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Coronavirus Pandemic

Vaccine hesitancy among healthcare professionals and the general population: Second important step in the fight against COVID-19

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Abstract

Introduction: This study aims at finding valuable information for predicting vaccination intentions against COVID-19 to guide future interventions to address hesitation.

Methodology: This observational study consists of 1010 volunteer health workers from the state hospitals in Bursa, and 1111 volunteers from the non-healthcare group, unvaccinated against COVID-19. In the study, the participants were asked about their sociodemographic information and reasons for refusing the COVID-19 vaccine by face-to-face interview.

Results: We classified the unvaccinated healthcare worker group as group 1, and the unvaccinated non-health workers group as group 2. Between groups 1 and 2, vaccination refusal, education level, income level, and pregnancy status were statistically significant ($p < 0.001$). The groups differed in the reasons for vaccine refusal and recommending vaccination to the relatives of those who refused vaccination ($p < 0.001$).

Conclusions: Healthcare workers have priority among high-risk groups considered candidates for early vaccination. Therefore, it is important to consider health professionals' attitudes towards COVID-19 vaccination to better address barriers to widespread vaccination. The role of healthcare professionals is also important, as it encourages the entire community to be vaccinated with role-modeling behavior and advises patients and communities.

Key words: Vaccine hesitancy; healthcare workers; COVID-19.

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Introduction

The coronavirus epidemic, which caused severe acute respiratory syndrome and emerged in Wuhan, China in December 2019, entered its third year. It was named SARS-CoV-2 by the International Virus Taxonomy Committee, infecting millions of people and causing a large number of deaths worldwide [1-3].

At the end of 2020 and the beginning of the following year, vaccines to combat COVID-19 were available, and health workers in many countries were identified as priority groups for COVID-19 vaccination [4,5] because the transmission risk of the COVID-19 disease to healthcare workers was three times higher than the general population [6]. While healthcare workers had to take care of COVID-19 patients for these vaccines, there was a high expectation that they would protect them because if we characterize the pandemic as a war, the frontline soldiers of this war were healthcare workers. By the end of 2021, it was estimated that more than half of healthcare workers in many western countries were either fully vaccinated or considering getting vaccinated [5,7,8].

Despite these optimistic reports from several countries, in the third quarter of 2021, vaccination anxiety and vaccine rejection became a global fear [4,9-11]. In a review of eight studies conducted at the end of 2020, COVID-19 vaccine acceptance rates among healthcare workers were less than 75% [10]. Another review including 76,471 healthcare professionals, showed that 22.5% of healthcare professionals worldwide were hesitant to get vaccinated. Another study published in 2021, estimated the COVID-19 vaccine acceptance rates among healthcare professionals to vary between 27.7% and 77.3% [11]. Surprisingly, most of these reviews and reports showed that among all healthcare professionals worldwide, nurses were more hesitant towards vaccination [10-13]. By October 2021, some countries all over the world

required healthcare workers to get the COVID-19 vaccine [13,14].

COVID-19 vaccine hesitancy has become a global problem [15-17]. It will be useful to analyze the resistant group and its reasons and make successful vaccination campaigns with strategies that eliminate concerns. The reasons for vaccination hesitancy among healthcare professionals are diverse, suggesting that it is vital to consider vaccination barriers specific to particular cultural settings and subgroups of healthcare professionals [18]. There were misconceptions that vaccines would not be safe and prevent the aforementioned diseases [19]. Nurses stand out as the group with the highest vaccine hesitancy among healthcare professionals [20]. There are differences related to vaccine hesitancy in sub-categories of health professions [20,21].

In the general population, the demographic factors associated with vaccine hesitancy were; living in a rural area, being at a low-income level, female gender, low education level, and the cost of vaccination in countries where the vaccine has financial value [17,22-25]. Studies in the international scientific arena show that vaccination hesitancy turns into acceptance over time in groups in which racial minorities are addressed [17,26-28]. Distrust in health authorities and injustice in vaccine trials [30] stands out as the reasons for indecision in these groups [29].

