Income inequality and willingness to accept COVID-19 vaccination in Islamic Republic of Iran

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Abstract

Background: Socioeconomic inequalities can affect vaccine acceptability and the effectiveness of vaccination programmes.

Aim: To investigate income inequality in willingness to vaccinate and identify its determinants in the Islamic Republic of Iran.

Method: This cross-sectional study was conducted in Hamadan City, Islamic Republic of Iran, in February and March 2021. It collected data from 864 respondents using a structured questionnaire and analysed them using Stata version 14. Logistic regression was used to assess the effects of covariates on willingness to vaccinate within income groups and a multivariate decomposition technique was applied to evaluate the factors influencing willingness to vaccinate across groups.

Results: We found that 39.2% of the participants were willing to accept the COVID-19 vaccination. Fewer participants in the low-income group than those in high-income group (33.5% vs 49.1%; $P < 0.001$) were willing to accept the vaccination. Female sex, having elderly family members and witnessing COVID-19-related deaths among relatives were primary contributors to the willingness to accept vaccination. In contrast, being employed, previous COVID-19 infection and holding a bachelor's degree had the main contradictory effects on the inequality of willingness to vaccinate.

Conclusion: The differences in income level among the participants affected their willingness to vaccinate. There is therefore a need for targeted interventions to increase COVID-19 vaccine acceptance and vaccination effectiveness among the different income groups within the study population.

Key words: income inequality, high-income, low-income, COVID-19, vaccine acceptability, vaccination, Iran

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Introduction

Vaccination has long been established as an effective strategy to prevent serious infectious diseases, promote human health, and reduce the fatal consequences of disease (*1*). Despite the urgent need to combat COVID-19 through vaccination, concerns about the acceptance of the vaccine persist worldwide. Vaccine hesitancy has been observed in many countries, with acceptance rates ranging from 97.0% in Ecuador to 23.6% in Kuwait (*2*). COVID-19 vaccine hesitancy has been studied in relation to the demographic, social, cultural and economic characteristics of individuals and their perception of the clinical features of vaccines, and concerns about safety and efficacy were the most common factors fuelling hesitancy (*3*). Given the emergence of variants of the coronavirus and the potential for future waves of COVID-19, vaccine hesitancy and inequality in vaccine acceptance could limit the effectiveness of vaccination programmes (*4,5*). While previous studies have explored the relationship between socioeconomic factors and vaccine coverage (*6,7*), few studies have focused on the socioeconomic determinants of vaccination tendency (*8,9*).

Income inequality is related to vaccine uptake. A 2012 study showed a negative relationship between vaccine coverage and income inequality at the municipal level (*10*). Although many countries strive for comprehensive COVID-19 vaccine coverage, vaccination programmes may disproportionately benefit different population groups (*11*). Factors such as access to health care, socioeconomic status and public awareness can lead to differences in how effectively vaccination programmes benefit different population groups.

A few studies have addressed the impact of income inequality on the uptake of COVID-19 vaccination (*10,12*). Given the significance of equitable vaccination intention and uptake during future waves of COVID-19, we investigated income inequality in willingness to vaccinate in Hamadan City, western Islamic Republic of Iran. Our objective was to identify factors contributing to this inequality, enhance vaccination coverage, eliminate barriers for income subgroups, and ultimately mitigate the disproportionate effects of future waves of COVID-19.

Methods

Data and study variables

This cross-sectional study was conducted in Hamadan City from 17 February to 6 March 2021. Data were gathered via an online questionnaire (available on the Porsline platform, accessible at: https://porsline.ir). Participants were required to complete informed consent forms, and their eligibility was confirmed at the beginning of the survey, ensuring that they were residents of Hamadan City and aged ≥ 18 years. To recruit participants, we used a convenience sampling method, inviting adults to join the study through well-known social media groups and channels on WhatsApp and Telegram, both of which are extensively used in the Islamic Republic of Iran. Following the invitation, a total of 936 individuals volunteered to participate in the study. After excluding invalid and missing responses, data from 864 participants were retained for the analysis.

