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Psychological Antecedents of Vaccination Among Health Vocational School Students: Associations With Self-Reported Infectious Diseases Course Exposure

Sağlık Meslek Yüksekokulu Öğrencilerinde Aşılanmanın Psikolojik Öncülleri: Enfeksiyon Hastalıkları Dersi Alma Öyküsü ile İlişkisi

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ABSTRACT

Background: Vaccine-related concerns may persist among future healthcare personnel. We assessed the 5C psychological antecedents of vaccination among health vocational school students and examined their associations with self-reported exposure to an infectious diseases course.

Materials and Methods: In this single-center, analytical, cross-sectional study conducted in Türkiye between May 11 and June 1, 2026, students completed a web-based questionnaire that included demographic characteristics, vaccine-related items, the Turkish 15-item 5C scale, course-related questions, and an optional open-ended question. Adjusted general linear models included age, class year, sex, programme group, and graduation from a health vocational high school.

Results: Of 427 records, 388 students were included in the analysis. Of these, 82.5% were female, and 59.5% reported taking an infectious diseases course. Internal consistency of the 5C subscales ranged from Cronbach's α = 0.593 to 0.888. Previous vaccine delay or non-vaccination was reported by 29.9% of participants and was associated with lower confidence scores and higher constraints scores (both $p < 0.001$). Among first- and second-year students (n = 379), self-reported course exposure was independently associated with lower constraints scores ($F = 16.544$, $p < 0.001$, partial $\eta^2 = 0.043$) and higher collective responsibility scores ($F = 10.206$, $p = 0.002$, partial $\eta^2 = 0.027$). Among students reporting course exposure, the perceived course impact score was 4.14 ± 0.65 and correlated with all five 5C domains. Safety or adverse-effect concerns were the leading specific theme in open-ended responses.

Conclusion: Vaccine-related concerns and behaviors consistent with hesitancy were identified among students at health vocational schools. Self-reported exposure to an infectious diseases course was associated with lower perceived constraints and greater collective responsibility. Educational strategies addressing vaccine safety, misinformation, practical barriers, and collective responsibility may strengthen vaccination-related competencies among future healthcare personnel.

Keywords: Vaccine hesitancy, vaccination, 5C scale, health vocational school students, infectious diseases education, vaccine confidence

ÖZ

Amaç: Aşıyla ilişkili kaygılar, geleceğin sağlık çalışanlarında da devam edebilmektedir. Bu çalışmada sağlık meslek yüksekokulu öğrencilerinde aşılanmanın psikolojik öncülleri 5C modeli ile değerlendirildi ve enfeksiyon hastalıkları dersi alma öyküsü ile ilişkisi incelendi.

Gereç ve Yöntemler: Türkiye'de 11 Mayıs-1 Haziran 2026 tarihleri arasında yürütülen bu tek merkezli, analitik-kesitsel çalışmada öğrenciler; demografik özellikler, aşıyla ilişkili sorular, Türkçe 15 maddelik 5C ölçeği, dersle ilişkili sorular ve isteğe bağlı açık uçlu sorudan oluşan çevrimiçi anketi tamamladı. Düzeltilmiş genel doğrusal modellerde yaş, sınıf düzeyi, cinsiyet, program grubu ve sağlık meslek lisesi mezuniyeti dikkate alındı.

Bulgular: Toplam 427 kayıttan 388 öğrenci analize dahil edildi; katılımcıların %82,5'i kadındı ve %59,5'i enfeksiyon hastalıkları dersi aldığını bildirdi. 5C alt boyutlarının iç tutarlılık katsayıları Cronbach α = 0,593 ile 0,888 arasında değişti. Katılımcıların %29,9'u daha

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Öz

önce bir aşıyı ertelediğini veya yaptırmadığını bildirdi; bu öğrencilerde güven puanı daha düşük, kısıtlama puanı ise daha yüksekti (her ikisi için $p < 0,001$). Birinci ve ikinci sınıf öğrencilerinde (n = 379), enfeksiyon hastalıkları dersi alma öyküsü daha düşük kısıtlama puanı ($F = 16,544$; $p < 0,001$; kısmi $\eta^2 = 0,043$) ve daha yüksek kolektif sorumluluk puanı ($F = 10,206$; $p = 0,002$; kısmi $\eta^2 = 0,027$) ile bağımsız olarak ilişkili bulundu. Dersi aldığını bildiren öğrencilerde algılanan ders etkisi puanı 4,14 ± 0,65 olup tüm 5C boyutlarıyla ilişkiliydi. Açık uçlu yanıtlarda en sık belirtilen özgül tema güvenlik veya yan etki kaygısıydı.

Sonuç: Sağlık meslek yüksekokulu öğrencilerinde aşı tereddüdüyle uyumlu kaygılar ve davranışsal örüntüler saptandı. Enfeksiyon hastalıkları dersi alma öyküsü, daha düşük algılanan kısıtlama ve daha yüksek kolektif sorumluluk ile ilişkiliydi. Aşı güvenliği, yanlış bilgi, uygulamaya ilişkin engeller ve kolektif sorumluluğu ele alan eğitim yaklaşımları, geleceğin sağlık çalışanlarının aşıyla ilişkili yetkinliklerini güçlendirebilir.

