

# Factors associated with early uptake of COVID-19 vaccination among healthcare workers in Azerbaijan, 2021

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## Abstract

**Introduction:** We evaluated uptake and factors associated with COVID-19 vaccination among health workers (HWs) in Azerbaijan.

**Results:** Among 1575 HWs, 73% had received at least one dose, and 67% received two doses; all received CoronaVac. Factors associated with vaccination uptake included no previous COVID-19 infection, older age, belief in the vaccine's safety, previous vaccination for influenza, having patient-facing roles and good or excellent health by self-assessment.

**Conclusion:** These findings could inform strategies to increase vaccination uptake as the campaign continues.

## KEYWORDS

COVID-19, health workers, pandemic, vaccination campaign, vaccine hesitancy

## 1 | INTRODUCTION

Vaccination is the best approach to reduce COVID-19 morbidity and mortality and to preserve healthcare infrastructures.<sup>1</sup> Health workers (HWs) are a critical group for vaccination; they provide essential delivery of the COVID-19 pandemic response and are at elevated risk of infection and onward transmission to vulnerable patients.<sup>2</sup> However, vaccine hesitancy among HWs is widespread globally.<sup>3</sup> Low COVID-19 vaccine uptake in HWs has previously been associated with vaccine safety concerns and younger age.<sup>4,5</sup>

In Azerbaijan, an upper-middle income country with a population of approximately 10 million people, the voluntary COVID-19 vaccination campaign began on January 18th, 2020, for the population deemed most at risk, including HWs. CoronaVac, an inactivated

vaccine developed by the Chinese firm Sinovac Biotech, was the main vaccine administered at the beginning of the campaign.

We used enrollment data from an ongoing study of COVID-19 vaccine effectiveness (VE) among HWs in Azerbaijan (clinicaltrials.gov description) to identify factors associated with uptake of the vaccine early in the campaign.

## 2 | UPTAKE OF THE COVID-19 VACCINE AMONG HEALTHCARE WORKERS IN AZERBAIJAN

From May 17 to July 17, 2021, we enrolled HWs across seven hospitals in Baku. Participants were enrolled per the COVID-19 VE study protocol; the study was publicized by each hospital's administration, and all HWs in all seven hospitals were offered enrollment regardless

Jason Doran and Nabil Seyidov contributed equally to this publication and share first authorship.

of whether they had been vaccinated or intended to get vaccinated. Participants completed an interviewer-led questionnaire, including questions about demographics, history of COVID-19 vaccine and infection, and knowledge and attitudes toward the vaccine. Vaccination and infection history for all participants was cross-checked with the national vaccination database and testing database, respectively. Data were entered into an electronic data management system ([www.sorgular.az](http://www.sorgular.az)) and exported into Stata v16.1 (Texas, United States of America).

We assessed factors associated with uptake of at least one dose of the COVID-19 vaccine, calculating odds ratios (with 95% confidence intervals). Stratified analyses were conducted to assess for potential effect modification. Factors associated with uptake of the COVID-19 vaccine at the univariable level (defined as  $p$  value < 0.1) were inserted into a stepwise forward multivariable regression model (with age included a priori), and retention was based on the model with the lowest Akaike information criterion. As the Azerbaijan Government advised (but did not enforce) that people previously infected with COVID-19 should wait at least 6 months before receiving the COVID-19 vaccine, we also conducted a sensitivity analysis excluding participants who reported COVID-19 infection in the 6 months prior to enrollment. In this model, we only retained variables that showed an association in the main analysis.

### 3 | ETHICAL STATEMENT

The study was approved by the Ethics Committee of Azerbaijan State Academy of Physical Culture and Sport (03/03/2021; Protocol #3/21) and the World Health Organization Ethical Review Committee (protocol no. CERC.0097C). All participants provided written informed consent.

### 4 | UPTAKE OF THE COVID-19 VACCINE AMONG HEALTHCARE WORKERS

Among 1575 participants enrolled in the study, 93% were female, and the mean age was 47 (range: 21–72). Participants included doctors (31%), nurses (45%), janitorial staff and food workers (18%), and other kinds of HWs (6%) (Table 1). Almost two-thirds (59%) of participants reported having no underlying clinical conditions, and 81% reported being in good-excellent health by self-assessment. A quarter of participants (24%) reported a previous infection with COVID-19. At enrollment, 73% ( $n = 1133$ ) of participants had received at least one dose, and 67% ( $n = 1017$ ) had received two doses of the COVID-19 vaccine; all participants received CoronaVac. Among the 442 unvaccinated HWs, 229 (52%) reported an infection with COVID-19 in the 6 months prior to their enrollment. Participants who had a COVID-19 infection in the 6 months prior to enrollment were demographically similar to those who did not report a previous COVID-19 infection (see Table S1).