The questionnaire comprised 4 sections. Questions about demographic and socioeconomic characteristics, health status, and factors related to perceived risk of COVID-19 infection, as well as individuals' trust in the effectiveness of foreign vaccines. Questions about household income were included as a categorical variable. After data collection, due to the low frequencies in some income groups, certain categories were merged, resulting in individuals being re-categorized into 2 income groups: low (≤ 6 million Tomans/month) and high (> 6 million Tomans/month). We included a question regarding individuals' willingness to be vaccinated (Would you like to be vaccinated if a COVID-19 vaccine was available?), which served as the dependent variable, with 2 response options: yes/no.

Twenty questions assessing knowledge about COVID-19 (nature of the disease, symptoms and severity, transmission methods, prevention, and treatment), with content validity index (CVI) and Cronbach's alpha values of 0.87 and 0.79, respectively. A 3-point Likert scale (false = 1, don't know = 2, true = 3) was used to score the participants' responses in this section.

We assessed knowledge about the COVID-19 vaccine with 6 questions (vaccine effectiveness, complications, injection turnaround time, and required number of injections). A 5-point Likert scale (strongly disagree = 1, disagree = 2, have no idea = 3, agree = 4, strongly agree = 5) was used to score these questions. The CVI and Cronbach's alpha for this section of the questionnaire were 0.95 and 0.78, respectively.

We included 11 questions to assess adherence to COVID-19 prevention guidelines. Scoring for these questions was conducted using a 5-point Likert scale (never = 1, rarely = 2, sometimes = 3, most times = 4, always = 5). The CVI and Cronbach's alpha for this questionnaire were 1.00 and 0.78, respectively.

Statistical analysis

Descriptive analysis was performed to compare the percentage/mean for willingness to vaccinate and the characteristics of individuals in the low- and high-income groups using the chi-square test and the independent *t*-test. The effect of participants' characteristics on willingness to vaccinate in the low- and high-income groups was estimated using logistic regression. We used a multivariate decomposition technique for non-linear response models to identify the factors influencing the difference in willingness to vaccinate between income groups (*13*). Our analysis focused on the observed inequality in willingness to vaccinate between low- and high-income groups, which we examined through 2 key components: endowment effects and coefficient effects. Endowment effects (characteristics component) identified how differences in characteristics (sex, age, etc.) between the income groups contribute to the overall difference in willingness to vaccinate. Coefficient effects (effects component) assessed how the differences in the impact of characteristics on willingness to accept contribute to the difference in willingness to vaccinate between income groups.

In decomposition analysis, the response function (Y) was estimated using logit regression, expressed as:

$$Y = Y(X_Y \beta_Y) = \frac{e^{X_Y \beta_Y}}{1 + e^{X_Y \beta_Y}}, \; Y \in \{Y_H, Y_L\} \quad (1)$$

where, Y_H and Y_L denote the mean willingness to vaccinate in high- and low-income groups and X_Y indicates a vector of covariates included in the study. β_Y refers to the vector of logit regression coefficients corresponding to each income group.

In the first stage of decomposition analysis, the difference in mean willingness to vaccinate among income groups was decomposed into the 2 main components: endowment effect (*E*) and coefficient effect (*C*), as follows:

$$Y_H - Y_L = \underbrace{\{Y(\bar{X}_H \beta_H) - Y(\bar{X}_L \beta_H)\}}_{E} + \underbrace{\{Y(\bar{X}_L \beta_H) - Y(\bar{X}_L \beta_L)\}}_{C} \quad (2)$$

In this equation, *E* is the portion of the willingness to vaccinate difference resulting from variations in population characteristics between the groups, while *C* accounts for the difference attributable to variations in the coefficients.

In the second stage, we conducted a detailed decomposition analysis to assess the endowment and coefficient effects of each explanatory variable on the observed inequality in willingness to vaccinate between the 2 income groups, using the following equations:

$$Y_H - Y_L = E + C = \sum_{k=1}^{K} W_{\Delta X_k} E + \sum_{k=1}^{K} W_{\Delta \beta_k} C = \sum_{k=1}^{K} E_k + \sum_{k=1}^{K} C_k \quad (3)$$

