

Article

Cost and Safety Perceptions as Determinants of COVID-19 Vaccination Intention in Saudi Arabia

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Abstract

Background: Public acceptance of vaccines during emerging infectious disease outbreaks is influenced by perceptions of safety, accessibility, and cost. Understanding these determinants during the early phase of a pandemic is important for informing vaccination policy and communication strategies. This study examined the role of vaccine cost and safety perceptions in shaping COVID-19 vaccination intention among adults in Saudi Arabia prior to national vaccine rollout. **Methods:** A cross-sectional electronic survey was conducted among adults residing in Saudi Arabia between August and September 2020. Participants were recruited through online distribution using social media and electronic communication channels. The questionnaire assessed socio-demographic characteristics, knowledge and perceptions regarding COVID-19, and intention to receive COVID-19 vaccination under five hypothetical scenarios reflecting vaccine cost and the availability of scientific safety and efficacy evidence. Multivariable logistic regression analyses were performed to identify factors associated with vaccination intention. **Results:** A total of 1293 respondents completed the survey. When vaccination was offered free of charge, 57.5% of participants reported that they would likely receive the vaccine. Vaccination intention declined as the hypothetical vaccine price increased, reaching 38.7% when the cost exceeded 100 SAR. Intention was lowest when vaccination was presented under conditions in which safety and efficacy evidence had not yet been confirmed. Age, gender, educational attainment, and prior seasonal influenza vaccination were associated with COVID-19 vaccination intention across several scenarios. **Conclusions:** Perceived vaccine affordability and confidence in scientific safety and efficacy evidence were important factors associated with COVID-19 vaccination intention during the early phase of the pandemic in Saudi Arabia. Providing vaccination without direct cost to recipients and communicating safety and efficacy evidence transparently may support public confidence and vaccine acceptance during future large-scale immunization campaigns. These findings should be interpreted as an early-pandemic baseline and should not be extrapolated to current post-rollout attitudes.

Keywords: COVID-19; vaccination intention; vaccine acceptance; vaccine confidence; Saudi Arabia



Academic Editor: Cheng-Wen Lin

Received: 3 June 2026

Revised: 14 July 2026

Accepted: 15 July 2026

Published: 17 July 2026

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1. Introduction

In early 2020, the World Health Organization (WHO) declared the outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), or COVID-19, a Public Health Emergency of International Concern (PHEIC) [1]. This declaration underscored the rapid transmission and global threat posed by the virus, which soon escalated into a worldwide pandemic. The Kingdom of Saudi Arabia, like many countries, experienced rapid spread of COVID-19, placing considerable pressure on the public health system and requiring swift national response measures [2]. Vaccination was widely recognized as a central strategy for controlling the pandemic and reducing morbidity and mortality. However, successful vaccination campaigns depend not only on vaccine availability but also on public acceptance. Previous experience with seasonal influenza and pandemic influenza vaccines has demonstrated that vaccine hesitancy, safety concerns, and perceived barriers to access can substantially influence vaccination uptake [3,4]. Understanding the factors that shape vaccination intentions is therefore essential for effective pandemic response planning. Prior research has shown that vaccine acceptance during emerging infectious disease outbreaks is influenced by multiple factors, including perceived safety, confidence in scientific evidence, demographic characteristics, and previous vaccination behavior. Individuals with prior seasonal influenza vaccination have often demonstrated greater willingness to accept newly developed vaccines, while concerns regarding vaccine safety, side effects, and efficacy remain common barriers to uptake [5–7]. Notably, vaccine hesitancy has been shown to persist even among vaccinated individuals [8]. Sociodemographic factors such as education level, employment status, and age have also been associated with differences in vaccination intention in several international studies [6,9]. In Saudi Arabia, public attitudes toward vaccination have been influenced by experiences with previous vaccination campaigns, including the H1N1 influenza pandemic and seasonal influenza immunization programs, where safety concerns and relatively low uptake were observed in some populations [3,4]. These experiences highlight the importance of understanding how perceptions of risk, safety, and access influence vaccine acceptance in the Saudi context. The COVID-19 pandemic further underscored how public perceptions of affordability, safety, and access can critically shape vaccine uptake. During the early phase of the pandemic, before large-scale vaccine rollout, uncertainty surrounding vaccine safety, efficacy, and availability may have influenced public willingness to accept vaccination. Few early-pandemic studies in Saudi Arabia examined vaccination intention under explicit price scenarios alongside perceptions of vaccine safety and scientific evidence. In this context, the present study examined COVID-19 vaccination intention among adults in Saudi Arabia during the early phase of the pandemic prior to vaccine rollout. Specifically, the study assessed vaccination intention under five hypothetical scenarios reflecting vaccine cost and the availability of scientific safety and efficacy evidence. By evaluating how affordability and confidence in safety data influence vaccination decisions, this study provides baseline insights relevant to vaccination policy, risk communication, and preparedness planning for future public health emergencies. Understanding how affordability and confidence in scientific evidence influence vaccination decisions is essential for informing public health policy and strengthening preparedness for future health emergencies. It is important to note that this study was conducted in August–September 2020, prior to the regulatory approval of any COVID-19 vaccine, and reflects public attitudes during a period of substantial uncertainty regarding vaccine safety, efficacy, and access. The findings are therefore inherently contextual and should be interpreted as an early-pandemic baseline assessment; they are not intended to characterize, predict, or be extrapolated to vaccination attitudes or behaviors in the current post-rollout context.

