Original Paper

RELATIONSHIP BETWEEN ATTITUDE TOWARDS VACCINATION AGAINST COVID-19 AND SOCIALDEMOGRAPHIC, HEALTH-RELATED AND PSYCHOLOGICAL PARAMETERS AMONG UNVACCINATED HOSPITAL EMPLOYEES IN LATVIA

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The coronavirus disease (COVID-19) vaccination of healthcare workers has a critical role in protecting them, the patients, and society. The aim of this study was to explore attitude factors related to COVID-19 vaccination of unvaccinated hospital employees in Latvia. Data were collected from March to May 2021 among the employees of nine hospitals. Overall, 355 respondents took part in the online survey. The respondents in this group ranged from 19 to 71 years old. The results of the hierarchical multiple regression found that sex, previous influenza vaccination, and psychological parameters, are related to more of an attitude of denial regarding vaccination among unvaccinated hospital employees. In conclusion, our study suggests that respondents without previous influenza vaccination, and having concern about the speed of vaccine production, distrust in recommendations of specialists, belief about not being a risk group, belief that the vaccine does not protect oneself and others, belief that COVID-19 is made up, and vaccines are a threat, are related to a more negative attitude towards COVID-19 vaccination.

Keywords: *healthcare workers, COVID-19 vaccination, influencing factors.*

INTRODUCTION

The coronavirus disease (COVID-19) is a global public health emergency that has caused significant challenges to health care systems all over the world (Ackah *et al.,* 2022). The first case of the disease in Latvia was detected on 2 March 2020 (Ministry of Health of Latvia, 2020). To protect oneself and others, the World Health Organisation (WHO) provided instructions to maintain physical distance, wear a mask, clean hands, and get vaccinated as soon as possible (WHO, 2022a). At the end of December 2020, in Europe and Latvia, the COVID-19 vaccination process started for the first priority group — healthcare workers (HCW), who were directly exposed to COVID-19 patients daily (CDC, 2020). After that, the possibility of vaccination was extended to other groups of residents, including all hospital employees. HCW play a central role in the COVID-19 pandemic by discussing vaccination against COVID-19 with their patients and relatives (WHO, 2022b). They also have a higher risk of infection (WHO, 2022c). Despite the rates of mortality due to COVID-19 worldwide, some HCW were either uncertain or in some cases did not plan to receive the COVID-19 vaccine (Kirzinger *et al.,* 2021). One of the WHO's main goals regarding COVID-19 vaccination is to support all countries to reach 70% vaccination coverage in the general population, including 100% of HCW (WHO, 2022d). The Cabinet of Ministers of the Republic in Latvia declared an Emergency Situation on 9 November 2021 with epidemiological safety requirements from 15 November, which required a vaccination or recovery certificate to continue working in the hospital (Cabinet of Ministers, 2021).

At the beginning of the vaccination process the acceptance of HCW towards COVID-19 vaccination varied. A systematic review and meta-analysis of cross-sectional studies

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showed that willingness regarding COVID-19 vaccination among HCW was 51% (Luo *et al.,* 2021). In different countries it varied from 27.7% in the Democratic Republic of the Congo (Nzaji *et al.,* 2020) to 96.2% in several Asian countries (Chew *et al.,* 2021). A study on HCW in Latvia (n = 1444) in May 2021, showed accepting attitudes towards COVID-19 vaccination in 76.1% of cases. Resistance of unvaccinated hospitals employees (n = 335) comprised 38.6% of cases, but 49.9% were unsure. Only 24% of unvaccinated hospital employees showed an accepting attitude but for some reason were not vaccinated yet (Lielsvagere-Endele *et al.,* 2021).