In which, $W_{\Delta x_k}$ and $W_{\Delta \beta_k}$ are the contributions of the *k*th covariate to *E* and *C* respectively, calculated through the use of 2 formulae, as follows:

$$W_{\Delta x_k} = \frac{\beta_H^k(\bar{X}_H^k - \bar{X}_L^k)}{\sum_{k=1}^{K} \beta_H^k(\bar{X}_H^k - \bar{X}_L^k)} \quad (4)$$

$$W_{\Delta \beta_k} = \frac{\bar{X}_L^k(\beta_H^k - \beta_L^k)}{\sum_{k=1}^{K} \bar{X}_L^k(\beta_H^k - \beta_L^k)} \quad (5)$$

Additionally, it holds that:

$$\sum_k W_{\Delta x_k} = \sum_k W_{\Delta \beta_k} = 1.0 \quad (6)$$

In this context, $W_{\Delta x_k}$ represents the endowment effect of the *k*th explanatory variable, calculated as the relative difference in the mean of that variable between the 2 income groups, weighted by its effect in the high-income group. In the same way, $W_{\Delta \beta_k}$ indicates the coefficient effect of the *k*th explanatory variable, which is determined by the relative difference in the variable's effect between the 2 groups, weighted by the mean of that variable in the low-income group.

All analyses were carried out using Stata, version 14, with statistical significance set at 0.05.

Ethics approval

This study was approved by the ethics committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1399.912). All the study procedures were performed in accordance with the relevant guidelines and regulations of the committee. Participants voluntarily accepted to complete the questionnaire and were informed about all aspects of the study. They provided their consent to participate in the study by signing an electronic informed consent form.

Results

Table 1 presents the distribution of willingness to vaccinate and sociodemographic characteristics across income groups. Of the 936 individuals who signed up for the study, data from 864 were analysed, and 339 participants (39.2%) reported willingness to vaccinate. Notably, willingness to vaccinate was significantly lower among low-income participants than their high-income counterparts (33.5% vs 49.1%; $P < 0.001$).

A greater proportion of people in the low-income group had a lower education level (below bachelor's degree) (Table 1). The high-income group had a higher proportion of employed individuals, a history of COVID-19 infection and trust in the effectiveness of foreign vaccines than the low-income group. Those in the high-income group were older (mean age 37.7 years) than those in the low income group (33.8 years) (Table 1) and demonstrated better knowledge scores about COVID-19 and its vaccines ($P < 0.05$).

The logistic regression results presented in Table 2 indicate that, within the low-income group, individuals with bachelor's degree were more likely to affirm their willingness to vaccinate than others. Those employed were 78% more likely to assert willingness to vaccinate than their counterparts. Individuals with a history of COVID-19 infection among their first- and second-degree relatives were 72% more likely to report willingness to vaccinate. A higher knowledge score regarding the COVID-19 vaccine was associated with a 19% higher probability of willingness to vaccinate ($P < 0.05$).

In the high-income group, females were 2.1 times more likely to declare willingness to vaccinate than males. Conversely, the probability of willingness to vaccinate among individuals with a history of COVID-19 was 66% lower than that of their counterparts. Individuals with a history of COVID-19 and those with

Table 1. Sociodemographic characteristics and willingness to vaccinate among low- (≤ 6 million Tomans/month) and high-income (> 6 million Tomans/month) groups, Hamadan, Islamic Republic of Iran, 2021 *(continued)*

Characteristic	Total (N = 864) No. (%)	Low-income group (n = 544) No. (%)	High-income group (n = 320) No. (%)	*P* value
Willingness to vaccinate				
No	525 (60.8)	362 (66.5)	163 (50.9)	< 0.001
Yes	339 (39.2)	182 (33.5)	157 (49.1)	
Sex				
Male	400 (46.3)	241 (44.3)	159 (49.7)	0.125
Female	464 (53.7)	303 (55.7)	161 (50.3)	
Marital status				
Unmarried	361 (41.8)	234 (43.0)	127 (39.7)	0.338
Married	503 (58.2)	310 (57.0)	193 (60.3)	
Education level				
< Bachelor	261 (30.2)	222 (40.8)	39 (12.2)	< 0.001
Bachelor	355 (41.1)	207 (38.1)	148 (46.3)	
Post graduate	248 (28.7)	115 (21.1)	133 (41.6)	

Table 1. Sociodemographic characteristics and willingness to vaccinate among low- (≤ 6 million Tomans/month) and high-income (> 6 million Tomans/month) groups, Hamadan, Islamic Republic of Iran, 2021 *(concluded)*

