



Original Article

Attitudes toward COVID-19 disease and vaccination in Hungary: A comparison of nurses and health workers against non-health workers

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ABSTRACT

Background & Aim: Hungary started to administer several COVID-19 vaccines; however, attitudes toward COVID-19 and vaccination are still poorly understood. This study aimed to explore how the attitudes toward COVID-19 disease are associated with the attitudes toward COVID-19 vaccination in Hungary and compare the attitudes of health and non-health workers toward COVID-19 disease and vaccination in Hungary.

Methods & Materials: Using a descriptive, cross-sectional design, we recruited a sample of 1820 persons through an electronic survey. In addition to the sociodemographic questions, the attitudes towards COVID-19 disease and vaccination were assessed through self-developed, literature-based questionnaires. Principal component analysis, Spearman's correlation, linear regression, and the Mann-Whitney test were used in the data analysis.

Results: The mean age for the study participants (n=1735) was 43.8 ± 6.2 years, and females were the majority (84.6%). Overall, participants showed good attitudes toward COVID-19 disease (mean score= 3.48, SD= 0.43) as compared to their attitudes toward COVID-19 vaccination (Mean score= 2.67, SD= 0.44). A positive correlation was found between the attitudes toward COVID-19 disease and attitudes toward vaccination in Hungary (r= 0.247, p< 0.01). Nurses and other health workers showed more positive attitudes toward COVID-19 vaccination than non-health workers.

Conclusion: Hungarian decision-makers should intervene to improve the public's willingness to be vaccinated against COVID-19 or future pandemics. Health workers' knowledge and positive attitudes should be utilized in the media to encourage the general population to be vaccinated. The suggested questionnaires need to be validated for future pandemics' use.

Introduction

The pandemic of coronavirus disease 2019 (COVID-19) was caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and it first emerged at the end of 2019 in Wuhan, China (1,2). Until recently, this pandemic had a catastrophic impact on the world, which indicated strict and timely policies aimed at containing the pandemic (3). Worldwide, the basic infection control protocol was to limit disease transmission, usually by encouraging social

distancing, hand sanitization, and wearing masks in addition to partial or complete lockdowns (4,5). However, medical technology, including inventing effective antivirals and vaccines, remained the most hopeful way to eliminate the pandemic and decrease disease morbidity and mortality. As regards antivirals, no drug was specifically invented to combat SARS-CoV-2 (6). The antiviral drug; *Remdesivir*, approved by the U.S. Food and Drug Administration (FDA)



for emergent use in patients with severe illness (7,8), was not recommended for use by the WHO in November 2020 (9).

Scientists and pharmaceutical companies have been challenged to develop specific vaccines against SARS-CoV-2 as soon as possible (10,11). About 63 vaccines have been in different phases of human clinical trials (10). Moderna and Pfizer-BioNTech's mRNA vaccines have been approved in the U.S. for emergency use (10). At least one WHO-recognized authority has approved others for emergency or full use. These are Oxford–AstraZeneca, Sinopharm-BBIBP, Sputnik V, CanSino, Covishield, and Johnson & Johnson (12).

Governments, healthcare providers, and influential elites have a major goal to achieve the vaccines' widespread acceptance, as doubts about the vaccines' efficacy and safety have emerged among many people (11,13,14). These doubts might significantly hinder the achievement of immunization goals (11,13,15).

In Hungary, it was reported to WHO that from 3 January 2020 to 19 April 2023, there have been 2,200,211 confirmed cases of COVID-19, resulting in 48,743 deaths (16). Hungary was the first country in the European Union to use Russia's Sputnik V and China's Sinopharm vaccines. Hungary also approved the emergent use of CanSino and Covishield at the end of March 2021 (17). As of 18 March 2023, a total of 16,568,528 vaccine doses had been administered in Hungary (16).

