



Preparedness of Health Professionals to Take COVID-19 Vaccination at Jugal Hospital, Harar, Ethiopia, 2021

Sağlık Profesyonellerinin COVID-19 Aşısı Yaptırmaya Hazır Bulunuşluğu, Jugal Hastanesi, Harar, Etiyopya, 2021

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Abstract

Introduction: Worldwide, vaccine doubtfulness is a growing menace to health safety. The World Health Organization named it as one of the top ten fears to health in 2019. Substantial rejection of the COVID-19 vaccine by healthcare experts can produce a bad image of Coronavirus disease 2019 (COVID-19) vaccination on the public because healthcare workers are pioneers for the general public. This research is aimed to assess the preparedness of health professionals to take COVID-19 vaccination in Jugal Hospital.

Methods: Hospital-based cross-sectional study was executed among health professionals from October 1 to October 15, 2021. The census method, applied for sampling method, was used. The data were collected using self-administered questionnaires. The data were explored using IBM SPSS software package version 20.0. Monovariate, bivariate, and multivariate logistic regression analyses were performed. In multivariate analysis, statistically significant variables were selected based on p-values (<0.05), and the adjusted odds ratio (AOR) was used to describe the strength of association with a 95% confidence interval (CI).

Results: Among the participants, 35.32% of health professionals wished to receive the COVID-19 vaccine, whereas the rest (64.68%) showed vaccine hesitancy. Preparedness to receive COVID-19 vaccination was significantly associated with sex (AOR=2.41; 95% CI: 1.240–4.845; p=0.013), professionals with a history of chronic illness (AOR=9.15; 95% CI: 2.02–12.17), and perceived degree of risk of COVID-19 infection (AOR=3.64; 95% CI: 2.26–6.79).

Discussion and Conclusion: Overall, this study showed low acceptance and high doubtfulness of the COVID-19 vaccine among health professionals in Jugal Hospital. Addressing uncertainties related to vaccine safety and giving more information on the safety of vaccines may be necessary to eliminate doubts.

Keywords: COVID-19 vaccine hesitancy; Healthcare professionals; Preparedness

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Coronavirus disease 2019 (COVID-19), first reported in December 2019,^[1] was affirmed a worldwide epidemic by the World Health Organization (WHO) on March 11, 2020.^[2] It spread around the world and became the utmost community health disaster of the world in this era.^[3]

As of November 2021, the virus had infected almost 252 million people worldwide, and the number of deaths had reached five million.^[4] In Ethiopia, 368,106 positive coronavirus cases were found. The count of death due to the virus was 6583, and the recovery count was 343,898.^[5]

According to the WHO, at least 115,000 health professionals succumbed to COVID-19.^[4] Morbidity was high among nurses, whereas mortality was high among doctors. It might be due to less availability of personal protective equipment or a high flow of patients.^[6]

On March 26, 2021, 83 vaccines were in the clinical development stage and 184 were at the preclinical development stage.^[7] Internationally, many vaccines have been considered safe and effective for human use, such as Pfizer, Oxford/AstraZeneca, Moderna, Janssen, Sputnik V, Sinovac, and Sinopharm.^[8–11] Vaccine effectiveness extending from 50% to 95% has been tested.^[12] Some vaccines need to be taken twice, whereas others just once, various manufacturing stages of the vaccines make encounter in vaccine selection among the community.^[13]

Due to the insufficient stock of COVID-19 vaccines worldwide, governments have prioritized highly jeopardizing groups to get the first stock of vaccines. Health professionals were among the ones in the group.^[14]

Vaccine hesitancy is defined as a delay in taking or rejecting vaccination despite its obtainability.^[15] In 2014, the WHO strategic advisory group of experts produced a report on vaccination and classified people into three groups: confidence, complacency, and convenience.^[16] COVID-19 is a soaring danger to worldwide health security, and the WHO named it as one of the top ten intimidations to global health in 2019.^[17]

Averting vaccine doubtfulness among health professionals is essential because they are the most significant part of the public and primacy target group to be inoculated. Even in industrialized nations, health professionals have shown distrust toward vaccines.^[18,19] This is a great apprehension as they are the most trustworthy sources for the public, and their reluctance on vaccines will create an impact on the public.