Characteristic	Total (N = 864)	Low-income group (n = 544)	High-income group (n = 320)	*P* value
	No. (%)	No. (%)	No. (%)	
Employed				
No	396 (45.8)	304 (55.9)	92 (28.8)	< 0.001
Yes	468 (54.2)	240 (44.1)	228 (71.3)	
Underlying disease				
No	477 (55.2)	295 (54.2)	182 (56.9)	0.450
Yes	387 (44.8)	249 (45.8)	138 (43.1)	
Family member aged > 60 years				
No	653 (75.6)	398 (73.2)	255 (79.7)	0.212
Yes	211 (24.4)	146 (26.8)	65 (20.3)	
History of COVID-19 infection				
No	613 (71.0)	410 (75.4)	203 (63.4)	< 0.001
Yes	251 (29.1)	134 (24.6)	117 (36.6)	
History of COVID-19 infection among relatives				
No	292 (33.8)	184 (33.8)	108 (33.8)	0.982
Yes	572 (66.2)	360 (66.2)	212 (66.3)	
History of death from COVID-19 infection among relatives				
No	649 (75.1)	409 (71.2)	240 (75.0)	0.952
Yes	215 (24.9)	135 (24.8)	80 (25.0)	
Trust in effectiveness of foreign vaccine				
No	492 (56.9)	330 (60.7)	162 (50.6)	0.004
Yes	372 (43.1)	214 (39.3)	158 (49.4)	
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	
Age (years)	35.26 (10.8)	33.82 (10.0)	37.70 (11.7)	< 0.001
Knowledge about COVID-19 disease (score)	56.64 (3.3)	56.45 (3.1)	56.96 (3.6)	0.027
Knowledge about COVID-19 vaccine (score)	21.18 (4.1)	20.90 (4.1)	21.66 (4.2)	0.009
Adherence to COVID-19 prevention guidelines (score)	47.84 (6.0)	47.61 (6.1)	48.23 (5.9)	0.147

a history of death due to COVID-19 among their first- and second-degree relatives were more likely to express willingness to vaccinate than their counterparts by 90% and 114%, respectively. A higher knowledge score regarding the COVID-19 vaccine increased the probability of willingness to vaccinate by 15%, and individuals who trusted the effectiveness of foreign vaccines were twice as likely to report willingness to vaccinate than others ($P < 0.05$) (Table 2).

Table 3 shows the results of the multivariate decomposition analysis. Overall, the decomposition results indicated that the measured inequality in willingness to vaccinate between the low- and high-income groups was primarily attributable to the difference in coefficients (coefficient effect) rather than differences in the distribution of participants' characteristics (endowment effect) between the 2 groups. While the difference in coefficients had a positive (contributory) effect of 112.6%, the difference in participants' characteristics had a counteracting effect of 12.6% on the measured inequality in willingness to vaccinate.

The detailed decomposition results revealed the following: female sex, having family members aged over 60 years, and a history of death due to COVID-19 among first- and second-degree relatives significantly contributed to the inequality in willingness to vaccinate, accounting for 50.6%, 32.2%, and 29.4%, respectively. We observed a 32.1% positive contribution of trust in the effectiveness of foreign vaccines, significant at the 10% level. Conversely, being employed, having a history of COVID-19 infection, and being educated to bachelor's degree level mitigated this inequality, with counteracting effects of 49.7%, 36.4%, and 30.9%, respectively.

Regarding the endowment effects, differences in knowledge about the COVID-19 vaccine, trust in the

Table 2. Logistic regression odds ratios for willingness to vaccinate among low- (≤ 6 million Tomans/month) and high-income (> 6 million Tomans/month) groups, Hamadan, Islamic Republic of Iran, 2021

