

Vaccine Literacy, Knowledge, and Acceptance Among University Students in the West Bank, Palestine: A Comparative Cross-Sectional Study of Health and Non-Health Students

Saif Al-Din Asfour

An-Najah National University

Bara Sawalmeh

An-Najah National University

Salma Jabr

An-Najah National University

Fahmee Mahareeq

An-Najah National University

Dawod Jawabreh

An-Najah National University

Hasan Khouli

`hassankhouli113@gmail.com`

An-Najah National University

Research Article

Keywords: vaccine literacy, vaccine acceptance, vaccine hesitancy, university students, Palestine

Posted Date: July 31st, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10168245/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Vaccine hesitancy remains a significant public health challenge globally, and vaccine literacy is increasingly recognized as a key determinant of vaccine acceptance. Data on vaccine literacy and acceptance among university students in Palestine are scarce, and no study has directly compared these outcomes across health and non-health disciplines in this setting. This study aimed to assess vaccine literacy, knowledge, and acceptance among Palestinian university students and identify associated factors with vaccine acceptance.

Methods

A cross-sectional study was conducted at multiple universities across the West Bank, Palestine, during the 2025–2026 academic year. A total of 633 university students completed a structured, self-administered questionnaire distributed via Google Forms. The instrument comprised four sections assessing sociodemographic characteristics, vaccination history and information sources, vaccine knowledge (10 binary items), and vaccine literacy and acceptance using validated five-point Likert scales. Non-parametric group comparisons were performed using the Mann–Whitney U test and Chi-square test. Spearman correlation and multivariable linear regression were used to identify predictors of vaccine acceptance.

Results

The median age of participants was 19 years (IQR: 18–21), and 72.4% were female. Median scores were moderate across all domains: vaccine knowledge 5.0/10 (IQR: 3.0–6.0), vaccine literacy 3.50/5 (IQR: 3.0–3.88), and vaccine acceptance 3.11/5 (IQR: 2.78–3.56). While 67.8% of students reported receiving recommended vaccines in the past five years, seasonal influenza vaccination was critically low at 9.5%. Health-related students scored significantly higher than non-health students in knowledge, literacy, acceptance, vaccine uptake, and trust in official sources (all $p \leq 0.010$). Female students demonstrated higher knowledge ($p = 0.021$) and literacy scores ($p < 0.001$), while male sex was independently associated with higher acceptance in multivariable analysis ($\beta = 0.086$, $p = 0.013$). Trust in official information sources was the strongest independent predictor of vaccine acceptance ($\beta = 0.332$, $p < 0.001$), followed by vaccine knowledge ($\beta = 0.239$, $p < 0.001$), health faculty enrollment ($\beta = 0.139$, $p < 0.001$), age ($\beta = 0.093$, $p = 0.006$), and vaccine literacy ($\beta = 0.079$, $p = 0.025$). The regression model explained 32.9% of the variance in acceptance (adjusted $R^2 = 0.329$). Key misconceptions identified included beliefs that multiple vaccines weaken the immune system (correctly refuted by only 25.1%) and that no vaccine can be given during pregnancy (correctly refuted by only 21.6%).

Conclusion

Palestinian university students demonstrate moderate vaccine literacy and acceptance, with health-related students outperforming their non-health peers across all measures. Trust in official sources is the dominant predictor of vaccine acceptance, underscoring the need for trust-centered communication strategies alongside educational interventions. The critically low influenza vaccination rate and persistent vaccine misconceptions highlight actionable targets for university-based and national public health programs. Integrating vaccine literacy content across all academic disciplines and establishing structured on-campus vaccination programs are recommended as scalable, high-impact strategies.

Introduction

Vaccination programs are one of the greatest public health successes of all time. They have led to longer life spans and an enormous decline in the death rate across the world(1, 2). Since the introduction of the Expanded Program on Immunization (EPI) in 1974, immunization against 14 different pathogens have been achieved. This global intervention has produced approximately 10.2 billion years of full health for citizens worldwide and has accounted for 40% of the decline in the rates of death among infants (1).

In addition to protecting individuals, vaccines also confer herd immunity when coverage is high. This can slow or stop the spread of infection through the population by slowing, or even eliminating, disease transmission within communities and protecting vulnerable populations (1).

Despite the success of vaccination programs worldwide, vaccine hesitancy remains a major public health concern. Vaccine hesitancy refers to a delay in acceptance or rejection of vaccination despite the presence of vaccination services (3, 4). In 2019, the World Health Organization (WHO) reported that vaccine hesitancy ranked among the top 10 global health threats (5). The COVID-19 vaccination experience amplified vaccine hesitancy amongst the global population, which have hindered herd immunity (6). This phenomenon emerged mainly due to concerns regarding vaccine safety, effectiveness, and trust in healthcare systems, governments, and pharmaceutical companies. Additionally, the widespread distribution of misinformation about vaccines and the vaccination process through social media platforms further encourages the idea of hesitancy and heavily influences public perceptions regarding vaccination (7–9).

The term "vaccine literacy" (VL) is defined as having the skill set (knowledge), motivation, and ability (competence) to find (seek), understand (comprehend), evaluate (evaluate), and utilize (use) accurate information about vaccines to make an informed choice about them and get vaccinated (10, 11). VL includes more than just having "medical knowledge" or the individual capacity to access the health system and determine their own ability to make a particular health decision; it also requires being able to assess the possible consequences of their own actions on health (11).

According to studies, vaccine acceptance depends heavily on health literacy skills, wherein individuals with lower levels of health literacy may be more vulnerable to hesitancy when they are presented with

misinformation about vaccines (5, 11, 12). Moreover, evidence has shown that people who have higher levels of vaccine literacy also tend to trust vaccines and the healthcare system, believing both are safe and effective (11). Additionally, meta-analyses suggest that interactive-critical vaccine literacy is an excellent predictor of intention to vaccinate (11, 13). University students represent an important population for vaccine literacy research because they are continuously exposed to digital information sources that may shape their perspective on the topic. Furthermore, students enrolled in health-related majors may potentially influence ideas related to vaccination in the future through their professional practice. Students may also have the potential to unintentionally transmit communicable diseases to the more vulnerable population (14).

