



Evaluation of Personal Protective Behaviors Among Healthcare Workers After Receiving COVID-19 Vaccination

COVID-19 Aşısı Yaptıran Sağlık Çalışanlarının Kişisel Koruyucu Davranışlarının Değerlendirilmesi

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Abstract

Aim: The aim of the study was to evaluate personal protective behaviors after COVID-19 vaccination in healthcare workers.

Material and Method: This cross-sectional study was conducted with healthcare workers (physician, dentist, midwife, nurse, health officer or emergency medicine technician) in Bursa City Hospital between 01.09.2021 and 01.09.2022. Data was collected with a questionnaire form which was sent to participants via an instant messaging application or email.

Results: All participants had received at least one dose of a COVID-19 vaccine and 31.0% had had experienced at least one COVID-19 infection. It was determined that while the use of N95 masks in the workplace ($p<0.001$) and in daily life ($p<0.001$) decreased following vaccination among healthcare workers, the use of three-layer surgical masks increased. The great majority did not alter behaviors after vaccination. The frequency of being present in crowded places was higher in those without a history of COVID-19 ($p=0.023$). In the multivariable regression analysis, a reported 'decrease' in the number of masks used in the workplace was associated with profession (those other than Nurse/Midwife/Health officer) and smoking status (non-smokers) ($p=0.001$ and $p=0.025$, respectively).

Conclusions: It can be said that healthcare professionals maintain their personal protective behaviors in the hospital and in daily life even after receiving COVID-19 vaccination. Of note, healthcare workers other than Nurse/Midwife/Health officer and non-smokers had a higher likelihood of reporting a decrease in the number of masks they were using in the workplace.

Keywords: Pandemic, SARS-CoV-2, COVID-19 vaccines, personal protective equipment

Öz

Amaç: Çalışmanın amacı, sağlık çalışanlarında COVID-19 aşılması sonrası kişisel koruyucu kullanım davranışlarının değerlendirilmesidir.

Gereç ve Yöntem: Bu kesitsel araştırma, 01.09.2021-01.09.2022 tarihleri arasında Bursa Şehir Hastanesinde sağlık çalışanları (hekim, diş hekimi, ebe, hemşire, sağlık memuru veya acil tıp teknisyeni) ile yapılmıştır. Veriler anket formu ile toplanmış ve bir anlık mesajlaşma uygulaması veya e-posta yoluyla katılımcılara gönderilmiştir.

Bulgular: Tüm katılımcılar en az bir doz COVID-19 aşısı almıştı ve %31.0'ı en az bir COVID-19 enfeksiyonu geçirmişti. Sağlık çalışanlarında aşılama sonrası işyerinde ($p<0.001$) ve günlük hayatta ($p<0.001$) N95 maske kullanımı azalırken, üç katlı cerrahi maske kullanımının arttığı belirlendi. Büyük çoğunluk aşılamadan sonra davranışlarını değiştirmediler. COVID-19 öyküsü olmayanlarda kalabalık ortamlarda bulunma sıklığı daha yüksekti ($p=0.023$). Çok değişkenli regresyon analizinde işyerinde kullanılan maske sayısında bildirilen 'azalma' meslek (Hemşire/Ebe/Sağlık memuru dışındakiler) ve sigara içme durumu (sigara içmeyenler) ile ilişkilendirildi ($p=0.001$ ve $p=$ sırasıyla 0.025).

Sonuç: Sağlık profesyonellerinin hastanede ve günlük yaşamda kişisel koruyucu davranışlarını COVID-19 aşısı olduktan sonra bile sürdürdükleri söylenebilir. Hemşire/Ebe/Sağlık memuru ve sigara içmeyenler dışındaki sağlık çalışanlarının işyerinde kullandıkları maske sayısında azalma bildirme olasılıklarının daha yüksek olduğunu belirtmek gerekir.