2. Methods

2.1. Study Design and Setting

A cross-sectional electronic survey was conducted among adults residing in Saudi Arabia between August and September 2020, during the early phase of the COVID-19 pandemic and prior to the national rollout of COVID-19 vaccines. The survey was distributed electronically through university networks and social media platforms using a convenience sampling approach. The study protocol was approved by the Institutional Review Board of King Saud University (IRB No. E-20-4785), with approval granted in April 2020.

2.2. Participants and Eligibility Criteria

Adults aged 18 years or older residing in Saudi Arabia were eligible to participate. Both Saudi nationals and non-Saudi residents were included. Participants were required to be able to read Arabic or English and provide electronic informed consent prior to completing the questionnaire.

Participants were recruited through electronic distribution of the survey link via university channels and social media platforms. The target sample size was set at 1000 respondents to allow for subgroup description and exploratory analyses. A total of 1293 individuals completed the survey and were included in the final analysis.

2.3. Ethical Considerations

Electronic informed consent was obtained from all participants through a mandatory checkbox acknowledgment prior to survey initiation. The Institutional Review Board approved a waiver of handwritten signatures due to the minimal-risk nature of the study and the absence of procedures requiring written consent outside the research context. Participants were provided with information about the study objectives and voluntary nature of participation before beginning the survey. No personal identifiers were collected at any stage of the study to ensure participant anonymity and confidentiality.

2.4. Survey Instrument and Data Collection

Data were collected using a structured questionnaire adapted from previously published surveys assessing attitudes toward pandemic influenza vaccination, including studies examining avian influenza [4,10] and influenza A/H1N1 [11,12] vaccination behavior. The questionnaire was translated into Arabic and subsequently back-translated to ensure linguistic accuracy. Content validity was assessed by three faculty members with expertise in public health and epidemiology. A pilot test was conducted among 20 adults to evaluate clarity, comprehension, and cultural appropriateness of the survey items. Minor wording modifications were made based on pilot feedback. Responses from pilot participants were not included in the final analysis. The final questionnaire consisted of 35 items organized across five thematic domains: socio-demographic characteristics (8 items), knowledge of COVID-19 transmission (4 items), perceptions of COVID-19 severity and risk (7 items), perceptions regarding COVID-19 vaccination (6 items), and intention to receive COVID-19 vaccination under five hypothetical scenarios reflecting vaccine cost and scientific evidence availability (5 items). Participants were asked sequentially about their intention to receive a COVID-19 vaccine under five hypothetical scenarios reflecting vaccine cost and availability of scientific evidence. The vaccine cost thresholds used across the five hypothetical scenarios (<50 SAR, 50–100 SAR, >100 SAR) were adapted from prior pandemic influenza vaccination studies using tiered price scenarios, and were selected to capture a range of financial access barriers relevant to the Saudi economic context. In 2020, these thresholds corresponded to approximately <USD 13, approximately USD 13–27, and >approximately USD 27, respectively, relative to a private-sector monthly minimum wage of 4000 SAR (ap-

proximately USD 1067). For contextual reference, seasonal influenza vaccination in Saudi Arabia was available at no cost through Ministry of Health primary healthcare centers for designated priority groups (healthcare workers, adults aged ≥ 65 years, individuals with chronic conditions, and pilgrims) at the time of the survey. For members of the general public outside these priority groups, influenza vaccines were available through private healthcare facilities at an estimated out-of-pocket cost of approximately 50–150 SAR (approximately USD 13–40), depending on the facility and vaccine formulation. This pre-existing cost structure may have shaped respondents' reference expectations regarding COVID-19 vaccine pricing, and a cost of more than 100 SAR may therefore have represented a meaningful financial barrier for lower-income and unemployed respondents within our sample (35.9% of participants reported being unemployed and not actively seeking work). The scenarios included vaccination offered free of charge; vaccination costing less than 50 SAR (approximately <USD 13); vaccination costing between 50 and 100 SAR (approximately USD 13–27); vaccination costing more than 100 SAR (>approximately USD 27); and vaccination offered when safety and efficacy evidence had not yet been fully confirmed. Participants reported vaccination intention using response categories of unlikely (certainly not or mostly not), unsure, and highly likely (mostly likely or definitely likely). Additional variables assessed included demographic characteristics, knowledge of COVID-19 transmission, perceived severity of COVID-19, perceived risk of infection in the coming year, comparisons between COVID-19 and seasonal influenza, and perceptions regarding the COVID-19 vaccine. Candidate predictors for regression analyses included age group, gender, education level, employment status, region of residence, nationality, and prior seasonal influenza vaccination (ever and during the previous year).