Although vaccine literacy received worldwide attention, evidence among university students in middle to low-income countries still remain limited. Few studies have directly compared vaccine literacy and vaccine acceptance between students enrolled in health-related and non-health-related disciplines. In Palestine, data on vaccine literacy and vaccine acceptance among university students are rare. Understanding these differences may help identify educational gaps and inform targeted interventions aimed at improving vaccine acceptance and uptake among the community. Therefore, this study aimed to assess vaccine literacy and vaccine acceptance among Palestinian university students, compare outcomes between health and non-health students, and identify factors associated with vaccine literacy and vaccine acceptance (10, 11, 14).

Methods

2.1 Study design and population

This study is a multicenter cross-sectional descriptive design that evaluated vaccine literacy and acceptance among a population consisting of multiple university students in the West Bank, Palestine during the academic year 2025–2026. It aimed to compare the level of vaccine literacy and acceptance between health-related and non-health-related undergraduate students.

2.2 Sample size and calculation

The required number of participants was estimated by using a standard sample size formula via Raosoft for cross-sectional studies, with a 95% confidence level, a 5% margin of error, and a 50% expected response distribution. The minimum sample size for our study is 384. Final analysis included 643 responses that were gathered from Palestinian university students in the West Bank. 10 responses were excluded due to incomplete data.

2.3 Measures and Data Collection

Data were collected using a structured, self-administered questionnaire distributed via Google Forms to ensure consistency and completeness. The questionnaire was developed after reviewing previously published studies, the vaccine literacy component was derived from validated health literacy tools (15),

while items related to vaccine acceptance were based on established vaccine hesitancy frameworks such as the 5C model (16). The development of the questionnaire was also guided by similar cross sectional studies evaluating vaccine literacy and attitudes among the Arab population (17).

The questionnaire form is divided into four sections. Part A covered sociodemographic characteristics, including age, sex, university, faculty, major, year of study, and cumulative GPA (optional). Part B evaluated health-related background data such as the presence of chronic diseases and vaccination history over the past five years, including seasonal influenza vaccination and COVID 19 vaccination, the primary sources of information regarding vaccines, and the degree of confidence in official health sources. Part C assessed participants' knowledge about vaccines through multiple questions including herd immunity, vaccine safety, the necessity of booster shots, adult vaccination, pregnant vaccination, rare side effects of vaccine, at any age can people start vaccination and vaccination in people with chronic illnesses. The responses were collected using three options: true, false, or "I don't know." The last part was to evaluate vaccine literacy and acceptance. For vaccine literacy using a five-point Likert scale ranging from "never" to "always" to record participants' responses to statements assessing their ability to access, understand, evaluate, and application of vaccine-related information (15). For vaccine acceptance using a five-point Likert scale ranging from "strongly disagree" to "strongly agree" to record participants' responses to statements assessing attitudes toward vaccine safety, trust in health authorities, willingness to receive recommended vaccines, and perceptions of vaccine benefits and risks (16).

Vaccine literacy and acceptance scores were calculated as the mean of Likert-scale items (range 1–5), with higher scores indicating higher literacy and acceptance. Participants were also asked to list perceived barriers to vaccination and how they would like to learn more about vaccine awareness.

The internal consistency of the questionnaire was assessed using *Cronbach's alpha* coefficient for each scale (vaccine literacy and acceptance). *Cronbach's alpha* values of 0.732 and 0.860 were established for the literacy and acceptance scores, respectively. A p-value below 0.05 was considered statistically significant.

2.4 Data and statistical analysis

Statistical Package for the Social Sciences (SPSS) software (version 27) was used for all statistical analyses. Descriptive statistics were used to summarize participants' characteristics, with categorical variables represented as frequencies and percentages, and continuous variables expressed as medians and interquartile ranges (IQR). Scores for knowledge, vaccine literacy, and vaccine acceptance were determined by analyzing participants' responses to the questionnaire items. The Mann–Whitney U test was used to look at differences between groups, such as health and non-health students, sex, and vaccination status. This was because the data were analyzed using non-parametric methods. Variables with theoretical relevance and significant bivariate associations were entered into the multivariable linear regression model to identify independent predictors of vaccine acceptance.

2.5 Ethical considerations

The study protocol was reviewed and approved by the Institutional Review Board (IRB) at An-Najah National University (IRB Protocol Number: Med. Nov. 2025/195). Participation in the study was completely voluntary and anonymous to ensure privacy, and informed consent was obtained from all participants before completing the questionnaire. Any type of information collected was kept private and for research purposes only.

Results

Participants Characteristics

A total of 633 university students were included at the final analysis, all of them with no missing data. The median age of participants was 19 years (IQR: 18–21). Females comprised 72.4% (n = 458) of the population, while males accounted for 27.6% (n = 175) of the population. Participants were approximately equally distributed between faculty categories with 50.1% (n = 317) representing health-related majors, while 49.9% (n = 316) were non-health students. The majority of students were in their first year of study (42.7%), followed by second year students (22.7%). Most participants reported not having a chronic disease (96.8%, n = 613). Regarding academic GPA, the majority of participants reported their GPA was between 3.0 and 3.5 (26.7%), followed by 22.9% who reported their GPA was below 2.5 and, 17.9% who reported their GPA was between 2.5 and 3.0. The remainder of the sample (22.1%) reported having a GPA greater than 2.5.