Anahtar Kelimeler: Pandemi, SARS-CoV-2, COVID-19 aşılı, kişisel koruyucu ekipman



INTRODUCTION

The cause of COVID-19, declared a pandemic by the World Health Organization (WHO) on 11.03.2022, is the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).^[1] The global crisis caused by COVID-19 can still be considered one of the largest public health crises, well into its third year.^[2,3] As of 12.10.2022, there are 605,912,418 confirmed cases of COVID-19, including 6,491,649 deaths reported worldwide. In Türkiye, there are 16,829,941 confirmed cases, with 100,979 deaths.^[4]

COVID-19 pandemic has prompted scientists and public health officials around the world to rapidly improve our knowledge of this disease and develop new measures. Vaccines are the most effective long-term strategy to control and prevent the COVID-19 pandemic.^[2] According to WHO data, 12,589,972,108 doses of COVID-19 vaccine were administered worldwide and a total of 152,059,687 doses were administered in Türkiye (as of September 2022).^[4] Alongside vaccines, multi-layered interventions, which also include preventive measures to reduce the spread of COVID-19, are important in pandemic control.^[2,5] Since the beginning of the pandemic, those who perceive SARS-CoV-2 as a threat have implemented preventive measures against the disease, such as frequent testing, contact tracing, vaccination programs and personal protective measures (hand cleaning, physical distancing, wearing masks, etc.).^[6]

“Peltzman Effect” is about individuals’ respond to safety measures with a compensatory increase in risky behavior.^[7-9] There is not enough evidence yet on the behavioral responses of society to preventive measures after COVID-19 vaccination. While a high vaccination rate is critical to end the pandemic, increased vigilance in infectious cases and reduced preventive measures due to a heightened sense of perceived security could lead to an alarming increase in cases.^[10] The aim of the study was to evaluate the PPB of healthcare workers after receiving COVID-19 vaccine(s).

MATERIAL AND METHOD

This cross-sectional study was carried out with healthcare professionals at Bursa City Hospital between 01.09.2021 and 01.09.2022. Ethics committee approval was obtained from Bursa City Hospital Ethics Committee (Date: 22.09.2021, Decision No: 2021-17/5).

Healthcare professionals (physicians, dentists, midwives, nurses, health officers or emergency medicine technicians) were included in the study group. The questionnaire form was distributed through an instant messaging application and e-mail groups and applied between 7.10.2021 and 31.11.2021 via Google forms. In the questionnaire, sociodemographic characteristics, employment status, medical history, COVID-19 vaccination history and personal protective equipment (PPE) usage were asked. Smoking

status, chronic diseases, isolation measures, and type of masks used (none, cloth mask, surgical masks, respirators –referred to as N95) were also gathered. According to the Centers for Disease Control and Prevention (CDC), the N95 mask is the type of mask that filters at least 95% of airborne particles.^[11] Participants were asked about their PPB (handwashing frequency, daily mask count, disinfectant usage, exposure to crowds) and their usage of PPE before and after vaccination. To make comparisons, they were expected to provide a relative response regarding their post-vaccination behaviors compared to their pre-vaccination behaviors (decreased, same, increased). Perception of safety following vaccination was scored on a Likert scale, ‘0’ indicated that they did not feel safe at all, while ‘5’ indicated absolute certainty of safety. In the preparation of the questions, COVID-19 guide prepared by the Ministry of Health of the Republic of Türkiye was used.^[12]

The COVID-19 vaccine used for the first time in Türkiye was administered to healthcare personnel and then population aged 65 and over.^[13] According to the most recently updated data (25.09.2022), 93.32% of the population had received at least a single dose of either vaccine, while completed (two doses) vaccination was reported as 85.64%.^[14]

Statistical Analysis

All analyses were performed using IBM SPSS Statistics (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). For the normality check, the Kolmogorov-Smirnov test was used. Data are given as median (1st quartile-3rd quartile) for continuous variables according to non-normality of distribution, and as frequency (percentage) for categorical variables. Mask type before and after vaccination were analyzed with the marginal homogeneity test. Between groups analyses were performed with the chi-square test. Logistic regression analyses were performed to determine significant factors independently associated with the decrease in mask usage frequency at work. Variables were analyzed with univariate regression analysis and those with statistical significance were included into the multivariate model. The statistical significance threshold was accepted as $p < 0.05$.