2.5. Statistical Analysis

Descriptive statistics were used to summarize participant characteristics and survey responses. Categorical variables were reported as frequencies and percentages, while continuous variables were summarized using means and standard deviations. Associations between participant characteristics and vaccination intention were assessed using Pearson's chi-square tests. For regression analyses, vaccination intention was dichotomized as likely to vaccinate (mostly or definitely likely) versus unsure or unlikely (unsure, mostly not, or certainly not). Separate multivariable logistic regression models were constructed for each of the five vaccination scenarios to identify factors associated with vaccination intention. Candidate predictors included age group, gender, education level, employment status, region of residence, nationality, and prior seasonal influenza vaccination (ever and during the previous year). Predictor variables were entered as categorical variables using reference categories, and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Variables not retained in the final multivariable models, including categories of categorical variables, are omitted from Table 4. All statistical analyses were performed using IBM SPSS Statistics 29 (IBM Corp., Armonk, NY, USA). Given the cross-sectional nature of the study, all reported associations between socio-demographic variables and vaccination intention are descriptive and do not permit causal inference.

3. Results

3.1. Participant Characteristics

A total of 1293 respondents completed the survey and were included in the analysis. Participants were predominantly female (76.9%), and 51.0% were younger than 30 years. Participants aged 30–39 years accounted for 22.7%, whereas 6.0% were aged ≥ 60 years. Most respondents had completed a bachelor's degree (54.1%), followed by high school or diploma education (28.6%), while 15.4% held a master's degree or higher. Regarding

employment status, 35.5% were full-time employees, 18.9% were unemployed and seeking employment, and 35.9% reported being unemployed and not seeking employment. Nearly half of participants (48.7%) reported having ever received a seasonal influenza vaccine, whereas 13.5% reported receiving influenza vaccination during the preceding year. The majority of respondents were Saudi nationals (95.3%), and 73.6% resided in Riyadh. Detailed socio-demographic characteristics stratified by prior influenza vaccination history are presented in Table 1. Prior influenza vaccination differed significantly by age group, education level, and employment status (all $p < 0.001$), but not by gender ($p = 0.184$). The proportion reporting prior influenza vaccination was higher among the older age groups and participants with higher educational attainment.

Table 1. Socio-demographic characteristics of participants stratified by prior influenza vaccination status ($n = 1293$).

Characteristic	Total <i>n</i> (%)	Ever Vaccinated (Yes) <i>n</i> = 630 <i>n</i> (%)	Never Vaccinated (No) <i>n</i> = 663 <i>n</i> (%)	<i>p</i> -Value
Gender				
Female	994 (76.9)	495 (49.8)	499 (50.2)	0.184
Male	299 (23.1)	135 (45.2)	164 (54.8)	
Age (years)				
<30	660 (51.0)	275 (41.7)	385 (58.3)	<0.001
30–39	294 (22.7)	148 (50.3)	146 (49.7)	
40–49	139 (10.8)	78 (56.1)	61 (43.9)	
50–59	122 (9.4)	78 (63.9)	44 (36.1)	
≥60	78 (6.0)	51 (65.4)	27 (34.6)	
Education level				
Intermediate or below	25 (1.9)	9 (36.0)	16 (64.0)	<0.001
High school/Diploma	370 (28.6)	148 (40.0)	222 (60.0)	
Bachelor’s degree	699 (54.1)	341 (48.8)	358 (51.2)	
Master’s degree or higher	199 (15.4)	132 (66.3)	67 (33.7)	
Employment status				
Full-time employee	459 (35.5)	258 (56.2)	201 (43.8)	<0.001
Part-time employee	40 (3.1)	20 (50.0)	20 (50.0)	
Unemployed (seeking work)	245 (18.9)	105 (42.9)	140 (57.1)	
Freelancer	85 (6.6)	42 (49.4)	43 (50.6)	
Unemployed (not seeking work)	464 (35.9)	205 (44.2)	259 (55.8)	
Nationality				
Saudi	1228 (95.3)	597 (48.6)	631 (51.4)	0.243
Non-Saudi	61 (4.7)	33 (54.1)	28 (45.9)	

Note: Percentages within Yes/No columns reflect the proportion within each demographic subgroup (row%). Chi-square p -values compare distribution across the full subgroup. Saudi and Non-Saudi counts sum to 1289; 4 respondents did not report nationality.

3.2. Intention to Receive COVID-19 Vaccination Under Different Scenarios

Participants' intention to receive COVID-19 vaccination varied across the five hypothetical scenarios. When vaccination was offered free of charge, 57.5% of respondents reported that they would likely receive the vaccine. Intention decreased as the hypothetical cost increased. When the vaccine price exceeded 100 SAR, 38.7% reported willingness

to vaccinate. The lowest vaccination intention was reported under the scenario in which safety and efficacy evidence had not yet been confirmed by clinical trials. The distribution of vaccination intention across the five scenarios is illustrated in Figure 1.