### 5 | ATTITUDES OF HEALTHCARE WORKERS TOWARDS THE COVID-19 VACCINE

Most HWs (62%) agreed or strongly agreed that the COVID-19 vaccine was safe, whereas 28% were neutral. Nearly all participants (91%) believed that the COVID-19 vaccine was extremely, very, or somewhat effective in preventing illness. One-third of participants (36%) were not worried about becoming ill from COVID-19. Over a third of participants (34%) reported knowing a great deal about the vaccine, and 60% agreed or strongly agreed that they would regret if they were unvaccinated (Figure 1).

### 6 | FACTORS ASSOCIATED WITH COVID-19 VACCINE UPTAKE AMONG STUDY PARTICIPANTS

HWs > 60 years old were more likely to be vaccinated against COVID-19 compared with HWs < 35 years old (aOR: 1.8; 95% CI: 1.09–2.86). Participants who received the influenza vaccine in 2019–20 were twice as likely to have received the COVID-19 vaccine compared with those who did not (aOR: 2.3; 95% CI: 1.67–3.2). Participants with a patient-facing role were 41% more likely to have received the vaccine than those who did not (aOR: 1.41; 95% CI: 1.1–1.84). Participants who characterized their health as fair or poor were half as likely to have received the COVID-19 vaccine compared with those in excellent health (aOR: 0.49; 95% CI: 0.31–0.81). Participants who did not strongly agree or agree that the vaccine was safe were much less likely to have received the COVID-19 vaccine than those who did (aOR: 0.25; 95% CI: 0.13–0.49). Finally, those who said they would not regret not receiving the COVID-19 vaccine were significantly less likely to have received the vaccine compared with those who said they would regret it (aOR: 0.31; 95% CI: 0.2–0.47).

Compared with participants previously infected with COVID-19, those who were not known to be previously infected were nine times more likely to have received the COVID-19 vaccine (aOR: 8.98; 95% CI: 6.7–11.9). However, associations with vaccination uptake remained in the sensitivity analysis that excluded HWs who reported a COVID-19 infection in the 6 months prior to enrollment (Table S2).

### 7 | DISCUSSION

We found that factors associated with COVID-19 vaccination uptake among HWs were no previous COVID-19 infection, older age, belief in the vaccine's safety, previous vaccination for influenza, patient-facing roles, and good or excellent health by self-assessment. Focusing public health messaging on younger individuals and increasing messaging about vaccine safety could lead to increased uptake in the remaining population of unvaccinated HWs in Azerbaijan. HWs in nonpatient facing roles have suffered considerable morbidity and higher infection rates during the COVID-19 pandemic.<sup>6</sup> Targeting this

**TABLE 1** Demographic and health characteristics associated with receiving at least one dose of COVID-19 vaccine, Azerbaijan, 2021: Univariate and multivariate analysis results

