Navigating the crossroads of health and wealth: socioeconomic inequality in flu vaccination uptake among the elderly in Iran

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Abstract

Background: There is limited evidence regarding socioeconomic-related inequalities in flu vaccination uptake among the elderly in developing countries like Iran. This study aims to examine these inequalities and identify the main determinants of observed inequalities among the elderly in Iran.

Method: In this cross-sectional study, we collected data on sociodemographic factors, economic status, flu vaccination history, and reasons for receiving or declining the vaccine among 1,192 individuals aged 60 years and older through multistage sampling in 2024. Monthly household expenditures were used as a proxy to measure the economic status of the participants' households. We initially employed multiple logistic regression to assess the main factors affecting flu vaccination uptake among the samples. Subsequently, we utilized the concentration curve (CC) and concentration index (CI), specifically Wagstaff normalized CI and Erreygers normalized CI, to illustrate and quantify socioeconomic inequalities in flu vaccination uptake. Additionally, decomposition analysis was conducted to identify primary determinants of economic-related inequality in flu vaccination.

Results: This study found that the prevalence of flu vaccination uptake among the elderly was 29.69% (n=354) for the current or previous flu season and 40.81% (n=486) for having ever received a flu vaccination at any time in their lives. Key factors influencing vaccination included education level, monthly household expenditures, consultations with health professionals, trust in healthcare providers, and prior vaccination history. Both Wagstaff normalized CI and Erreygers normalized CI indicated that vaccination distribution was disproportionately concentrated among wealthier groups. Decomposition analysis revealed that flu vaccination history (101.1%), household costs (21.3%), consultations regarding flu vaccination from health centers or professionals (13.6%), trust in health professionals concerning flu vaccination (12.4%), and education level (7.9%). were significant determinants of observed inequalities.

Conclusion: This study highlights significant socioeconomic inequalities in flu vaccination uptake among the elderly in Iran, indicating that wealthier individuals are more likely to receive vaccinations. Addressing these disparities through targeted interventions is essential for improving vaccination rates and overall public health outcomes among vulnerable populations.

Keywords: Socioeconomic status, inequality, flu vaccination, elderly

Introduction

Seasonal influenza, commonly referred to as the flu, has a significant impact on public health each winter, resulting in a marked increase in primary care visits, thousands of hospitalizations, and elevated mortality rates.(1, 2, 3). It is estimated that annually, 5–10% of adults and 20–30% of children are infected by the virus (4). Each year, flu accounts for approximately 140,000 hospitalizations and over 36,000 deaths in the United States, while in Canada, it is responsible for around 6,000 deaths and 75,000 hospital admissions; additionally, excess mortality figures for the United Kingdom, Denmark, and the Netherlands are reported to be about 11,000, 400, and 2,000, respectively (5). Iran is among the countries in the Eastern Mediterranean Region (EMRO) facing a considerable burden from influenza. According to the 2017 global burden of disease estimates, the incidence of influenza in Iran was 587 cases per 100,000 people, with a mortality rate of 0.8 per 100,000 people (6).

The most cost-effective approach to reducing the burden of influenza in all countries is vaccination (7). According to estimates from the Centers for Disease Control and Prevention (CDC)(8), the flu vaccination in the USA during the 2021-2022 season played a significant role in public health by preventing approximately 1.8 million cases of flu-related illnesses, 970,000 medical visits due to flu symptoms, 22,000 hospitalizations linked to the virus, and around 1,000 deaths associated with influenza. Regarding the flu vaccination, there are two very important issues that need to be considered: first, the rate of vaccine uptake among high-risk groups, including pregnant women, children aged 6 years and younger, and adults aged 65 and older; and second, the socioeconomic inequalities in vaccine uptake among different groups.

The vaccination rates vary among different countries, and they have not yet reached optimal levels (75% vaccination coverage in key target groups for the seasonal influenza vaccine recommended by the WHO)(9, 10). In a study conducted in Iran in 2015 among individuals aged 60 and older, it was found that only 11% of the surveyed population had received the influenza vaccine (11). This low vaccination rate is particularly concerning given that a systematic review indicated that the prevalence of influenza in Iran varied significantly, ranging from 1.3% to 52% across different populations, including adults, children, and various regions (12). In Turkey, a 2022 study found that 45.6% of elderly individuals (aged 65 and above) had received the flu vaccine (13). Similarly, a 2015–2016 survey in Brazil reported influenza vaccination coverage of 73.0% (95% CI: 70.6–

75.2) among those aged 60 and older (14). Seasonal influenza vaccination rates in Saudi Arabia have been reported to range from 12.7% to 55.0% in various studies (15).

In addition to examining the percentage of individuals in the community who receive the influenza vaccine and estimating vaccine uptake, it is also critically important to understand the economic and social inequalities in flu vaccination rates. Several factors can influence socioeconomic inequalities in influenza vaccination uptake among older adults in Iran and other countries. Limited access to transportation can hinder reaching vaccination centers, especially for those living in rural or underserved areas. Although vaccines are often provided free of charge to high-risk groups, out-of-pocket costs when using private providers may still pose a barrier. Cultural beliefs and vaccine hesitancy, shaped by trust in healthcare providers and concerns about vaccine safety, also affect vaccination rates. Furthermore, differences in education and health literacy influence awareness and acceptance of vaccines. A study conducted in the UK found that vaccination rates were notably lower among individuals living in more disadvantaged neighborhoods, despite these areas experiencing higher hospitalization rates due to flu infections (16). Furthermore, another study revealed that economic and social factors, such as income and education, serve as strong indicators of socio-economic status that are closely linked to influenza vaccination rates. This research highlights the existence of socio-economic inequalities across various age groups and points out significant differences in influenza vaccine uptake observed across European countries, particularly among older adults (17). By understanding these disparities, we can more effectively address the barriers to vaccination and improve public health outcomes for all segments of the population.