Characteristic	Low-income group		High-income group	
	OR	95% CI	OR	95% CI
Female sex (Ref: male)	1.06	0.7–1.60	2.13**	1.24–3.67
Age	0.98†	0.95–1.00	0.98	0.96–1.01
Status married (Ref: unmarried)	0.99	0.61–1.62	1.04	0.52–2.08
Education level (Ref: < bachelor)				
Bachelor	2.10**	1.31–3.36	0.77	0.34–1.75
Postgraduate	1.63†	0.93–2.85	1.44	0.62–3.33
Employed (Ref: no)	1.78**	1.17–2.72	0.75	0.94–1.04
Underlying disease (Ref: no)	0.86	0.58–1.30	1.02	0.60–1.74
Family member aged > 60 years (Ref: no)	0.74†	0.53–1.03	1.46	0.90–2.35
History of COVID-19 infection (Ref: no)	1.07	0.67–1.71	0.34***	0.19–0.61
History of COVID-19 infection among relatives (Ref: no)	1.72*	1.08–2.73	1.90*	1.04–3.47
History of death from COVID-19 infection among relatives (Ref: no)	0.86	0.54–1.37	2.14*	1.14–4.00
Knowledge about COVID-19 disease	1.01	0.94–1.09	1.03	0.94–1.13
Knowledge about COVID-19 vaccine	1.19***	1.13–1.27	1.15***	1.07–1.24
Adherence to COVID-19 prevention guidelines	1.01	0.97–1.05	0.99	0.94–1.04
Trust in effectiveness of foreign vaccine (Ref: no)	1.06	0.69–1.64	2.00*	1.13–3.55

*†P < 0.1; *P < 0.05; **P < 0.01; ***P < 0.001.*

OR = odds ratio; CI = confidence interval; Ref = reference category

Table 3. Inequality in willingness to vaccinate among participants from low- (≤ 6 million Tomans/month) and high-income (> 6 million Tomans/month) groups, Hamadan, Islamic Republic of Iran, 2021

Characteristic	Overall			
	Mean		%	
WTV (low-income group)	0.33			
WTV (high-income group)	0.49			
Difference	0.16			
Due to endowments	-0.02		-12.55	
Due to coefficients	0.18		112.55	
Total	0.16			
	Specific groups			
	Endowment effect		Coefficient effect	
	Mean	%	Mean	%
Female sex	-0.008**	-5.07	0.079*	50.62
Age	-0.011	-7.36	0.051	32.87
Being married	0.246×10−3	0.16	0.005	3.23
Education level				
< Bachelor	0.001	1.13	0.031	19.89
Bachelor	-0.004	-3.04	-0.048**	-30.93
Postgraduate	0.013†	8.39	0.011	6.88
Employed	0.015	9.88	-0.078*	-49.70
Underlying disease	-0.126×10−3	-0.08	0.016	10.06
A family member aged > 60 years	-0.007	-4.32	0.050*	32.15
History of COVID-19 infection	-0.25**	-15.97	-0.057**	-36.40
History of COVID-19 infection among relatives	0.092×10−3†	0.06	0.013	8.54
History of death from COVID-19 infection among relatives	0.271×10−3**	0.17	0.046*	29.37
Knowledge about COVID-19	0.003	1.93	0.221	141.29
Knowledge about COVID-19 vaccine	0.021***	13.53	-0.146	-93.51
Adherence to COVID-19 prevention guidelines	-0.001	0.85	-0.174	-111.48
Trust in effectiveness of foreign vaccine	0.013*	8.65	0.050†	32.10

*†P < 0.1, *P < 0.05, **P < 0.01, ***P < 0.001.*

effectiveness of foreign vaccines, and a history of death among first- and second-degree relatives between low- and high-income groups increased the measured inequality in willingness to vaccinate by 13.5%, 8.7%, and 0.2%, respectively. In contrast, a history of COVID-19 infection and being female reduced this inequality, with the counteracting effects of -16% and -5.1%, respectively.

Discussion

This study investigated income inequality in the willingness to receive COVID-19 vaccination and its underlying determinant factors among residents of Hamadan City, western Islamic Republic of Iran. The overall willingness to vaccinate was 39.2%, which is lower than reported in some other countries (*2*,*14*,*15*). This disparity may be attributed to differences in study timing as well as variations in the participants' demographic, cultural, social and economic characteristics. The high-income group reported a higher willingness to vaccinate than the low-income group. Previous research has consistently shown a relationship between economic status and vaccine willingness (*16*–*19*). A 2018 global study highlighted the close association between income level and vaccine hesitancy and its underlying reasons. In low-income countries, a lack of knowledge and awareness was the primary reason for vaccine rejection, whereas in high-income countries, concerns about the risk/benefit of the vaccine were more common (*20*).

