

The attitudes and perceptions towards the Covid-19 vaccine among dental staff at the University of the Western Cape, South Africa

SADJ July 2022, Vol. 77 No. 6 p346 - p351

F Kimmie-Dhansay¹, N Potgieter², L Roodt³, D Parumaul⁴, I Pretorius⁵, C Prins⁶, SL Ramaphoko⁷, S Rhini⁸, C Ruiters⁹, S Naidoo¹⁰

ABSTRACT

Introduction

Despite the well-known increased risk of exposure to the Covid-19 virus in a dental setting, vaccination rates among staff members are low. This information, as well as the possible associations to demographic profiles, may be useful for authorities to adequately address specific concerns and uncertainties.

Aims and Objectives

To determine the attitudes and perceptions towards the COVID-19 vaccine among dental staff at the UWC Oral Health Centers.

Design

A cross-sectional design was used.

Methods

An anonymous, online, validated questionnaire was used to collect the data.

Results

Majority (91.4%) of the participants had received the Covid-19 vaccine while just over 12% stated that they would not take the booster vaccination. Significant associations between the level of education and the attitudes and perceptions of staff were found.

Conclusions

While the majority had a positive attitude towards the Covid-19 vaccine, specific concerns and uncertainties were identified and will need to be addressed in order to improve vaccination rates among staff members.

Keywords: "Covid-19 vaccine"; "vaccine hesitancy"; "cross-sectional study"; "South Africa"; "Dental Staff"

Author affiliations:

1. Faheema Kimmie-Dhansay: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
2. Nicoline Potgieter: Department of Paediatric Dentistry, Faculty of Dentistry, University of the Western Cape, South Africa
3. Lida Roodt: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
4. Dhinita Parumaul: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
5. Irene Pretorius: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
6. Carlien Prins: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
7. Samuel Lebea Ramaphoko: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
8. Sisipho Rhini: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
9. Corrine Ruiters: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa
10. Sudeshni Naidoo: Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa

Corresponding author: Faheema Kimmie-Dhansay

Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa

E-mail: fkimmie@uwc.ac.za;

Tel: +27 21 937 3152

Author contributions:

Faheema Kimmie-Dhansay:	16%
Nicoline Potgieter:	16%
Lida Roodt:	9%
Dhinita Parumaul:	9%
Irene Pretorius:	9%
Carlien Prins:	9%
Samuel Lebea Ramaphoko:	9%
Sisipho Rhini:	9%
Corrine Ruiters:	9%
Sudeshni Naidoo:	5%

INTRODUCTION

COVID-19 is a communicable disease that is also known as severe acute respiratory syndrome coronavirus 2 (SARS-COV 2) and was announced a pandemic on the 11th of March 2020^{1,2}. The Covid-19 virus's most common route of spread is through tiny droplets propelled during coughing or speech from individuals infected with the virus, within a space of 6 feet¹.

According to the National Institute for Communicable Diseases, the first COVID-19 case in South Africa was identified and recorded on the 5th of March 2020 in KwaZulu-Natal³. The first confirmed case of COVID-19 reported in the Western Cape was on the 11th of March 2020 in the City of Cape Town⁴. There are 9 provinces in South Africa, and the Western Cape Province is the 3rd largest province with a population of nearly 7 million people, according to the Western Cape Government official website. The total number of positive COVID-19 cases for the Western Cape, up to the 05 of January 2022, was 3 494 696 infections, with a total of 91 561 deaths⁵.

Global efforts were made to develop an effective and safe vaccine against this COVID-19 virus. The following vaccines were developed with different approaches: Oxford Univ-AstraZeneca, Gamaleya Sputnik V

and Johnson & Johnson (vital vector, genetically modified virus); Pfizer-BioNTech, Moderna, Curevac and Curevac (RNA, nucleic acid, incorporating part of the virus genetic code); Sinopharm and Sinovac (Inactivated or attenuated virus); Inovio (DNA, synthetic DNA fragments) and EpiVAcCorona and Novavax (Protein subunit)⁶. According to a recent systematic review, the effectiveness of COVID-19 vaccines against a range of SARS-CoV-2 outcomes showed an 89.1% vaccine effectiveness for the prevention of infection, 97.2% prevention in hospitalizations, 97.4% vaccine effectiveness for the prevention of ICU admission or severe disease and 99.0% effectiveness for the prevention of COVID-19 related deaths⁷. The Johnson & Johnson, PfizerBioNTech vaccine is currently implemented, specifically for health care workers through the Sisonke Programme in South Africa⁸.