RESULTS

Among participants, 81.8% were female and 18.2% were male, median age was 35 (22-62). The frequency of experiencing COVID-19 at least once was 31.0% and the frequency of direct contact with COVID-19 cases was 83.0%. The entire research group had received at least one dose of vaccine. The frequency of four doses of vaccine in the study group was 21.9%. The frequency of healthcare professionals feeling “safe” after vaccination was 91.4% (**Table 1**).

Table 1. Summary of participants' characteristics and vaccination status

Age, years, (range 22-62)	35 (27-43)
Sex	
Female	477 (81.8%)
Male	106 (18.2%)
Marital status	
Married	388 (66.6%)
Single	195 (33.4%)
Occupation	
Physician	83 (14.2%)
Nurse/Midwife/Health officer	421 (72.2%)
Other medical personnel	79 (13.6%)
Duration of employment, years (range: 0.75-39)	12 (3-20)
Smoking status	
Non-smoker	344 (59.0%)
Ex-smoker	65 (11.1%)
Smoker	174 (29.8%)
Chronic disease	149 (25.6%)
Diabetes mellitus	19 (3.3%)
Hypertension	38 (6.5%)
COPD	3 (0.5%)
Asthma	34 (5.8%)
Heart diseases	17 (2.9%)
Malignancy	8 (1.4%)
Other	82 (14.1%)
COVID-19 infection history	
None	402 (69.0%)
One time	174 (29.8%)
Two times	7 (1.2%)
Isolation due to contact	134 (23.0%)
Direct contact with patients	484 (83.0%)
Doses of COVID-19 vaccination	
1	15 (2.6%)
2	145 (24.9%)
3	295 (50.6%)
4	128 (21.9%)
COVID-19 vaccination (1st dose)	
No	0 (0.0%)
Biontech	59 (10.1%)
Sinovac	524 (89.9%)
COVID-19 vaccination (2nd dose)	
No	15 (2.6%)
Biontech	58 (9.9%)
Sinovac	510 (87.5%)
COVID-19 vaccination (3rd dose)	
No	160 (27.4%)
Biontech	367 (63.0%)
Sinovac	56 (9.6%)
COVID-19 vaccination (4th dose)	
No	455 (78.0%)
Biontech	122 (20.9%)
Sinovac	6 (1.0%)
Type of vaccine received	
Only Biontech	55 (9.4%)
Only Sinovac	154 (26.4%)
Both	374 (64.2%)
Feeling "safe" after vaccination	
0 (Not at all)	50 (8.6%)
1	34 (5.8%)
2	93 (16.0%)
3	201 (34.5%)
4	139 (23.8%)
5 (Absolutely)	66 (11.3%)

Data are given as median (1st quartile-3rd quartile) for continuous variables according to non-normality of distribution and as frequency (percentage) for categorical variables
COPD: Chronic obstructive pulmonary disease

It was determined that three people before the vaccination and two people after the vaccination did not use masks. Cloth mask usage frequency before vaccination was 6.0%, while it was 6.9% after vaccination. It was determined that while the use of N95 masks decreased in the workplace ($p < 0.001$) and daily life ($p < 0.001$) after vaccination, the use of three-layer surgical masks increased (**Table 2**).

Table 2. Type of mask before and after vaccination

	Before vaccination	After vaccination	p
At work			
None	3 (0.5%)	2 (0.3%)	
Cloth mask	35 (6.0%)	40 (6.9%)	<0.001
Surgical mask	374 (64.2%)	415 (71.2%)	
Respirators (N95, etc.)	171 (29.3%)	126 (21.6%)	
Daily life			
None	7 (1.2%)	9 (1.5%)	
Cloth mask	45 (7.7%)	49 (8.4%)	<0.001
Surgical mask	460 (78.9%)	483 (82.8%)	
Respirators (N95, etc.)	71 (12.2%)	42 (7.2%)	

Data are given as frequency (percentage)

After vaccination, the vast majority of healthcare workers continued their behavior of washing hands at work, washing hands in daily life, using masks at work, using masks in daily life, using disinfectants at work, and using disinfectants in daily life. Most importantly, only a marginal proportion of participants reported a decrease in these protective measures after vaccination (**Table 3**).