Hungary administered several COVID-19 vaccines and encouraged the population to get any of these vaccinations. However, attitudes toward COVID-19 disease and vaccination are still poorly understood (18–21). Also, it is not yet understood whether these attitudes differ among nurses, health workers, and the general population. To the best of our knowledge, this study is among the first in

Hungary to assess the public's attitudes toward COVID-19 disease and vaccination and compare them with nurses' and health workers' attitudes. Most published studies explored either COVID-19 or the vaccine; this study is distinguished because it explores the relationship between attitudes toward the COVID-19 disease and attitudes toward the COVID-19 vaccination. This study aimed to (1) explore the relationships between attitudes toward the COVID-19 disease and attitudes toward the COVID-19 vaccination in Hungary and (2) compare the attitudes of nurses and health workers against non-health workers in Hungary toward the COVID-19 disease and the COVID-19 vaccination.

Methods

A descriptive, cross-sectional design was utilized in this study. Using Google Forms, a structured questionnaire was designed and incorporated into a generic link. The generic link was shared on Facebook in the period between August and December 2020. A total of 1820 anonymous participants were recruited to participate in this study; the number of valid responses was 1735. The inclusion criteria were being at least 18 years old, being able to understand the Hungarian language, and living in Hungary. The participants were asked to independently and anonymously complete the online questionnaire.

To ensure adequate statistical power, a priori sample size calculation was done using G*Power software. Using the regression analysis with a medium effect size, significance set at 5%, and power at 0.95, a total sample of 988 participants was required. In the post hoc test, our 1735 participants provided a power of 0.99, which is statistically enough to draw conclusions.

Participants were asked about a set of sociodemographic questions, including gender, age, place of residence (city, village), marital status (single, married, divorced,

widow), educational level (8 general or less, vocational school, vocational training, graduation certificate, college or university degree), employment status (worker, non-worker), and occupation (health worker, non-health worker).

Additionally, the authors reviewed the related literature and developed a 62-item questionnaire comprising two main sections. The first section included 26 items to assess participants' attitudes toward COVID-19. Regarding the attitudes toward vaccines in the second section, participants responded to 36 items. All of these items were 5-point Likert-type questions (strongly disagree, strongly agree). The two sections' internal reliabilities (Cronbach's α) were 0.72 and 0.79, respectively.

The content validity of these questionnaires was assessed by reviewing their items by a panel of two nurses and three public health specialists. The panel has agreed that the items in the two questionnaires are valid to be used. Furthermore, construct validity was assessed using factor analysis, with a factor loading of 0.3 or more considered good.

The Kaiser-Meyer-Olkin (KMO) value is one of the most important metrics in assessing the suitability of variables for factor analysis (20,21). The KMO was 0.951 for the COVID-19 questionnaire and 0.954 for the vaccines questionnaire, which is excellent. The initial commonality is derived from the squares of multiple correlation coefficients. We considered all variables whose commonality reached a value of 0.30. Consequently, we had to eliminate one variable about attitudes toward vaccines. Similarly, one variable about attitudes toward COVID-19 was excluded. Thus, the final analysis included 25 variables related to COVID-19 and 35 variables related to the COVID-19 vaccination. The standard deviation was checked using Levene's F-test. If the standard deviation ($p > 0.05$) was the

same in the two groups, the two-sample t-test results were considered relevant. In the case of different standard deviations ($p < 0.05$), Welch's test was taken into account. A one-way analysis of variance (ANOVA) was used for several groups. A principal component analysis (PCA) with varimax rotation (at an angle of 90°) was performed to evaluate the validity.

The PCA results from Bartlett's Test of Sphericity indicate that variables are correlated ($(300) = 19744.135, p < .001$) for the COVID-19 questionnaire and ($(630) = 36603.018, p < .001$) for the vaccine questionnaire. Four factors were extracted using a rule for extracting factors (eigenvalue greater than 1), explaining 41.27%, 10.20%, 5.43%, and 4.52% of the variance in all 25 variables of the COVID-19 questionnaire. After orthogonal rotation, 61.4% of the variance was explained by four factors. Regarding the vaccine questionnaire, six factors were extracted to explain 40.42%, 14.13%, 5.87%, 3.48%, 3.23%, and 2.99% of the variance in all 35 variables. After orthogonal rotation, 70.1% of the variance was explained by six factors.