Another group with hesitancy about vaccination was pregnant women. In the UK, it was reported that 98% of 1714 pregnant women admitted to the emergency services due to COVID-19 between February 1 and September 30, 2021, were unvaccinated [31]. However, based on the information about vaccines today, we have no identifiable reason to believe that there will be particular risks for pregnant women that outweigh the benefits of vaccination [32]. Therefore, pregnant women at high risk of exposure to SARS-CoV-2 [severe acute respiratory syndrome coronavirus 2] (eg, healthcare workers) or with comorbidities that increase their risk of serious illness can be vaccinated based on obstetrician advice [33].

In the context of public health, if a high rate of vaccination is reached, the vaccine is seen as the material with the highest protection and prevention and has a very important place in the fight against infections [32]. To combat the rapidly spreading COVID-19 pandemic, which has been affecting the world for nearly 3 years and spreading rapidly, a high level of vaccination is required to provide indirect protection for the entire society, return to our old social order, and revive the economy [33]. In addition to reducing COVID-19 transmission, high vaccination, also reduces the risk of infection in the vulnerable population or low-defense risk groups by making herd immunity [33,34]. COVID-19 has a value of 5.7 reproduction number, as being very high, the population needs to be vaccinated at a rate of at least 82.5% to provide herd immunity, and cutting off the circulation of the microorganism makes it more difficult [35].

This study is concerned with finding valuable information in predicting vaccination intentions against COVID-19 to guide future interventions to address hesitation. The study aims to examine the reasons for vaccine rejection against COVID-19 to dispel vaccine doubts and to find solutions to guide future vaccine promotion interventions.

Methodology

This observational study consists of 1010 unvaccinated healthcare workers from the state hospitals in Bursa and other 1111 unvaccinated volunteers who were not health workers. A total of 1010 healthcare workers participated in the study, consisting of 25 physicians, 522 midwives and nurses, 148 primary healthcare workers, and 315 allied health personnel. The participants were asked about their sociodemographic characteristics and the reasons for refusing the COVID-19 vaccine by face-to-face or telephone interview method. Written or verbal (by telephone) informed consent was obtained from all participants included in the study. Volunteers, who are not healthcare professionals, were selected by calling a total of 9862 people who did not come to be vaccinated despite getting a COVID-19 vaccination appointment across Bursa. A total of 1111 volunteers who agreed to be included in the study and answered the questions were included in the study. Ethics committee approval was obtained for the study from the University of Health Sciences Turkey, Bursa City Hospital Clinical Research Ethics Committee with the protocol number 2021-7/10 dated 2021/04-21.

In this study, to determine the sociodemographic characteristics of the participants, their educational status, marital status, title, income, pregnancy status, and COVID-19 status were asked. Responses from 1010 healthcare personnel and 1111 non-health personnel volunteers who were not vaccinated despite being in the priority group for the COVID-19 vaccine were recorded under 22 headings.

Statistical analysis

The findings of the study are published in 'The jamovi project (2021) and evaluated with jamovi

(Version 2.0.0) [Computer Software]. The chi-square test was used for group comparisons of categorical variables. Due to the large sample size, the effect size (r) was calculated by using Cramer's V correlation analysis to determine the relationships between the nominal variables in those whose *p* value was significant. Analysis interpretations were made by taking into account the values suggested by Cohen (1988) and the effect value was accepted as small between 0.05-0.15, a medium between 0.15-0.25, and a large effect value above 0.25. Numerical variables were shown with corresponding values of mean ± standard deviation (Mean ± SD), and categorical variables were shown using the number of observations and percentage (n%) notation. Comparisons with a *p* value below 0.05 were considered significant in the study.

Results

Our study included 1010 healthcare workers who refused to be vaccinated against COVID-19 in hospitals affiliated with Bursa Provincial Health Directorate and 1111 citizens who were in the vaccination group living in Yıldırım district and refused the COVID-19 vaccine. Educational status, title information, education level,

Table 1. Variable Distributions of the Groups.