Table 3. Change in protective behaviors after vaccination

Handwashing frequency at work	
Decreased	18 (3.1%)
Same	461 (79.1%)
Increased	104 (17.8%)
Handwashing frequency in daily life	
Decreased	20 (3.4%)
Same	461 (79.1%)
Increased	102 (17.5%)
Number of masks used in work	
Decreased	47 (8.1%)
Same	428 (73.4%)
Increased	108 (18.5%)
Number of masks used in daily life	
Decreased	45 (7.7%)
Same	441 (75.6%)
Increased	97 (16.6%)
Disinfectant usage frequency at work	
Decreased	62 (10.6%)
Same	419 (71.9%)
Increased	102 (17.5%)
Disinfectant usage frequency in daily life	
Decreased	72 (12.3%)
Same	416 (71.4%)
Increased	95 (16.3%)
Frequency of being present in crowded places	
Decreased	69 (11.8%)
Same	365 (62.6%)
Increased	149 (25.6%)

Data are given as frequency (percentage)

There was no relationship between feeling safe after vaccination and having a chronic disease ($p=0.940$). The distribution of mask types used in the workplace ($p=0.818$) and in daily life ($p=0.753$) after vaccination was similar between those with and without chronic disease. There was no relationship between having a chronic disease and handwashing frequency at work ($p=0.969$), handwashing frequency in daily life ($p=0.890$), number of masks used at work ($p=0.691$), number of masks used in daily life ($p=0.842$), disinfectant usage frequency at work ($p=0.792$), disinfectant usage frequency in daily life ($p=0.906$) (Table 4).

Table 4. Summary of protective behaviors after vaccination with regard to chronic disease

	Chronic disease		P
	Absent (n=434)	Present (n=149)	
Feeling "safe" after vaccination			
0 (Not at all)	37 (8.5%)	13 (8.7%)	0.940
1	27 (6.2%)	7 (4.7%)	
2	67 (15.4%)	26 (17.4%)	
3	152 (35.0%)	49 (32.9%)	
4	104 (24.0%)	35 (23.5%)	
5 (Absolutely)	47 (10.8%)	19 (12.8%)	
Type of mask, at work			
None	1 (0.2%)	1 (0.7%)	0.818
Cloth mask	31 (7.1%)	9 (6.0%)	
Surgical mask	307 (70.7%)	108 (72.5%)	
Respirators (N95, etc.)	95 (21.9%)	31 (20.8%)	
Type of mask, daily life			
None	6 (1.4%)	3 (2.0%)	0.753
Cloth mask	38 (8.8%)	11 (7.4%)	
Surgical mask	361 (83.2%)	122 (81.9%)	
Respirators (N95, etc.)	29 (6.7%)	13 (8.7%)	
Handwashing frequency at work			
Decreased	13 (3.0%)	5 (3.4%)	0.969
Same	343 (79.0%)	118 (79.2%)	
Increased	78 (18.0%)	26 (17.4%)	
Handwashing frequency in daily life			
Decreased	15 (3.5%)	5 (3.4%)	0.890
Same	345 (79.5%)	116 (77.9%)	
Increased	74 (17.1%)	28 (18.8%)	
Number of masks used in work			
Decreased	37 (8.5%)	10 (6.7%)	0.691
Same	315 (72.6%)	113 (75.8%)	
Increased	82 (18.9%)	26 (17.4%)	
Number of masks used in daily life			
Decreased	35 (8.1%)	10 (6.7%)	0.842
Same	328 (75.6%)	113 (75.8%)	
Increased	71 (16.4%)	26 (17.4%)	
Disinfectant usage frequency at work			
Decreased	44 (10.1%)	18 (12.1%)	0.792
Same	313 (72.1%)	106 (71.1%)	
Increased	77 (17.7%)	25 (16.8%)	
Disinfectant usage frequency in daily life			
Decreased	54 (12.4%)	18 (12.1%)	0.906
Same	311 (71.7%)	105 (70.5%)	
Increased	69 (15.9%)	26 (17.4%)	
Frequency of being present in crowded places			
Decreased	51 (11.8%)	18 (12.1%)	0.297
Same	265 (61.1%)	100 (67.1%)	
Increased	118 (27.2%)	31 (20.8%)	

