

Socio-demographic determinants of influenza vaccination uptake behavior

A nationwide cross-sectional study in Saudi Arabia

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ABSTRACT

الأهداف: دراسة في المحددات الاجتماعية والديموغرافية لقبول تلقي لقاح الأنفلونزا بين السكان في السعودية.

المنهجية: أجريت دراسة مستعرضة على مستوى المملكة العربية السعودية خلال شهر ديسمبر 2020م وانتهى باخذ رأي 1650 مشاركاً الاستطلاع. جمعت البيانات إلكترونياً باستخدام استبيان منظم. أجرينا تحليل الانحدار اللوجستي لإقامة ارتباط بين سلوك قبول تلقي اللقاحات والديموغرافية الاجتماعية للمشاركين في الدراسة.

النتائج: من بين 1650 مشاركاً، أبلغ 31.5% أنهم تلقوا لقاح الأنفلونزا العام 2019-2020م. أظهر تحليل الانحدار اللوجستي أن العمر أعلى من 45 عاماً (AOR: 2.20, 95% CI: [1.15-3.05], $p=0.002$)، والحالة الاجتماعية المتزوجة، (AOR: 1.75, 95% CI: [1.28-3.51], $p=0.001$)، والحصول على شهادات الدراسات العليا (aOR=1.51, 95% CI: [1.05-2.23])، أظهرت الدراسة أيضاً أن العوامل المهمة والمرتبطة بالحصول على اللقاح هي خطر الإصابة بالأنفلونزا (aOR=2.15, 95% CI: [1.30-5.72], $p=0.001$) والمعرفة حول اللقاح (aOR=1.71, 95% CI: [1.08-4.22], $p=0.001$).

الخلاصة: تشير النتائج إلى أن الجهود المبذولة لزيادة قبول تلقي لقاح الأنفلونزا يجب أن تركز على زيادة الوعي والتثقيف حول فوائد التطعيم، وخاصة بين الشباب.

Objectives: To investigate the sociodemographic determinants of flu vaccine uptake among the Saudi population.

Methods: A nationwide cross-sectional study was carried out in Saudi Arabia in December 2020, and 1,650 participants took the survey. Data were collected electronically using a structured questionnaire. Logistic regression analysis was carried out to establish the association between vaccine uptake behavior and sociodemographic characteristics of the study participants.

Results: Out of the 1650 participants, 31.5% reported having received the flu vaccine during the 2019-2020 flu season. The logistic regression analysis showed that age above 45 years (adjusted odds ratio [aOR]=2.20, 95% confidence interval [CI]: [1.15-3.05], $p=0.002$),

being married (aOR=1.75, 95% CI: [1.28-3.51], $p=0.001$), and having a postgraduate degree (aOR=1.51, 95% CI: [1.05-2.23], $p=0.044$) were significant factors associated with higher vaccine uptake. The study also showed that the perceived risk of getting the flu (aOR=2.15, 95% CI: [1.30-5.72], $p=0.001$) and knowledge regarding the vaccine (aOR=1.71, 95% CI: [1.08-4.22], $p=0.001$) were significant factors associated with vaccine uptake.

Conclusion: The findings suggest that efforts to increase flu vaccine uptake should focus on increasing awareness and education regarding the benefits of vaccination, particularly among young individuals.

Keywords: influenza vaccination, flu shot, seasonal flu vaccines, hesitancy, flu vaccine

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Influenza is generally referred to as the flu. It is caused by the influenza virus and is an extremely contagious illness of respiratory system. The flu can result in severe complications, including pneumonia, and can lead to death, especially in vulnerable populations, such as the elderly and those with underlying medical conditions.^{1,2} The World Health Organization (WHO) has recognized that influenza vaccination is the most effective way to

prevent the flu and its complications.³ In addition, mass vaccination is crucial in controlling the spread of the flu and reducing its overall impact on public health.

Saudi Arabia (SA) has a large and growing population with a high prevalence of medical conditions that increase the risk of severe influenza-related complications. The Saudi Ministry of Health (MOH) recommends the seasonal influenza vaccination yearly for all patients with asthma, chronic obstructive pulmonary disease, diabetes, all types of chronic diseases, neurological disorders, and immune deficiency, and for the patients who are on long-term aspirin therapy.⁴

Furthermore, it recommends the yearly influenza vaccination for people with obesity, women with pregnancy, children in age group 6 months to 5 years, individuals above 50 years, and all healthcare workers. Moreover, the MOH strictly endorses the pilgrims to get vaccinated against the seasonal flu before carrying out Hajj.⁴ The MOH prioritizes the health and well-being of its citizens and residents by offering free flu vaccinations. Regardless of insurance coverage, all individuals, both Saudi and non-Saudi, can receive the vaccine without cost. Despite the availability of influenza vaccines in SA, the uptake of vaccination has been low in the past.⁵⁻⁹ This is a concern for public health and studies are needed to identify the factors that can bring on behavior change towards vaccination uptake among the population in SA.