Although the Johnson & Johnson vaccine program may not eliminate COVID-19, it provides the best protection against severe COVID-19 cases that result in hospitalization and death⁹, but it is not as effective as Moderna and Pfizer-BioNTech, or compared to single dose Johnson & Johnson vaccines¹⁰. To date, more than 9.37 billion vaccine doses have been administered globally¹¹. As of the 7th January 2022, 28.3 million doses have been administered against the COVID-19 across South Africa¹². According to the Centre for Disease Control and Prevention, the side effects of the Johnson & Johnson vaccine and Pfizer vaccine are similar which include pain, redness, localized swelling at injection site, fatigue, headaches, flu-like fever, headache, nausea, vomiting, chills, joint pain, and exhaustion¹³. There appears to be a general lack of understanding regarding the mechanism of action and possible complications of the Covid-19 vaccine, specifically causing an allergic reaction especially seen with Pfizer-BioNTech¹³.

Dentists and dental staff face daily risks of cross infection due to exposure to high levels of microorganisms found not only in the patient's oral cavity, but also in the aerosols generated by dental instrumentation^{14,15}. Ultrasonic generated aerosols and the use of high-speed rotary instruments create a large amount of infectious aerosol droplets that can remain suspended in the air for extended periods of time after a dental procedure^{16,17}. The University of the Western Cape (UWC) in Cape Town, South-Africa, has two oral health centres that serve the Tygerberg and Mitchell's Plain communities. The University of the Western Cape was designated a World Health Organization (WHO) Collaborating Centre for Oral Health and is at the forefront of oral health developments while serving underprivileged communities. The oral health centres consist of a combination of academic, administrative and support staff for both teaching and clinical care. All staff members working in the oral health centres, regardless of their role, are in one way or another, exposed to the high-risk dental environment.

Despite the availability of the Covid-19 vaccine free of charge to all staff members, many opted not to accept the vaccine. The ideal would be for all staff members to be vaccinated against the Covid-19 virus, thereby limiting cross-infection and contributing to the safety of

staff, students and the patients at the two oral health centres. It is therefore important to identify and address specific concerns and uncertainties and thus improve vaccination rates.

The aim of the present study was to determine the attitudes and perceptions towards the COVID-19 vaccine among dental staff at the UWC Oral Health Centers. A secondary aim was to determine if there were any associations between the demographics (age, sex, staff type and level of education) and the staff's attitudes and perceptions.

MATERIALS AND METHODS

A cross-sectional study was conducted by means of an anonymized online survey. The study was approved by and ethical clearance obtained from the UWC Biomedical Research Ethics Committee (ref no. BM21/5/3). A human resources representative shared the link to the online survey with all the staff members. Participation was also voluntary and no incentive was set for participants, other than the new UWC specific data that would be gained. The included population consisted of the staff compliment included all professions actively working in the oral health centers (clinical, administrative, academic and support staff) for the Dental Faculty at the University of the Western Cape. Participation in the study was voluntary and participants could withdraw from the study at any stage. Using a 50% prevalence for attitudes, a sample size of 184 participants was necessary for a 5% precision and a 95% confidence interval for a limited sample of 368 staff members at the Dental Faculty.

The questionnaire was based on a validated questionnaire¹⁸ and included 16 questions. The first four questions recorded demographic details (age group, gender, staff type and level of education) followed by two questions regarding individual vaccine records (previous vaccinations and vaccination against Covid-19). Four questions on the attitudes and four on the perceptions of dental staff towards the Covid-19 vaccine were also recorded. The responses to "yes/ no" and Likert scale questions were coded as "1" for "yes/ agree" and "0" for "no/ don't know/ undecided/ disagree." Total scores were respectively calculated by summing the raw scores of each category of questions ranging from 0–4 for attitudes and perceptions. A score of zero was indicative of poor attitudes and perceptions, whereas a score of 4 was indicative of excellent attitudes and perceptions. REDCAP[®] was used for data capturing.