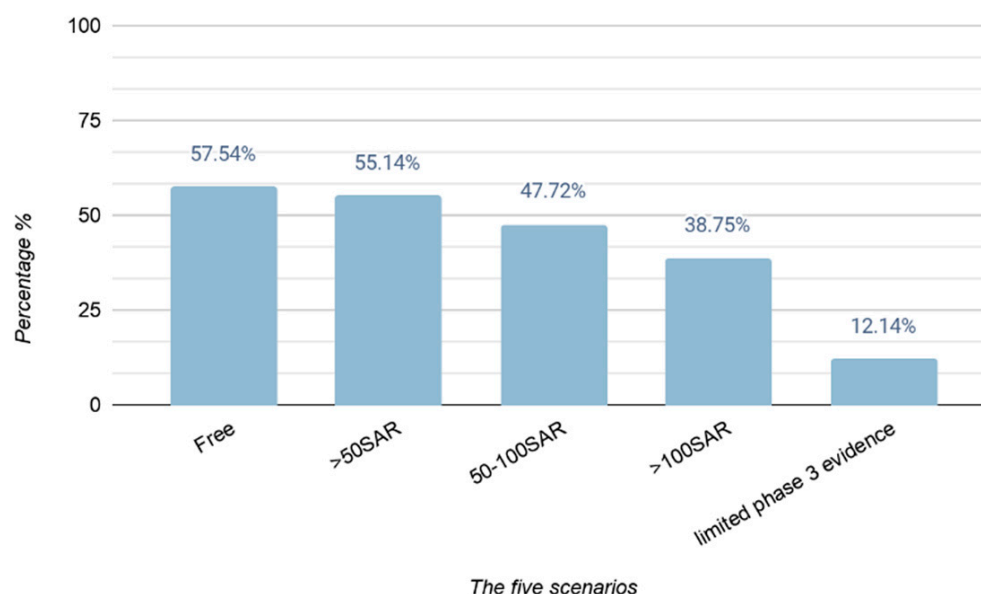


Figure 1. Intention to receive COVID-19 vaccination under five scenarios (free; <50 SAR; 50–100 SAR; >100 SAR; no/limited safety–efficacy evidence). Error bars indicate 95% CI.

3.3. Knowledge and Perceptions Regarding COVID-19

Most respondents correctly identified multiple modes of COVID-19 transmission, with 85.6% indicating that droplets, contaminated objects, and contact with infected individuals were possible transmission routes. Regarding perceived fatality rates, 44.7% estimated adult mortality between 1% and 5%, whereas 19.8% estimated mortality greater than 5%. When asked whether COVID-19 could cause severe and irreversible damage to the body, 5.3% strongly agreed, 22.7% agreed, 29.5% reported uncertainty, and 42.5% disagreed or strongly disagreed.

Perceptions regarding the potential course of the pandemic varied. 39.2% of respondents considered a large-scale national outbreak in the following year likely, while 26.3% reported uncertainty. When compared with seasonal influenza, 46.7% of respondents perceived the transmission rate of COVID-19 to be much higher, and 37.4% perceived the severity of disease to be much higher. Detailed knowledge and perception responses stratified by gender, age group, and employment status are presented in Table 2. Correct identification of all listed transmission routes was more frequent among respondents aged ≥ 30 years than among those aged <30 years (87.8% versus 83.5%; $p = 0.017$). Respondents aged ≥ 30 years were also more likely to agree that COVID-19 could cause severe or irreversible bodily damage than respondents aged <30 years (31.3% versus 24.8%; $p = 0.012$), whereas no corresponding gender difference was observed ($p = 0.877$). No statistically significant differences were observed according to employment status for the variables presented in Table 2.

Table 2. Knowledge and perceptions regarding COVID-19 stratified by gender, age group, and employment status ($n = 1293$).

Variable	Total n (%)	Female n (%) $n = 994$	Male n (%) $n = 299$	p -Value	<30 Years n (%) $n = 660$	≥30 Years n (%) $n = 633$	p -Value
Correct transmission knowledge							
All listed routes correct	1107 (85.6)	858 (86.3)	249 (83.3)	0.147	551 (83.5)	556 (87.8)	0.017
Other responses	186 (14.4)	136 (13.7)	50 (16.7)		109 (16.5)	77 (12.2)	
Perceived COVID-19 fatality rate							
<1%	269 (20.8)	196 (19.7)	73 (24.4)	0.208	155 (23.5)	114 (18.0)	0.082
1–5%	578 (44.7)	449 (45.2)	129 (43.1)		278 (42.1)	300 (47.4)	
>5%	256 (19.8)	197 (19.8)	59 (19.7)		130 (19.7)	126 (19.9)	
Don't know	190 (14.7)	152 (15.3)	38 (12.7)		97 (14.7)	93 (14.7)	
COVID-19 causes severe/irreversible damage to the body							
Agree/Strongly agree	362 (28.0)	280 (28.2)	82 (27.4)	0.877	164 (24.8)	198 (31.3)	0.012
Neutral	381 (29.5)	295 (29.7)	86 (28.8)		196 (29.7)	185 (29.2)	
Disagree/Strongly disagree	550 (42.5)	419 (42.2)	131 (43.8)		300 (45.5)	250 (39.5)	

Note: n (%) represents the proportion within each demographic subgroup. p -values were calculated using Pearson's chi-square test. Employed participants ($n = 584$) included full-time employees, part-time employees, and freelancers. Unemployed participants ($n = 709$) included respondents seeking and not seeking employment.