According to previous studies, sociodemographic variables, such as sex, age, education level, and type of work (Li *et al.,* 2021) have been associated with the attitude towards COVID-19 vaccination. Studies indicate that women choose not to vaccinate more often than men among HCW (Al-Sanafi and Sallam, 2021). Younger age among HCW was a predictor of vaccine refusal (Wang *et al.,* 2020). Also, lower education was a predictive factor for refusal to vaccinate (Shekhar *et al.*, 2021). Nurses were less willing to vaccinate than other HCW, especially physicians (Gagneux-Brunon *et al.,* 2020). Some studies found that direct patient care was associated with higher vaccination rates against Covid-19 among HCW (Farah *et al.*, 2022; Gagneux-Brunon *et al.,* 2020). However, influences of direct COVID-19 patient care and occupation on vaccination are ambiguous (Li *et al.,* 2021).

Health-related factors, such as previous influenza vaccination (Krishnamurthy *et al.,* 2021), chronic illness (Angelo *et al.,* 2021; Li *et al.*, 2021; Luo *et al.*, 2021), and pregnancy (Toth-Manikowski *et al.,* 2022) also had an influence on attitude. However, another study showed that vaccination acceptance rates were higher among physicians, men, and those who did not receive regular seasonal influenza shots each year (Ikiisik *et al.,* 2022). In some cases, pregnancy was a predictor of willingness to get vaccinated as well as the belief that the vaccine is safe among healthcare workers (Perez *et al.,* 2022), in others — HCW were less likely to receive the COVID-19 vaccine if they believed the vaccine might negatively impact pregnancy (Toth-Manikowski *et al.,* 2022).

The attitude towards COVID-19 vaccination can also be influenced by different psychological determinants. For HCW, the strongest contributor to vaccination hesitancy are a lack of confidence in vaccination. Vaccine decision-making is influenced by a number of factors, including cultural, social and political factors, individual and group factors, and especially factors related to the vaccine itself, such as the speed of vaccine development. The belief that a vaccine may be ineffective or even harmful because it was developed too quickly is a predictor of vaccine refusal (Sheikh *et al.,* 2021). Self-perceived risk is one of the components of vaccination readiness, but concerns about safety, efficacy, effectiveness, and distrust of the government are barriers (Li *et al.,* 2021). Also, HCW have questions or concerns that they would like to discuss with a specialist

(Peirolo *et al.,* 2022). This is important because a correlation exists between belief in conspiracy and vaccine hesitancy. Conspiracy beliefs were prevalent since the start of the COVID-19 pandemic, and were later linked to vaccination against COVID-19 (Sallam *et al.,* 2020), and can also exist among HCW (Al-Sanafi and Sallam, 2021).

Vaccine hesitancy is defined as the: "[…] delay in acceptance or refusal of vaccines despite the availability of vaccination services" (WHO, 2014). The WHO regarded vaccine hesitancy as one of the ten global health threats in 2019 (WHO, 2014). HCW are the most trusted advisors and influencers of vaccination decisions. Although HCW are one of the groups that accept vaccination in most cases, studies have shown that even vaccinated individuals sometimes have apprehensions or doubts about the safety of vaccines (Dube *et al.,* 2013).

This study aims to explore related factors to the attitude towards COVID-19 vaccination of unvaccinated hospital employees in Latvia. The study had three key research questions: Q1: To what extent can sociodemographic variables explain the attitude towards COVID-19 vaccination? Q2: To what extent can health-related variables explain the attitude toward COVID-19 vaccination? Q3: To what extent can psychological parameters explain the attitude towards COVID-19 vaccination?

MATERIALS AND METHODS

The data were obtained in the cross-sectional survey study "Latvian healthcare workers` attitude toward COVID-19 vaccination" in cooperation with Latvian hospitals and Rīga Stradiņš University.

Respondents were selected from nine hospitals located in different towns in Latvia during the timeframe of March to May 2021. A total of 1444 respondents took part in the survey, but only those who were unvaccinated (n = 355) were included in this analysis. The age of respondents in this group ranged from 19- to 71-years old (M = 41.21; SD = 12.53). 93% of respondents were women. Respondents worked in different professions, most of them nurses (34%) and administration (26%). In addition, most respondents had at least a bachelor's degree (82%). The obtained results are presented in Table 1.

This study used the self-developed survey "Healthcare workers` attitude towards COVID-19 vaccination" (Lielšvāgere-Endele *et al.*, 2021). The survey consisted of sociodemographic data, health related variables, and components of psychological parameters.