Characteristics	Group		*p*
	1	2	
Gender			
Men	261	439	$p < 0.001$
Women	749	672	$\chi^2 = 44.7$
Education			
Illiterate	0	52	
Literate	0	31	
Primary school degree	20	440	
Middle school/ primary education degree	27	143	$p < 0.001$
High school graduate	145	252	$\chi^2 = 960$
Associate degree	170	41	r = 0.673
Bachelor's degree	576	132	
Master's degree	60	19	
Phd and above	12	1	
Marital status			
Single	308	158	$p < 0.001$
Devorced	12	35	$\chi^2 = 108$
Widow	6	46	r = 0.226
Married	684	872	
Pregnancy distribution			
Yes	111	30	$p < 0.001$
No	899	1081	$\chi^2 = 58.6$ r=0.166
Smoking			
Sometimes	57	78	
Smoked everday	214	254	$p < 0.001$
Never smoked	717	716	$\chi^2 = 21.7$
Quit smoking	22	63	
The reasons for vaccine rejection			
Affected by the statements of antivaccine opponents	0	23	
The concerns of vaccine side effectsHE	108	241	
Having negative thoughts about vaccine companies	8	21	
New discovery of the vaccine	24	44	$p < 0.001$
Did not trust the vaccine content	170	295	$\chi^2 = 185$
Negative news in press	1	25	r = 0.296
Religious reasons	1	1	
Other	698	461	
Recommended vaccination to their relatives			
Yes	850	619	$p < 0.001$
No	160	492	$\chi^2 = 201$
Monthly income			
Income less than expense	144	594	$p < 0.001$
Income than expense	146	49	$\chi^2 = 372$
Income equal to expense	720	468	r=0.419

R: Cramer's V analysis effect value; χ^2: Chi-square analysis; $p < 0.05$ significant.

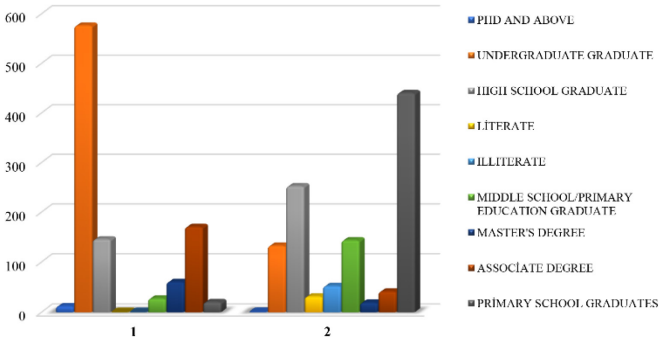
and other sociodemographic findings of health workers and non-health workers were recorded (Figure 1).

2121 people who refused to be vaccinated were included in the study. Of the individuals in the entire study population, 67% (n = 1421) were women, and 33% (n = 700) were men. Regarding the marital status of the population, 22% (n = 466) were single and 73.4% (n = 1556) were married. The educational status of the study population was as follows: 21.7% (n = 460) were primary school graduates, 18.7% (n = 397) were high school graduates, 33.4% (n = 708) were undergraduate graduates and 2.5% (n = 52) were illiterate. We found that 81.3% (n = 1725) of the people live in their home environment with 4 or fewer people, and in terms of monthly income, 34.8% (n = 738) of the person's income is less than the person's expenses, and 56% (n = 1118) of the person's income is equal to their expenses. There was pregnancy in 6.6% (n = 141) of those included in the study. In addition, 22.4% (n = 475) had at least one chronic disease, while 19.9% (n = 423) were using regular medication. While 22.1% (n = 468) of the individuals smoked every day, 67.6% (n = 1433) declared that they had never smoked. The reasons for vaccine refusal were; 21.9% (n = 465) did not trust the vaccine content, 16.5% (n = 349) stated concerns about vaccine side effects, and 54.6% (n = 1159) stated reasons outside the reasons questioned in our study. It is also noteworthy that 69.3% (n = 1469) of individuals declared that they recommend vaccination to their relatives (Table 1).

We categorized the health workers as Group 1 (n = 1010) and the non-health workers as Group 2 (n = 1111).

The results of the statistical analysis revealed that 30.5% (n = 308) of the individuals in Group 1 were

Figure 1. Distribution of Educational Status.



singles, while 14.2% (n = 158) of individuals in Group 2 were single. Married individuals in Group 1 are 67.7% (n = 684), while married individuals in Group 2 are 78.5% (n = 872). Although there was a statistically significant difference in marital status between Group 1 and Group 2 who refused the vaccine, a moderate effect value was found in Cramer's V analysis ($p < 0.001$, r = 0.226).