Microsoft Excel was used for data cleaning, editing, sorting, and coding. The excel file was then imported into STATA software (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC.). Confounders such as age, sex, level of education and staff type were also recorded. Descriptive statistics (i.e., frequencies, percentages, means, standard deviations) and first-order analysis (i.e., chi-square tests, Fisher's exact test) were performed. Likewise, t-tests or one-way ANOVA or Kruskal Wallis tests were performed to determine significant relations of the mean attitudes scores with sociodemographic information. A Pearson's correlation was used to determine

correlations between attitudes and perceptions. Finally, factors that significantly differed in terms of perception scores, were included into multivariate linear regression analysis with perceptions, as the dependent variables. All tests were deemed statistically significant at $p < 0.05$.

RESULTS

There was a 28.5% ($n = 105$) response rate out of 368 potential participants. This response rate is close to the expected response rate for internal surveys and above the expected response rate of external surveys.¹⁹ Only 6 participants indicated that they have never received a vaccine in their life time.

The majority ($n = 96$) of the participants had already received either the Johnson & Johnson (90.63%) or Pfizer (9.38%) Covid-19 vaccine. Table 1 indicates the demographics of the participants in this study, with a majority being female (61.9%), clinical staff (64.76%) with postgraduate qualifications (52.38%).

More than 80% felt that the vaccine was safe and 96% felt that they would take the vaccine without hesitation (Table II).

The distribution of attitude and perception scores by demographic profiles are reported in Table III.

Higher scores are indicative of positive attitudes and perceptions with regards to the COVID-19 vaccine. None of the adjusted models using forward or backward elimination had an impact on attitudes or perceptions. Therefore, only simple (unadjusted) regression models were presented for attitudes and perception scores. Although not statistically significant, males had a better attitude towards the COVID-19 vaccine compared to females, but this was not the case for the perception scores.

There was a statistically significant, moderately positive correlation between attitude and perception, $p = 0.0043$. In other words, participants with a better attitude also had a better perception towards the COVID-19 vaccine.

In Table IV, it is evident that older individuals were more likely to have higher (positive) perceptions scores compared to the younger participants. In fact, older participants had an increased perception score of 1.99 units greater than their younger counterparts. However, attitude scores did not differ by age group. Attitudes and perception scores did not differ between administrative or clinical staff. There was no statistically significant difference in attitude or perception scores for different levels of education.

Table I. Baseline demographics ($n=105$)

		n(%)
Sex	Female	65 (61.9)
	Male	40 (38.1)
Age category	< 41 years	52 (49.52)
	≥ 41 years	53 (50.48)
Staff Type	Admin	37 (35.24)
	Clinical	68 (64.76)
Level of Education	High school or below	17 (16.19)
	University	33 (31.43)
	Post-graduate	55 (52.38)

Table II. Responses to close questions related to attitudes and perceptions towards the Covid-19 vaccine ($n=105$)

Attitudes		n (%)
Do you think that the Covid-19 vaccine is safe?	Yes	87 (82.86)
	No/Don't know	18 (17.14)
Will you take the Covid-19 vaccine without hesitation?	Yes	96 (91.43)
	No	9 (8.57)
I will encourage my family/friends/relatives to get vaccinated	Agree	97 (92.38)
	Disagree/Undecided	8 (7.62)
Would you consider taking the booster vaccination?	No	13 (12.38)
	Yes	92 (87.62)
Perceptions		
Do you think the Covid-19 vaccine may have side effects?	Yes	97 (92.38)
	No	8 (7.62)
The Covid-19 vaccine is necessary to combat the global Coronavirus pandemic.	Agree	94 (89.52)
	Disagree/Undecided	11 (10.47)
In your opinion, who do you think should be vaccinated?	Everyone	100 (95.24)
	HCW/OHCW/Individuals with comorbidities	5 (4.76)
Do you think that if everyone in the society maintains the preventive measures, Covid-19 will be eradicated?	Yes	25 (23.81)
	No	80 (76.19)

Table III. Distribution of Attitude and Perception scores by demographics (n=105)