[Insert Table 1 Here]

Table 1
Baseline Characteristics of the Participants (n = 633)

Variable	Frequency (%) / Median (IQR)
Age [Median (IQR)]	19.00 (18.00–21.00)
Gender	
Female	458 (72.4%)
Male	175 (27.6%)
Faculty Category (Health/Non-Health)	
Health Students	317 (50.1%)
Non-Health Students	316 (49.9%)
Study Year	
First	270 (42.7%)
Second	144 (22.7%)
Third	85 (13.4%)
Fourth	91 (14.4%)
Fifth	36 (5.7%)
Sixth	7 (1.1%)
GPA	
> 3.5	140 (22.1%)
3.0–3.5	145 (22.9%)
2.5–3.0	169 (26.7%)
< 2.5	66 (10.4%)
Chronic Disease	
Yes	20 (3.2%)
No	613 (96.8%)

Vaccination Behaviors and Information Sources

Overall, 67.8% (n = 429) of the participants reported receiving the recommended vaccinations during the past 5 years, whereas only 9.5% (n = 60) of participants had received the seasonal influenza vaccine. The most commonly reported source of information was the Ministry of Health (56.4%), followed by healthcare professionals like doctors and nurses (43.8%), then the World Health Organization (42.8%).

Social media, family and friends and news outlets were reported by 33.0%, 34.1%, and 19.1%. Regarding trust in official vaccine information sources, nearly half of participants reported a moderate level of trust (47.1%, n = 298), while 40.6% reported high or very high trust.

[Insert Fig. 1 Here]

Vaccine literacy and acceptance scores were calculated using means of Likert score scales (1–5). The median vaccine knowledge was 5.0 out of 10 (IQR: 3.0–6.0). The median vaccine literacy score was 3.50 out of 5 (IQR: 3.0-3.88) indicating moderate literacy. Similarly, the median vaccine acceptance score was 3.11 out of 5 (IQR: 2.78–3.56), reflecting moderate vaccine acceptance. Cronbach's alpha coefficients were used to check the internal consistency of the study scales. Internal consistency was moderate for the knowledge scale (Cronbach's alpha = 0.635) and acceptable for the vaccine literacy scale (Cronbach's alpha = 0.732), while the acceptance scale demonstrated an excellent level of internal consistency (Cronbach's alpha = 0.860).

[Insert Table 2 Here]

Table 2		
Vaccine-related behaviors & information sources		
Variable	Yes n (%)	No n (%)
Section A: Vaccination Behaviors		
Receiving recommended vaccines	429 (67.8%)	204 (32.2%)
Influenza Vaccination	60 (9.5%)	573 (90.5%)
Section B: Sources of Vaccine Information		
Doctor/nurse	277 (43.8%)	356 (56.2%)
WHO	271 (42.8%)	362 (57.2%)
Ministry of Health	357 (56.4%)	276 (43.6%)
Social media	209 (33.0%)	424 (67.0%)
Family/friends	216 (34.1%)	417 (65.9%)
News	121 (19.1%)	512 (80.9%)

[Insert Table 3 Here]

Table 3
Descriptive Statistics and Reliability of Main Study Scales

Scale	Items (n)	Score Range	Median (IQR)	Cronbach's α
Knowledge score	10	1–10	5.00 (3.00–6.00)	0.635
Vaccine literacy	8	1–5	3.50 (3.00–3.88)	0.732
Vaccine acceptance	9	1–5	3.11 (2.78–3.56)	0.860
Individual vaccine literacy and vaccine acceptance scores were calculated as the mean of the corresponding Likert-scale items (range 1–5). Owing to non-normal score distributions, results are presented as median (IQR).				

Group Comparisons

Non-parametric tests, specifically the Mann-Whitney U test for continuous variables and the Chi-square test for categorical variables, indicated statistically significant differences in knowledge, vaccine literacy, and vaccine acceptance scores between students in health-related disciplines and those in non-health-related fields, with health students showing higher scores on all measures ($p < 0.001$). Health students also reported greater uptake of recommended vaccines ($p = 0.010$) and higher trust in official information sources ($p < 0.001$). It was also revealed that individuals who took the influenza vaccine showed significantly higher knowledge scores ($p = 0.031$), as well as higher vaccine acceptance ($p = 0.001$) and were more likely to recommend vaccines to others ($p < 0.001$). The analysis also revealed that females had a significantly higher knowledge ($p = 0.021$) and literacy scores ($p < 0.001$), whereas no significant sex differences were observed in vaccine acceptance, recommended vaccine uptake, and trust in official sources.

[Insert Table 4 Here]

Table 4
Comparison of Participant Characteristics

Variable	Faculty Category		<i>p-value</i>
	Health (n = 317)	Non-Health (n = 316)	
Vaccine Knowledge Score (MR)	364.00	269.85	< 0.001
Vaccine Literacy Scale (MR)	350.36	286.54	< 0.001
Vaccine Acceptance Scale (MR)	364.56	269.29	< 0.001
Receiving Recommended Vaccines (MR)	332.14	301.81	0.010
Trust in sources (MR)	350.11	283.78	< 0.001
Influenza Vaccination			
	Vaccinated (n = 60)	Not-Vaccinated (n = 573)	
Vaccine Knowledge Score (MR)	364.90	311.98	0.031
Vaccine Literacy Scale (MR)	315.00	317.21	<i>0.929</i>
Vaccine Acceptance Scale (MR)	390.54	309.30	0.001
Receiving Recommended Vaccines (MR)	392.63	309.08	< 0.001
Trust in sources (MR)	368.53	311.60	0.013
Sex			
	Female (n = 458)	Male (n = 175)	
Vaccine Knowledge Score (MR)	327.24	290.20	0.021
Vaccine Literacy Scale (MR)	335.56	268.42	< 0.001
Vaccine Acceptance Scale (MR)	312.64	328.42	<i>0.330</i>
Receiving Recommended Vaccines (MR)	316.03	319.53	<i>0.791</i>
Trust in sources (MR)	308.98	338.00	<i>0.053</i>
MR: Mean Rank			
Note: Continuous Variables were compared using the Mann–Whitney U test and categorical variables were compared using Chi-Square			
Significant Values are presented in Bold.			

Correlation and Regression Analyses

Spearman correlation analysis revealed significant positive correlations between vaccine knowledge and literacy ($\rho = 0.336$, $p < 0.001$), vaccine knowledge and acceptance ($\rho = 0.425$, $p < 0.001$), and vaccine literacy and acceptance ($\rho = 0.257$, $p < 0.001$). Trust in information sources was also positively correlated with vaccine knowledge ($r = 0.301$, $p < 0.001$), vaccine literacy ($\rho = 0.150$, $p < 0.001$), and vaccine acceptance ($\rho = 0.471$, $p < 0.001$). Notably, trust in official sources demonstrated the strongest correlation with vaccine acceptance, indicating that higher trust levels were associated with greater acceptance of the concept of vaccination.