When we look at the distribution of education levels of the groups, there is no illiterate or literate person in Group 1, while 57% (n = 576) of the group had a bachelor's degree, 16.8% (n = 170) were an associate degree graduate and in Group 2, 39.6% (n = 440) were primary school graduates, 22.7% (n = 252) were high school graduates, and 4.7% (n = 52) were illiterate (Figure 2). Although there was a statistically significant difference between Group 1 and Group 2 who refused the vaccine in terms of education levels, Cramer's V analysis showed a large effect value ($p < 0.001$, r = 0.673).

When we look at the distribution of education levels of the groups, there is no illiterate or literate person in Group 1, while 57% (n = 576) of the group has a bachelor's degree, 16.8% (n = 170) is an associate degree graduate, and 2% (n = 20) While they were primary school graduates, in Group 2, 39.6% (n = 440) were primary school graduates, 22.7% (n = 252) were

Figure 2. Pregnancy Distribution.

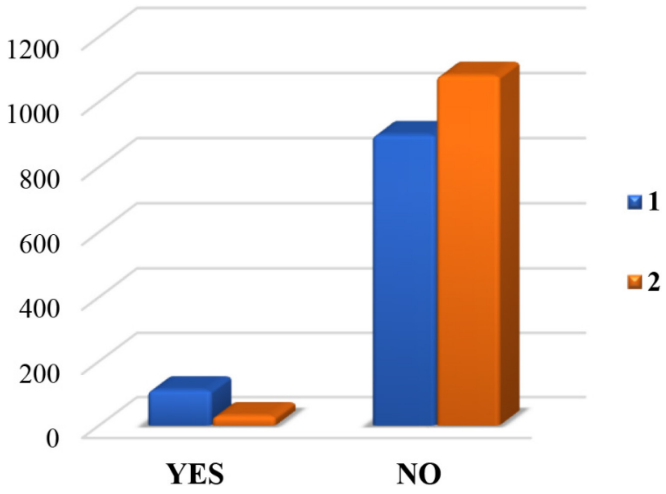
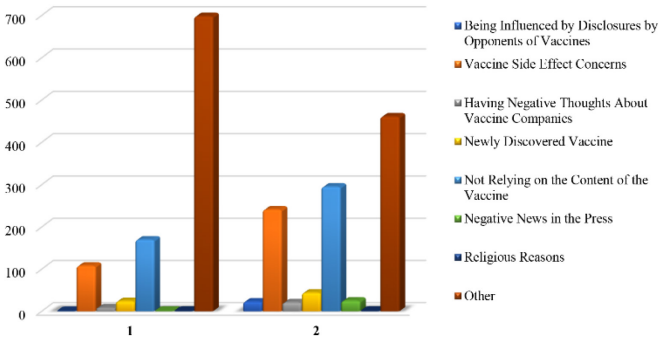


Figure 3. Reasons for Vaccine Rejection.



high school graduates, and 4.7% (n = 52) were illiterate (Figure 2). Although there was a statistically significant difference between Group 1 and Group 2 who refused the vaccine in terms of education levels, Cramer's V analysis showed a large effect value ($p < 0.001$, r = 0.673).

On examining the pregnancy status of the groups, we found that 11% (n = 111) of women were pregnant in Group 1, and this rate was 2.7% (n = 30) in Group 2 (Figure 3). It was found that the pregnancy rates as well as the income level were different between the groups. Although there was a statistically significant difference in terms of pregnancy status between Group 1 and Group 2 who refused the vaccine, a moderate effect value was found in Cramer's V analysis ($p < 0.001$, r = 0.166).

When we compared the groups for the reasons of refusing the vaccine, 16.8% (n = 170) vs 26.6% (n = 295) did not trust the vaccine content, 10.7% (n = 108) vs 21.7% (n = 241), concerns about vaccine side effects, 0% (n = 0) vs 2.1% (n = 23) were affected by the statements of anti-vaccine opponents, and 69.1% (n = 698) vs 41.5% (n = 461) declared a reason other than the reasons asked (Figure 4). Although there was a statistically significant difference between Group 1 and Group 2 who refused the vaccine in terms of reasons for refusal, Cramer's V analysis showed a large effect value ($p < 0.001$, r = 0.296).