Data are given as median (1st quartile-3rd quartile) for continuous variables according to non-normality of distribution and as frequency (percentage) for categorical variables

No correlation was found between safety perception after vaccination and history of COVID-19 ($p=0.142$). The distribution of mask types used in the workplace ($p=0.352$) and in the daily life environment ($p=0.407$) after vaccination was similar between those with and without a history of COVID-19. There was no relationship between having a history of COVID-19 and handwashing frequency at work ($p=0.939$), handwashing frequency in daily life ($p=0.554$), number of masks used at work ($p=0.087$), number of masks used in daily life ($p=0.155$), disinfectant usage frequency at work ($p=0.189$) and disinfectant usage frequency in daily life ($p=0.213$) (Table 5).

Table 5. Summary of protective behaviors after vaccination with regard to COVID-19 disease history

	COVID-19 disease history		p
	Absent (n=402)	Present (n=181)	
Feel safe after vaccination			
0 (None)	32 (8.0%)	18 (9.9%)	0.142
1	18 (4.5%)	16 (8.8%)	
2	67 (16.7%)	26 (14.4%)	
3	134 (33.3%)	67 (37.0%)	
4	100 (24.9%)	39 (21.5%)	
5 (Absolutely)	51 (12.7%)	15 (8.3%)	
Type of mask, at work			
None	2 (0.5%)	0 (0.0%)	0.352
Cloth mask	29 (7.2%)	11 (6.1%)	
Surgical mask	278 (69.2%)	137 (75.7%)	
Respirators (N95, etc.)	93 (23.1%)	33 (18.2%)	
Type of mask, daily life			
None	8 (2.0%)	1 (0.6%)	0.407
Cloth mask	37 (9.2%)	12 (6.6%)	
Surgical mask	328 (81.6%)	155 (85.6%)	
Respirators (N95, etc.)	29 (7.2%)	13 (7.2%)	
Handwashing frequency at work			
Decreased	12 (3.0%)	6 (3.3%)	0.939
Same	317 (78.9%)	144 (79.6%)	
Increased	73 (18.2%)	31 (17.1%)	
Handwashing frequency in daily life			
Decreased	16 (4.0%)	4 (2.2%)	0.554
Same	316 (78.6%)	145 (80.1%)	
Increased	70 (17.4%)	32 (17.7%)	
Number of masks used in work			
Decreased	39 (9.7%)	8 (4.4%)	0.087
Same	288 (71.6%)	140 (77.3%)	
Increased	75 (18.7%)	33 (18.2%)	
Number of masks used in daily life			
Decreased	36 (9.0%)	9 (5.0%)	0.155
Same	296 (73.6%)	145 (80.1%)	
Increased	70 (17.4%)	27 (14.9%)	
Disinfectant usage frequency at work			
Decreased	49 (12.2%)	13 (7.2%)	0.189
Same	283 (70.4%)	136 (75.1%)	
Increased	70 (17.4%)	32 (17.7%)	
Disinfectant usage frequency in daily life			
Decreased	56 (13.9%)	16 (8.8%)	0.213
Same	283 (70.4%)	133 (73.5%)	
Increased	63 (15.7%)	32 (17.7%)	
Being in crowded places frequency			
Decreased	44 (10.9%)	25 (13.8%)	0.023
Same	242 (60.2%)	123 (68.0%)	
Increased	116 (28.9%)	33 (18.2%)	

Data are given as median (1st quartile-3rd quartile) for continuous variables according to non-normality of distribution and as frequency (percentage) for categorical variables

Multivariate logistic regression analysis revealed that occupation and smoking status were independently associated with reporting a “decrease” in the number of masks used in the workplace after vaccination. Nurse/midwife/health officers ($p=0.001$) were less likely to report a decrease in the number of masks used in the workplace after vaccination than physicians and other medical personnel; whereas, non-smokers ($p=0.025$) were more likely to report a decrease in the number of masks used in the workplace after vaccination than ex-smokers and smokers (Table 6, Figure 1, Figure 2).