Sociodemographic data included information about respondents' sex, questions about respondents' chronic disease, pregnancy, and previous influenza vaccination status. Response options were: (1) Yes; (2) No. Components of psychological parameters included seven items: (1) I am worried about the speed of vaccine production; (2) I do not trust pharmaceutical companies; (3) I do not trust the recommen-

Table 1. Characteristics of respondents (n = 355)

Characteristics	n (%)
Sex	
Women	331 (93.2)
Men	24 (6.8)
Education level	
Basic education	4 (1.1)
Vocational education	5 (1.4)
General secondary education	29 (8.2)
Vocational secondary education	71 (20.0)
Incomplete higher education or studying	36 (10.1)
College education	42 (11.8)
Bachelor's degree	105 (29.6)
Master's degree or Doctor of Medicine degree	59 (16.6)
Doctorate	4 (1.1)
Occupational classification	
Doctor	25 (7.0)
Nurse	122 (34.4)
Medical assistant	10 (2.8)
Midwife	5 (1.4)
Physician`s assistant	6 (1.7)
Assistant nurse	43 (12.1)
Junior nurse assistant (sanitary)	28 (7.9)
Other specialists	23 (6.5)
Administration	93 (26.2)
Direct COVID-19 patient care	
Yes	118 (18.8)
No	237 (81.2)
Previous influenza vaccine status	
Have been vaccinated	83 (12.1)
Have not been vaccinated	272 (87.9)
Chronic disease	
Yes	90 (24.8)
No	265 (75.2)
Pregnancy	
Yes	18 (5.1)
No	337 (94.9)
Attitude	
Acceptance	41 (11.5)
Delaying	177 (49.9)
Resistance	137 (38.6)

dations of specialists about vaccines; (4) I believe that I am not a risk group; (5) I believe that by getting vaccinated, I am protecting myself and others; (6) I do not believe the government about the severity of COVID-19; (7) I believe that COVID-19 is made up and that vaccines are a threat to me. Response options were: (1) Completely disagree; (2) Rather disagree; (3) Rather agree; (4) Completely agree. The attitude towards COVID-19 vaccination was assessed by asking "Please rate your attitude towards the COVID-19 vaccination and choose the most relevant". Response options were: (1) Acceptance (I have already been vaccinated or will be vaccinated as soon as possible); (2) Delaying (I'm ready to get vaccinated, but not now); (3) Resistance (I don't want to get vaccinated). The obtained results are presented in Table 2.

The survey was conducted online, anonymously, and on a voluntary basis. The survey was first approved by hospital

Table 2. Components of psychological variables (n = 355)

	M	SD
I am worried about the speed of vaccine production.	3.25	0.91
I don't trust pharmaceutical companies.	2.43	0.99
I do not trust the recommendations of specialists about vaccines.	2.47	0.95
I believe that I am not in a risk group.	2.84	1.08
I believe that by getting vaccinated, I am protecting myself and others.	2.41	1.07
I do not believe the government about the severity of the COVID-19.	2.58	1.11
I believe that COVID-19 is manmade and that vaccines are a threat to me.	2.43	1.05

management and then sent out to hospital staff by the hospital management representative via e-mail, internal information system, and/or SMS.

SPSS software v.20.0 was used for processing and analysis of the data. The main statistical methods applied were the Pearson correlation coefficient and hierarchical linear regression analysis.

RESULTS

First, we tested correlation between attitudes to vaccination and sociodemographic variables (age, sex, education, and direct COVID-19 patient care), three health-related variables (chronic disease, pregnancy, and previous influenza vaccination status), as well as between the psychological variables of vaccination (concern about the speed of vaccine production; trust in pharmaceutical companies; recommendations of specialists and the government; belief about being in a risk group; belief about vaccine protection for oneself and others; belief about COVID-19 being made up and vaccines being a threat).