The COVID-19 pandemic has influenced influenza vaccination attitudes and behaviors in several ways(18, 19, 20). Increased public awareness of respiratory infections and intensified health campaigns during the pandemic may have encouraged more people, especially high-risk groups, to seek flu vaccination as a preventive measure. However, concerns about potential exposure to COVID-19 at healthcare facilities, along with misinformation and vaccine hesitancy, may have discouraged some individuals from getting vaccinated. Additionally, healthcare resources were heavily directed toward managing COVID-19, which may have temporarily disrupted routine vaccination services, affecting access to the flu vaccine.

In Iran, influenza vaccination for older adults and other high-risk groups is conducted according to the guidelines issued by the Ministry of Health and Medical Education (MoHME). These guidelines specify priority groups eligible to receive the vaccine free of charge, including adults aged 65 years and older, pregnant women, individuals with specific chronic diseases, children, and healthcare workers. The recommended vaccination period begins in mid-September and continues through the end of autumn. Individuals can receive the influenza vaccine through two main channels. High-risk groups, such as older adults, are eligible to receive the vaccine free of charge by visiting public healthcare centers. Additionally, these individuals, as well as healthy individuals who wish to do so, can obtain and receive the vaccine through the private sector by paying the associated costs. Both Iranian-manufactured and imported vaccines are available in the public and private healthcare sectors in Iran(21).

To the best of our knowledge, there is a significant lack of studies examining socio-economic inequalities in flu vaccination uptake in developing countries like Iran (22). Moreover, it is crucial to emphasize that there are no published studies in Iran investigating whether socio-economic-related inequalities in flu vaccine uptake exist among both general and non-general populations using well-established methods, such as the Wagstaff concentration index and decomposition method. To fill this gap in the literature, this study aims to answer three key questions: First, what is the prevalence of flu vaccine uptake among individuals aged 60 years and older in western Iran? Second, does socio-economic inequality exist in flu vaccine uptake within this population? Finally, this study will identify the main determinants contributing to the observed inequalities, helping to inform strategies for improving vaccination rates among vulnerable groups.

Methods and materials

Study setting

This cross-sectional study was conducted among individuals aged 60 and older in Kermanshah city, the capital of Kermanshah province in western Iran, to investigate socioeconomic inequalities in flu vaccination uptake and their main determinants. According to the latest prediction by the Iranian Statistical Center (ISC) for 2024 (23), the total population of Kermanshah province is approximately 1,990,000, of which 12.15% are aged 60 and above. For Iran as a whole, this figure is about 11.84%, with 1,018,600 people aged 60 and above out of a total population of 86,042,753.

Samples, Study sampling and data collection

In this cross-sectional study, we collected data on sociodemographic factors, economic status, flu vaccination history, and reasons for receiving or declining the vaccine among 1,192 individuals aged 60 years and older in Kermanshah city, the capital of Kermanshah province, between September and November 2024.

Samples size was calculated as follow:

$$n = \frac{{z^2}_{1-\frac{\alpha}{2}} * p\,(1-q)}{d^2}$$

The significance level (α) was set at 0.05. Based on the results of a study conducted in 2012, the influenza vaccination coverage rate was approximately 10%(24); therefore, we used p = 0.1 in this study. The margin of error (d) was set at 0.02. By substituting these values into the formula above, the required sample size was calculated to be 864. Considering an effect size of 1.15 and a 15% rate of incomplete questionnaires, the total sample size was adjusted to 1,143. Finally, 1,200 participants were included in the study. After excluding incomplete questionnaires, 1,192 samples were included in the final analysis. A multistage sampling method was used to select the participants. First, Kermanshah city was divided into five distinct regions: north, east, south, west, and central. Then, 240 participants were selected from each region using a convenience sampling technique.

Based on previous studies(14, 24, 25) and the study objectives, a self-administered questionnaire was used for data collection. The questionnaire consisted of two sections. The first section included 17 questions related to sociodemographic and economic information, such as age, gender, education level, type of employment, health insurance status, household size, monthly household income, and monthly household expenditures. The second section contained 7 questions focused on flu vaccine uptake over the past year, reasons for receiving or not receiving the flu vaccine, the impact of COVID-19 on flu vaccination rate, and other related factors.

Dependent and explanatory variables

The outcome variable in this study was influenza vaccination status, defined as a binary variable equal to one if a person received the flu vaccine in the current or previous year, and zero otherwise. The explanatory variables included age, gender, education level, marital status, monthly household expenditures, presence of chronic diseases, self-rated health, vaccination for other diseases, whether anyone in the household works in healthcare, advice about flu vaccination from health centers or professionals, trust in health professionals regarding flu vaccination, and history of flu vaccination in past years.