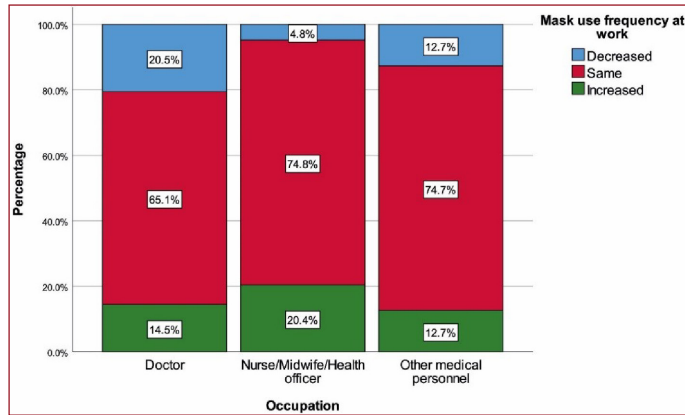


Figure 1. Change in mask use frequency at work after vaccination with regard to occupation

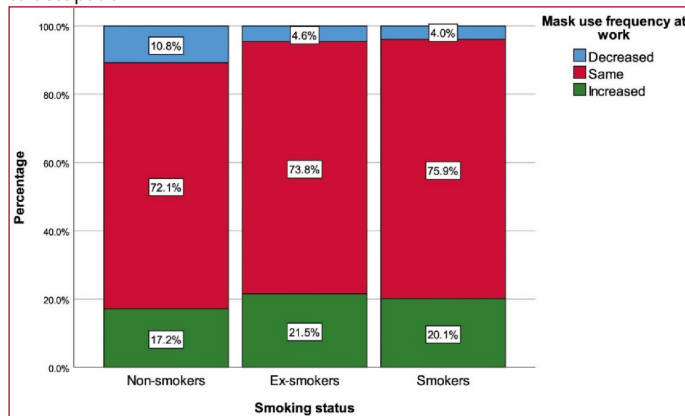


Figure 2. Change in mask use frequency at work after vaccination with regard to smoking status

DISCUSSION

The impact of vaccination in controlling the spread of SARS-CoV-2 varies widely, depending not only on efficacy and coverage, but also on concurrent adherence to non-pharmaceutical interventions.^[15] The decrease in personal protective measures in the society may cause an uncontrolled increase in cases.^[10] It becomes even more important that individuals do not pay attention to measures, as it may coincide with the rise of variants.^[16]

The value of face masks is further increased by the ongoing uncertainty of the pandemic, the emergence of new variants, reduced vaccine efficacy, diminished immunity, seasonal variation in case numbers and increased contagion. COVID-19 peaks have raised questions about whether or how long face masks will be required.^[5] Vaccination protects from disease development, nonetheless immunity decreases a few months after vaccination. Masks, on the other hand, play an important role in the control of infection by interfering with transmission, regardless of antibody level and variant.^[3] Healthcare professionals, caregivers and visitors should wear an appropriate mask when caring for patients with or without COVID-19, maintaining hand hygiene each time they touch their medical mask or face, and continuing to adhere to physical distancing.^[17] Vaccinated individuals may have a false perception of their long-term immunity. This may have negative consequences, such as delaying booster doses or decreasing compliance with PPB.^[18]

In a study conducted, it was reported that mask usage frequency reduced by 22% after vaccination.^[19] In the study by Varas et al., unvaccinated participants were found to be less likely to stop physical distancing than participants who received at least one dose of vaccine. On the other hand, it has been reported that vaccination is not one of the predictive factors of mask use and hand washing.^[20] Karayürek et al. reported that the vaccine had a positive effect on reducing the fear and anxiety levels of dentists, but adherence to protective measures reduced after vaccination (such as the use of PPE and pre-operative

Table 6. Factors associated with decrease the number of masks used in work after vaccination, logistic regression analysis results