Pearson correlations were computed. It was found that age ($r = -0.04$, $p > 0.05$), education ($r = -0.02$, $p > 0.05$), direct COVID-19 patient care ($r = -0.06$; $p > 0.05$) and having a chronic disease ($r = 0.08$, $p > 0.05$) or pregnancy ($r = -0.02$, $p > 0.05$) were not statistically significantly correlated with attitude towards vaccination in the unvaccinated HCW sample. Significant weak correlations were found between the attitude towards vaccination and sex (being female was associated with the attitude of denial regarding vaccination, $r = -0.13$, $p < 0.01$), and previous influenza vaccination (being vaccinated against influenza was associated with an accepting attitude to vaccination $r = 0.24$, $p < 0.01$). Attitude towards vaccination was correlated with all seven psychological parameters — concern about the speed of vaccine production ($r = 0.33$, $p < 0.01$), belief about not being in a risk group ($r = 0.39$, p 0.01), belief about vaccine protection for oneself and others ($r = -0.55$, $p < 0.01$), distrust in pharmaceutical companies ($r = 0.39$, $p < 0.01$), distrust in recommendations of specialists about vaccines ($r = 0.43$, $p < 0.01$), distrust in government about the severity of COVID-

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19 ($r = 0.39$, $p < 0.01$), and belief about COVID-19 being made up and vaccines being a threat ($r = 0.49$, $p < 0.01$).

Since all psychological variables were found to be associated with attitude towards vaccination, in the next stage of data analysis, to determine the incremental effect of psychological variables in predicting the attitude towards vaccination after accounting for sex and influenza vaccination, hierarchical linear regression (using the Enter method) was used. R^2 change effect sizes were interpreted by Cohen (1988) conventions (change effects of 0.01, 0.06, and 0.14 were interpreted as small, medium, and large, respectively). Attitude to vaccination score was included as the dependent variable to be predicted by the score of sex in Model 1, influenza in Model 2, and scores of psychological variables in Model 3, as the predictors for attitude towards vaccination in the last step of the hierarchical regression model. The obtained results are presented in Table 3.

The hierarchical multiple regression revealed that in Model 1, sex contributed significantly to the regression model, F $(1,352) = 5.92$, $p < 0.05$) and accounted for 1.3% of the variation in the attitude towards vaccination. This incremental effect of sex was significant but small in its change effects. Introducing Model 2, the previous influenza vaccine status variable explained an additional 7% variation in the attitude towards vaccination, and this change in R^2 was significant, F $(2,352) = 13.80$, $p < 0.01$. This incremental effect was significant but medium in its change effects. Finally, when all eight independent psychological variables were included in Model 3 of the regression model, neither the distrust of pharmaceutical companies nor non-belief in the government about the severity of COVID-19 were significant predictors of the attitude towards vaccination. The

Table 3. Results of hierarchical linear regression analysis, predicting the attitude towards vaccination in HCW (n = 355)

Model 1	($\Delta R^2 = 1\%$, F = 5.92*)
Sex	β = –0.13*
Model 2	($\Delta R^2 = 7\%$, F = 13.80**)
Sex	β = –0.13*
Previous influenza vaccine status	β = 0.24**
Model 3	($\Delta R^2 = 42\%$, F = 29.22**)
Sex	β = –0.09*
Previous influenza vaccine status	β = 0.09*
I am worried about the speed of vaccine production	β = 0.10*
I believe that I am not in a risk group	β = 0.12*
I believe that by getting vaccinated, I am protecting myself and others	β = –0.33**
I do not trust pharmaceutical companies	β = 0.06 n.s.
I do not trust the recommendations of specialists about vaccines	β = 0.12*
I do not believe the government about the severity of COVID-19	β = 0.02 n.s.
I believe that COVID-19 is made up and that vaccines are a threat to me	β = 0.12*

n = 355; *$p < 0.05$, **$p < 0.01$;

most important predictors in the attitude of denial regarding vaccination were concern about the speed of vaccine production, non-belief that vaccination protects oneself and others, non-belief about being in a risk group, distrust of the recommendations of specialists about vaccines, and the belief that COVID-19 is made up and that vaccines are a threat. Together, the six independent variables accounted for 42% of the variance in the attitude of denial regarding vaccination, and this change in R^2 was significant, F $(9,345) = 29.22$, $p < 0.01$. This incremental effect of psychological variables was not only significant, but also large in its change effects.