The economic status of participants was initially assessed using two questions about their total monthly household expenditures and income, both reported in Iranian Rials (IRR). The response options for each question were categorized as less than 100 million IRR, 100 to 150 million IRR, and more than 150 million IRR. Subsequently, the correlation between these two variables was analyzed and found to be 0.8. Considering that the variance of expenditures was lower than that of income, and following the recommendation of Wagstaff et al. (26), we ultimately selected monthly household expenditures as the primary indicator for assessing economic status and measuring inequality.

Data analysis

Descriptive analysis and main determinant of flu vaccination

Continuous variables were reported as mean ± standard deviation (SD), and categorical variables as frequency (percentage). First, we conducted univariate analyses to examine the relationship between explanatory variables and influenza vaccination status using chi-square tests for categorical variables and independent t-tests for continuous variables. Variables with a p-value less than 0.05 were then included in a multiple logistic regression model to identify the main factors influencing influenza vaccination among the study participants. Adjusted odds ratios (AOR) and corresponding p-values were calculated and reported for the multiple logistic regression analysis.

Measuring socioeconomic inequality in flu vaccination

We utilized the concentration curve (CC) and Wagstaff normalized CI and Erreygers normalized CI (27, 28, 29) to illustrate and quantify socioeconomic disparities in flu vaccination among the study participants. The CC plots the cumulative proportion of flu vaccination prevalence on the y-

axis against the cumulative proportion of individuals, arranged according to a socioeconomic indicator on the x-axis. When the concentration curve is positioned below the line of perfect equality, it signifies that the health variable is more prevalent among individuals with higher economic status, and vice versa. The concentration index ranges from -1 to +1, where a value of zero indicates no socioeconomic inequality. A negative value suggests that the health variable is more prevalent among lower-income individuals, while a positive value indicates greater prevalence among those with higher income. Given that our outcome variable of interest (flu vaccination) is binary, the CI does not adhere to the -1 to +1 range. Therefore, in accordance with Wagstaff's methodology(28), we normalized the CI by dividing it by its mean (μ).**Decomposing socioeconomic inequality in flu vaccination**

We decomposed the concentration index (CI) to identify the main factors contributing to the observed socioeconomic inequality in influenza vaccination. To do this, we used the following linear regression model to relate the influenza vaccination uptake variable ,y, to a set of k explanatory factors, x_k :

$$y = \alpha + \sum_k \beta_k \, x_k + \, \varepsilon \qquad (3)$$

The CI for flu vaccination uptake, y, can be decomposed as follows:(30)

$$CI = \sum_k \left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k + \frac{GC_\varepsilon}{\mu} \qquad (4)$$

In this equation CI shows the CI for flu vaccination uptake, $\bar{x}_k$ is the mean of explanatory variable x_k, C_k is the CI for x_k, similarly to the overall CI. The term $\frac{\beta_k \bar{x}_k}{\mu}$ is the elasticity of flu vaccination uptake with respect to the explanatory variable x_k. The summation term $\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k$ reflects the contribution of each explanatory factor x_k to the CI. The final term, $\frac{GC_\varepsilon}{\mu}$, represents the residual component and captures the socioeconomic-related inequality in health outcomes that cannot be explained by systematic variations in x_k cross different wealth groups(31).

The normalized CI can be expressed using the following formula:

$$C_n = \frac{CI}{1-\mu} = \frac{\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k}{1-\mu} + \frac{\frac{GC_\varepsilon}{\mu}}{1-\mu} \qquad (5)$$

Since flu vaccination uptake is a binary variable, we used marginal effects obtained from a logit model in the decomposition analysis (31).

All analyses were performed using Excel and Stata 17.0 software (Stata Corporation) and the significance level was set at $p < 0.05$.

Results

Table 1 illustrates the descriptive characteristics of the participants included in the study. The study indicated that the average age of respondents was 69.03 years, with a slight majority being male (52.4%) compared to females (47.6%). In terms of household income, 66.4% reported earning more than 15 million IRR monthly, which aligns with the finding that 52.9% indicated their household costs exceeded this amount. Trust in health professionals regarding flu vaccination varied among respondents, with 26.4% expressing very high or high trust, while 43.7% rated their trust as medium. Among the participants, 40.5% reported having a chronic disease, while a substantial majority of 87.2% indicated that they had been vaccinated for other diseases, including COVID-19.

<<< Table 1>>>

Our study found that the prevalence of flu vaccination uptake in the past year or this year was 29.69% (95% CI: 27.17% to 32.36%), while the prevalence of flu vaccination at any point in life was 40.81% (95% CI: 38.04% to 43.63%) among older adults in Iran. **Figure 1** illustrates the reasons and corresponding percentages for both declining and receiving the influenza vaccination among individuals aged 60 and older in Iran for the year 2024. The data indicate that awareness and knowledge regarding the influenza vaccine serve as the primary motivating factor for vaccination, accounting for 20.3%. This is closely followed by the influence of family and friends, which affects 23.7% of respondents. In contrast, the findings reveal that fear of side effects constitutes the most significant barrier to vaccination, impacting 22.6% of individuals, with high vaccination costs also representing a notable obstacle at 20.7%.