	Univariable		Multivariable	
	OR (95% CI)	p	OR (95% CI)	p
Age, years	0.981 (0.948-1.017)	0.297		
Sex, Male	0.772 (0.336-1.775)	0.543		
Marital status, Single	0.661 (0.335-1.305)	0.233		
Occupation, Nurse/Midwife/Health officer	0.249 (0.135-0.459)	<0.001	0.328 (0.169-0.635)	0.001
Duration of work, years	0.979 (0.947-1.012)	0.205		
Smoking status, Non-smoker	2.760 (1.344-5.666)	0.006	2.342 (1.114-4.922)	0.025
Chronic disease	0.772 (0.374-1.593)	0.484		
COVID-19 disease history	0.430 (0.197-0.941)	0.035	0.455 (0.203-1.022)	0.057
Isolation due to contact	1.163 (0.586-2.310)	0.665		
Direct contact with patients	1.435 (0.592-3.477)	0.424		
Doses of COVID-19 vaccination, 4 doses	1.954 (1.032-3.699)	0.040	0.901 (0.438-1.856)	0.778
Type of vaccination, Only Sinovac	0.384 (0.160-0.923)	0.032	0.445 (0.177-1.121)	0.086
Type of mask at work before vaccination, Respirators	2.078 (1.135-3.807)	0.018	1.563 (0.825-2.963)	0.171
Nagelkerke R2	-	-	0.136	-

OR: Odds Ratio, CI: Confidence Interval

mouth rinsing).^[21] There are also studies reporting positive changes in PPB after vaccination. For instance, Calamari et al. reported that vaccinated people had higher mask usage than unvaccinated people.^[22] In a study conducted by Zhang et al. with healthcare professionals, PPB demonstrated a significant positive change after vaccination.^[23] In another study conducted among healthcare professionals, it was reported that the correct mask usage rates increased significantly after vaccination.^[24] In the current study, it was determined that PPB such as the number of masks used by healthcare professionals, hand hygiene and social distancing remained at the same levels after vaccination. Of note, there was no relationship between daily mask counts and vaccination status in multivariable analysis. Previously, healthcare professionals were not found to decrease their PPB even when they experienced a positive perception of safety following vaccination,^[25] similar to our results. Kaim et al. reported that social distancing and mask use were not associated with vaccination.^[26] Similar results have been demonstrated in different studies, which demonstrates that healthcare professionals' PPB have not changed after vaccination.^[27,28] The fact that the current research group consists of healthcare personnel, the high level of compliance with PPB or the support provided by health policies and trainings for PPB may be among the reasons causing this strict adherence to measures. Differences in COVID-19 control techniques, policies and socioeconomic levels between countries at the time of studies could influence adherence to protective measures and personal perceptions associated with vaccination.

The effectiveness of face masks on the incidence of COVID-19 is dependent on mask material and mask fit.^[3] WHO states that filtering and breathability are important characteristics of masks, and that cloth (fabric) masks should be constructed with three layers. The innermost layer of cloth masks should consist of absorbent material such as cotton, the middle layer of non-absorbent material such as polypropylene and the outermost layer of non-absorbent material such as polyester or polyester blend.^[17] The frequency of cloth mask usage among healthcare professionals in our study group was 6% before vaccination and 6.9% after vaccination. It was concluded that the use of cloth masks, which are likely to be unsafe due to the lower frequency of replacement and the variety of materials produced, is a subject that should be investigated more.

Being a healthcare professional during the COVID-19 pandemic is an independent predictor of higher mask usage frequency.^[22] In another study, it was reported that the change in the correct mask usage rates of physicians and nurses after the COVID-19 vaccine was found to be similar.^[24] Lopez et al. reported that there was no difference between professions in terms of social distancing and PPB.^[25] In another study, it was reported that nurses and physicians were similar in terms of appropriate use of PPE for COVID-19.^[27] In the current study, nurse/midwife/health

officer professions were less likely to decrease the number of masks they used in the hospital than physicians and other health personnel. Similarly, in the study of Zhang et al. it was reported that healthcare professionals with higher education levels had better knowledge about COVID-19, but had worse PPB.^[23] Since the number of masks used in a day varies in terms of the number of situations that a healthcare personnel touches or needs to change their mask and the mobility of the department where they work, the decreasing number of masks in some healthcare personnel may not necessarily indicate inappropriate mask use. While those in the nurse/midwife/health officer profession did not reduce the number of masks they use for their job, physicians may have experienced a change in workload. Since our data are based on self-reports of healthcare professionals due to cross-sectional design, we cannot directly evaluate the appropriateness of masks use among healthcare personnel.