This research is aimed to assess the preparedness of health professionals to take COVID-19 vaccination.

Materials and Methods

Study Design, Period, Population, and Data Collection

A hospital-based quantitative cross-sectional study was performed; there were around 285 healthcare professionals in the hospital. The data were collected from October 1 to October 15, 2021. As the total number of health professionals is few, all healthcare workers working in the hospital were considered the source population. All healthcare workers in the hospital who had direct contact with patients were included in the study. However, healthcare workers who were absent at the time of data collection and who did not want to participate in the study were excluded. A self-administered questionnaire was used to collect the data.

Data Processing and Analysis

IBM SPSS software package version 20.0 (IBM Corp, Armonk, NY) was used for entering, cleaning, and analyzing. First descriptive statistics of percentages and frequency distribution using tables and figures were carried out to explore the sociodemographic characteristics.

Logistic regression was used to assess the association between the dependent and independent variables. All factors with $p < 0.05$ in the bivariate logistic regression analysis were further entered into a multivariate model to control confounding effects (Table 1). Adjusted odds ratio (AOR) with 95% confidence interval (CI) and p -value were calculated. A p -value < 0.05 was considered statistically significant.

Ethical Considerations

Ethics approval was obtained (Ref. no. HHSC-079/2021), and consent was obtained from all participants. Confidentiality was maintained throughout the study.

Results

Sociodemographic Characteristics

Among 285 participants, 252 filled the questionnaires, which makes a response rate of 88.42%. Of these, 111 (44.05%) respondents were in the age group 31–45 years, 131 (51.98%) were male, 150 (59.52%) were not married, 102 (40.48%) were nurses, and 155 (61.51%) had 3–5 years of work experience (Table 2).

Health Status and COVID-19 Experience of the Participants

Among the participants, more than a quarter (28.97%) had a chronic disease. About three-fourths (75%) of the respon-

Table 1. Socio-demographic characteristics of the health care workers (n=252)

Variables	Category	Frequency	Percentage
Age category (in years)	18–30	86	34.13
	31–45	111	44.05
	46–60	45	17.86
	61+	10	3.97
Sex	Male	131	51.98
	Female	121	48.02
Marital status	Married	102	40.48
	Not married	150	59.52
Profession type	Specialist	6	2.38
	Emergency surgeon	3	1.19
	Physicians (health officers)	33	13.10
	Nurse	102	40.48
	Midwifery	36	14.29
	Medical laboratory	10	3.97
	Pharmacist and pharmacy technician	26	10.32
	X-ray technician	10	3.97
	Anesthetist	9	3.57
	Others	17	6.75
Highest qualification level	Diploma	122	48.41
	1 st degree	121	48.02
	2 nd degree	9	3.57
Years of working experience	1–2	65	25.79
	3–5	155	61.51
	More than 5	30	11.90

dents stated that they had direct contact with COVID-19 patients. Only 7 (2.78%) stated a previous COVID-19 infection, and 27 (10.71%) had tested for COVID-19. Of these, 177 (70.24%) participants perceived that they were at a higher risk of COVID-19 infection (Table 3).

Vaccine Uncertainty and Willingness to Accept COVID-9 Vaccine

Less than half of the healthcare workers (35.32%) believed that the COVID-19 vaccine was safe and wanted to get vaccinated, whereas 60.32% did not intend to take vaccines and the rest (4.37%) did not decide. Among 152 health professionals who were not willing to get vaccinated, 147 (96.71%) expressed a fear of the side effects of COVID-19 vaccines (Table 4).