<<< Figure 1>>>

The findings from the multiple logistic regression model (**Table 2**) indicate that key factors influencing influenza vaccination among individuals aged 60 and older include education level

(adjusted OR = 2.44), monthly household expenditures (adjusted OR = 5.71 for expenditures between 10 and 15 million IRR and adjusted OR = 5.26 for expenditures above 15 million IRR), and consultation with health professionals (adjusted OR = 5.47), all of which significantly enhance the likelihood of vaccination. Additionally, trust in healthcare providers (adjusted OR = 0.45 for medium trust and adjusted OR = 0.23 for low trust) and previous vaccination history (adjusted OR = 273.25) are critical determinants.

<<< Table 2>>>

There is a disparity in flu vaccination rates among individuals included in the study based on their economic status. Our study indicated that among individuals in the lower socioeconomic group, the prevalence of flu vaccination in the past year or this year was only 8.91% (95% CI: 5.33% to 14.55%), while it was significantly higher at 36.29% (95% CI: 32.62% to 40.13%) among wealthier individuals. The normalized Concentration Indices for both the Wagstaff and Erreygers measures of flu vaccination in the past year or this year are presented in **Table 3**. As shown in **Table 3**, the concentration indices are positive and statistically significant for both measures (p-value<0.001), indicating that there is a pro-rich economic inequality in flu vaccination rates among individuals aged 60 and over in Iran. **Figure 2** presents the concentration curve for flu vaccination among individuals aged 60 and older. The curve is positioned below the 45-degree line, suggesting that flu vaccination is more prevalent among wealthier individuals.

<<< Table 3>>>

<<< Figure 2>>>

Supplementary 1 and Figure 3 present the findings from the decomposition analysis of economic-related inequality in flu vaccination in Iran. As shown in Figure 3, several factors significantly contribute to inequality in vaccination rate. Notably, the variable flu vaccination at any point in life has the most substantial impact, with a contribution of 101%. This indicates that prior vaccination history is crucial for reducing inequalities in vaccine uptake; achieving an equitable distribution of flu vaccinations among participants could potentially decrease economic-related inequality by 101%. Additionally, monthly household expenditures (21.3%) and consultations regarding flu vaccination from health centers or professionals (13.6%) also have

significant effects on vaccination disparities, highlighting the importance of economic factors and access to professional guidance in influencing vaccination rates. Furthermore, trust in health professionals concerning flu vaccination (12.4%) and education level (7.9%) emerge as important determinants of observed inequality.

<<< Figure 3>>>

Discussion

Seasonal influenza significantly impacts public health, leading to increased healthcare visits, hospitalizations, and mortality, especially among vulnerable populations (6, 32). Furthermore, vaccination is the most effective method for preventing infections and severe complications associated with influenza viruses, particularly among at-risk groups such as the elderly, children, individuals with chronic diseases, and pregnant women. (7, 33). Previous evidence from high income countries has shown a significant disparity in flu vaccination uptake across socioeconomic groups (2, 5, 17); however, information on these inequalities in lower middle income countries (LMICs) like Iran is limited. To address this gap in the literature, this study aims to examine the socioeconomic inequality in flu vaccination among individuals aged 60 years and older and to identify the main determinants of the observed inequality.

Our study revealed that the prevalence of flu vaccination among older adults in Iran was 29.69% for the past year and 40.81% for vaccination at any point in their lives. These findings are higher than those reported in previous studies conducted in Iran; however, they remain significantly lower than the standard rates recommended by the WHO (75% among the elderly (34)) and those reported in studies from developed countries among the elderly (72.8% among older adults in the UK(2)). A study conducted among 1,350 Iranian adults aged 60 years and older in 2012 found that only 10.4% of this population had received flu vaccinations within the past year (11). There are two main reasons for the higher prevalence of influenza vaccination observed in our study. The first reason is that the study was conducted in the post-COVID-19 pandemic period, and previous research has shown that the pandemic had a positive impact on flu vaccination rates. A study conducted in the UK (2) found that after the onset of the COVID-19 pandemic, there was an increase in flu vaccine uptake across all age groups. The second reason is that we asked participants whether they had received the influenza vaccine in the current year or the previous year, which naturally leads to a higher prevalence estimate over two years compared to a one-year estimate. In

another study conducted in Saudi Arabia in 2023(15), it was reported that the prevalence of seasonal influenza vaccine uptake over the preceding 12 months was 31.8%. Although this statistic is somewhat analogous to our findings, there are significant distinctions between the two studies. Our research specifically targeted individuals aged 60 years and older, whereas the Saudi study encompassed adults aged 18 years and above.

Our study also demonstrated that there is no significant relationship between age, sex, marital status, and employment in the health sector within the household and flu vaccination uptake. . In a study conducted in Iran in 2012 (24), the results indicated that sex, marital status, and place of residence had no significant relationship with influenza vaccine uptake. Additionally, there was a positive correlation between educational level and income, which aligns with our findings. In our study education level, household economic status, self-rated health status, the presence of chronic diseases, consultations regarding flu vaccination from health centers or professionals, trust in health professionals concerning flu vaccination, and having received the flu vaccine at any point in life were identified as key derivers of flu vaccination. Others have reported that income and education are strong proxies for socio-economic status associated with flu vaccination uptake(17). A systematic review (35) reported that having chronic diseases and receiving advice from doctors, health professionals, family members, and close friends, as well as access to free vaccinations were key factors associated with influenza vaccine uptake. Our study also indicated that the influence of family and friends is a significant motivating factor for vaccination, impacting 23.7% of participants.