Several studies have assessed the determinants of influenza vaccination behavior, including individual-level factors such as age, gender, education, income, and health condition.¹⁰⁻¹⁵ Studies have investigated the role of social determinants, including access to healthcare, health literacy, and cultural beliefs.^{13,16,17} However, the results of these studies have been inconsistent, and many have been carried out in countries with different cultural and health systems than SA.

A study from China reported that there was some level of hesitancy among the elderly respondents (37.18%) toward influenza vaccination, in which 19.28% elderly were uncertain and 17.90% rejected influenza vaccination.¹⁴ Respondents who considered themselves as greatly vulnerable to influenza infection and aware that they are the priority group had lower odds for rejecting vaccination.¹⁴

In SA, a study reported that 89.0% of healthcare providers are aware of guidelines and recommendations

for the influenza vaccine. However, the utilization of the vaccine is only 55.0%.⁶ The perceived risk of severity of influenza was higher in the group that received the vaccine than in the noncompliant group.⁶

Regardless of the importance of influenza vaccination, limited research has been carried out in SA to explore the determinants of vaccine uptake behavior among the Saudi population. The knowledge regarding the factors that influence vaccine uptake is central in the development of effective strategies to increase vaccine coverage and reduction in the burden of influenza in SA. Therefore, the present study aimed to examine the determinants of influenza vaccination uptake behavior among the Saudi population. The study utilizes a nationwide cross-sectional design, to fill the gap in our understanding of the determinants of influenza vaccination behavior in SA.

Methods. A nationwide cross-sectional study was carried out to assess the determinants of influenza vaccination uptake behavior among the Saudi population in SA. The inclusion criteria for the study were: age 18 years and above, both gender, and Saudis and non-Saudis. Participants were from the cities of Abha, AlAhasa, Al Jouf, AlKharj, Dammam, Hail, Jazan, Jeddah, Al-Madinah Al-munawarah, Makkah, Najran, Qassim, Qatif, Riyadh, Tabuk, and Taif (from different regions of SA). The participants were selected using a snowball sampling method. The sample size was calculated based on the prevalence of influenza vaccination uptake in previous studies, taking into account a 95% confidence level (CI) and a 5% margin of error.^{8,18}

The data collection process was carried out through electronic means using SurveyMonkey in December 2020. A survey instrument in both Arabic and English was developed to collect data on sociodemographic characteristics, knowledge of flu vaccine (“do you know there is a vaccine available for flu, which should be taken yearly to protect yourself and your family from flu?”), behavior with respect to influenza immunization (“have you previously undergone a seasonal flu vaccine?” “did you receive a seasonal flu vaccine for the 2019-2020 flu season?”), perceived risk (“have you ever refused a vaccine for yourself or your child on the grounds of perceiving it as ineffective or hazardous?”), and history of hesitancy (“have you ever postponed a vaccine recommended by a physician?”). The responses to knowledge, behavior, perceived risk, and hesitancy questions were collected as “yes,” “no,” and “not sure.”

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The ethical approval was obtained from the institutional review board of the Saudi Electronic University, Riyadh, SA (SEUREC-CHS20110). The study was carried out in accordance to the principles of Helsinki Declaration. Informed consent was provided by all the participants prior to participating in the study. Anonymized data were used for the analysis and reporting of study findings.

Statistical analysis. Initially, we described the participants demographic and immunization characteristics in the study. The counts and percentages, mean \pm standard deviation (SD), and median (interquartile range) were used as appropriate. We then utilized a graphical representation to demonstrate the percentage of participants who received flu vaccination during the study period.

The logistic regression model was employed to find the odds of receiving influenza immunization (flu shots) among the participants. First, we calculated the unadjusted odds ratios (ORs), which was followed by adjusting for sociodemographic characteristics and any other underlying trends in a stepwise manner. The OR is described along with 95% CIs and exact *p*-values. Robust standard errors was used to describe the clustering of cases.