The decomposition analysis revealed that coefficient effects accounted for the highest proportion of the observed inequality in willingness to vaccinate. Differences in the coefficients may arise from variations in attitudes, knowledge and behaviours regarding COVID-19 vaccination between the 2 income groups.

Even when considering an equal proportion of female participants in both income groups, high-income women reported higher willingness to vaccinate than their low-income counterparts. While several studies have indicated that women may exhibit higher vaccine hesitancy (*14*,*16*,*21*,*22*), other research has reported contrary findings (*23*) or found no sex-based difference (*24*). Our study, however, found that the relationship between willingness to vaccinate and sex is influenced by income. The higher willingness to vaccinate among affluent women may be linked to their health-related concerns and lower risk-taking behaviours. It is possible that high-income women were more optimistic about the effectiveness of the COVID-19 vaccine (*25*), which could reflect their willingness to be vaccinated. In terms of endowment effects, we found that the lower proportion of women in the high-income group served to slightly narrow the inequality gap for willingness to vaccinate when assuming equal probabilities of willingness to vaccinate across both income groups. This is a consequence of the lower representation of females in the high-income group.

Working for an employer appears to reduce the inequality gap in vaccination willingness. Being employed statistically significantly increased the probability of willingness to vaccinate among low-income individuals, but did not appear to influence willingness to vaccinate in the high-income group. Social pressure (*26*) and the diversity of occupations (*27*) within both income groups may have contributed to these differences in willingness to vaccinate. A study conducted in the United States of America found that vaccine hesitancy varied significantly across occupation categories, with rates decreasing below 10% in fields such as computers/mathematics; life/physical/social sciences; education; and arts/design. Conversely, vaccine hesitancy increased to 25–45% in occupations like construction/extraction; transportation; protective services; and production, including food processing and meat packing (*27*). It appears that employed low-income participants perceived a higher risk associated with not getting vaccinated, which may have driven their higher willingness to vaccinate. Among low-income individuals, significant income loss due to COVID-19 infection could further explain their higher willingness to vaccinate. The limited and inadequate support for low-wage workers during the COVID-19 pandemic (*28*) imposed considerable economic burdens, likely contributing to their heightened willingness to vaccinate.

Our results indicate that although history of COVID-19 infection was more prevalent among high-income individuals than their low-income counterparts, the former were less likely to report willingness to vaccinate. Even when we assumed an equal prevalence of COVID-19 infection across both income groups, low-income individuals with a history of COVID-19 were still more likely to express willingness to vaccinate, which contributed to narrowing the measured inequality gap in willingness to vaccinate. Economic hardships experienced by low-income participants during the COVID-19 pandemic likely contributed to their elevated willingness to vaccinate (*28*). A recent study found that perceived risk of disease and concerns about vaccine safety can be predictors of vaccine inclination (*29*). This suggests that low-income individuals may have prioritized potential morbidity associated with subsequent COVID-19 infections over their fears regarding vaccine side-effects, resulting in their higher willingness to vaccinate.

Having an elderly family member was associated with a widening of the measured inequality in willingness to vaccinate. Other research has demonstrated that the elderly experienced higher rates of COVID-19 infection (*30*), disease severity and negative clinical outcomes (*31*), which may have increased the perceived risk among high-income individuals for their older family members. This increased perception of risk could explain their higher willingness to vaccinate and the exacerbation of the inequality gap. Recent research links higher risk perception to a higher propensity for vaccination (*22*,*32*). This could also be a result of the higher perceived benefits of vaccination among the advantaged group, which has been associated with lower vaccine hesitancy (*22*).

Our findings indicate that, despite a lower overall level of education and fewer individuals having a bachelor's

degree in the low-income group, those who were educated to bachelor's degree level exhibited a higher willingness to vaccinate. This suggests a reduction in income inequality in relation to willingness to vaccinate. While some existing studies support the notion that vaccination tendency generally increases with educational attainment (*18*,*19*,*33*), higher educational levels in the high-income group did not exacerbate the observed inequality in willingness to vaccinate. Interestingly, individuals with postgraduate education in the low-income group, as well as those who had a bachelor's degree or higher in the high-income group, appeared to have distinct reasons for their vaccine hesitancy. Concerns about unknown side-effects and uncertainty regarding vaccine efficacy, safety, and convenience may have amplified vaccine hesitancy among these populations (*19*). Although educated individuals are typically better equipped to navigate health information, social influences such as family, friends and the media also significantly impact health decision-making (*34*). Implementing practical strategies focused on vaccine communication efforts and improving health literacy could further empower educated individuals in low-income groups to make informed decisions, thereby narrowing the inequality gap in willingness to vaccinate.