Factors Associated with Healthcare Workers Intention to Accept COVID-19 Vaccine

After controlling for possible confounders, sex, chronic illness, and risk to COVID-19 were statistically associated with healthcare workers’ willingness to take COVID-19. The count of female healthcare workers who expressed

their willingness to take the COVID-19 vaccine was two times more than that of male healthcare workers (AOR=2.41; 95% CI: 1.240–4.845; p=0.013). The intention of healthcare workers with a history of chronic illness to take the COVID-19 vaccine was nine times more than those without a history of chronic illness (AOR=9.15; 95% CI: 2.02–12.17). Healthcare workers who perceived a high degree of risk had four times more intention than those who perceived a low degree of risk (AOR=3.64; 95% CI: 2.26–6.79).

Discussion

In this study, 35.32% of healthcare workers were prepared to take the COVID-19 vaccine, which was more than the number of participants in a study conducted in the Democratic Republic of Congo (28%),^[20] but less than that in studies performed in southwestern Ethiopia (48.4%),^[21] Ghana (39.3%),^[22] and Nepal (38.3%).^[23] The percentage of participants in the study was lower than a cross-sectional survey conducted in 10 countries: 58% in the Eastern Mediterranean region,^[24] 68.8% in Turkey,^[25] 50% in Malta,^[26] and 48.6% in France and French-speaking part of

Table 2. Health status and COVID-19 experience of the health care workers (n=252)

Variables	Category	Frequency	Percentage
Do you have chronic disease	Yes	73	28.97
	No	179	71.03
Are you infected by COVID-19	Yes	7	2.78
	No	245	97.22
Direct contact with anyone diagnosed with COVID-19 at the hospital	Yes	189	75.00
	No	63	25.00
Do you have Direct contact with anyone diagnosed with COVID-19 outside hospital	Yes	38	15.08
	No	214	84.92
Do you Know any friends, neighbors, or colleagues infected by Coronavirus	Yes	252	100.00
	No	0	0.00
Have you ever tested for COVID-19	Yes	27	10.71
	No	225	89.29
What was your Results of COVID test	Positive	7	25.93
	Negative	18	66.67
	I don't know	2	7.41
How do you Perceived susceptibility to COVID-19 infection for yourself	High	177	70.24
	Medium	75	29.76
	Low	0	0.00

Belgium and Canada.^[27] The discrepancy might be methodological, such as study area, study period, and socio-economic differences.

In this study, male healthcare workers had more intention to take the COVID-19 vaccine than female healthcare workers. This finding is consistent with the results of other studies which indicate that male healthcare workers are more likely to accept COVID-19 vaccines compared with female healthcare workers.^[28-35] Many studies reported that the reasons for gender difference in COVID-19 vaccine acceptance may be due to higher risks for COVID-19 hospitalization, infection, and death among males.^[36-38]

This study showed that COVID-19 vaccine acceptance was more among participants who perceived a higher degree of risk to COVID-19 infection. The result of this study was also supported by the findings of other studies which state that fear of COVID-19 and self-perceived risk of coronavirus infection were associated with COVID-19 vaccine acceptance among healthcare workers.^[39] Vaccine acceptance may be promoted by the perceived susceptibility and creating awareness on the seriousness of the infectious disease.^[40]

In this study, healthcare workers with chronic illnesses were found to have high intention to take COVID-19 vaccines than their counter partners. This may be related to the high risk of COVID-19-related lethality combined with the presence of chronic medical illness.^[41] A possi-

Table 3. Vaccine hesitancy and intention to accept COVID-9 vaccine among health care workers (n=252)

Is the vaccine needed to end the pandemic?		
Yes	187	74.21
No	65	25.79
I don't know	11	4.37
Should healthcare workers receive the vaccine?		
Yes	187	74.21
No	54	21.43
I don't know	11	4.37
Are vaccines safe?		
Yes	89	35.32
No	11	4.37
I don't know	152	60.32
Are you willing to be vaccinated if the vaccine is offered to you?		
Yes	89	35.32
No	152	60.32
Not decide	11	4.37
If no, what is your reason for refusal?		
Unreliability of COVID-19 vaccine clinical trials	143	94.08
Fear of the vaccine's side effects	147	96.71
Vaccine would not give immunity for long period	107	70.39
Fear of acquiring COVID-19 through the vaccination	97	63.82
Preference for Natural Immunity	77	50.66

ble reason might be healthcare workers are aware that underlying chronic disease conditions are a higher risk factor of infection and death from COVID-19.