Furthermore, multivariable logistic regression was used to explore the behavioral characteristics of the participants who received flu shots compared to those who did not. We calculated the unadjusted ORs for the association between sociodemographic characteristics,

immunization behavior, and the outcome variable. Variables that showed association at the univariable level ($p < 0.1$) were entered into a multivariable model. Finally, parsimonious model was built employing the backward regression. The data was tested for collinearity between variables, and for the clustering of cases was accounted for. The Stata (version 17; StataCorp., College Station, TX, USA) software was utilized for data management and analyses.

Results. Of the 1650 study participants, only 520 (31.5%) reported that they had received a flu vaccine for the year 2019-2020 (Figure 1). Table 1 presents the sociodemographic characteristics of the study population, which consists of 1650 participants. The age of participants ranged from 18-53 years, and most of the participants belonged to 36-45 (30.54%) years age group. The majority of participants were male (58.79%), Saudi nationals (56.84%), married (43.33%), and residing in Riyadh (37.57%). The education level of participants ranged from postgraduate to high school, with more participants having a graduate degree (34.67%) and having private job/self-employment (46.36%). Table 1 highlights the diversity of the study population in terms of sociodemographic characteristics.

Table 2 summarizes the results of the logistic regression analysis for sociodemographic determinants of seasonal flu vaccine uptake among respondents in SA (N=1650). The results showed that the age group above 45 years had the highest likelihood of receiving

Did you received a seasonal flu vaccine for the 2019-2020 flu season (last year)?

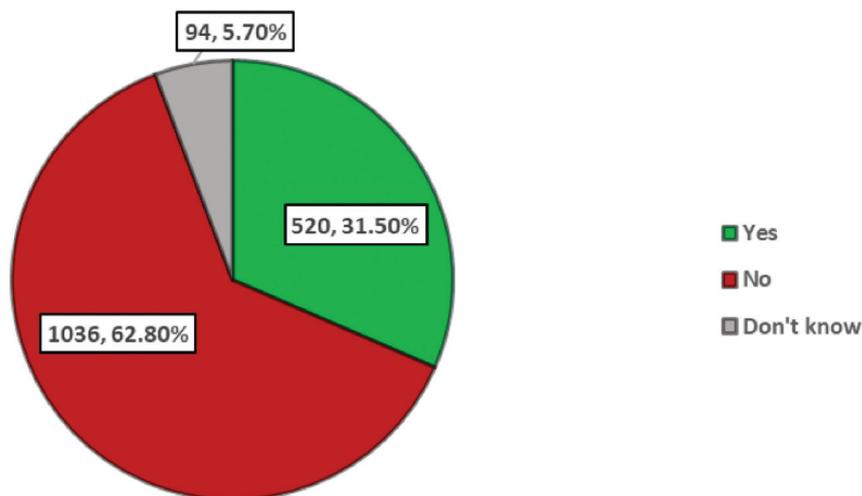


Figure 1 - Uptake of flu (influenza) vaccine among the study participants (N=1650).

Table 1 - Socio-demographic characteristics of the study population (N=1650).

Characteristic	n (%)
Age	
18-25	415 (25.1)
26-35	424 (25.7)
36-45	504 (30.5)
above 45 years	307 (18.6)
Gender	
Male	970 (58.8)
Female	680 (41.2)
Marital status	
Married	715 (43.3)
Single	802 (48.6)
Separated/divorced/widowed	133 (8.1)
Nationality	
Saudi	938 (56.8)
Non-Saudi	712 (43.1)
City of resident	
Riyadh	620 (37.6)
Dammam	325 (19.7)
Jeddah	260 (15.8)
Other	445 (27.0)
Education	
Postgraduate	380 (23.0)
Graduate	572 (34.7)
Diploma	430 (26.1)
High school	268 (16.2)
Occupation	
Private/self-employed	765 (46.4)
Government	615 (37.3)
Not-working	270 (16.4)

Values are presented as numbers and percentages (%).

the vaccine (adjusted odds ratio [aOR]=2.20, 95% CI: [1.15-3.05], $p=0.002$). However, there was no significant difference between gender (aOR=0.80, 95% CI: [0.58-1.10], $p=0.181$) or nationality (aOR=1.38, 95% CI: [0.81-2.84], $p=0.425$). The results also indicated that married individuals were more likely to receive the vaccine than single individuals (aOR=1.75, 95% CI: [1.28-3.51], $p=0.001$). Regarding education, individuals with a postgraduate degree had a higher likelihood of receiving the vaccine than those with a high school education (aOR=1.51, 95% CI: [1.05-2.23], $p=0.044$). Lastly, there was no significant difference in vaccine uptake between individuals who were not working (aOR=1.19, 95% CI: [0.73-2.68], $p=0.630$) and self-employed or working in the government sector (aOR=1.47, 95% CI: [0.97-2.23], $p=0.063$).