A multiple linear regression analysis revealed a variety of significant variables that affect vaccine acceptance. Trust in official sources ($\beta = 0.332$, $p < 0.001$), knowledge score ($\beta = 0.239$, $p < 0.001$), being enrolled in a health-related field ($\beta = 0.139$, $p < 0.001$), age ($\beta = 0.093$, $p = 0.006$), literacy score ($\beta = 0.079$, $p = 0.025$), and male sex ($\beta = 0.135$, $p = 0.013$) were independently associated with higher vaccine acceptance. In contrast, influenza vaccination status was not significantly associated with vaccine acceptance after adjustment. The regression model explained 32.9% of the variance in vaccine acceptance ($aR^2 = 0.329$).

[Insert Table 5 Here]

Table 5 Spearman Correlation Matrix: Vaccine Knowledge, Literacy, and Acceptance						
Variable	Vaccine Knowledge		Vaccine Literacy		Vaccine Acceptance	
	<i>r</i>	<i>p-value</i>	<i>r</i>	<i>p-value</i>	<i>r</i>	<i>p-value</i>
Vaccine Knowledge Score	1.00					
Vaccine Literacy Scale	0.336	< 0.001	1.00			
Vaccine Acceptance Scale	0.425	< 0.001	0.257	< 0.001		
Trust in official sources	0.301	< 0.001	0.150	< 0.001	0.471	< 0.001
r = Spearman rho (ρ)						

[Insert Table 6 Here]

Table 6
Multivariable Linear regression analysis of factors affecting vaccine acceptance

Variable	B	SE	β	p value	95% CI Lower	95% CI Upper
Age	0.034	0.013	0.093	0.006*	0.010	0.059
Faculty Category						
Non-Health (Reference)						
Health	0.194	0.049	0.139	< 0.001*	0.099	0.290
Sex						
Female (Reference)						
Male	0.135	0.054	0.086	0.013*	0.028	0.242
Vaccine Knowledge Score	0.075	0.012	0.239	< 0.001*	0.052	0.097
Vaccine Literacy Score	0.087	0.038	0.079	0.025*	0.011	0.162
Influenza Vaccination status						
Not-Vaccinated (Reference)						
Vaccinated	0.147	0.079	0.061	0.062	-0.007	0.301
Trust in official sources	0.276	0.029	0.332	< 0.001*	0.219	0.333
*Significant Variables are labelled in bold. Note: Reference categories are indicated were applicable. Unstandardized (B) and standardized (β) regression coefficients with standard errors (SE) and 95% confidence intervals (CIs) were obtained from multivariable linear regression analysis.						

Discussion

In this study, vaccine literacy, knowledge, and acceptance were evaluated among university students in Palestine and compared across health-related and non-health-related disciplines. The principal finding was that participants demonstrated moderate levels of vaccine literacy and vaccine acceptance, with relatively low vaccine knowledge scores. Higher scores for knowledge, literacy, and acceptance (all $p \leq 0.01$) were in students enrolled in health-related disciplines. Trust in official sources was the most significant determinant of vaccination acceptance ($\beta = 0.332$, $p < 0.001$), followed by vaccine knowledge ($\beta = 0.239$). Significant positive correlations were observed among vaccine literacy, knowledge, and acceptance. Although 67.8% of students reported receiving other recommended immunizations, a

critically low seasonal influenza vaccination rate of 9.5% shows a considerable gap in adult immunization coverage (18).

The median knowledge score was 5.0 out of 10, which is similar to results from university students in other regions and countries (10, 11, 14). When looking at individual questions, there was significant variation. Most students knew that vaccines undergo thorough safety testing before approval (86.4%) and that the benefits of immunization go beyond infancy (65.7%). Still, many important misconceptions remained. Only 25.1% believed that taking several vaccinations did not damage the immune system, a widespread misunderstanding that contributes to global hesitation (3, 8). Only 21.6% recognized that some vaccines can be safely administered during pregnancy (19–21). These gaps can have serious effects in practice. Myths about immune suppression can disrupt multi-dose vaccine schedules, and not knowing about pregnancy vaccination can lead to forgotten opportunities to protect newborns (3, 19, 22–26). Only 35.1% of participants were aware of the annual adult influenza vaccination recommendations, which explains the 9.5% observed influenza vaccination rate (19, 27). Similar patterns of misinformation profiles have been documented in the UAE, Saudi Arabia, and Jordan (4, 15, 28), implying that these knowledge deficits represent a regional pattern rather than being specific to the Palestinian context (29–31). These findings suggest that factual knowledge gaps are present even among university students and may contribute to delayed opportunities to get vaccinated.

Regarding vaccine literacy, participants demonstrated moderate levels of functional and interactive knowledge. They felt most confident when checking whether sources were trustworthy and comparing information from different sources. However, they were less sure about telling accurate information from misleading content or finding information needed to make decisions about vaccines. Some studies have found that vaccine literacy remains low across most groups, regardless of education level, aligning with current findings among Palestinian university students (11, 29–32). Interactive-critical literacy strongly predicts whether people intend to get vaccinated and also shows a significant correlation with acceptance ($r = 0.257$, $p < 0.001$), though this was weaker than the correlation between knowledge and acceptance ($r = 0.425$) (13, 33). This suggests that declarative knowledge may more directly influence acceptance than information-processing skills in this context. Biasio noted that vaccine literacy is often overlooked in public health, and even well-educated people can lack information about vaccines (34). The modest literacy levels found in this study, especially given that one-third of students get their information from social media, may explain this problem (35). Another possible explanation is that although university students have frequent access to online information, exposure alone does not necessarily translate into the ability to correctly comprehend and evaluate vaccine-related information.