3.4. Perceptions Regarding COVID-19 Vaccination

Participants reported varied perceptions regarding COVID-19 vaccination. When asked whether vaccination would be inconvenient, 15.8% strongly agreed, 16.0% agreed, 32.8% were uncertain, 24.1% disagreed, and 11.4% strongly disagreed. Most respondents (68.8%) believed that the safety and efficacy of the COVID-19 vaccine would be confirmed through clinical trials, whereas 31.2% reported uncertainty. Regarding expected side effects, 38.3% anticipated a few side effects, 41.4% reported uncertainty, 14.9% anticipated severe side effects, and 5.5% expected no side effects. In addition, 59.8% of respondents agreed or strongly agreed that COVID-19 vaccination should be recommended for all individuals in Saudi Arabia. Perceptions regarding COVID-19 vaccination stratified by gender, age group, education level, and employment status are presented in Table 3. Agreement that COVID-19 vaccination should be recommended for everyone was more frequent among females than males (62.9% versus 49.5%; $p < 0.001$) and among respondents aged ≥30 years than among those aged <30 years (63.3% versus 56.4%; $p = 0.003$). No statistically significant difference was observed according to education level for this item ($p = 0.140$). Agreement that vaccination should be recommended for everyone did not differ significantly according to employment status ($p = 0.303$).

Table 3. Perceptions regarding COVID-19 vaccination stratified by gender, age group, and education level ($n = 1293$).

Variable	Total n (%)	Female n (%) $n = 994$	Male n (%) $n = 299$	p	<30 yrs n (%) $n = 660$	≥30 yrs n (%) $n = 633$	p	≤High School $n = 395$	≥Bachelor n (%) $n = 898$	p
Vaccination will be inconvenient										
Agree/Strongly agree	411 (31.8)	310 (31.2)	101 (33.8)	0.583	228 (34.5)	183 (28.9)	0.022	143 (36.2)	268 (29.8)	0.023

Table 3. Cont.

Variable	Total <i>n</i> (%)	Female <i>n</i> (%) <i>n</i> = 994	Male <i>n</i> (%) <i>n</i> = 299	<i>p</i>	<30 yrs <i>n</i> (%) <i>n</i> = 660	≥30 yrs <i>n</i> (%) <i>n</i> = 633	<i>p</i>	≤High School <i>n</i> = 395	≥Bachelor <i>n</i> (%) <i>n</i> = 898	<i>p</i>
Neutral	424 (32.8)	332 (33.4)	92 (30.8)		218 (33.0)	206 (32.5)		132 (33.4)	292 (32.5)	
Disagree/Strongly disagree	458 (35.4)	352 (35.4)	106 (35.5)		214 (32.4)	244 (38.5)		120 (30.4)	338 (37.6)	
Clinical trials will confirm vaccine safety and efficacy										
Yes	890 (68.8)	691 (69.5)	199 (66.6)	0.307	449 (68.0)	441 (69.7)	0.445	251 (63.5)	639 (71.2)	0.004
Uncertain	403 (31.2)	303 (30.5)	100 (33.4)		211 (32.0)	192 (30.3)		144 (36.5)	259 (28.8)	
Expected vaccine side effects										
None	71 (5.5)	55 (5.5)	16 (5.4)	0.983	37 (5.6)	34 (5.4)	0.867	22 (5.6)	49 (5.5)	0.395
Few	495 (38.3)	378 (38.0)	117 (39.1)		246 (37.3)	249 (39.3)		140 (35.4)	355 (39.5)	
Severe	192 (14.9)	147 (14.8)	45 (15.1)		100 (15.2)	92 (14.5)		62 (15.7)	130 (14.5)	
Uncertain	535 (41.4)	414 (41.7)	121 (40.5)		277 (42.0)	258 (40.8)		171 (43.3)	364 (40.5)	
COVID-19 vaccination should be recommended for everyone										
Agree/Strongly agree	773 (59.8)	625 (62.9)	148 (49.5)	<0.001	372 (56.4)	401 (63.3)	0.003	222 (56.2)	551 (61.4)	0.140
Neutral	261 (20.2)	203 (20.4)	58 (19.4)		152 (23.0)	109 (17.2)		88 (22.3)	173 (19.3)	
Disagree/Strongly disagree	259 (20.0)	166 (16.7)	93 (31.1)		136 (20.6)	123 (19.4)		85 (21.5)	174 (19.4)	

Note: *n* (%) reflects column proportions within each demographic subgroup. ≤High school includes intermediate or below (*n* = 25) and high school/diploma (*n* = 370). ≥Bachelor's degree includes bachelor's degree (*n* = 699) and master's degree or higher (*n* = 199). *p*-values from Pearson's chi-square test.

3.5. Factors Associated with Vaccination Intention

Multivariable logistic regression models were conducted to examine associations between socio-demographic characteristics and vaccination intention across the five scenarios. Age, gender, education level, nationality, employment status, region of residence, and prior influenza vaccination history were associated with vaccination intention in several models. Participants aged younger than 30 years had lower odds of vaccination intention compared with those aged ≥60 years in several scenarios. Male participants also demonstrated lower odds of vaccination intention compared with females across several scenarios. Higher educational attainment was associated with increased odds of vaccination intention in several models. Nationality and employment status were also associated with vaccination intention in specific scenarios. The full results of the multivariable logistic regression analyses are presented in Table 4.