The multiple logistic regression analysis in **Table 3** shows the association between various factors and the uptake of the seasonal flu vaccine among the respondents in SA (N=1650). The results showed that the perceived risk of getting the flu (aOR=2.15, 95% CI: [1.30-5.72],

$p=0.001$) and knowledge regarding the seasonal flu vaccine (aOR=1.71, 95% CI: [1.08-4.22], $p=0.001$) were significant factors associated with vaccine uptake. The study also found that having a history of receiving the flu vaccine (aOR=2.25, 95% CI: [0.92-4.92], $p=0.081$) and a history of vaccine hesitancy (aOR=2.12, 95% CI: [0.85-4.90], $p=0.078$) were not significant factors associated with vaccine uptake. The results were adjusted for sociodemographic factors: age, gender, education, nationality, city of residence, and occupation.

Discussion. The current study results provide an insights into the determinants of seasonal flu vaccine uptake among the Saudi population. The results showed that older individuals had a higher likelihood of receiving the vaccine than younger individuals. This may be due to the older participants' awareness that influenza vaccination is recommended by the Saudi MOH for people above 50 years. The present study's finding is consistent with previous research findings that older individuals are more likely to receive the flu vaccine.^{14,15,19,20} However, no significant differences were found between gender and vaccine uptake, which is in contrast to some previous studies that found a higher likelihood of vaccine uptake among women.^{9,16,21} There could be several reasons for the differences observed between the present study and other similar studies results. One possible explanation is that differences might have resulted from the higher participation rates of males (58.79%). Another explanation for the difference in vaccine uptake between males and females could be related to cultural or societal factors specific to the population studied. For example, in some societies, men may be more likely to engage in behaviors that put them at a higher risk of contracting influenza, which may increase their motivation to receive the vaccine.

The study also found that married individuals had a higher likelihood of receiving the vaccine, which is consistent with findings from previous studies.²²⁻²⁴ Furthermore, individuals with a postgraduate degree had a higher likelihood of receiving the vaccine, indicating that a higher education level may influence the decision to receive the vaccine. These outcomes also suggest that knowledge regarding influenza vaccination might be behind the higher uptake of the vaccination in these groups, which was observed in the present study.

However, there was no significant difference in vaccine uptake between individuals based on occupation and nationality, suggesting that these factors are not associated with the behavior of vaccine uptake.

In addition to sociodemographic factors, the multiple logistic regression analysis showed that the perceived risk

Table 2 - Logistic regression analysis for socio-demographic determinants towards uptake of seasonal flu vaccine among respondents in Saudi Arabia.

Variables	"Received a seasonal flu vaccine for the 2019-2020 flu season"			
	OR (95% CI)	P-values	Adjusted OR (95% CI)	P-values
<i>Age</i>				
18-25	Ref		Ref	
26-35	1.13 (0.69-2.35)	0.803	1.11 (0.51-1.56)	0.412
36-45	0.89 (0.60-1.25)	0.453	0.95 (0.48-1.44)	0.226
above 45	2.41 (1.00-4.15)	0.049	2.20 (1.15-3.05)	0.002
<i>Gender</i>				
Male	Ref		Ref	
Female	0.73 (0.55-0.96)	0.029	0.80 (0.58-1.10)	0.181
<i>Marital status</i>				
Single	Ref		Ref	
Separated/divorced/widowed	1.36 (0.76-2.41)	0.293	1.71 (0.97-3.14)	0.090
Married	2.13 (1.20-3.06)	0.001	1.75 (1.28-3.51)	0.001
<i>Nationality</i>				
Saudi	Ref		Ref	
Non-Saudi	1.27 (0.89-2.90)	0.177	1.38 (0.81-2.84)	0.425
<i>City of residence</i>				
Riyadh	Ref		Ref	
Dammam	0.94 (0.66-1.33)	0.733	0.96 (0.66-1.40)	0.869
Jeddah	1.21 (0.79-1.85)	0.378	1.23 (0.79-1.92)	0.350
Others	1.35 (0.96-1.90)	0.076	1.41 (0.99-2.00)	0.055
<i>Highest education</i>				
High school	Ref		Ref	
Diploma	1.14 (0.71-1.83)	0.572	1.06 (0.63-1.78)	0.801
Under graduate	1.11 (0.75-1.62)	0.593	1.17 (0.78-1.76)	0.438
Post graduate	2.78 (0.87-4.31)	0.260	1.51 (1.05-2.23)	0.044
<i>Current occupation</i>				
Not working	Ref		Ref	
Private/self-employed	1.31 (0.70-2.57)	0.939	1.19 (0.73-2.68)	0.630
Government	1.39 (1.04-1.85)	0.024	1.47 (0.97-2.23)	0.063