Table 4. Bivariate and Multivariate analysis

Variables Injury	COR with 95% CI	AOR with 95% CI	p
Sex			
Male	1	1	
Female	2.03 (1.619–6.108)*	2.41 (1.24–4.85)**	0.013
Highest qualification level			
Diploma	1		
Above diploma	3.02 (1.95–6.18)*	1.03 (0.297,5.41)	0.092
Are you infected by COVID-19 previously?			
Yes	3.01 (1.32–6.10)*	2.03 (0.27,3.48)	0.083
No	1		
Health care workers with a history of chronic illness			
Yes	4.54 (1.19–8.18)*	9.15 (2.02,12.17)**	0.011
No	1	1	
How do you Perceive susceptibility of yourself to COVID 19 infection			
High	3.11 (2.92–7.11)*	3.64 (2.26–6.79)**	0.001
Low	1		

*: Significant at p<0.05 in bivariate analysis; **: Significant at p<0.05 in multivariate analysis; COR: Crude odds ratio; AOR: Adjusted odds ratio; CI: Confidence interval.

This study reported that the most common reason for the refusal of the COVID-19 vaccine by healthcare professionals was the fear of potential side effects of the COVID-19 vaccine, which matches with other studies performed on the COVID-19 vaccine hesitancy worldwide.^[42–46]

Limitations

This study was a cross-sectional study, and therefore temporal relationship was not known. Also, the study included only one public government hospital and did not represent all health professionals in Harar, Ethiopia.

Conclusion

This study showed that preparedness to accept the COVID-19 vaccine was relatively small (35.32%), whereas hesitancy was high (64.68%). The rejection of the COVID-19 vaccine by healthcare professionals can create an undesired image of the COVID-19 vaccination program to the general public because healthcare workers are considered the pioneers. The findings of this research demonstrate that awareness of the benefit of COVID-19 vaccination is needed among healthcare providers.

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References

1. World Health Organization. Archived: WHO timeline - COVID-19. Available at: <https://www.who.int/news/item/27-04-2020-who-timeline---covid-19>. Accessed Aug 23, 2021.
2. World Health Organization. WHO Director-General’s opening remarks at the media briefing on COVID-19. Available at: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>. Accessed Feb 16, 2022.
3. UNHCR Malaysia. Public Health during COVID-19. Available at: <https://www.unhcr.org/en-my/health-covid-19.html>. Accessed 23 Aug 2021.
4. World Health Organization. WHO Health Emergency Dashboard. Available at: <https://covid19.who.int/>. Accessed Feb 17, 2022.
5. Worldometer. Available at: <https://www.worldometers.info/coronavirus/country/ethiopia>. Accessed Feb 17, 2022.
6. NHS Providers. Mental health PPE and testing concerns must be addressed. Available at: <https://nhsproviders.org/news-blogs/news/mental-health-ppe-and-testing-concerns-must-be-addressed>. Accessed Feb 17, 2022.
7. World Health Organization. Landscape of novel coronavirus candidate vaccine development worldwide. Geneva, Switzerland: WHO; 2021. Available at: <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>. Accessed Feb 17, 2022.
8. Dal-Ré R, Stephens R, Sreeharan N. "Let me choose my COVID-19 vaccine". *Eur J Intern Med* 2021;87:104–5. [CrossRef]