Table 4. Multivariable logistic regression analysis of factors associated with intention to receive COVID-19 vaccination under five scenarios.

Predictor (Reference)	Free Vaccine OR (95% CI)	<50 SAR OR (95% CI)	50–100 SAR OR (95% CI)	>100 SAR OR (95% CI)	Limited Safety/Efficacy Evidence OR (95% CI)
Age (≥60 years)					
40–49 years	0.99 (0.54–1.83)	1.18 (0.64–2.17)	1.37 (0.75–2.52)	—	—

Table 4. *Cont.*

Predictor (Reference)	Free Vaccine OR (95% CI)	<50 SAR OR (95% CI)	50–100 SAR OR (95% CI)	>100 SAR OR (95% CI)	Limited Safety/Efficacy Evidence OR (95% CI)
<30 years	0.36 (0.20–0.64)	0.44 (0.25–0.79)	0.47 (0.27–0.83)	0.57 (0.33–0.99)	0.76 (0.40–1.45)
Gender (Female)					
Male	0.47 (0.35–0.65)	0.51 (0.38–0.70)	0.53 (0.40–0.71)	0.51 (0.38–0.67)	—
Education level (≤Intermediate)					
Bachelor's degree	3.13 (1.08–9.08)	4.60 (1.47–14.37)	2.99 (1.20–7.47)	1.90 (0.85–4.26)	—
Master's degree or higher	3.01 (1.00–9.06)	4.21 (1.31–13.61)	—	—	—
Employment status (Full-time employee)					
Freelancer	0.78 (0.48–1.27)	—	—	—	—
Part-time employee	1.66 (0.86–3.21)	—	—	—	—
Unemployed and not seeking work	0.67 (0.47–0.96)	0.62 (0.44–0.88)	0.58 (0.41–0.82)	0.66 (0.47–0.92)	—
Region (Other regions)					
Riyadh	—	—	—	1.35 (1.06–1.73)	—
Nationality (Saudi)					
Non-Saudi	2.12 (1.27–3.52)	2.40 (1.44–3.99)	3.07 (1.82–5.18)	2.79 (1.64–4.75)	—
Ever received seasonal influenza vaccination (No)					
Yes	0.62 (0.49–0.80)	0.73 (0.58–0.93)	0.72 (0.57–0.91)	0.74 (0.59–0.93)	0.71 (0.54–0.94)
Received seasonal influenza vaccination during the previous year (No)					
Yes	0.66 (0.45–0.96)	—	0.60 (0.41–0.87)	0.60 (0.41–0.87)	—

Notes: OR = odds ratio; CI = confidence interval; SAR = Saudi Riyal. —Not retained in the final multivariable model.

4. Discussion

This study provides an early-pandemic assessment of COVID-19 vaccination intention in Saudi Arabia before national vaccine rollout. Vaccination intention declined as hypothetical vaccine cost increased and was lowest when safety and efficacy evidence remained limited. Sociodemographic characteristics were also associated with vaccination intention under selected scenarios. These principal findings are discussed below in relation to the international and Saudi literature and their implications for future vaccination planning.

The price gradient in vaccination intention documented in the present study is consistent with findings from large-scale international surveys conducted during the early COVID-19 pandemic. Lazarus et al. (2021), in a global survey spanning 19 countries and approximately 13,400 respondents, reported that acceptance of a free COVID-19 vaccine varied from 55% to 88% across countries, with acceptance declining markedly when hypothetical costs were introduced [13]. Wang et al. (2020), in a nationwide Chinese survey ($n = 2058$), similarly documented acceptance rates exceeding 80% for free vaccines, declining significantly with increasing price [14]. Schwarzingger et al. (2021), in a French working-age population ($n = 1047$), estimated that even modest co-payments would reduce vaccine acceptance by 15–20 percentage points [15]. Soares et al. (2021), in a systematic review of COVID-19 vaccine hesitancy studies, identified perceived vaccine cost as a structural bar-

rier across multiple national surveys, particularly among lower-income and unemployed populations [16], consistent with our finding that unemployed respondents demonstrated lower odds of vaccination intention across multiple cost scenarios. Cordina et al. (2021) similarly identified affordability among the primary determinants of vaccine hesitancy in a Maltese national survey [17]. These convergent findings reinforce the international policy relevance of our results. Broader syntheses of the international literature have similarly concluded that affordability and structural access are recurrent determinants of COVID-19 vaccine acceptance across diverse settings [18,19].

The strong influence of safety evidence on vaccination intention observed in the present study also aligns with international evidence. Dror et al. (2020), in a cross-national study across six countries, found that perceived vaccine safety was the single most important determinant of COVID-19 vaccine acceptance, explaining more variance in intention than any other variable [20]. Malik et al. (2020), in a US national survey ($n = 672$), identified trust in vaccine safety and efficacy as the primary facilitator of vaccination intention [21]. Kerr et al. (2021), in an experimental study of UK adults ($n = 4437$), demonstrated that providing information about vaccine effectiveness significantly increased vaccination intention, while information about side effects had a smaller but significant negative effect [22]. These studies collectively support the view that confidence in safety evidence is an important consideration for supporting vaccine acceptance, underscoring the importance of transparent communication of clinical trial outcomes and post-marketing safety data. Consistent with these observations, subsequent evidence has reinforced the central role of vaccine confidence and trust in scientific and public-health institutions in shaping vaccination decisions [23–25].