We anticipated that losing relatives due to COVID-19 would correlate with increased fear of infection, thereby raising willingness to vaccinate. Our findings support this expectation; in the high-income group, the death of relatives corresponded with increased willingness to vaccinate, whereas, in the low-income group, such losses had no correlation with willingness to vaccinate. This divergence contributed to an expanding gap in willingness to vaccinate between income classes, likely reflecting differing responses to the deaths of relatives. The heightened fear among financially advantaged individuals may explain their greater willingness to vaccinate. However, the mechanisms driving the findings in the low-income group remain unclear and requires further investigation. It is possible that trust in the quality of health services within the formal healthcare system played a role in shaping willingness to vaccinate among low-income participants regarding the deaths of relatives. Specifically, experiencing low-quality health services (*35*) could diminish their willingness to vaccinate, highlighting the need for a more nuanced understanding of these dynamics.

Increased knowledge of the COVID-19 vaccine within the high-income group contributed to an expanded inequality gap, likely due to their better health literacy. Conversely, lower socioeconomic status is often linked to inadequate health literacy (*36*), further widening this divide.

Trust in foreign vaccines was higher among the high-income group, where this trust directly correlated with increased willingness to vaccinate. Conversely, low-income individuals showed no relationship between vaccine trust and willingness to vaccinate, contributing to a widening inequality gap, with some increases statistically significant at the 10% level. Access to accurate information about vaccine efficacy and side-effects may be crucial for improving acceptance, while disparities in available information sources likely exacerbate these differences. The ability to afford foreign vaccines further explains the greater willingness to vaccinate among higher-income individuals (*19*).

This study was a pioneering effort to examine income inequality in relation to willingness to vaccinate in the Islamic Republic of Iran. However, its cross-sectional design imposed significant limitations. It precludes the establishment of causal relationships, meaning observed correlations should not be interpreted as causal. Future longitudinal studies are necessary to confirm these findings and understand fluctuations in willingness to vaccinate over time. Conducting the research in only one Iranian city may limit the generalizability of the results, highlighting the need for broader studies across multiple regions.

In our study, we used convenience sampling through social networks to gather data on income inequality in willingness to receive the COVID-19 vaccination. This approach permitted timely and accessible data collection during the restrictions of the pandemic, allowing us to quickly gather insights from readily available participants. Convenience sampling proved to be a practical and cost–effective method, facilitating the research process in a challenging environment. However, it is important to acknowledge certain limitations of using convenience sampling. The reliance on convenience sampling may have introduced sampling bias, as the participants may not represent the broader population, potentially affecting the generalizability of our findings.

The reliance on online questionnaires may have introduced self-selection and accessibility biases. Individuals without internet access or those less-inclined to respond to online surveys are likely underrepresented, further limiting the diversity of our sample and the insights into the varied experiences and attitudes across different demographic groups.

Conclusion

Our study identified significant income inequality in willingness to vaccinate, primarily influenced by individual knowledge, attitudes and behaviours toward COVID-19 vaccination. Contributing factors included sex, having elderly family members, death due to COVID-19 among relatives, and knowledge of the vaccine. Factors such as being in employment, holding a bachelor's degree, and previous COVID-19 infection contributed to reducing this inequality gap. This highlights the potential effectiveness of targeted interventions for low-income population subgroups, to further narrow the willingness to vaccinate gap. A comprehensive strategy addressing knowledge dissemination, attitude shifts, and behavioural changes is crucial for enhancing vaccination rates and fostering equity in willingness to vaccinate.

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Inégalités de revenus et volonté d'accepter la vaccination contre la COVID-19 en République islamique d'Iran

Résumé

Contexte : Les inégalités socio-économiques peuvent affecter l'acceptabilité des vaccins et l'efficacité des programmes de vaccination.