Values are presented as odds ratio (OR) and adjusted OR and 95% confidence interval (CI).

of getting the flu and knowledge regarding the seasonal flu vaccine were significant factors associated with vaccine uptake. This finding highlights the importance of health education and promotion programs to increase awareness on the flu vaccine and its associated risks and benefits. A study from SA carried out on healthcare professionals reported that predictors for vaccination uptake were the participant confidence on vaccination prevents influenza infection, participant's awareness of the vaccination guidelines, and the presence of standing orders regarding influenza vaccines.¹⁸ Another study from SA carried out by Alenazi et al,⁶ reported that influenza vaccine uptake is associated with primary healthcare workers perception toward risk to the severity of influenza. A study by Hou et al¹³ reported that the participants who considered themselves to be highly susceptible to influenza infection and knew that they belong to the priority group for influenza vaccination showed significantly lower odds of rejecting vaccination, which supports our findings.

However, history of receiving the flu vaccine and vaccine hesitancy were not significant factors associated with vaccine uptake. A study from SA described that of the 237 (47.8%) participants who were at least once vaccinated against influenza, 88 (37.1%) participants got vaccinated regularly in every influenza season.¹⁸ This finding suggests that awareness regarding vaccination is important for seasonal vaccine uptake, and though the Saudi MOH engages in media campaigns every year, they can increase the outreach by utilizing social platforms, such as Twitter, WhatsApp, and Instagram. The spread of information regarding the availability of free vaccination, risk population recommended by MOH for vaccination, and safety and benefits of flu vaccination should be initiated before the flu season to motivate people to uptake the vaccine.

Study limitations. The study adopted a cross-sectional design which prevents causal interpretations, and the participants may not be the true representative of the general population of SA. Furthermore, as the

Table 3 - Logistic Regression analysis for factors potentially associated with the uptake of flu vaccine among respondents in Saudi Arabia (N=1650).

Variables	"Received a seasonal flu vaccine for the 2019-2020 flu season"			
	OR (95% CI)	P-values	Adjusted OR (95% CI)	P-values
<i>Have you ever refused a vaccine for yourself or a child because you considered it as ineffective or dangerous? (Perceived risk)</i>				
No	Ref		Ref	
Yes	1.83 (1.32-4.21)	0.042	2.15 (1.30-5.72)	0.001
<i>Do you know there is a vaccine available for flu, which should be taken yearly to protect yourself and your family from flu? (Knowledge regarding seasonal flu vaccine)</i>				
No	Ref		Ref	
Yes	2.32 (1.03-5.37)	0.028	1.71 (1.08-4.22)	0.001
<i>Have you ever received a flu vaccine? (Behavior towards vaccination)</i>				
No	Ref		Ref	
Yes	2.85 (1.03-4.80)	0.031	2.25 (0.92-4.92)	0.081
<i>Have you ever postponed a vaccine recommended by a physician? (History of hesitancy)</i>				
Yes	Ref		Ref	
No	2.30 (0.61-4.80)	0.088	2.12 (0.85-4.90)	0.078

Values are presented as odds ratio (OR) and adjusted OR and 95% confidence interval (CI).

study collected self-reported data, the results might be effected by recall and social desirability biases. Due to the exclusion of the population who could not use SurveyMonkey selection bias might have resulted. We acknowledge that not all individuals may have had access to the internet or may have been unable to complete the survey due to technical difficulties, and this could have affected our sample's representativeness. There may be unmeasured factors that affect the determinants of influenza vaccination uptake behavior, and these factors were not considered in the study. The study is based on data collected in a single year, and future studies may be needed to confirm the findings over a longer period.

Though there are a few limitations, the results of this study highlight the factors that play a significant role in influenza vaccination uptake behavior among the Saudi population and can inform future interventions aimed at increasing vaccine uptake in SA.

Healthcare providers and policymakers in SA can use this information to develop targeted educational programs and interventions to increase vaccine uptake among the population. Future studies should aim to confirm the results of the current study and identify the most effective strategies to increase vaccine uptake in SA.

In conclusion, the current study results provide a new insights into the determinants of seasonal flu vaccine uptake among the Saudi population. The study highlights the importance of the perceived risk of getting the flu and knowledge regarding the seasonal flu vaccine as significant factors associated with vaccine uptake.

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