The association between younger age and lower vaccination intention in the present study is consistent with international evidence. Sallam (2021), in a systematic review of 30 surveys across 33 countries, found that younger age was one of the most consistent predictors of lower COVID-19 vaccine acceptance, potentially reflecting lower perceived personal risk [26]. Machida et al. (2021), in a Japanese survey ($n = 2365$), reported that younger adults had significantly lower vaccination intention independent of other demographic factors [27]. The significantly lower vaccination intention among male respondents is consistent with findings from Alfageeh et al. (2021) in a Saudi population-based study ($n = 2137$) [28] and from Mahmud et al. (2021) applying the health belief model in Saudi adults [29], both of which identified gender as a significant demographic determinant of vaccination intention. The positive association between higher educational attainment and vaccination intention mirrors findings from Alzahrani et al. (2021) in the SRIGVAC Saudi study ($n = 7235$) [30], Wong et al. (2020) in Malaysia [31], and Alasqah et al. (2022) in a Saudi population-based survey [32]. The subgroup analyses provide additional context for these associations by demonstrating differences in knowledge, perceived disease severity, confidence in clinical evidence, and support for universal vaccination across selected demographic groups. Collectively, these findings reinforce the importance of tailoring vaccine communication to the informational needs and risk perceptions of different population subgroups. Comparable demographic gradients in vaccine acceptance—spanning age, gender, and educational attainment—have been documented across a range of national and regional studies [33–37].

4.1. Strengths and Limitations

This study has several strengths. It represents one of the early assessments of COVID-19 vaccination intention in Saudi Arabia conducted prior to national vaccine rollout. The survey included a relatively large sample size and captured public perceptions during a period characterized by uncertainty regarding vaccine safety, efficacy, and access. By

examining vaccination intention under explicit cost and evidence scenarios, the study provides a structured assessment of how financial barriers and scientific uncertainty may influence vaccine decision-making.

Several limitations should be considered when interpreting the findings. First, as with all cross-sectional studies, the design of the present study precludes the establishment of causal or temporal relationships between the independent variables examined and vaccination intention. The multivariable logistic regression models employed identify statistical associations between socio-demographic characteristics and reported intention to vaccinate under different hypothetical scenarios; however, these associations cannot be interpreted as evidence of causal directionality. Longitudinal study designs would be necessary to assess the predictive value of pre-rollout vaccination intentions for actual vaccination behavior, as well as the temporal stability of the attitudes and perceptions measured in this study. Second, a critical contextual limitation of this study is its temporal specificity. The data were collected during August–September 2020, a moment defined by unprecedented uncertainty regarding the safety, efficacy, cost, and availability of COVID-19 vaccines. The hypothetical scenarios employed in the survey reflected conditions that were real and relevant at the time of data collection but have since been substantially transformed by the global regulatory approvals, post-marketing surveillance evidence, and national immunization programs that followed. The attitudes and intentions captured in this study cannot and should not be extrapolated to characterize current (2026) public perceptions of COVID-19 vaccination, which are shaped by entirely different informational, experiential, and policy contexts. Third, the survey used a convenience sampling approach facilitated through online distribution via social media platforms and university networks, which may have introduced systematic selection bias. The sample was predominantly female (76.9%), which is a recognized characteristic of online health survey populations in Saudi Arabia and likely reflects differential engagement with digital platforms across genders. This gender imbalance may limit the generalizability of the findings to the broader Saudi adult population, particularly given that male respondents demonstrated lower odds of vaccination intention across several scenarios. A large proportion of respondents also resided in Riyadh (73.6%), which may further limit representativeness of the findings to other regions of the Kingdom. Future studies should employ stratified or probability-based sampling methodologies to achieve a more demographically representative sample. Fourth, adults aged 60 years and older were substantially underrepresented in the study sample ($n = 78$; 6.0%), relative to their proportion in the Saudi population and their priority status as a high-risk group for severe COVID-19 outcomes. The electronic distribution methodology is likely to have undersampled older adults who may have lower rates of engagement with social media and university networks. Future studies should employ targeted recruitment strategies—including direct outreach through primary healthcare centers and community settings—to ensure adequate representation of older adults and other high-risk population groups. Fifth, the study did not collect data on respondents' underlying medical conditions or comorbidities. The presence of chronic health conditions—such as diabetes, cardiovascular disease, and chronic respiratory illnesses—is known to influence both perceived susceptibility to severe COVID-19 and willingness to accept vaccination. The absence of comorbidity data therefore limits the ability to characterize risk-stratified vaccination intentions and may mask important variation in vaccine acceptance between high-risk and low-risk population subgroups. Future studies should incorporate standardized assessment of comorbidity burden to enable risk-stratified analyses of vaccination intention. Sixth, although content validity was assessed through expert review and a pilot test was conducted among 20 adults prior to full deployment, formal internal consistency statistics—such as Cronbach's alpha—were not calculated for the multi-item perception domains included in

