbclid=IwAR3oKj6B4c9o70dqra-T8JzqQaqr7bk8m2nGoVO9k0nRGz8qHk8jxhrDgDo

5. Thanapluetiwong S, Chansirikarnjana S, Sriwannopas O, Assavapokee T, Ittasakul P. Factors associated with COVID-19 vaccine hesitancy in Thai seniors. Patient Prefer Adherence 2021;15 :2389–403. doi: 10.2147/ppa.s334757

6. Rosenberg ES, Holtgrave DR, Dorabawila V, Conroy M, Greene D, Lutterloh E, et al. New COVID-19 cases and hospitalizations among adults, by vaccination status - New York, May 3–July 25, 2021. MMWR Morb Mortal Wkly Rep 2021;70(34):1150–5. doi: 10.15585/mmwr.mm7034e1

7. Amit AML, Pepito VCF, Sumpaico-Tanchanco L, Dayrit MM. COVID-19 vaccine brand hesitancy and other challenges to vaccination in the Philippines. PLoS Glob Public Health 2022;2(1):e0000165. doi: 10.1371/journal.pgph.0000165

8. Khan MSR, Watanapongvanich S, Kadoya Y. COVID-19 Vaccine Hesitancy among the younger generation in Japan. Int J Environ Res Public Health 2021;18(21):11702. doi: 10.3390/ijerph182111702

9. Wu J, Ma M, Li Q, Guo X, Tarimo CS, Jia S, et al. Dynamic trends and underlying factors of COVID-19 vaccine booster hesitancy in adults: Cross-sectional observational study. JMIR Public Health Surveill. 2023;9:e44822. doi: 10.2196/44822

10. National Foundation for Infectious Diseases. Why Vaccinations Are Vital for Older Adults. 2021 [cited 2022 May 3]. Available from: https://www.nfid.org/2021/09/24/why-vaccinations-are-vital-forolderadults/#:%7E:text=Vaccines%20can%20help%20prevent%20flu,get%20vaccinated%20for%20COVID%2D19.

11. Syed Alwi SAR, Rafidah E, Zurraini A, Juslina O, Brohi IB, Lukas S. A survey on COVID-19 vaccine acceptance and concern among Malaysians. BMC Public Health 2021;21(1). doi: 10.1186/s12889-021-11071-6

12. Marzo RR, Sami W, Alam MZ, Acharya S, Jermsittiparsert K, Songwathana K, et al. Hesitancy in COVID-19 vaccine uptake and its associated factors among the general adult population: a cross-sectional study in six Southeast Asian countries. Trop Med Health 2022;50(1). doi: 10.1186/s41182-021-00393-1

13. Larson HJ, Hartigan-Go K, de Figueiredo A. Vaccine confidence plummets in the Philippines following dengue vaccine scare: why it matters to pandemic preparedness. Hum Vaccin Immunother 2018; 15(3): 625–7. doi: 10.1080/21645515.2018.1522468

14. Alibrahim J, Awad A. COVID-19 vaccine hesitancy among the public in Kuwait: A cross-sectional survey. Int J Environ Res Public Health 2021;18(2):885. doi: 10.3390/ijerph18020885

15. Landicho-Guevarra J, Reñosa MDC, Wachinger J, Endoma V, Aligato MF, Bravo TA, et al. Scared, powerless, insulted and embarrassed: hesitancy towards vaccines among caregivers in Cavite Province, the Philippines. BMJ Glob Health 2021;6(9):e006529. doi: 10.1136/bmjgh-2021-006529

16. Wang Q, Yang L, Jin H, Lin L. Vaccination against COVID-19: A systematic review and meta-analysis of acceptability and its predictors. Prev Med 2021; 150: 106694. doi: 10.1016/j.ypmed.2021.106694

17. Razai MS, Chaudhry UAR, Doerholt K, Bauld L, Majeed A. Covid-19 vaccination hesitancy. BMJ 2021; n1138. doi: 10.1136/bmj.n1138

18. Centers for Disease Control and Prevention. COVID-19 and Your Health. 2020 [cited 2022 May 1]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/your-health/about-covid-19/basics-covid-19.html

19. World Health Organization. Strategic Advisory Group of Experts (SAGE) on Immunization. 2021 [cited 2022 May 3]. Available from: https://www.who.int/groups/strategic-advisory-group-of-experts-on-immunization