DISCUSSION

In the present study, we examine whether and to what extent sociodemographic, health-related, and psychological variables can explain the attitude towards COVID-19 vaccination among unvaccinated hospital employees in Latvia.

Previous sociodemographic variables are strongly associated with the attitude towards COVID-19 vaccination, particularly sex, age, education level, and occupation (Luo *et al.*, 2021; Li *et al.*, 2021). Studies have shown that being a man, older, and a physician are positive predictive factors for vaccination, but women and nurses are more vaccine hesitant. Our data also suggest that women are more negatively inclined towards vaccination than men, which is consistent with previous studies. However, our correlation is small, most likely because of the unequal distribution between sexes. Although the correlation between sex and attitude towards COVID-19 vaccination is strongly related in most cases, the possible explanations are still unclear. According to our full research version, open-ended questions suggest that women's arguments regarding vaccination, unlike men, were related to the possible effect on pregnancy and reproductive health, belief in natural protective capabilities, and the belief that vaccination is being imposed (Lielšvāgere-Endele *et al.*, 2021). Age, education level, and direct COVID-19 patient care did not have any relevance in our data. Examining the relationship between occupation and attitude was not possible in our data because of insufficient respondents in most professions.

Previous influenza vaccine, chronic illness (Luo *et al.*, 2021; Li *et al.*, 2021), and pregnancy (Toth-Manikowski *et al.,* 2022) are health-related variables that are associated with attitudes towards COVID-19 vaccination. Our data show a correlation between previous influenza vaccination and a more positive attitude towards COVID-19 vaccination. A possible explanation can be related to the fact that those who have received influenza vaccination tend to pay more attention to the prevention of respiratory diseases and have more knowledge regarding vaccines (Luo *et al.*, 2021). Refusal of the COVID-19 vaccine can be related to hesitancy among HCW, not only regarding COVID-19 vaccination, but in general (Pan American Health Organization, 2021). Having a chronic illness, pregnancy, and having

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been infected by COVID-19 did not show a significant correlation in our data.

Results of this study show that all included psychological variables had a significant correlation with attitude towards COVID-19 vaccination. Although sex and previous flu vaccination were significant, the psychological parameters explained negative attitudes towards vaccination to the greatest extent. The belief that vaccination cannot protect oneself and others had the strongest correlation with the attitude of denial. This finding was consistent with other previous studies finding that the reasons for willingness to be vaccinated among nurses were to protect the family, oneself, patients and the community (Manning *et al.,* 2021). Perceived risk is an important consideration for taking the COVID-19 vaccine (Li *et al.*, 2021; Peirolo *et al*., 2021), which concurs with our findings, because belief of not being in a risk group was associated with the attitude of denial. In general, in Latvia, institutional trust is related to COVID-19 vaccination (Surina *et al.*, 2022). According to findings in the HCW group worldwide, distrust of the government and lack of confidence in health authorities could lead to vaccine hesitancy (Miyachi *et al.*, 2020). In our data we can also see a correlation related to distrust in pharmaceutical companies, distrust in recommendations of specialists, and distrust in government about the severity of the COVID-19. Concern about the speed of vaccine production was also related to greater denial. One study found that almost half of the surveyed HCW thought that the development of the vaccines may have been rushed or that the vaccines may not have been thoroughly tested (Puertas *et al.*, 2022). It is considered that HCW are exposed to more professional information, which can lead to concerns about the effectiveness and safety of the COVID-19 vaccine (Luo *et al.*, 2021). In some cases, it can be related to conspiracy beliefs. Conspiracy beliefs regarding COVID-19 can predict distress, anxiety, and job and life satisfaction among HCW (Chen *et al.,* 2020). The attitude of denial in our data was correlated with the belief about COVID-19 being made up and vaccines being a threat.