The median vaccine acceptance score was 3.11/5, indicating generally positive but mixed views. Most participants agreed that vaccine benefits outweigh risks (mean: 3.34) and that they trust approved vaccines (mean: 3.31). However, they were less certain about getting vaccinated themselves (mean: 3.12) or recommending it to others (mean: 3.04). Concerns about serious side effects had the lowest score (mean: 2.72), implying that safety worries are the main barrier to acceptance (19). Results from additional research are consistent with this [4, 7, 8, 20]. Only 44.5% of students knew that serious

vaccine side effects are very rare, which helps explain these concerns and shows how knowledge gaps can lead to doubt (30). Similar patterns have been found in the UAE and in global reviews of health literacy and COVID-19 vaccine acceptance (4, 5, 30). These findings indicate that interventions should focus on addressing concerns about vaccine safety while simultaneously improving knowledge regarding the rarity of serious adverse events.

Health-related students consistently showed higher levels of vaccine knowledge, literacy, acceptance, uptake, and trust in institutions, indicating a strong relation (30). Being enrolled in a health-related faculty remained significantly associated with greater vaccine acceptance after controlling for other factors ($\beta = 0.194$, $\beta = 0.139$, $p < 0.001$). This suggests that health education plays a key role in acceptance. Similar patterns were seen in Kazakhstan and in other studies, likely because health students learn about physiology, epidemiology, and public health in their courses (6, 14). This difference between disciplines stands out for several reasons. Non-health students, who make up about half the sample and include many future Palestinian professionals, educators, and community leaders, appear more at risk of believing vaccine misinformation, probably due to having less scientific training. According to previous studies, general education helps protect against hesitancy (36). The current findings suggest that adding vaccine literacy to all curricula, not just health sciences, could help address this issue. This approach is structural, scalable, and cost-effective, and could have a broad impact (10, 30, 34).

Female students show significantly higher scores than male students in both knowledge ($p = 0.021$) and literacy ($p < 0.001$). On the other hand, no significant sex differences were determined in vaccine acceptance ($p = 0.330$), recommended vaccine uptake ($p = 0.791$), or trust in official sources ($p = 0.053$). The regression model showed that being male was independently associated with higher vaccine acceptance ($\beta = 0.086$, $p = 0.013$). This trend, where females have more knowledge but males are more accepting, does not always appear in the literature. Some regional studies find that females have more positive attitudes toward vaccines, while others report the opposite or no significant difference (4). One possible explanation is that females may perceive vaccine risks differently or be more attentive to vaccine-related information, although this hypothesis warrants further investigation. Similar results have been found in other health literacy studies.

Trust in official vaccine information sources appeared as the most significant independent predictor of acceptance ($\beta = 0.332$, $B = 0.276$, $p < 0.001$). It was also the strongest bivariate correlate in the Spearman matrix ($r = 0.471$), surpassing both knowledge ($r = 0.425$) and literacy ($r = 0.257$). This order: trust, then knowledge, then literacy has important theoretical and practical implications. It challenges the information-deficit model of hesitancy, which assumes that hesitancy is mainly due to a lack of knowledge that can be fixed by providing accurate information (3, 8, 11). The data here suggest that accurate information must first pass through a filter of institutional trust before it can influence vaccination intent. A previous study found that trust in health authorities was a key factor in vaccine practices in the UAE (4). A similar study also found that the source of vaccine information and institutional trust shaped acceptance among parents (7). In our study, half of the participants reported only moderate trust in official sources, even though they relied on them as their main information source.

There is a real risk when people use a source but do not actually trust it. Seeing different stories on social media or through informal networks can quickly lower confidence in vaccines. Health campaigns that only share information without building trust in institutions are unlikely to have much effect on this group (2, 8). The regression model explained 32.9% of the variance in acceptance (adjusted $R^2 = 0.329$), indicating that other factors, such as religious beliefs, peer norms, and past healthcare experiences, account for the remaining variance and should be explored in future research (17, 22).

More than half of the participants (56.4%) obtained their vaccine information from the Ministry of Health, followed by healthcare professionals (43.8%) and the WHO (42.8%). Social media and family or friends were mentioned by 33.0% and 34.1% of respondents. Even though most students used official sources, almost half (47.1%) reported only moderate trust, and 12.3% reported low or very low trust. This mix means that confidence in vaccines can be weakened by competing stories from informal sources (7, 12). Students who had received the influenza vaccine (9.5%) showed higher knowledge, acceptance, recommended vaccine uptake, and trust than those who had not, which aligns with the two-way relationship between vaccination behavior and positive vaccine attitudes described in other studies (14). This pattern suggests that easy access to on-campus influenza vaccination could help increase overall vaccine understanding, creating a positive cycle that benefits public health (6, 10, 37). Together, these findings emphasize that increasing access to reliable vaccine information should be accompanied by efforts to strengthen public trust in health institutions.

Strengths and Limitations

This study has several important strengths. To our knowledge, it is among the first studies to simultaneously evaluate vaccine knowledge, vaccine literacy, and vaccine acceptance among university students across multiple Palestinian universities in the West Bank. The inclusion of students from diverse academic institutions and both health- and non-health-related disciplines enhances the diversity of the sample and improves the generalizability of the findings within the university student population. In addition, the relatively large sample size exceeded the calculated minimum requirement, providing adequate statistical power for subgroup comparisons and multivariable analyses. The use of validated instruments with acceptable-to-good internal consistency further strengthens the reliability of the findings. Finally, the comprehensive analytical approach, including group comparisons, correlation analyses, and multivariable regression, enabled the identification of independent predictors of vaccine acceptance while accounting for potential confounding factors.

However, this study has several limitations. First, the cross-sectional design precludes causal inference between vaccine knowledge, literacy, trust, and acceptance. Second, the use of an online self-administered questionnaire may have introduced self-report and recall biases. Third, although the regression model explained approximately one-third of the variance in vaccine acceptance, other potentially important determinants, including cultural beliefs, previous healthcare experiences, peer influence, and religious factors, were not evaluated and should be explored in future research.