One of the key findings of this study is that inequality in flu vaccination, both in this or last year and over a lifetime, was pro-rich in Iran. This means that the distribution of flu vaccinations was more concentrated among wealthier groups. Our study revealed that the prevalence of flu vaccination in the last year or this year was 8.91% among poorer individuals compared to 36.29% among the wealthiest individuals. This difference in vaccination rates underscores the substantial socioeconomic barriers that hinder access to healthcare services, especially vaccinations. These results are consistent with wider patterns noted in public health research (2, 17), which frequently show that individuals with higher socioeconomic status are more likely to receive vaccinations. Our decomposition analysis indicated that several key factors were the main drivers of the observed inequality in flu vaccination. These factors include flu vaccination history at any point

in life, household economic status, consultations regarding flu vaccination from health centers or professionals, trust in health professionals concerning flu vaccination, and education level. For instance, the contribution of consultations regarding flu vaccination from health centers or professionals to economic-related inequality was 13.6%. This suggests that achieving a more equitable distribution of consultations would result in a 13.6% reduction in economic-related inequality in flu vaccination uptake. These factors collectively highlight the multifaceted nature of health inequalities related to flu vaccination. Addressing these determinants through targeted interventions, such as enhancing public awareness campaigns, improving access to healthcare services, and fostering trust between communities and health professionals, is essential for reducing disparities in vaccination rates and improving overall public health outcomes.

This study is the first to investigate economic-related disparities in flu vaccination among the elderly in Iran, identifying key factors contributing to these inequalities. However, several limitations should be acknowledged when interpreting the findings. First, the data were obtained through a cross-sectional survey, which limits causal inference regarding the relationship between flu vaccination uptake and its determinants. Cross-sectional designs provide only a snapshot in time, making it difficult to establish the directionality of observed associations. Second, the study's geographic focus on a single province in western Iran restricts the generalizability of the results to other regions with potentially different demographic and socioeconomic characteristics. Third, the use of convenience sampling within each region introduces a serious risk of selection bias. This non-random sampling method may have led to the inclusion of participants who are not fully representative of the broader elderly population, thereby limiting the external validity of the findings. Consequently, caution is warranted when extrapolating these results to the entire elderly population of Iran. Fourth, reliance on self-reported vaccination status may result in underestimation or overestimation of flu vaccine uptake due to recall bias or inaccurate reporting. Finally, approximately 31.4% of the study population was illiterate, which could have introduced additional biases in data collection. To mitigate this, trained interviewers with a bachelor's degree in Public Health administered the questionnaires and entered responses directly, enhancing data accuracy and reliability.

Policy implication

The influenza vaccination rate among older adults in Iran remains considerably low compared to many other countries and the World Health Organization's (WHO) recommended target of 75%(36). While some European countries report vaccination coverage above 50% in this age group(37), this study indicated that only about 29.7% of Iranian elderly individuals receive the influenza vaccine, which is far below global standards. This low uptake highlights the urgent need for targeted interventions to increase vaccination rates among the elderly in Iran. To address this, public health strategies should focus on raising awareness about the benefits and safety of influenza vaccination through tailored education campaigns, improving vaccine accessibility via primary healthcare centers and community health workers, and involving family members and healthcare providers to encourage vaccine acceptance. Furthermore, our study revealed significant socioeconomic inequalities in influenza vaccination coverage among older adults, with those in lower economic strata being less likely to receive the vaccine. This disparity highlights the financial and social barriers that vulnerable elderly populations face in accessing preventive healthcare services. To reduce these inequalities in the Iranian context, policymakers should consider implementing free vaccination programs specifically targeting low-income groups, including in the private sector, or increasing access to influenza vaccines in the public sector for the elderly. However, since vaccination is already free and insurance coverage has limited impact, additional strategies are needed. These may include mobile vaccination clinics to reach homebound or rural elderly, community outreach programs to raise awareness and trust, and partnerships with local organizations to facilitate vaccine delivery. Integrating influenza vaccination efforts with existing social support and poverty alleviation initiatives can also improve equitable access. Together, these approaches can contribute to reducing both the overall burden of influenza and the socioeconomic gaps in vaccine uptake among Iran's elderly population.

Conclusion

Based on the findings of this study, it is evident that economic-related disparities in flu vaccination among the elderly in Iran are significant and multifaceted. The prevalence of flu vaccination remains alarmingly low, particularly among poorer individuals, highlighting substantial socioeconomic barriers that hinder access to essential healthcare services. Addressing these disparities requires targeted interventions aimed at improving public awareness, enhancing healthcare access, and fostering trust between communities and health providers.

Declarations

Ethics approval and consent to participate

The research protocol was reviewed and approved by the Research Deputy of Kermanshah University of Medical Sciences, with the approval number IR.KUMS.REC.1403.307. The study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. Before data collection began, the researchers verbally explained the study's purpose to each potential participant and obtained their verbal consent to participate. Participants were informed of their right to withdraw from the study at any time without consequence.

Consent for publication

Not applicable.

Conflict of interest

The authors have no conflicts of interest to declare.

Availability of data and materials

The datasets are not publicly available but are available from the corresponding author upon reasonable request.