		Attitudes		Perceptions	
		Total mean (SD)	p-value	Total mean (SD)	p-value
Gender	Females	2.969 (0.56)	0.3374	3.554 (0.90)	0.8769
	Males	3.075 (0.53)		3.525 (0.96)	
Age category	< 41 years	3.481 (0.99)	0.4961	2.903 (0.57)	0.0489 *
	≥ 41 years	3.604 (0.84)		3.113 (0.51)	
Staff Type	Admin	3.622 (0.72)	0.5202	3.108 (0.52)	0.1734
	Clinical	3.500 (0.92)		2.956 (0.56)	
Level of Education	High school/ below	3.25 (0.97)	0.2109	3.235 (0.56)	0.1770
	University	3.485 (1.03)		2.969 (0.59)	
	Post-graduate	3.673 (0.82)		2.964 (0.51)	

*statistically significant.

Table IV. Unadjusted and Attitudes and Perceptions regression with demographic variables.

		Attitudes		Perceptions	
		Unadjusted Coefficients		Unadjusted Coefficients	
		Estimate (95% Confidence Interval)	p-value	Estimate (95% Confidence Interval)	p-value
Clinical Staff	Clinical	-0.65 (-0.495 to 0.252)	0.52	-1.37 (-0.372 to 0.068)	0.173
Age category	> 41 years	0.68 (-0.234 to 0.48)	0.496	1.99 (0.001 to 0.418)	0.049 *
Sex	Male	-0.16 (-0.397 to 0.34)	0.877	0.96 (-0.112 to 0.323)	0.337
Education level	University	0.00 (-0.292 to 0.791)	0.363	-1.64 (-0.587 to 0.055)	0.104
	Post-graduate	-0.16 (-0.066 to 0.941)	0.088	-1.81 (-0.57 to 0.027)	0.074

*statistically significant.

DISCUSSION

The aim of the present study was to determine the attitudes and perception towards the COVID-19 vaccine among dental staff at the UWC Oral Health Centers.

The results of the present study show that overall, age did not impact the attitudes ($p = 0.4961$) of participants, but that perception scores were statistically significantly higher (more positive) in older participants ($p = 0.0489$) towards the Covid-19 vaccine. Al-Zalfawi *et al.*²⁰ and Islam *et al.*¹⁸ found that neither attitudes or perception scores differed between different age groups. Participants that attended university and post-graduate studies did not appear to have more favourable attitudes ($p = 0.2109$), or perceptions ($p = 0.1770$).

Al-Zalfawi *et al.*²⁰ found that attitudes scores differed between sexes, but perception scores did not differ. Similarly, Islam *et al.*¹⁸ found that sex had a statistically significant impact on attitude scores. In the current study it was found that sex did not have statistically significant ($p > 0.05$) impact on attitudes or perceptions scores (Table I), however, the present study did not have an equal number of male and female participants which may have skewed this comparison.

Nearly all the participants (95.24 %) reported that everyone should be vaccinated against COVID-19 and this finding was higher than the findings in a study by Haque *et al.*²¹ According to Alam *et al.*,²² less than 50% of healthcare workers in Bangladesh, and 46% of Bangladeshi citizens were interested in receiving the COVID-19 vaccination if it became available is much

lower than the present study population (91.43%). Older individuals also had a statistically significantly higher perceptions score compared to younger individuals (Table IV). This finding agrees with Rzymiski *et al.*,²³ who found that 71% of Polish adults, and 55.3% of Saudi adults were willing to receive the COVID-19 Vaccination compared to the 12.38% of dental staff in the present study¹³.

CONCLUSIONS

The present study revealed that majority of the staff at the UWC oral health centres, have positive attitudes and perceptions towards the COVID-19 vaccine. Attitudes and perception scores were statistically significantly lower for participants without post-graduate training. The findings suggest that policy makers should provide specific information regarding the mechanism of action of the vaccine, possible side effects and the necessity of booster shots, to improve the and strengthen the attitudes and perceptions among dental staff towards the Covid-19 vaccine, especially among staff with lower levels of education. Focused informative interventions will help alleviate uncertainties, reduce vaccine hesitancy and improve the success rate of the vaccine roll out.