Since smoking behavior is characterized by inhalation and repetitive hand-mouth movements that are recommended to be avoided to reduce viral contamination, it is expected that smokers will not comply with personal protective measures necessary to prevent COVID-19 spread.^[29] Peixoto et al. reported that ex-smokers are more likely to wear masks in public than current and non-smokers.^[30] Other previously published studies have reported that individuals who do not smoke or smoke less are more likely to comply with COVID-19 preventive measures.^[31-34] On the other hand, Massey et al. reported that risk communication about COVID-19 and smoking was associated with higher mask wearing among smokers.^[35] In this study, the number of masks used by non-smokers at work was found to be more likely to decrease. This may have been because smokers and ex-smokers may have remained concerned about possible exposure due to their perception of being in a high-risk group.

Patterson et al. reported that those who perceive COVID-19 as a serious risk tended to have personal health concerns and were taking protective measures.^[36] It is reported that chronic disease status is significantly associated with COVID risk perceptions and the desire to be vaccinated.^[37] Chan et al. reported that there was no relationship between having a chronic disease and preventive measures against COVID-19.^[38] In two previous studies, no relationship was found between compliance with social distancing and the presence of comorbidity.^[32,39] In this study, similar to the studies in the literature, no significant difference was found between those with and without chronic diseases in terms of personal protective measures after vaccination.

Previous history of COVID-19 has been directly associated with decreased adherence to both social distancing and personal protective measures.^[25] Kaim et al. reported that those infected with the COVID-19 were less likely to wear masks or adhere to social distancing compared to vaccinated individuals without a history of COVID-19.^[26] In a prospective study by Calamari et al., previous COVID-19 was initially found

to be unrelated to mask usage; however, follow-up analysis revealed that COVID-19 history was one of the independent factors associated with reduced mask usage.^[22] In the present study, no relationship was found between COVID-19 history and various factors, including safety perception after vaccination, the distribution of mask types used and the frequency of protective behavior; however, the frequency of being in crowded places was found to be higher in those who did not have a history of COVID-19. Differences between the time elapsed since the infection, the severity of the previous infection and the case/vaccination rates in the population where the studies were conducted may have affected the results.

Enforcing and supporting vaccinations whenever possible and ensuring sustainability of personal protective measures remain as the best approaches against the ongoing pandemic.^[6] Recommending continuation of protective behaviors after vaccination is unlikely to be effective when the number of cases in the population is very low. Establishing a clearly articulated, realistic, understandable, reliable and actionable set of priorities that sets out the best practices to follow after vaccination can be beneficial to the continuity of public health protection.^[16]

The cross-sectional design of this study is one of the most important limitations which prevents time-bound analyses that could have provided more reliable information regarding causality. In relation, we asked individuals to characterize their frequency of protective measures in three groups (increased, decreased, same), which may be a problematic approach since this only assesses quantity without discerning the qualitative aspect of individual measures. Direct observation of appropriateness of behaviors would have provided stronger evidence. The fact that the study was conducted in a single center with very high vaccine adherence is another limitation. Despite these, the results of this research are valuable as they share detailed results regarding the relationships between vaccination and PPB of healthcare professionals.

CONCLUSIONS

As a result, it can be concluded that there is no remarkable loss of focus regarding PPB after COVID-19 vaccination among healthcare professionals. Non-smokers and healthcare professionals other than nurses, midwives and health officers were more likely to decrease the number of masks they used in the workplace. There was no relationship between the presence of chronic disease and PPB. No relationship was found between PPB and a history of COVID-19, except that those without a history of COVID-19 were more likely to be present in crowded places. There is a need for population-based and prospective studies evaluating vaccination and PPB in the population, with a potential view to assess the influence of healthcare professionals' attitudes on this matter.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethics committee approval was obtained from Bursa City Hospital Ethics Committee (Date: 22.09.2021, Decision No: 2021-17/5).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

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