While 84.1% (n = 850) of Group 1 recommended vaccination to their relatives, this rate was found to be 55.7% (n = 619) in Group 2. In both groups, the rate of recommending vaccination to their relatives despite refusing to be vaccinated is remarkable. Although there was a statistically significant difference between Group 1 and Group 2 who refused the vaccine in terms of recommending their relatives to be vaccinated, Cramer's V analysis showed a large effect value ($p < 0.001$, r = 0.308).

In summary, in the Cramer's V correlation analysis of the variables with a statistically significant difference ($p < 0.05$) between Group 1 and Group 2 who refused to be vaccinated, the ones with a large effect size were education level, monthly income level, reasons for refusing the vaccine, and recommending their relatives to the medium level. The effect of pregnancy status on vaccine rejection between the groups was also questioned.

Discussion

Developing vaccine delivery strategies to combat COVID-19 pandemic is an important public health challenge. Health belief model or protection motivation theory behavioral models have been developed to better explain vaccine hesitancy and reduce this behavior pattern [36]. Each of these models has implications for various factors such as effective leaders, religious or cultural issues, knowledge/awareness ratio, risk-benefit balance, and the role of healthcare providers. It includes several major determinant categories: individual and collective effects, contextual effects, and specific immunization considerations [37,38].

Many healthcare workers have been vaccinated since vaccines became available. Institutions providing long-term inpatient treatment were given priority, and until January 17, 2021, 77.8% of these institutions' staff and 37.5% of the staff of other healthcare facilities were vaccinated with at least one dose. It was observed that at least 50% of the health workers working in these facilities were vaccinated for up to a quarter of the year [5].

Health workers who refused to be vaccinated stated that they did not trust the government and health policies; In particular, according to the information received from medical experts, shows that high trust in regulatory authorities plays an important role in increasing the vaccination rate of healthcare professionals and in our fight against vaccine rejection. It was determined that the development was very fast and the lack of FDA approval was the reason [39].

In the meta-analysis conducted by Troiano by including 15 studies in 2021, the most common reasons for vaccine rejection included: opposition to vaccines in general, safety concerns/thinking that a hastily produced vaccine is too dangerous, seeing the vaccine as useless due to the harmless nature of COVID-19, lack of vaccine in general, distrust about the efficacy of the vaccine, and belief of being vaccinated possibly by passing the infection [39]. In our study, the most common reason for vaccine rejection in both groups was similar to the literature as not trusting the vaccine content.

Differences in vaccine refusal among occupations are valid for the COVID-19 vaccine [40]. Although the group rejecting the vaccine among health workers shows differences, nurses are at the forefront of vaccine rejection in general, as in our study. We think that occupational group differences in other studies are affected by both individual and social multiple parameters for vaccine hesitancy and anti-vaccination.

In a study of male and female participants, male participants also had lower vaccine hesitancy scores than female participants. It is consistent with the findings of previous studies that report higher vaccine hesitancy among women, similarly, vaccine hesitancy

in women in our study is higher than in men [41-43]. This can be explained by the weight of female workers among health workers, the fact that women have more concerns about safety during the pandemic, and the idea of being able to become pregnant [44-46]. Different from our study, in countries such as France, Germany, Sweden, and Russia, women's families are more concerned about their health. They were more likely to accept any vaccine, considering that they would be decisive in their decisions and would have higher levels of empathy for the safety and comfort of their families [47].

In our study, it was observed that vaccine refusal had exactly the opposite effect with marital status for both groups. In a study conducted with 242 participants, no significant relationship was found between the participant's marital status and their willingness to have the COVID-19 vaccine [48].

In a study examining the reasons that increase or decrease vaccination, it was shown that the health service providers' recommendation of the vaccine had the highest positive effect on the participants [49] due to the role model behaviors of the healthcare professionals, who are the key determinants for increasing the prevalence of the vaccine in the society, especially to eliminate the hesitations of healthcare personnel about vaccines. It will be a solution to many public health problems [50]. Because it is still an important problem that the desired level of vaccination among health workers cannot be achieved and the vaccine is not recommended to the normal population by this group [51]. In the present study, it is pleasing that the rate of recommending the COVID-19 vaccine to their relatives is high among healthcare workers who refuse the COVID-19 vaccine.