Clinical trial number:

Not applicable.

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Authors’ contributions

S.R., B.KM., S.A., A.HA., and F.N. developed the study concept, collected and analyzed the data, and drafted the initial report. S.R. and H.B. critically reviewed the paper, providing feedback on the first draft. S.R. and H.B. collaborated on implementing revisions and producing the final version of the manuscript. All authors have read and approved the final draft of the paper.

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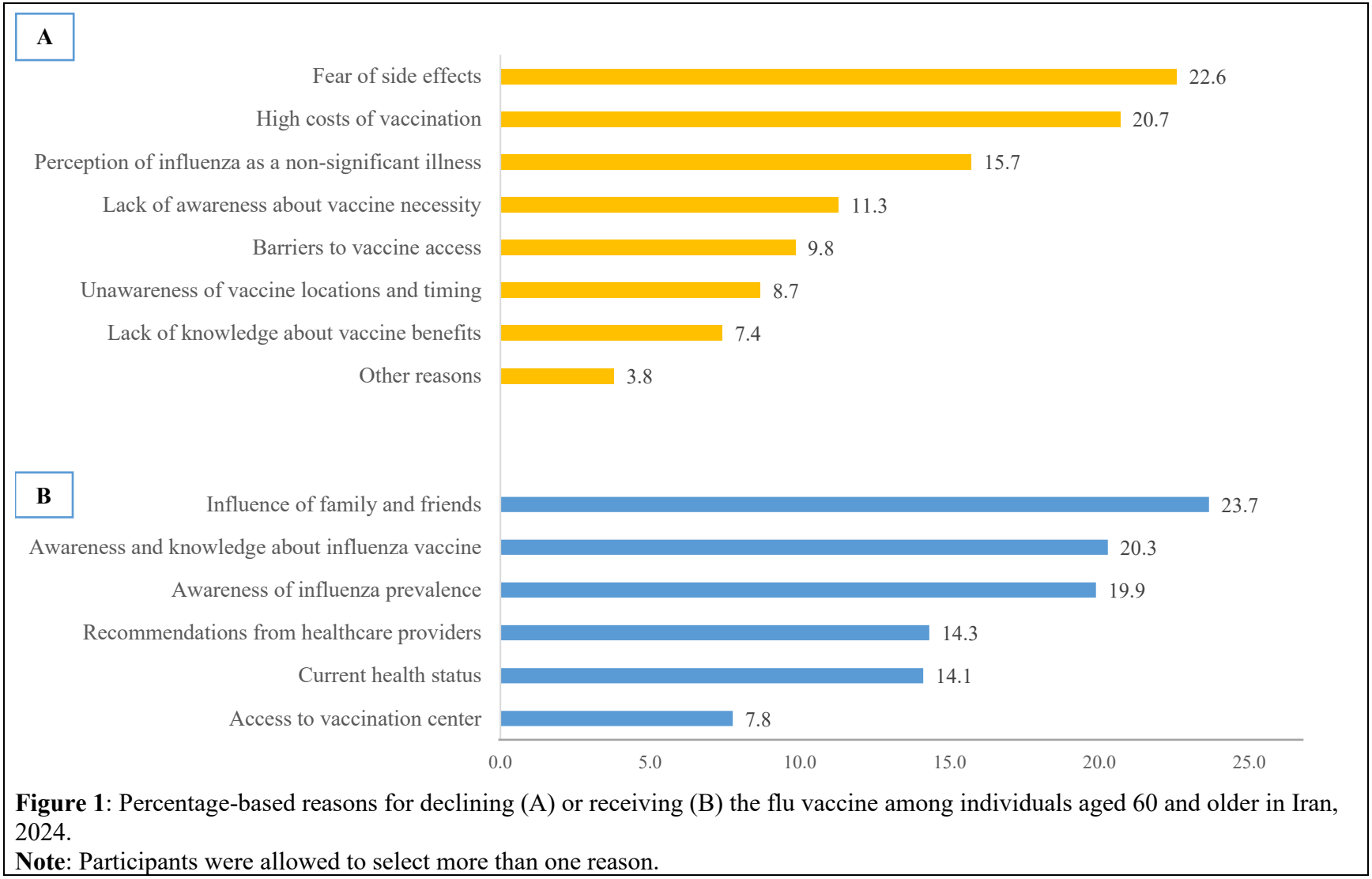

Figure 1: Percentage-based reasons for declining (A) or receiving (B) the flu vaccine among individuals aged 60 and older in Iran, 2024.

Note: Participants were allowed to select more than one reason.