9. Jones I, Roy P. Sputnik V COVID-19 vaccine candidate appears safe and effective. *Lancet* 2021;397(10275):642–3. [CrossRef]
10. Schraer R. COVID-19: Sputnik vaccine gives 92% protection in trial. Available at: <https://www.bbc.com/news/health-55900622>. Accessed Feb 17, 2022.
11. Cohen J. Dosing debates, transparency issues roil vaccine roll-outs. *Science* 2021;371 (6525):109–10. [CrossRef]
12. Kim JH, Marks F, Clemens JD. Looking beyond COVID-19 vaccine phase 3 trials. *Nat Med* 2021;27(2):205–11. [CrossRef]
13. Schwarzingler M, Watson V, Arwidson P, Alla F, Luchini S. COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics. *Lancet Public Health* 2021;6(4):e210–21. [CrossRef]
14. Kaur SP, Gupta V. COVID-19 Vaccine: A comprehensive status report. *Virus Res* 2020;288:198114. [CrossRef]
15. Jacobson RM, St Sauver JL, Finney Rutten LJ. Vaccine hesitancy. *Mayo Clin Proc* 2015;90(11):1562–8. [CrossRef]
16. MacDonald NE; SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;33(34):4161–4. [CrossRef]
17. World Health Organization. Ten threats to global health in 2019. Available at: <https://www.who.int/vietnam/news/feature-stories/detail/ten-threats-to-global-health-in-2019>. Accessed 31 Mar 2021.
18. Adebisi YA, Alaran AJ, Bolarinwa OA, Akande-Sholabi W, Lucero-Prisno DE. When it is available, will we take it? Social media users' perception of hypothetical COVID-19 vaccine in Nigeria. *Pan Afr Med J* 2021;38:230. [CrossRef]
19. Schaffer DeRoo S, Pudalov NJ, Fu LY. Planning for a COVID-19 Vaccination Program. *JAMA* 2020;323(24):2458–9. [CrossRef]
20. Ditekemena JD, Nkamba DM, Mutwadi A, Mavoko HM, Siewe Fodjo JN, Luhata C, et al. COVID-19 vaccine acceptance in the Democratic Republic of Congo: a cross-sectional survey. *Vaccines (Basel)* 2021;9(2):153. [CrossRef]
21. Angelo AT, Alemayehu DS, Dachew AM. Health care workers intention to accept COVID-19 vaccine and associated factors in southwestern Ethiopia, 2021. *PLoS One* 2021;16(9):e0257109.
22. Agyekum MW, Afrifa-Anane GF, Kyei-Arthur F, Addo B. Acceptability of COVID-19 vaccination among health care workers in Ghana. *Advances in Public Health* 2021;9998176. [CrossRef]
23. Paudel S, Palaian S, Shankar PR, Subedi N. Risk perception and hesitancy toward COVID-19 vaccination among healthcare workers and staff at a medical college in Nepal. *Risk Manag Healthc Policy* 2021;14:2253–61. [CrossRef]
24. Elhadi YAM, Mehanna A, Adebisi YA, Alnahari HM, Alenezi OH, Yahya DC, et al. Willingness to Vaccinate against COVID-19 among Healthcare Workers: An Online Survey in 10 Countries in the Eastern Mediterranean Region. *medRxiv Jun 13, 2021*, doi: 10.1101/2021.03.20.21253892. [CrossRef]
25. Kose S, Mandiracioglu A, Sahin S, Kaynar T, Karbus O, Ozbel Y. Vaccine hesitancy of the COVID-19 by health care personnel. *Int J Clin Pract* 2020;e13917. [CrossRef]
26. Grech V, Gauci C, Agius S. Withdrawn: Vaccine hesitancy among Maltese Healthcare workers toward influenza and novel COVID-19 vaccination. *Early Hum Dev* 2020:105213.
27. Verger P, Scronias D, Dauby N, Adedzi KA, Gobert C, Bergeat M, et al. Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020. *Euro Surveill* 2021;26(3):2002047.
28. Ruiz JB, Bell RA. Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey. *Vaccine* 2021;39(7):1080–6. [CrossRef]
29. Temsah MH, Barry M, Aljamaan F, Alhuzaimi A, Al-Eyadhy A, Saddik B, et al. Adenovirus and RNA-based COVID-19 vaccines' perceptions and acceptance among healthcare workers in Saudi Arabia: a national survey. *BMJ Open* 2021;11(6):e048586.
30. Baumgaertner B, Ridenhour BJ, Justwan F, Carlisle JE, Miller CR. Risk of disease and willingness to vaccinate in the United States: A population-based survey. *PLoS Med* 2020;17(10):e1003354. [CrossRef]
31. Neumann-Böhme S, Varghese NE, Sabat I, Barros PP, Brouwer W, van Exel J, et al. Once we have it, will we use it? A European survey on willingness to be vaccinated against COVID-19. *Eur J Health Econ* 2020;21(7):977–82. [CrossRef]
32. Shaw J, Stewart T, Anderson KB, Hanley S, Thomas SJ, Salmon DA, et al. Assessment of US healthcare personnel attitudes towards coronavirus disease 2019 (COVID-19) vaccination in a large university healthcare system. *Clin Infect Dis* 2021;73(10):1776–83. [CrossRef]
33. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, Banza Ndala DB, Mbidi Miema J, Luhata Lungoyo C, et al. Acceptability of vaccination against COVID-19 among healthcare workers in the Democratic Republic of the Congo. *Pragmat Obs Res* 2020;11:103–9. [CrossRef]
34. Shekhar R, Sheikh AB, Upadhyay S, Singh M, Kottewar S, Mir H, et al. COVID-19 vaccine acceptance among health care workers in the United States. *Vaccines (Basel)* 2021;9(2):119. [CrossRef]
35. Gagneux-Brunon A, Detoc M, Bruel S, Tardy B, Rozaire O, Frappe P, et al. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey. *J Hosp Infect* 2021;108:168–73.
36. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020;395(10223):507–13. [CrossRef]
37. Galbadage T, Peterson BM, Awada J, Buck AS, Ramirez DA, Wilson J, et al. Systematic review and meta-analysis of sex-specific COVID-19 clinical outcomes. *Front Med (Lausanne)* 2020;7:348. [CrossRef]
38. Peckham H, de Gruijter NM, Raine C, Radziszewska A, Ciurtin C, Wedderburn LR, et al. Male sex identified by global COVID-19 meta-analysis as a risk factor for death and ICU admission. *Nat Commun* 2020;11(1):6317. [CrossRef]
39. Kociolek LK, Elhadary J, Jhaveri R, Patel AB, Stahulak B, Cartland J. Coronavirus disease 2019 vaccine hesitancy among children's hospital staff: A single-center survey. *Infect Control Hosp Epidemiol* 2021;42(6):775–7. [CrossRef]
40. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J.