The relationship between education level and vaccine rejection, which has been proven by many previous studies and in line with the present study, the fact that vaccination refusal in our non-healthcare group is more common at the level of education under associate degree [42,52]

In a study of dental students on the impact of economic status on vaccine rejection, students in low and low-middle-income economies had significantly higher levels of vaccine hesitancy compared to their peers in upper-middle and high-income economies. Dentistry students were found to be an important determinant of their vocational education as 37.5%, 27.8% of low-middle-income, 25.2% of upper-middle-income, and 11.1% of high-middle income. [53] Students in low-income economies were hesitant about COVID-19 vaccines. This socioeconomic gradient of HCWs has been recently found among population groups in Italy, where perceived levels of economic hardship are significantly correlated in the decision between HCWs to vaccinate or not [52]. However, from a global perspective, more conclusive evidence is still needed on the relationship between economic status and vaccine acceptance. A recent systematic review also showed that the highest level of acceptance among healthcare workers was in a high-income country, Israel (78.1%), and the lowest in the low-income country, the Democratic Republic of the Congo (27.7%) [10]. Regardless of their methodological heterogeneity, cross-sectional studies have shown that admission levels of medical students in high-income countries such as Italy (86.1%) and Poland (92%) are much higher than in low-economy countries such as Egypt (35%) [54-56].

Vaccination during pregnancy is a topic that has been discussed for a long time, the intake of other routinely recommended vaccines is generally low during pregnancy. According to the data from the CDC as of 2017, tetanus vaccination is seen by half of the pregnant women and one-third of influenza vaccination. [57]. Higher health literacy was associated with a higher chance of getting the flu vaccine during pregnancy [58]. Tetanus and flu vaccines have long been recommended for use in pregnancy and there is a lot of evidence that they are safe, but many pregnant women do not choose these vaccines. COVID-19 vaccines, on the other hand, are very new and evidence is limited due to limited research on pregnant women. The result is expected lower vaccination rates. However, given that pregnant people infected with SARS-CoV-2 have a higher risk of ICU admission and death, and a higher risk of preterm birth it would be a hit to identify this group as a high priority for vaccination, such as healthcare workers [59]. Some women may get vaccinated as data grows on this topic, while others may hesitate. For the second group, the risk versus benefit discussion is important. It is very important to raise the health literacy of pregnant women or women who are considering pregnancy through education about pregnancy and vaccine acceptance in a non-pregnant person regarding vaccination against the risks that may arise in case of infection.

Conclusions

Increasing the public's interest in the vaccine shows that there is a need for global policies to eliminate negative attitudes toward the COVID-19 vaccine. In this study, it was found that people need researches and results that have the quality of rational proof that

COVID-19 vaccines are reliable. In this context, the necessity of explaining to the public the negative aspects of the course of the COVID-19 disease, the effects of infection and subsequent effects, and the good results of vaccination, especially at rates that can create herd immunity, comes forward. It can be thought that the lack of interest in the vaccine, especially in young individuals, is effective because the COVID-19 infection is more difficult in older individuals. However, awareness among young people about the danger of spreading the infection to other members of society should be ensured even if they survive the infection mildly. With the new policies to be determined, the knowledge level of the society on COVID-19 in a short time and the education of the societies in the long term can facilitate our way in new infections that our world may encounter.

Healthcare workers have priority among high-risk groups considered candidates for early vaccination. Therefore, it is important to consider health professionals' attitudes towards COVID-19 vaccination to better address barriers to widespread vaccination. The role of healthcare professionals is also important, as it encourages the entire community to be vaccinated with role-modeling behavior and provides advice to patients and communities.

Authors' Contributions

Conceived and design the analysis: SM, HA; Data Collection: FE; Contributed towards data and analysis tools: SM, FE; Data analysis: H; Manuscript writing: SM; Literature search and supervision: SE; Language check: SE, SM. Final approval of the version to be published: All authors.

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