	Total study population (%)	Number vaccinated <sup>a</sup> (%)	OR <sup>b</sup> (95% CI <sup>c</sup> )	p value	Adjusted OR <sup>b</sup> (95% CI <sup>c</sup> )	p value
Gender					<sup>d</sup>	<sup>d</sup>
Male	110 (7%)	79 (71.8%)	Ref.	0.97		
Female	1465 (93%)	1054 (71.9%)	1.006 (0.65–1.55)			
Age group						0.006
<35	191 (12.2%)	127 (66.5%)	Ref.		Ref.	
35–49	638 (40.6%)	455 (71.3%)	1.25 (0.88–1.77)	0.17	1.62 (1.08–2.4)	
50–59	468 (29.8%)	352 (75.2%)	1.53 (1.05–2.20)		2.18 (1.41–3.38)	
60+	274 (17.4%)	195 (71.2)	1.24 (0.83–1.85)		1.8 (1.09–2.86)	
Previous COVID-19 infection				<0.0001		<0.0001
Yes	375 (23.8%)	146 (38.9%)	Ref.		Ref.	
No	1200 (76.2%)	987 (82.3%)	7.3 (5.63–9.4)		8.98 (6.7–11.9)	
Household size					<sup>d</sup>	<sup>d</sup>
Live alone or with 1–2 people	302 (19.2%)	221 (73.2%)	Ref.	0.19		
Live with 2–4 people	760 (48.3%)	560 (73.7%)	1.02 (0.76–1.39)			
Live with 4+ people	513 (32.5%)	352 (68.6%)	0.80 (0.58–1.09)			
Preexisting comorbidities <sup>e</sup>					<sup>d</sup>	<sup>d</sup>
No	932 (59.2%)	696 (74.7%)	Ref.	0.004		
At least one	643 (40.8%)	437 (67.9%)	0.72 (0.57–0.89)			
Overall health status—self assessed				0.002		0.008
Excellent or very good	225 (14.6%)	181 (80.4%)	Ref.		Ref.	
Good	1042 (67.5%)	759 (72.8%)	0.69 (0.42–1.13)		0.57 (0.37–0.85)	
Fair or poor	276 (17.9%)	178 (64.5%)	0.44 (0.26–0.76)		0.49 (0.31–0.81)	
Smoking status				0.85	<sup>d</sup>	<sup>d</sup>
Never smoker	1515 (96.1%)	1088 (71.8%)	Ref.			
Previous or current smoker	60 (3.9%)	45 (78.6%)	1.44 (0.39–5.2)			
Received influenza vaccine in 2019–2020				<0.0001		<0.0001
No	1118 (70.9%)	764 (68.3%)	Ref.		Ref.	
Yes	457 (29.1%)	369 (80.7%)	1.95 (1.49–2.53)		2.3 (1.67–3.2)	
Occupation				0.19	<sup>d</sup>	<sup>d</sup>
Nurse or Midwife	590 (45%)	413 (70%)	Ref.			
Physician	408 (31.2%)	275 (67.4%)	0.88 (0.67–1.2)			
Janitorial staff or food worker	231 (17.6%)	182 (78.8%)	1.59 (1.1–2.3)			
Other	81 (6.2%)	58 (71.6%)	1.1 (0.64–1.81)			
Patient-facing role						0.03
No	657 (41.7%)	453 (68.9%)	Ref.	0.02	Ref.	
Yes	918 (58.3%)	680 (74.1%)	1.28 (1.03–1.60)		1.41 (1.1–1.84)	
COVID-19 vaccination is safe				<0.0001		<0.0001
Strongly agree	707 (44.9%)	560 (79.2%)	Ref.		Ref.	
Agree	267 (16.9%)	198 (74.2%)	0.75 (0.54–1.05)		0.92 (0.62–1.36)	
Neutral	443 (28.1%)	288 (65%)	0.49 (0.37–0.64)		0.65 (0.47–0.92)	
Disagree	103 (6.5%)	65 (63.1%)	0.44 (0.29–0.69)		0.52 (0.31–0.88)	
Strongly disagree	55 (3.5%)	22 (40%)	0.18 (0.10–0.31)		0.25 (0.13–0.49)	

(Continues)

TABLE 1 (Continued)