In the COVID-19 questionnaire, items c6, c9, c8, c10, c7, c5, c13, c22, and c11 were loaded on factor one (loadings were .797, .783, .773, .725, .712, .701, .700, .693, and .678, respectively). Since these items assessed the perceived risk of being infected with COVID-19, factor one was called "The perceived risk of infection." The items c20, c19, c17, c23, c25, c26, c18, and c15 were loaded on factor two (loadings were .729, .710, .701, .689, .682, .675, .671, and .547, respectively). The factor was called "The perceived need and effectiveness of the personal protective equipment" because its items assessed the perceived usefulness of masks and other personal protective equipment. The items c3, c14, c12, c4 and c1 were loaded on factor three (loadings were .729, .668, .647, .614, and .519, respectively).

Factor three was called "The fear of COVID-19 complications". Items c16, c24, and c21 were loaded on factor four (loadings were .714, .638, and .441, respectively). Factor four comprised three items related to knowledge about health care delivered during the pandemic. It was called "The perceived knowledge about COVID-19 and health services".

In the vaccine questionnaire, items v27, v26, v28, v31, v32, v30, v13, v29, v14, v15, v33, v11, and v12 were loaded on factor one (loadings were .873, .841, .833, .827, .790, .715, .713, .701, .699, .675, .656, .653 and .628, respectively). Because of its content, factor one was called "The perceived vaccine safety and accessibility". The items v20, v21, v23, v24, v22, v19, v34, and v17 were loaded on factor two (loadings were .922, .914, .895, .761, .660, .653, .636, and .532, respectively). Factor two was called "The perceived fear of vaccine side effects and complications". The items v8, v7, v16, v25 and v18 were loaded on factor three (loadings were .732, .624, .606, .442, and .437, respectively). Factor three was called "Uncertainty about the need for the vaccine." The items v2, v1, v3, and v10 were loaded on factor four (loadings were .637, .628, .620, and .515, respectively). Because of its tenor, factor four was called "The perceived benefits of COVID-19 vaccines". The items v4, v5, and v6 were loaded on factor five; (loadings were .748, .575, and .495 respectively). Factor five was called "Uncertainty about vaccines' efficacy." Items v36 and v9 were loaded on factor six, which is called "Knowledge about the vaccine" (loadings were .669 and .527, respectively).

This study was conducted after obtaining approval from the relevant institutional review board at Jerash University (JPU-N-06-2020). Additionally, informed consent was obtained from each participant, and all completed questionnaires were kept confidential and anonymous.

Furthermore, all study procedures were performed according to the Declaration of Helsinki of the World Medical Association. The current study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (22).

Statistical analysis was performed using the SPSS 17.0 statistical software package. The basic descriptive and frequency tests were used to describe the participants' sociodemographic characteristics, such as gender, age, and place of residence. The Kolmogorov-Smirnov and Shapiro-Wilk tests were significant for the dependent variables: the COVID-19 and vaccine questionnaires. This finding, in addition to the histogram shape, means that the data is not normally distributed. So, Spearman's correlation was used to explore the associations between the studied variables. By the law of large numbers and the central limit theorem (23), we preferred to run linear regression to predict the dependent variables. Based on the significant results found in Spearman's correlation, attitudes toward the COVID-19 disease and vaccination were the dependent variables, and employment status and occupation were the independent variables. Last, the Mann-Whitney test was used to compare the attitudes of health and non-health workers toward the COVID-19 disease and COVID-19 vaccination.

Results

The results showed that 84.6% of the respondents were females, 71.9% were married, and 50.3% were aged between 30 and 49 years. In terms of living place, around 75.4% of the participants live in Hungarian cities, while only 24.6% live in Hungarian villages. Concerning the participants' level of education, around 60.5% of the participants had either a college or university degree. Regarding their employment status, most of them (77.3%) were workers, and 22.7 were

non-workers (students, retired, or unemployed). Additionally, most of the respondents were nurses and health workers (59.1%). Generally, participants exhibited good attitudes toward COVID-19 disease

(mean score = 3.48, SD = 0.43) as compared to their attitudes toward COVID-19 vaccination (mean score = 2.67, SD = 0.44) (Table 1).