Limitations

There was a very low response rate, as only 28.5% of the staff population responded to the survey, however, a response rate of 33% is generally accepted²². The low response rate of staff could possibly be attributed to survey fatigue, as staff were overwhelmed by many online research projects conducted in the Covid-19 pandemic.

Author Contributions

The following statements should be used “Conceptualization, F.K.D. and N.P.; methodology, F.K.D.; software, F.K.D.; validation, F.K.D and L.R.; formal analysis, F.K.D.; investigation, F.K.D. and N.P.; resources, F.K.D.; data curation, L.R., D.P., I.P., C.P., S.L.R., S.R. C.R.; writing—original draft preparation, L.R., D.P., I.P., C.P., S.L.R., S.R. C.R.; writing—review and editing, F.K.D., N.P., S.N.; visualization, F.K.D.; supervision, S.N.; project administration, F.K.D. and N.P.; funding acquisition, S.N. All authors have read and agreed to the published version of the manuscript.”

Declaration of Funding: This research received no external funding

Ethics: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (BMREC) of University of the Western Cape (protocol code BM21/5/3 and date of approval: 29 June 2021). Participation in this study was voluntary and informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data can be found at this link, <https://zenodo.org/record/5776161>

Acknowledgments: The authors would like to thank the participants for partaking in this study

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

- Cennimo DJ, Bergman SJ, Olsen KM, Windle ML, Bronze MS, Miller MM. Coronavirus disease 2019. *Manhattan: Medscape*; 2021. Available from: <https://emedicine.medscape.com/article/2500114-overview#a1> Accessed on 06 January 2022.
- McArthur, R. The four types of COVID-19 vaccine – a snapshot. *South Africa: Healthcare IT News*; 2021. Available from: <https://www.healthcareitnews.com/news/emea/four-types-covid-19-vaccine-snapshot> Accessed on 06 January 2022.
- Mkhize, Z. First case of COVID-19 coronavirus reported in SA. *South Africa: National Institute for Communicable Diseases*; 2020. Available from: <https://www.nicd.ac.za/first-case-of-covid-19-coronavirus-reported-in-sa/#:~:text=FIRST%20CASE%20OF%20COVID-19%20CORONAVIRUS%20REPORTED%20IN%20SA> Accessed on 06 January 2022.
- Western Cape Government. First case of COVID-19 confirmed in the Western Cape [Internet]. *Western Cape: Western Cape Government*; 2020. Available from: <https://www.westerncape.gov.za/news/first-case-covid-19-confirmed-western-cape> Accessed on 06 January 2022.
- National Institute for Communicable Diseases. Latest confirmed cases of covid-19 in South Africa (5 January 2022). *Western Cape: Western Cape Government*; 2021. Available from: <https://www.nicd.ac.za/latest-confirmed-cases-of-covid-19-in-south-africa-5-january-2022> Accessed on 07 January 2022.
- The InterAcademic Partnership. The Different types of COVID-19 vaccines. 2021. Available from: <https://www.interacademies.org/publication/different-types-covid-19-vaccines>. Accessed on 07 July 2022.
- Zheng C, Shao W, Chen X, Zhang B, Wang G, Zhang W. Real-world effectiveness of COVID-19 vaccines: a literature review and meta-analysis. *Int J Infect Dis*. 2022;114:252-260. doi: 10.1016/j.ijid.2021.11.009. Epub 2021 Nov 17. PMID: 34800687; PMCID: PMC8595975.
- Hasan, I. Covid 19 vaccine rollout in South Africa ‘successful’. *Anatoly Agency*; 2021. Available from: <https://www.aa.com.tr/en/africa/covid-19-vaccine-rollout-in-south-africa-successful/2158634> Accessed on 06 January 2022.
- Bai, N. How Effective Is the Johnson & Johnson COVID-19 Vaccine? Here’s What You Should Know. *California: UCSF*; 2021. Available from: <https://www.ucsf.edu/news/2021/03/420071/how-effective-johnson-johnson-covid-19-vaccine-heres-what-you-should-know> Accessed on 06 January 2022
- Self WH, Tenforde MW, Rhoads JP, Gaglani M, Ginde AA, Douin DJ, *et al.* Comparative Effectiveness of Moderna, Pfizer-BioNTech, and Janssen (Johnson & Johnson) Vaccines in Preventing COVID-19 Hospitalizations Among Adults Without Immunocompromising Conditions - United States, March–August 2021. *MMWR Morb Mortal Wkly Rep*. 2021 Sep 24;70(38):1337-1343. doi: 10.15585/mmwr.mm7038e1. PMID: 34555004; PMCID: PMC8459899.
- Statistics and Research. Coronavirus (COVID-19) Vaccinations. [Internet]. https://ourworldindata.org/covid-vaccinations?country=OWID_WRL Accessed on 07 January 2022
- COVID-19 South African Online Portal. COVID-19 South African coronavirus news and information [Internet]. *South Africa: Department of Health*; 2021. Available from: <https://sacoronavirus.co.za/latest-vaccine-statistics/> Accessed on 07 January 2022.
- Simnani FZ, Singh D, Kaur R. COVID-19 phase 4 vaccine candidates, effectiveness on SARS-CoV-2 variants, neutralizing antibody, rare side effects, traditional and nano-based vaccine platforms: a review. *3 Biotech*. 2022;12(1):15. doi: 10.1007/s13205-021-03076-0. Epub 2021 Dec 12. PMID: 34926119; PMCID: PMC8665991.
- Yan J, Grantham M, Pantelic J, De Mesquita PJB, Albert B, Liu F, Ehrman S, Milton DK, Consortium EMIT. Infectious virus in exhaled breath of symptomatic seasonal influenza cases from a college community. *Proc Natl Acad Sci*. 2018; 115:1081–1086.
- Stadnytskyi V, Bax CE, Bax A, Anfinrud, P. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proc Natl Acad Sci*. 2020;117:11875–11877.
- Grenier, D. Quantitative analysis of bacterial aerosols in two different dental clinic environments. *Appl Environ Microbiol*. 1995;61:3165–3168. <https://doi.org/10.1128/AEM.61.8.3165-3168.1995>.
- Jones RM, Brosseau LM. Aerosol transmission of infectious disease. *J Occup. Environ. Med*. 2015, 57, 501–508. <https://doi.org/10.1097/JOM.0000000000000448>.
- Islam MS, Siddique AB, Akter R, Tasnim R, Sujana