Conclusion

This study provides one of the first comprehensive assessments of vaccine knowledge, literacy, and acceptance among university students across multiple Palestinian universities in the West Bank. While participants demonstrated moderate levels of vaccine literacy and vaccine acceptance, important knowledge gaps and misconceptions regarding vaccine safety, pregnancy vaccination, and influenza vaccination recommendations remained prevalent. Students enrolled in health-related disciplines consistently exhibited higher knowledge, literacy, and acceptance than their non-health peers, highlighting the need to expand vaccine education beyond health-related curricula. Trust in official information sources emerged as the strongest predictor of vaccine acceptance, emphasizing that improving vaccine confidence requires not only increasing public knowledge but also strengthening trust in healthcare institutions and evidence-based communication. Universities represent an ideal setting for targeted educational initiatives, digital health literacy programs, and accessible vaccination services. Future interventions should prioritize non-health students and address persistent misconceptions through coordinated university- and community-based public health strategies to improve vaccine confidence and uptake among young adults in Palestine.

Abbreviations

5C: 5C Model (Confidence, Complacency, Constraints, Calculation, Collective Responsibility)

CI: Confidence Interval

COVID-19: Coronavirus Disease 2019

EPI: Expanded Program on Immunization

GPA: Grade Point Average

IQR: Interquartile Range

IRB: Institutional Review Board

MR: Mean Rank

NNU: An-Najah National University

SD: Standard Deviation

SE: Standard Error

SPSS: Statistical Package for the Social Sciences

UAE: United Arab Emirates

VL: Vaccine Literacy

WHO: World Health Organization

Declarations

Ethics Approval and Consent to Participate:

Ethical approval was obtained from the Institutional Review Board of An-Najah National University (Protocol No. Med.Nov.2025/195). All participants provided informed consent before participation. The study was conducted in accordance with relevant institutional and international ethical guidelines and regulations

Consent for Publication:

Not Applicable

Competing Interests:

The authors declare that they have no competing interests.

Funding:

This research received no funding.

Author Contribution

HK and DJ contributed to the study conception and design. SA, SJ, BS, and FM participated in data collection and the first draft of the manuscript. HK performed the statistical analysis and interpreted the data. DJ and HK drafted the final draft of the manuscript and completed the final review. All authors critically reviewed the manuscript, approved the final version, and agree to be accountable for all aspects of the work.

Acknowledgement

The authors would like to thank all students who participated in this study for their time and valuable contributions.

Data Availability

The data used and analyzed during the current study are available from the corresponding author upon reasonable request.

References

1. Shattock AJ, Johnson HC, Sim SY, Carter A, Lambach P, Hutubessy RCW, et al. Contribution of vaccination to improved survival and health: modelling 50 years of the Expanded Programme on Immunization. *Lancet*. 2024;403(10441):2307. 10.1016/S0140-6736. (24)00850-X PubMed PMID: 38705159.
2. Sáfadi MAP. The importance of immunization as a public health instrument. *J Pediatr (Rio J)*. 2022;99(Suppl 1):S1. 10.1016/J.JPED. .2022.12.003 PubMed PMID: 36581310.
3. Galagali PM, Kinikar AA, Kumar VS. Vaccine Hesitancy: Obstacles and Challenges. *Curr Pediatr Rep*. 2022;10(4):241–8. 10.1007/S40124-022-00278-9 . PubMed PMID: 36245801.
4. Barqawi HJ, Samara KA, Kannas SM, Habbal O, AlSarraf NA, Dreezi MA, et al. Vaccine practices, literacy, and hesitancy among parents in the United Arab Emirates. *PLoS ONE*. 2024;19(8):e0307020. 10.1371/. JOURNAL.PONE.0307020 PubMed PMID: 39190761.
5. Fenta ET, Tiruneh MG, Delie AM, Kidie AA, Ayalew BG, Limenh LW, et al. Health literacy and COVID-19 vaccine acceptance worldwide: A systematic review. *SAGE Open Med*. 2023;11. 10.1177/20503121231197869 PubMed PMID: 37823070.
6. Abdigalimova H, Bolatova Z, Dauletaliyeva Z, Kayupova G, Nukeshtayeva K, Takuadina A, et al. Vaccination Literacy and Determinants of Vaccine Confidence Among University Students: Analyzing Attitudinal Barriers. *J Clin Med Kaz*. 2024;22(1):32–6. 10.23950/JCMK/15791.
7. Ashfield S, Donelle L, Tryphonopoulos P, Dubé È, Smith M. Digital health literacy, vaccine information sources, and vaccine acceptance among parents in Ontario: Quantitative findings from a mixed methods study. *PLOS Global Public Health*. 2024;4(5):e0003154. 10.1371/JOURNAL.PGPH.0003154.
8. Crosby LE, Real FJ, Cunningham J, Mitchell M. Overcoming Vaccine Hesitancy Using Community Based Efforts. *Pediatr Clin North Am*. 2023;70(2):359. .012 PubMed PMID: 36841602.
9. Butow P, Shaw J, Bartley N, Milch V, Sathiaraj R, Turnbull S, et al. Vaccine hesitancy in cancer patients: A rapid review. *Patient Educ Couns*. 2023;111. 10.1016/j.pec.2023.107680 . PubMed PMID: 36842287.
10. Gao S, Li Y, Wang X, Li S, Chen M, Yue B. Vaccine literacy, vaccination intention, and their correlation among adults in Mainland China: a cross-sectional study. *J Health Popul Nutr* 2024. 2024;43(1):1. 10.1186/S41043-024-00602-7 . PubMed PMID: 39127762.
11. Zhang E, Dai Z, Wang S, Wang X, Zhang X, Fang Q. Vaccine Literacy and Vaccination: A Systematic Review. *Int J Public Health*. 2023;68. 10.3389/IJPH.2023.1605606. /PDF PubMed PMID: 36866001.
12. Biasio LR, Zanobini P, Lorini C, Bonaccorsi G. Relevance of Vaccine Literacy Assessment Tools. *Int J Public Health*. 2023;68. 10.3389. /IJPH.2023.1605945 PubMed PMID: 37035103.