	Total study population (%)	Number vaccinated <sup>a</sup> (%)	OR <sup>b</sup> (95% CI <sup>c</sup> )	p value	Adjusted OR <sup>b</sup> (95% CI <sup>c</sup> )	p value
I will regret if I do not get the COVID-19 vaccine				<0.0001		<0.0001
Strongly agree	706 (44.8%)	568 (80.5%)	Ref.		Ref.	
Agree	242 (15.4%)	189 (78.1%)	0.86 (0.61–1.23)		0.94 (0.62–1.4)	
Neutral	382 (24.3%)	240 (62.8%)	0.41 (0.31–0.53)		0.49 (0.34–0.69)	
Disagree	66 (4.2%)	42 (63.6%)	0.42 (0.24–0.73)		0.61 (0.32–1.15)	
Strongly disagree	179 (11.4%)	94 (52.5%)	0.26 (0.19–0.38)		0.31 (0.2–0.47)	
How effective do you think the COVID-19 vaccine is in preventing you from getting sick with COVID-19?				<0.0001	<sup>d</sup>	<sup>d</sup>
Extremely effective	313 (19.9%)	247 (78.9%)	1			
Very effective	432 (27.4%)	337 (78.1%)	0.95 (0.66–1.35)			
Somewhat effective	695 (44.1%)	487 (70.1%)	0.63 (0.64–0.86)			
Not effective	99 (6.3%)	50 (50.5%)	0.27 (0.17–0.44)			
Not at all effective	36 (2.3%)	12 (33.3%)	0.13 (0.06–0.28)			
If I get a COVID-19 vaccination, I will be less likely to miss work because of getting sick with COVID-19				0.001	<sup>d</sup>	<sup>d</sup>
Strongly agree	1004 (63.8%)	742 (73.9%)	1			
Agree	211 (13.4%)	160 (75.8%)	1.1 (0.78–1.56)			
Neutral	306 (19.4%)	202 (66.1%)	0.69 (0.52–0.90)			
Disagree	34 (2.2%)	20 (58.8%)	0.50 (0.25–1.01)			
Strongly disagree	20 (1.3%)	9 (45%)	0.29 (0.1–0.70)			
How much do you know about the COVID-19 vaccine?				0.6	<sup>d</sup>	<sup>d</sup>
Nothing at all	94 (5.9%)	63 (67%)	1			
A little	420 (26.7%)	297 (70.7%)	1.18 (0.77–1.92)			
Some	526 (33.4%)	398 (75.7%)	1.53 (0.95–2.45)			
A lot	338 (21.5%)	234 (69.2%)	1.11 (0.67–1.80)			
A great deal	197 (12.5%)	141 (71.6%)	1.24 (0.73–2.10)			
How worried are you about getting sick with COVID-19 during the next 12 months?				0.32	<sup>d</sup>	<sup>d</sup>
Extremely worried	181 (11.5%)	124 (68.5%)	1			
Very worried	295 (18.7%)	211 (71.5%)	1.15 (0.77–1.73)			
Moderately worried	284 (18.0%)	209 (73.6%)	1.28 (0.85–1.92)			
A little worried	255 (16.2%)	174 (68.2%)	0.98 (0.66–1.48)			
Not worried at all	560 (35.6%)	415 (74.1%)	1.32 (0.91–1.89)			

<sup>a</sup>Vaccinated with at least one dose of a COVID-19 vaccine.

<sup>b</sup>Odds ratio.

<sup>c</sup>95% confidence interval.

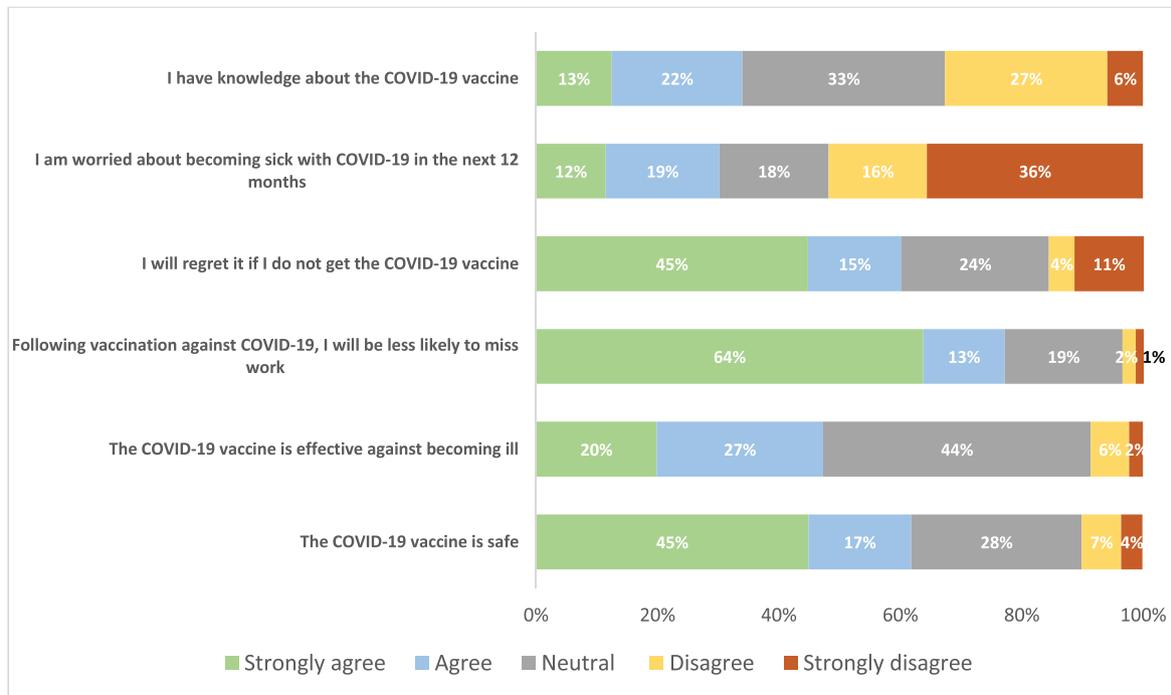
<sup>d</sup>Variable not included in final model.