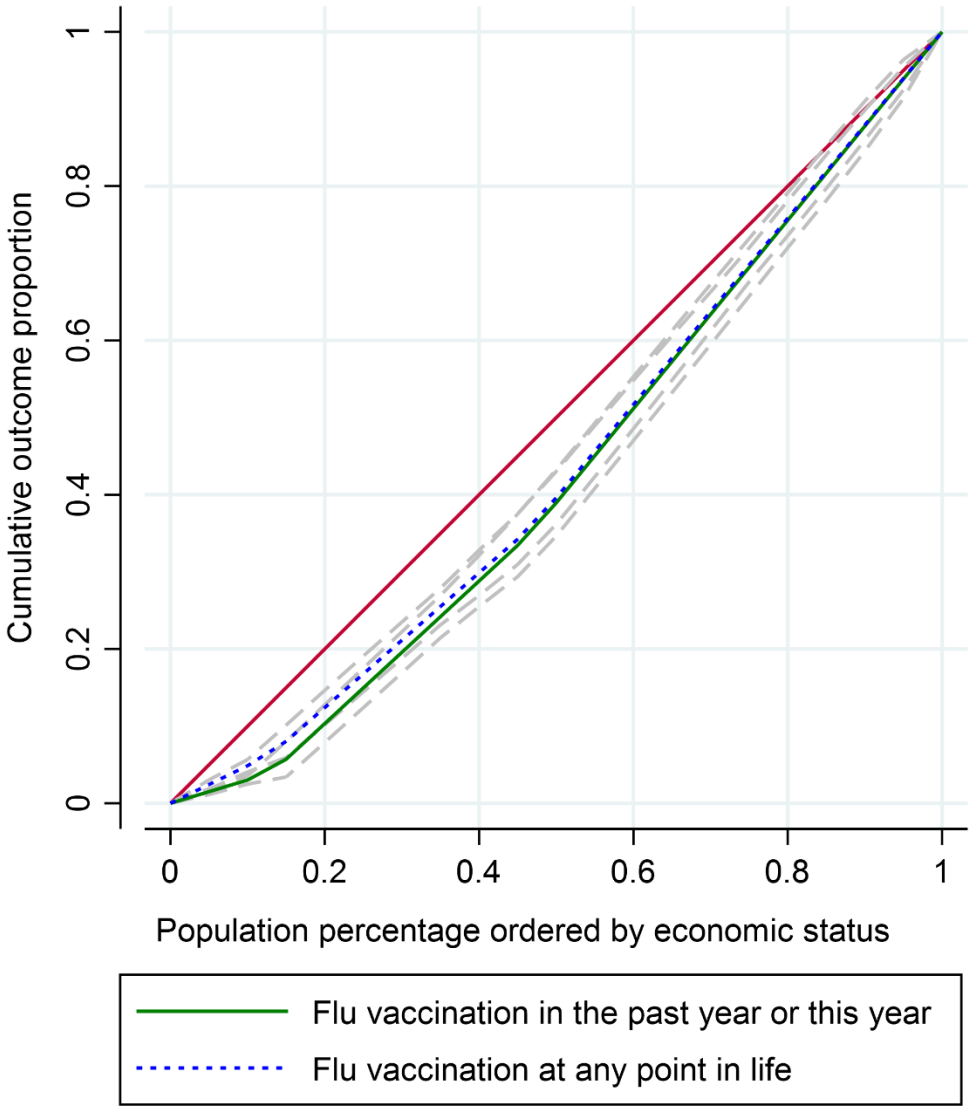

Figure 2: The concentration curve for flu vaccination among individuals aged 60 and over in Iran, 2024