Objectif : Étudier la relation entre les inégalités de revenus et la volonté d'accepter la vaccination contre la COVID-19 en République islamique d'Iran.

Méthodes : La présente étude transversale a été menée dans la ville de Hamadan (République islamique d'Iran) en février et mars 2021. Elle a recueilli et analysé les données de 864 répondants à l'aide d'un questionnaire structuré et du logiciel STATA version 14. La régression logistique a été utilisée pour évaluer les effets des covariables sur la volonté de se faire vacciner au sein des groupes de revenu ainsi qu'une technique de décomposition multivariée afin d'évaluer les facteurs influençant la volonté de vaccination parmi les groupes.

Résultats : Nous avons constaté que 39,2 % des participants étaient prêts à accepter la vaccination contre la COVID-19. Les participants dans le groupe à revenu faible étaient moins nombreux que ceux du groupe à revenu élevé (33,5 % contre 49,1 % ; $p < 0,001$) à être disposés à accepter la vaccination. Le fait d'être de sexe féminin, d'avoir des membres âgés au sein de la famille et d'avoir été témoin de décès liés à cette maladie parmi les proches représentait le principal facteur ayant contribué à la volonté d'accepter la vaccination. Le fait d'avoir un emploi avant la pandémie de COVID-19 et d'avoir un niveau d'éducation équivalent à un diplôme de licence figurait parmi les principaux facteurs ayant favorisé la volonté de se faire vacciner.

Conclusion : Les différences de niveau de revenu parmi les participants ont influencé leur volonté de se faire vacciner. Des interventions ciblées sont donc nécessaires pour accroître l'acceptation du vaccin contre la COVID-19 et l'efficacité de la vaccination dans les différents groupes de revenu au sein de la population d'étude.

عدم المساواة في الدخل والاستعداد لقبول التطعيم ضد كوفيد-19 في جمهورية إيران الإسلامية

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الخلاصة

الخلفية: يمكن أن تؤثر أوجه عدم المساواة الاجتماعية والاقتصادية على مدى مقبولية اللقاحات وفعالية برامج التطعيم.

الأهداف: هدفت هذه الدراسة الى الوقوف على العلاقة بين عدم المساواة في الدخل والاستعداد لقبول التطعيم ضد كوفيد-19 في جمهورية إيران الإسلامية.

طرق البحث: أُجريت هذه الدراسة المقطعية في مدينة همدان، بجمهورية إيران الإسلامية، في فبراير/ شباط ومارس/ آذار 2021. وجمعت الدراسة بيانات من 864 مستجيبًا، وحللتها باستبيان مُنظَّم والإصدار 14 من برنامج STATA، على التوالي. واستُخدم الانحدار اللوجستي لتقييم آثار المتغيرات المشاركة على الاستعداد للتطعيم داخل فئات الدخل، وأسلوب التحليل التفكيكي المتعدد المتغيرات لتقييم العوامل التي تؤثر على الاستعداد للتطعيم بين الفئات.

النتائج: تبين أن 39.2% من المشاركين كانوا على استعداد لقبول التطعيم ضد كوفيد-19. وكان عدد المشاركين الذين كانوا على استعداد لقبول التطعيم أقل في فئة الدخل المنخفض مقارنة بفئة الدخل المرتفع (33.5% مقابل 49.1%؛ قيمة الاحتمال < 0.001). وكان الانتماء للجنس الأنثوي، ووجود أفراد مسنِّين في الأسرة، ومعايشة وفيات مرتبطة بكوفيد-19 بين الأقارب من العوامل الرئيسية التي أسهمت في الاستعداد لقبول التطعيم. واعتُبر الالتحاق بوظيفة قبل جائحة كوفيد-19 والوصول في المستوى التعليمي إلى درجة البكالوريوس العاملين الرئيسيين اللذين أسهما في مدى الاستعداد للتطعيم.

الاستنتاجات: أثَّرت الاختلافات في مستوى الدخل بين المشاركين على مدى استعدادهم للتطعيم. ولذلك، هناك حاجة إلى تدخلات مستهدفة لزيادة قبول لقاحات كوفيد-19 وفعالية التطعيم بها بين مختلف فئات الدخل المشمولة بالدراسة.

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