- SH, Ward PR, Sikder, T. Knowledge, attitude and perceptions towards COVID-19 vaccinations: A cross-sectional community survey in Bangladesh. medRxiv 2021. Available from: <https://doi.org/10.1101/2021.02.16.21251802>, Preprint.
19. Cleave P. What is a good survey response rate? Smart Survey. December 2020. Available from: <https://www.smartsurvey.co.uk/blog/what-is-a-good-survey-response-rate#:~:text=It's%20also%20important%20to%20note,surveys%20at%2010%2D15%25> Accessed on 09 July 2021.
 20. Al-Zalfawi, S.M., Rabbani, S.I., Asdaq, S.M.B., Alamri, A.S., Alsanie, W.F., Alhomrani, M., Mohzari, Y., Alrashed, A.A., AlRifdah, A.H. and Almagrabe, T. Public Knowledge, Attitude, and Perception towards COVID-19 Vaccination in Saudi Arabia. *Int J Environ Res Public Health*, 2021; 18:10081.
 21. Haque, M.M.A., Rahman, M.L., Hossian, M., Matin, K.F., Nabi, M.H., Saha, S., Hasan, M., Manna, R.M., Barsha, S.Y., Hasan, S.R. and Siddiquea, S.R. Acceptance of COVID-19 vaccine and its determinants: Evidence from a large sample study in Bangladesh. *Heliyon*, 2021; 7:e07376.
 22. Alam, A.M., Azim Majumder, M.A., Haque, M., Ashraf, F., Khondoker, M.U., Mashreky, S.R., Wahab, A., Siddiqui, T.H., Uddin, A., Joarder, T. and Ahmed, S.M. Disproportionate COVID-19 vaccine acceptance rate among healthcare professionals on the eve of nationwide vaccine distribution in Bangladesh. *Expert review of Vaccines*, 2021; 20:1167–1175.
 23. Rzymiski, P., Poniedziałek, B. and Fal, A. Willingness to Receive the Booster COVID-19 Vaccine Dose in Poland. *Vaccines*, 2021; 9:1286.