Table 1. Participants characteristics (N=1735)

Variable	N	%
Gender		
Male	268	15.4
Female	1467	84.6
Age		
18-29 years	207	11.9
30-49 years	873	50.3
>=50	655	37.8
Residence		
City	1308	75.4
Village	427	24.6
Marital status		
Single	206	11.9
Married	1248	71.9
Divorced	220	12.7
Widow	61	3.5
Educational level		
8th class or less	21	1.2
Vocational school, Vocational training	94	5.4
Secondary school certificate	570	32.9
College / University degree	1050	60.5
Employment status		
Worker	1341	77.3
Non-worker	394	22.7
Occupation		
Health worker	1026	59.1
Non-health worker	696	40.1
Outcome scores		
Attitudes toward COVID-19 disease	Mean	SD
	3.48	0.43
Attitudes toward COVID-19 vaccination	2.67	0.44

The results of Spearman's correlation demonstrated some significant associations between the studied variables. Most importantly, the total score of attitudes toward COVID-19 disease was positively correlated with attitudes toward

COVID-19 vaccination. Also, the total score of attitudes toward vaccination was positively correlated with the employment status and occupation of the participants (Table 2).

Table 2. Correlations between participants' characteristics and their attitudes towards COVID-19 disease and vaccination

Variables	Gender	Age	Living place	Marital status	Education	Employment status	Occupation	Attitudes toward COVID-19	Attitudes toward vaccination
Gender	1.000	-.014	.055	.107	-.024	-.007	.026	.024	.035
Age	-.014	1.000	-.089	.403	.009	-.220	.018	-.022	.016
Living place	.055	-.089	1.000	-.067	-.165	-.048	-.019	.043	.001
Marital status	.107	.403	-.067	1.000	.001	-.076	.078	.010	.020
Education	-.024	.009	-.165	.001	1.000	.079	-.003	.010	.018
Employment status	-.007	-.220	-.048	-.076	.079	1.000	.056	-.008	.044
Occupation	.026	.018	-.019	.078	-.003	.056	1.000	.008	.111
Attitudes toward COVID-19	.024	-.022	.043	.010	.010	-.008	.008	1.000	.247
Attitudes toward vaccination	.035	.016	.001	.020	.018	.044	.111	.247	1.000

A linear regression analysis was run to determine the significant model predicting the total scores of both attitudes toward COVID-19 disease and attitudes toward COVID-19 vaccination. The predicting variables set by the researchers were the employment status and occupation of the participants. These predicting variables didn't predict the total score of attitudes toward

COVID-19 ($F(2, 1364) = 0.054, p = 0.947, R^2_{Adjusted} = -0.001$). However, these variables significantly predicted the total score of attitudes toward vaccination ($F(2, 1599) = 8.34, p < .001, R^2_{Adjusted} = 0.009$). Within the model predicting the total score of attitudes toward vaccination, the only predictor was occupation ($\beta = 0.086, p < .01$) (Table 3).

Table 3. Linear regression results for overall attitudes toward COVID-19 disease and vaccination (N= 1735)

Dependent variable	Attitudes toward COVID-19		Attitudes toward vaccination	
Model summary	$F(2, 1364) = 0.054, p = 0.947, R^2_{Adjusted} = -0.001$		$F(2, 1599) = 8.34, p < .001, R^2_{Adjusted} = 0.009$	
Predictors	β	t	β	t
Constant		55.81		29.34
Employment status	-0.003	-0.099	0.049	1.95
Occupation	0.009	-0.320	0.086	3.45

The Mann-Whitney test was used to compare the scores of attitudes toward COVID-19 disease and vaccination among nurses and health workers against those of non-health workers. The results were

significant in terms of attitudes toward vaccination ($Z = -4.43, p < .001$) but not for attitudes toward COVID-19 ($Z = -0.31, p = .761$) (Table 4).