The study suggests that different factors, such as not previously having an influenza vaccination, concern about the speed of vaccine production, distrust of recommendations of specialists, belief of not being in a risk group, belief of the vaccine not protecting oneself and others, belief about COVID-19 being made up and vaccines being a threat, can affect HCW attitude to an extent of 41.2% of denial attitude. This study could help develop a public campaign to inform and support HCW who are unsure about getting vaccinated. It is possible that compulsory vaccination can lead to HCW losing their jobs or feeling obliged to receive the vaccine contrary to their values or concerns (Luo *et al.*, 2021). It can be assumed that by feeling more confident, HCW will not only get vaccinated themselves, but also recommend vaccination to their patients and relatives (Pan American Health Organization, 2021).

One of the main strengths of this study was the opportunity to obtain data from unvaccinated HCW when vaccination was already possible. Therefore, the attitude towards COVID-19 was time sensitive, and the authors strongly indicate that these data reflect the situation in the spring of 2021. One of the main limitations is the gap in the relationship between occupation and attitude because of insufficient respondents in most professions. Secondly, a more accurate analysis would require equal distribution between sexes. Thirdly, the survey needs to be improved by using a theoretical background regarding health behaviour so that factors affecting attitudes can be comprehensively assessed.

CONCLUSIONS

In conclusion, our study suggests that respondents without previous influenza vaccination and having concern about the speed of vaccine production, distrust in recommendations of specialists, belief about not being a risk group, belief about the vaccine not protecting oneself and others, belief that COVID-19 is made up, and vaccines being a threat, are related to a more negative attitude towards COVID-19 vaccination. The psychological parameters play the most significant role in predicting negative attitudes. Therefore, it is crucial when organise vaccination campaigns for employees of medical institutions.

ETHICS

The study procedure was approved by the Ethics Committee of Rīga Stradiņš University (protocol code 22-2/205/2021). Informed consent was obtained from all subjects involved in the study.

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ATTIECĪBAS STARP ATTIEKSMI PRET COVID-19 VAKCINĀCIJU UN SOCIĀLDEMOGRĀFISKAJIEM, AR VESELĪBU SAISTĪTAJIEM UN PSIHOLOĢISKAJIEM PARAMETRIEM NEVAKCINĒTIEM SLIMNĪCU DARBINIEKIEM LATVIJĀ.

Koronavīrusa slimības (Covid-19) vakcinācijai veselības aprūpes speciālistiem ir izšķiroša nozīme sevis, pacientu un sabiedrības aizsardzībā. Šī pētījuma mērķis bija izpētīt saistītus faktorus ar nevakcinēto slimnīcu darbinieku attieksmi pret Covid-19 vakcināciju Latvijā. Dati tika apkopoti no 2021. gada marta līdz maijam. Kopumā tiešsaistes aptaujā piedalījās 355 nevakcinēti darbinieki. Respondenti šajā grupā bija no 19 līdz 71 gadam (M = 41,21; SD = 12,53). 93% aptaujāto bija sievietes. Hierarhiskā daudzkārtējā regresija atklāja, ka dzimums ($R2 = 0,01$, $F(1,352) = 5,92$, $p < 0,05$), iepriekšējā vakcinācija pret gripu ($\Delta R2 = 0,07$, $F(2,352) = 13,80$, $p < 0,01$) un psiholoģiskie faktori ($\Delta R2$) 0,42, F (9,345) = 29,22, $p < 0,01$), ir saistīti ar noliedzošāku attieksmi pret vakcināciju nevakcinēto vidū. Pētījuma rezultāti liecina, ka respondentiem bez iepriekšējas vakcinācijas pret gripu un kuriem ir bažas par vakcīnas ražošanas ātrumu, neuzticība speciālistu ieteikumiem, pārliecība par to, ka viņi neatrodas riska grupā, pārliecība, ka vakcīna nepasargā sevi un citus, pārliecība, ka Covid-19 ir izdomāts un vakcīnas ir drauds, ir negatīvāka attieksme pret Covid-19 vakcināciju.

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