the questionnaire. While the five vaccination intention items were analyzed as separate and conceptually distinct dependent variables rather than as a summative composite scale, future studies employing similar instruments should incorporate formal reliability assessment to strengthen the psychometric rigor of the survey tool and to facilitate meaningful comparison across studies. Finally, vaccination intention may not necessarily translate into actual vaccination behavior; however, intention has been widely used as a predictor of health decision-making in similar contexts [38]. A further limitation concerns the representativeness of the study sample. The use of a convenience sampling approach, facilitated through online distribution via social media platforms and university networks, may have introduced systematic selection bias. In particular, the sample was predominantly female (76.9%), which is a recognized characteristic of online health survey populations in Saudi Arabia and likely reflects differential access to and engagement with digital platforms across genders. This gender imbalance may limit the generalizability of the findings to the broader Saudi adult population, particularly given that male respondents demonstrated lower odds of vaccination intention across several scenarios in our analyses. Future studies should endeavor to employ stratified or probability-based sampling methodologies to achieve a more demographically representative sample. A further technical limitation pertains to the psychometric characterization of the survey instrument. Although content validity was assessed through expert review and a pilot test was conducted among 20 adults prior to full deployment, formal internal consistency statistics—such as Cronbach’s alpha—were not calculated for the multi-item perception domains included in the questionnaire. While the five vaccination intention items were analyzed as separate and conceptually distinct dependent variables rather than as a summative composite scale, future studies employing similar instruments should incorporate formal reliability assessment, including internal consistency estimation, to strengthen the psychometric rigor of the survey tool and to facilitate meaningful comparison across studies.

4.2. Policy and Public Health Implications

Despite these limitations, the findings offer several important implications for vaccination policy and pandemic preparedness. The observed sensitivity to vaccine cost supports the importance of maintaining cost-free access to vaccines during public health emergencies. In Saudi Arabia, COVID-19 vaccines were provided free of charge to all residents of the Kingdom—including both Saudi nationals and non-Saudi residents (expatriates)—through a network of Ministry of Health facilities, primary healthcare centers, hospital vaccination units, and dedicated vaccination centers from January 2021 onwards. This universal, cost-free access policy likely contributed to equitable access and broad population uptake, consistent with the finding that non-Saudi residents in our pre-rollout sample demonstrated significantly higher vaccination intention than Saudi nationals across most cost scenarios. The strong influence of safety and efficacy evidence on vaccination intention also highlights the critical role of transparent communication in sustaining public trust. Public health authorities should prioritize timely dissemination of clinical trial findings, regulatory evaluations, and pharmacovigilance data to address safety concerns and support informed decision-making among the public [39]. Furthermore, the demographic differences observed in vaccination intention suggest that targeted communication strategies may be necessary to address hesitancy in specific population groups, particularly younger adults [40]. Tailored messaging that addresses the concerns and motivations of different demographic groups may help improve vaccine acceptance during future public health emergencies. Importantly, although these data were collected during the early phase of the COVID-19 pandemic, they provide valuable baseline insights into public perceptions of vaccination under conditions of uncertainty. Understanding how financial barriers and

scientific evidence influence vaccine acceptance can inform preparedness strategies for future pandemics and emerging infectious disease threats [41]. These findings have direct implications for public health policy, particularly in relation to vaccine financing strategies and risk communication approaches. Ensuring cost-free access to vaccines and clearly communicating evolving scientific evidence may play a critical role in maintaining public trust and optimizing vaccine uptake in large-scale immunization programs. Although the data were collected during the early phase of the COVID-19 pandemic, the observed patterns of decision-making under conditions of uncertainty are likely applicable to future emerging infectious disease contexts, where similar challenges related to affordability and public confidence may arise.

5. Conclusions

This study provides an early-pandemic baseline for understanding COVID-19 vaccination intention in Saudi Arabia during August–September 2020 and should not be extrapolated to current vaccination attitudes. Within this historical context, vaccination intention declined as hypothetical vaccine cost increased and was lowest when safety and efficacy evidence remained limited. These findings support the importance of minimizing financial barriers and communicating vaccine safety and efficacy evidence transparently when planning vaccination programmes during future public health emergencies.

Author Contributions: N.A.: Conceptualization, Methodology, Formal analysis, Investigation, Writing—original draft, Project administration. T.M.A.: Methodology, Data curation, Writing—review & editing. A.A. (Abdullah AlDhuwaih): Methodology, Data curation, Writing—review & editing. A.A. (Abdulrahman AlOmar): Methodology, Data curation, Writing—review & editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki, and approved by the Institutional Review Board of King Saud University (protocol code E-20-4785 and date of approval: 15 April 2020).

Informed Consent Statement: All participants were informed about the purpose of the study, assured of confidentiality, and provided written consent prior to participation. Participation was voluntary, and respondents could withdraw at any time without consequence. Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: We gratefully acknowledge the collaborative contributions of Reem Bin Idris, Rema Alkahtani, Abeer Alkhodair, Sara AlAbdulkareem, and Najla Alkilani.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

COVID-19	Coronavirus Disease 2019
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WHO	World Health Organization
EUA	Emergency Use Authorization
SAR	Saudi Riyal
PHEIC	Public Health Emergency of International Concern
IRB	Institutional Review Board

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