Table 4. The Mann-Whitney test results comparing the scores of attitudes toward COVID-19 disease and vaccination among nurses and health workers against non-health workers

	Non-Health workers Mean rank	Health workers Mean rank	Z-score
Attitudes toward COVID-19	680.04	686.67	-0.31
Attitudes toward vaccination	738.98	843.42	-4.43

Discussion

This study aimed to explore the relationships between attitudes toward the COVID-19 disease and COVID-19 vaccination in Hungary. The results showed a significant positive correlation between attitudes toward the COVID-19 disease and attitudes toward the COVID-19 vaccination. This means that higher scores of attitudes toward the COVID-19 disease are associated with higher scores of attitudes toward vaccination. This finding looks reasonable, as those feeling positively and responsibly about the COVID-19 disease might understand the importance of vaccines in stopping this pandemic. This result is also consistent with a previous study, which found that knowledge about COVID-19 is one of the determinants of accepting vaccines for COVID-19 (24). In our study, no significant relationships were found between socio-demographics and attitudes toward the COVID-19 disease and the COVID-19 vaccination. This finding might be different from a Chinese study that found significant relationships between willingness to be vaccinated against COVID-19 and gender, age, education, and living place (25). Our finding was also different from what a Saudi study found: that females and older people have better attitudes toward COVID-19 (26).

Also, the results showed a significant positive correlation between attitudes toward vaccination and employment status. Those who are employed have higher scores in attitudes toward vaccination than those who are unemployed. This result can be explained by the feeling of responsibility and willingness to stay working if one takes the vaccine. This result is also consistent with previous studies. This finding is congruent with what a previous study demonstrated: the employed persons in Kenya showed better attitudes toward COVID-19 than the unemployed persons (27).

Additionally, the results showed a significant positive correlation between

attitudes toward vaccination and occupation. Moreover, the results showed that occupation is a predictor of attitudes toward vaccination. These results mean that health workers have better attitudes toward vaccination than non-health workers. These results can be explained by the health workers' knowledge about the risks and complications of being infected by a coronavirus. This result is consistent with what a Chinese study found: health workers are more eager than general people to get the COVID-19 vaccine (25). On the other hand, this result didn't match another study, which found no association between vaccine acceptance and being a health worker (28).

Also, the results showed that employment status and occupation didn't predict attitudes toward the COVID-19 disease. This result might contradict a Spanish study that found that a quarter of the participating non-health workers spent around three hours a day learning about COVID-19 (29). However, a Saudi study might partially support this finding, which concluded that some health workers' attitudes toward COVID-19 disease require improvement (30).

This study also aimed to compare the attitudes of nurses and health workers against those of non-health workers in Hungary toward the COVID-19 disease and the COVID-19 vaccination. The results showed that health workers and non-health workers showed no significant differences in their attitudes toward COVID-19. This result disagrees with a Saudi study that found significant differences between health and non-health students regarding COVID-19 (31). The reason behind this difference might be that our study compared the general population; 40% of them have low education below a college certificate.

In terms of attitudes toward vaccination, the mean ranks were significantly higher for nurses and health workers than for non-health workers. This finding might be

explained by the awareness and knowledge of nurses and health workers about the consequences of COVID-19. On the other hand, this result is congruent with a Chinese study that concluded that health workers are more willing than non-health workers to be vaccinated against COVID-19 (25). This finding is also congruent with another study: the Iraqi health workers were more enthusiastic about getting COVID-19 vaccines than the Iraqi general population (32).

Limitations

Although this study is one of the few that assessed the attitudes of a large Hungarian sample towards COVID-19 disease and vaccination, it nevertheless has some methodological limitations that necessitate consideration when interpreting the findings. First, the cross-sectional design and collecting data in the period between August and December 2020 might hide the development of attitudes and information regarding COVID-19 disease and vaccination afterward. Second, although the questionnaires used showed good reliability and validity, using questionnaires that have not been validated may be subject to measurement error.

Conclusion

The current study revealed a significant relationship between attitudes toward COVID-19 disease and vaccination in Hungary. This finding might open a new door to encourage the population's vaccination, especially in future pandemics; changing attitudes toward COVID-19 or future pandemics should be parallel to changing attitudes toward their vaccinations. Additionally, the current study revealed positive attitudes among nurses and health workers toward COVID-19 vaccinations as compared to non-health workers. Healthcare decision-makers should utilize this finding to strategize and intervene to improve the

public's willingness to be vaccinated against COVID-19 or future pandemics. For instance, the general population (non-health workers) can be informed using official and social media channels about the attitudes of nurses and health workers towards COVID-19 vaccinations. This might encourage the general population to get vaccinated against future pandemics.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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