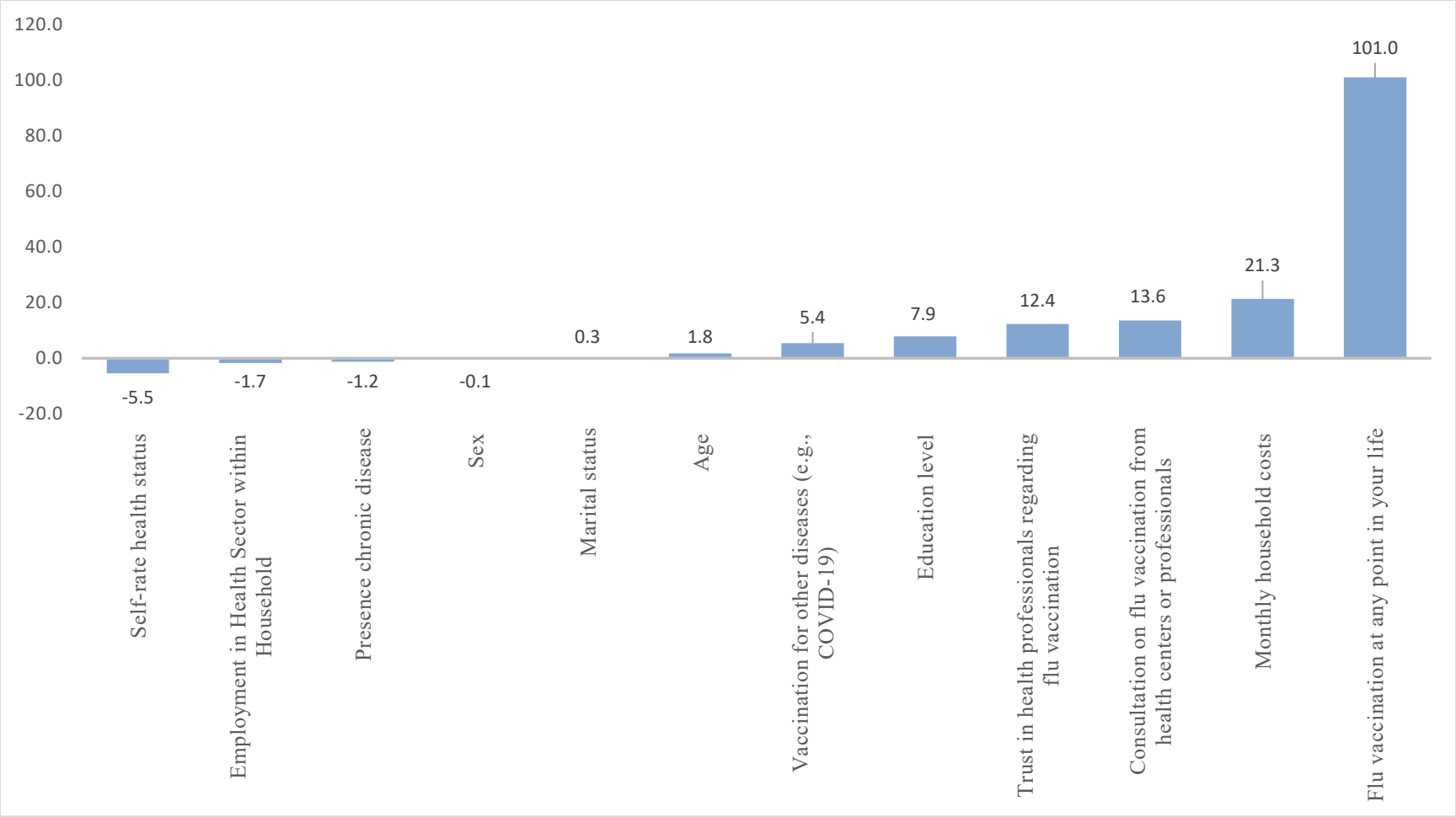

Figure 3: Contribution percentages of various factors to economic-related inequality in flu vaccination among individuals aged 60 and older, as determined by decomposition analysis.

Table 1: Descriptive characteristics of individuals aged 60 years and older included in the study, 2024

Variable		N	Percent
Flu vaccination in the past year or this year	Yes	354	29.7
	No	838	70.3
Flu vaccination at any point in your life	Yes	486	40.8
	No	705	59.2
Age	69.03 ± 7.07	1192	100
Sex	Male	625	52.4
	Female	567	47.6
Education level	Illiterate	374	31.4
	Literate	818	68.6
Marital status	Married	1048	87.9
	Single	49	4.1
	Others	95	8.0
Employment in Health Sector within Household	Yes	142	11.9
	No	1050	88.1
Monthly household expenditures	Less than 10 million IRR	157	13.2
	Between 10 and 15 million IRR	404	33.9
	More than 15 million IRR	631	52.9
Monthly household income	Less than 10 million IRR	100	8.4
	Between 10 and 15 million IRR	300	25.2
	More than 15 million IRR	792	66.4
Presence chronic disease	Yes	709	40.5
	No	483	59.5
Self-rate health status	Very good	22	1.8
	Good	242	20.3
	Fair	443	37.2
	Poor	376	31.5
	Very poor	109	9.2
Vaccination for other diseases (e.g., COVID-19)	Yes	1039	87.2
	No	153	12.8
Consultation on flu vaccination from health centers or professionals	Yes	258	21.6
	No	934	78.4
Trust in health professionals regarding flu vaccination	Very high and high	315	26.4
	Medium	521	43.7
	Low and very low	356	29.9

Table 2: Multiple logistic regression model of key factors influencing flu vaccination among individuals aged 60 and older in Iran, 2024

Variable	Adjusted OR	p-value
Age	0.98***	0.338
Sex (ref. female)		
Male	1.20***	0.277
Education level (ref. Illiterate)		
Literate	2.44*	0.004
Marital status (ref. married)		
Single	0.73***	0.540
Others	0.52***	0.108
Employment in Health Sector within Household (ref. no)		
Yes	0.66***	0.192
Monthly household expenditures (ref. less than 10 million IRR)		
Between 10 and 15 million IRR	5.71*	<0.001
More than 15 million IRR	5.26*	<0.001
Presence chronic disease (ref. no)		
Yes	1.51***	0.071
Self-rate health status (ref. very poor)		
Very good	1.39***	0.738
Good	0.27**	0.028
Fair	0.26**	0.018
Poor	0.25**	0.017
Vaccination for other diseases (e.g., COVID-19) (ref. no)		
Yes	2.44***	0.182
Consultation on flu vaccination from health centers or professionals (ref. no)		
Yes	5.47*	<0.001
Trust in health professionals regarding flu vaccination (ref. very high and high)		
Medium	0.45**	0.002
Low and very low	0.23*	<0.001
Flu vaccination at any point in your life (ref.no)		
Yes	273.25*	<0.001
Number of observations =1,192; LR chi2(18) = 933.73; Prob > chi2 = <0.001; Log likelihood = -258.20756 Pseudo R2 = 0.6439		

Note: OR: odds ratio. *0.001, **0.05, and ***not significant.

Table 3: Results of concentration index for flu vaccination among 60 years and over in Iran, 2024

	Flu vaccination in the past year or this year	Flu vaccination at any point in life
Wagstaff normalized CI		
Value	0.2069	0.2150
p-value	<0.001	<0.001
95% CI	0.1432 to 0.2705	0.1561 to 0.2739
Erreygers normalized CI		
Value	0.1727	0.2078
p-value	<0.001	<0.001
95% CI	0.1196 to 0.2259	0.1509 to 0.2647