<sup>e</sup>Preexisting comorbidities included cancer, chronic heart disease, hypertension, chronic kidney disease, chronic liver disease, chronic lung disease, diabetes, immunocompromisation, neurological disease, obesity, and autoimmunity.

population with tailored messaging to increase vaccination coverage is therefore also critical.

Previous vaccination against influenza was positively associated with vaccination against COVID-19. In Azerbaijan, similar to other

former Soviet Union countries, influenza vaccination is not readily available, and coverage is very low compared with other European countries.<sup>7</sup> The target population for influenza vaccines is largely similar to the initial priority groups for COVID-19 vaccines—HWs and



**FIGURE 1** Knowledge and perceptions of the COVID-19 vaccine among health workers in Azerbaijan

those at higher risk for severe outcomes from infection.<sup>8</sup> Barriers to uptake of the influenza vaccine include negative attitudes toward the vaccine and lack of knowledge<sup>9</sup>—similar reasons to those we found to be associated with Covid-19 vaccine hesitancy in our study. Improved provision and promotion of the influenza vaccine to HWs and vulnerable adults in Azerbaijan may have a positive effect in promoting current and future COVID-19 vaccination campaigns.

Our study also found that those with a nonexcellent self-assessed health status were less likely to be vaccinated. A Canadian study found that chronic conditions, income, and stress can all significantly influence self-perceived health status.<sup>10</sup> Better understanding reasons for poor self-assessed health status in Azerbaijan, and targeting public health messaging about the benefits of COVID-19 vaccine to these populations, who could perhaps be most vulnerable to the effects of COVID-19 infection, is critical.

Early vaccine uptake was high in this cohort of HWs in Azerbaijan; 73% were vaccinated with at least one dose and 67% with two doses of CoronaVac. Such uptake compares favorably with HWs in other parts of the world: from 22.7% in The Congo,<sup>11</sup> 68.6% in Turkey,<sup>12</sup> 75% in France,<sup>13</sup> and 77.3% in the United States,<sup>14</sup> according to a recent systematic review.<sup>15</sup> It is also likely that vaccine uptake in HWs in Azerbaijan has increased since data collection for this study. High vaccination uptake among HWs in Azerbaijan may have a positive effect on the continued vaccination campaign in the general population, because HWs are considered a reliable source of information on vaccination and their acceptance of the vaccine may influence their patients' uptake.<sup>16,17</sup>

Our study has limitations. As only a proportion of HWs from seven hospitals in Baku were included, and the study was voluntary,

our results may suffer from selection bias and may not be generalizable to all HWs in Azerbaijan. We also did not collect information about socioeconomic status, education, ethnicity, and religion, which may influence vaccine uptake.

## 8 | CONCLUSION

Although Covid-19 vaccine uptake was high in this cohort of HWs in Azerbaijan, we identified a number of factors associated with lower vaccine uptake among HWs that could be targeted in order to increase uptake of the vaccine among HWs in Azerbaijan and help contain the pandemic.

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### AUTHOR CONTRIBUTIONS

**Jason Doran:** Conceptualization; data curation; formal analysis; investigation; methodology; supervision; validation; visualization. **Nabil Seyidov:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization. **Samir Mehdiyev:** Conceptualization; data curation; formal analysis; funding acquisition; methodology; software; validation. **Giorgia Gon:** Methodology; visualization. **Esther Kissling:** Conceptualization; data curation; formal analysis. **Trent Herdman:** Conceptualization; formal analysis; methodology. **Javahir Suleymanova:** Conceptualization. **Ana Paula Couthino Rehse:** Conceptualization; data curation. **Richard Pebody:**

Supervision; validation. **Mark A. Katz:** Funding acquisition; investigation; supervision; validation; visualization. **Gahraman Hagverdiyev:** Supervision; validation.

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## PEER REVIEW

The peer review history for this article is available at <https://publons.com/publon/10.1111/irv.12978>.

## DATA AVAILABILITY STATEMENT

Anonymized data may be provided upon request.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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