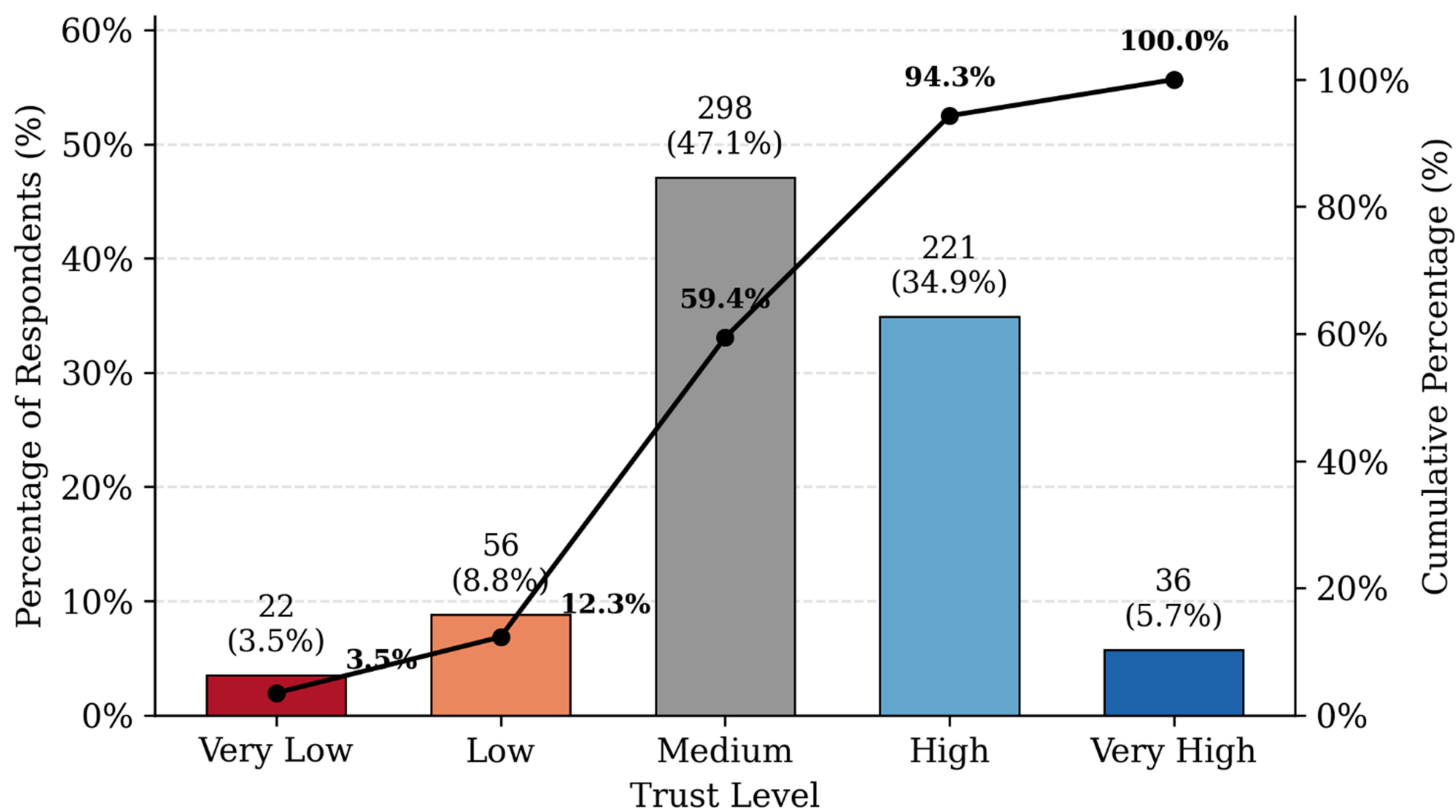
13. Isonne C, Iera J, Sciurti A, Renzi E, De Blasiis MR, Marzuillo C, et al. How well does vaccine literacy predict intention to vaccinate and vaccination status? A systematic review and meta-analysis. *Hum Vaccin Immunother.* 2024;20(1). 10.1080/21645515.2023.2300848 . PubMed PMID: 38174706.
14. Shon EJ, Lee L. Effects of Vaccine Literacy, Health Beliefs, and Flu Vaccination on Perceived Physical Health Status among Under/Graduate Students. *Vaccines (Basel).* 2023;11(4):765. doi:10.3390/VACCINES11040765 PubMed PMID: 37112677.
15. Al-Qerem W, Jarab A, Al Bawab AQ, Eberhardt J, Alasmari F, Hammad A, et al. Validation of an Arabic tool for assessing vaccination literacy: A factor and Rasch analysis. *Hum Vaccin Immunother.* 2024;20(1). 10.1080/21645515.2024.2381297 . PubMed PMID: 39036977.
16. ElHafeez SA, Elbarazi I, Shaaban R, ElMakhzangy R, Aly MO, Alnagar A, et al. Arabic validation and cross-cultural adaptation of the 5C scale for assessment of COVID-19 vaccines psychological antecedents. *PLoS ONE.* 2021;16(8):e0254595. 10.1371. /JOURNAL.PONE.0254595 PubMed PMID: 34437554.
17. Nour R, Powell L, Alnakhi WK, Mamdouh H, Sleibi R, Hussain HY, et al. Validation and psychometric evaluation of the Arabic Adult Vaccine Hesitancy Scale. *Hum Vaccin Immunother.* 2025;21(1). 10.1080/21645515.2025.2560152 . PubMed PMID: 40966173.
18. World Health Organization. State of Palestine: WHO and UNICEF estimates of immunization coverage: 2022 revision. 2022.
19. Veronese G, Mahamid F, Bdier D. Concerns, perceived risk, and hesitancy on COVID-19 vaccine: a qualitative exploration among university students living in the West Bank. *Epidemiol Infect.* 2023;151:e139. 10. 1017/S0950268823001267 PubMed PMID: 37548186.
20. Pogue K, Jensen JL, Stancil CK, Ferguson DG, Hughes SJ, Mello EJ, et al. Influences on Attitudes Regarding Potential COVID-19 Vaccination in the United States. *Vaccines (Basel).* 2020;8(4):1–14. doi:10.3390/VACCINES8040582 PubMed PMID: 33022917.
21. Lewis JR. What Is Driving the Decline in People’s Willingness to Take the COVID-19 Vaccine in the United States? *JAMA Health Forum.* 2020;1(11):e201393–201393. 10.1001. /JAMAHEALTHFORUM.2020.1393 PubMed PMID: 36218404.
22. Alsuwaidi AR, Hammad HAAK, Elbarazi I, Sheek-Hussein M. Vaccine hesitancy within the Muslim community: Islamic faith and public health perspectives. *Hum Vaccin Immunother.* 2023;19(1):2190716. 10.1080/21645515.2023.2190716 . PubMed PMID: 36914409.
23. Bonhoeffer J, Kochhar S, Hirschfeld S, Heath PT, Jones CE, Bauwens J, et al. Global alignment of immunization safety assessment in pregnancy – The GAIA project. *Vaccine.* 2016;34(49):5993–7. 10.1016/j.vaccine.2016.07.006 . PubMed PMID: 27751641.
24. Zhang J, Li Z, Li S, Li P, Xie J, Yang Y. Research progress in vaccination during pregnancy. *Front Immunol.* 2025;16:1687362. 10.3389/FIMMU.2025.1687362. /TEXT PubMed PMID: 41235235.
25. Adeyanju GC, Engel E, Koch L, Ranzinger T, Shahid IBM, Head MG, et al. Determinants of influenza vaccine hesitancy among pregnant women in Europe: a systematic review. *Eur J Med Res.* 2021;26(1):116. 10.1186/S40001-021-00584-W . PubMed PMID: 34583779.