- Vaccine hesitancy: an overview. *Hum Vaccin Immunother* 2013;9(8):1763–73. [\[CrossRef\]](#)
41. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al; China Medical Treatment Expert Group for Covid-19. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020;382(18):1708–20. [\[CrossRef\]](#)
 42. Chou WS, Budenz A. Considering emotion in COVID-19 vaccine communication: addressing vaccine hesitancy and fostering vaccine confidence. *Health Commun* 2020;35(14):1718–22.
 43. Dror AA, Eisenbach N, Taiber S, Morozov NG, Mizrahi M, Zigran A, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. *Eur J Epidemiol* 2020;35(8):775–9. [\[CrossRef\]](#)
 44. Khan YH, Mallhi TH, Alotaibi NH, Alzarea AI, Alanazi AS, Tanveer N, et al. Threat of COVID-19 vaccine hesitancy in Pakistan: the need for measures to neutralize misleading narratives. *Am J Trop Med Hyg* 2020;103(2):603–4. [\[CrossRef\]](#)
 45. Murphy J, Vallières F, Bentall RP, Shevlin M, McBride O, Hartman TK, et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nat Commun* 2021;12(1):29. [\[CrossRef\]](#)
 46. Roy B, Kumar V, Venkatesh A. Health care workers' reluctance to take the Covid-19 vaccine: a consumer-marketing approach to identifying and overcoming hesitancy. *NEJM Catalyst Innovations in Care Delivery* 2021;1(6).