26. Faucette AN, Unger BL, Gonik B, Chen K. Maternal vaccination: moving the science forward. *Hum Reprod Update*. 2015;21(1):119–35. 10.1093/. HUMUPD/DMU041 PubMed PMID: 25015234.
27. Schmid P, Rauber D, Betsch C, Lidolt G, Denker ML. Barriers of Influenza Vaccination Intention and Behavior – A Systematic Review of Influenza Vaccine Hesitancy, 2005–2016. *PLoS ONE*. 2017;12(1):e0170550. 10.1371/. JOURNAL.PONE.0170550 PubMed PMID: 28125629.
28. AlMuammar S, Albogmi A, Alzahrani M, Alsharef F, Aljohani R, Aljilani T. Herpes zoster vaccine awareness and acceptance among adults in Saudi Arabia: a survey-based cross-sectional study. *Tropical Diseases, Travel Medicine and Vaccines* 2023 9:1. 2023;9(1):17-. 10.1186/S40794-023-00202-Z
29. Gusar I, Konjevoda S, Babić G, Hnatešen D, Čebihin M, Orlandini R, et al. Pre-Vaccination COVID-19 Vaccine Literacy in a Croatian Adult Population: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2021;18(13). 10.3390/IJERPH18137073 . PubMed PMID: 34281009.
30. Al-kafarna M, Matar SG, Almadhoon HW, Almaghary BK, Zaazouee MS, Elrashedy AA, et al. Public knowledge, attitude, and acceptance toward COVID-19 vaccines in Palestine: a cross-sectional study. *BMC Public Health* 2022. 2022;22(1):1. 10.1186/S12889-022-12932-4 . PubMed PMID: 35300647.
31. Alzoubi H, Alnawaiseh N, Al-Mnayyis A, Abu-Lubad M, Aqel A, Al-Shagahin H. Covid-19 - Knowledge, attitude and practice among medical and non-medical university students in Jordan. *J Pure Appl Microbiol*. 2020;14(1):17–24. 10.22207/JPAM.14.1.04.
32. Alam Z, Mohamed S, Nauman J, Al-Rifai RH, Ahmed LA, Elbarazi I. Hesitancy toward vaccination against COVID-19: A scoping review of prevalence and associated factors in the Arab world. *Hum Vaccin Immunother*. 2023;19(2). 10.1080/21645515.2023.2245720 . PubMed PMID: 37594508.
33. Shouli MM, Ayed A, Shouli KM, Alekel K. Knowledge and Perception of the Employees Towards COVID-19 Vaccination at Palestinian Universities. *SAGE Open Nurs*. 2023;9. doi:10.1177/23779608231176880 PubMed PMID: 37223220.
34. Biasio LR. Vaccine literacy is undervalued. *Hum Vaccin Immunother*. 2019;15(11):2552–3. 10.1080/21645515. 2019.1609850 PubMed PMID: 31013184.
35. Chiara L, Marco DR, Patrizio Z, Roberto BL, Paolo B, Duccio G, et al. Vaccination as a social practice: towards a definition of personal, community, population, and organizational vaccine literacy. *BMC Public Health*. 2023;23(1). 10.1186/S12889-023-16437-6 . PubMed PMID: 37553624.
36. Michel JP, Goldberg J, Education. Healthy Ageing and Vaccine Literacy. *J Nutr Health Aging*. 2021;25(5):698–701. 10.1007/s12603-021-1627-1 . PubMed PMID: 33949640.
37. Shon EJ, Choe S, Lee L, Ki Y, Influenza Vaccination Among US. College or University Students: A Systematic Review. *Am J Health Promot*. 2021;35(5):708–19. doi:10.1177/0890117120985833 PubMed PMID: 33530696.

Figures

Trust in Official Vaccine Information Sources

(N = 633)



Note: Trust was measured on a 5-point ordinal scale (1 = Very Low to 5 = Very High).

Figure 1

Distribution of participant trust in official vaccine information sources (N = 633). Bars represent the percentage of respondents reporting each trust level (raw n shown above each bar, with percentage in parentheses). The overlaid line indicates cumulative percentage across trust levels. Trust was measured on a 5-point ordinal scale ranging from 1 (Very Low) to 5 (Very High).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryTable1VaccineLiteracy.docx](#)