Anahtar Kelimeler: Aşı tereddüdü, aşılama, 5C ölçeği, sağlık meslek yüksekokulu öğrencileri, enfeksiyon hastalıkları eğitimi, aşı güveni

Introduction

Vaccination remains one of the most effective public health interventions for preventing infectious diseases and their related morbidity and mortality (1). However, vaccine uptake is not determined solely by vaccine availability. Individual perceptions, trust in vaccines and healthcare systems, perceived barriers, information-seeking behaviors, and social responsibility may all influence vaccination decisions (2,3).

Vaccine hesitancy has been described as a delay in acceptance or refusal of vaccines despite the availability of vaccination services (2). It represents a complex, context-dependent phenomenon that may vary across time, place, population, and vaccine type. Although confidence in vaccine safety and effectiveness is an important determinant of vaccine acceptance, vaccination behavior is also influenced by perceived disease risk, practical or psychological barriers, individual information-seeking patterns, and willingness to protect others through vaccination (2,3).

The 5C model was developed to assess five psychological antecedents of vaccination: confidence, complacency, constraints, calculation, and collective responsibility (4,5). Confidence reflects trust in vaccine safety and effectiveness, healthcare professionals, and the healthcare system. Complacency is the perception of vaccine-preventable diseases as low risk or of vaccination as unnecessary. Constraints represent perceived structural or psychological barriers that may interfere with vaccination. Calculation reflects extensive information-seeking and deliberation regarding vaccination, whereas collective responsibility refers to the willingness to protect others through one's own vaccination behavior. Importantly, these constructs represent distinct psychological antecedents; therefore, the 5C scale is interpreted using separate subscale scores rather than a single total score (4).

The Turkish version of the 15-item 5C scale has demonstrated acceptable psychometric properties and provides a standardized instrument for assessing vaccination-related psychological antecedents in Türkiye (5). Its use may help identify specific domains that could be targeted through vaccine communication, educational interventions, and preventive health strategies.

Students enrolled in health-related programmes constitute an important population because they may encounter vaccine-related questions during clinical training and may later contribute to patient education, preventive healthcare practices, and public confidence in vaccination. Previous studies among healthcare students in Türkiye and other countries have shown that vaccine-related concerns, uncertainty, and delay or refusal behaviors may persist despite health-related training (6,7). These findings suggest that educational exposure alone may not be sufficient to address the multidimensional determinants of vaccination behavior.

Educational approaches addressing vaccine hesitancy may need to include not only factual knowledge about vaccines but also vaccine safety communication, misinformation appraisal, risk-benefit assessment, practical barriers to vaccination, and respectful communication with hesitant individuals (8). Infectious disease courses may provide an appropriate setting for integrating the education of future healthcare personnel.

The present study aimed to assess the psychological antecedents of vaccination among students enrolled in a health vocational school using the Turkish version of the 15-item 5C scale. The primary objective was to examine the association between a self-reported history of having taken an infectious diseases course and the five subscale scores of the 5C. Secondary objectives were to evaluate students' reports regarding content on vaccines and vaccine hesitancy in the course, to assess the perceived impact of the course on vaccine-related attitudes and professional perspectives, and to examine the relationship between 5C scores and self-reported vaccine delay or non-vaccination.

Materials and Methods

Study Design and Setting

This single-center, analytical cross-sectional survey was conducted between May 11 and June 1, 2026, among students enrolled at a health vocational school in İstanbul, Türkiye. The study aimed to assess the psychological antecedents of vaccination among students at health vocational schools and examine their association with self-reported histories of taking an infectious diseases course.

Participants and Sampling

The target population comprised approximately 2,500 actively enrolled students. All eligible students aged 18 years or older were invited to participate. Because participation was voluntary, a voluntary response (non-probability) sampling approach was used.

Assuming a target population of 2,500 students, the minimum required sample size was estimated to be 334 participants with a 95% confidence level and a 5% margin of error. A web-based, self-administered questionnaire was made available to eligible students.

A total of 427 questionnaire responses were obtained, corresponding to an approximate response rate of 17.1% of the target population. Records were excluded if electronic informed consent was not provided (n = 37), if the response was identified as a duplicate record (n = 1), or if the participant belonged to a programme outside the prespecified study population (n = 1). The final analytic sample consisted of 388 students.

Survey Instrument and Variables

The questionnaire consisted of three sections: demographic and educational characteristics, vaccine-related experiences and attitudes, and course-related questions. The Turkish and English versions of the study questionnaire are provided in Supplementary File 1 and Supplementary File 2, respectively.

For analytical purposes, individual academic programmes were categorised into five programme groups according to their predominant curricular and clinical focus: laboratory and diagnostic programmes; patient care and clinical-contact programmes; emergency, operating room, and anaesthesia programmes; oral health, dental, and pharmacy-related programmes; and administrative, technical, and other programmes.

Demographic and educational variables included age, sex, class year, academic program group, graduation from a health vocational high school, previous vaccine-related education, and clinical practice or internship experience. Vaccine-related variables included vaccination within the previous year, self-reported vaccine delay or non-vaccination, prior exposure to vaccine hesitancy, and the presence of a healthcare worker in the family.

The primary exposure variable was a self-reported history of having taken an infectious-disease course. Students who reported taking such a course were also asked whether the course had addressed vaccines and vaccine hesitancy. Response options were “yes”, “no”, and “not sure”.

Assessment of Psychological Antecedents of Vaccination

Psychological antecedents of vaccination were assessed using the Turkish version of the 15-item 5C scale developed by Betsch et al. (4) and adapted into Turkish by Demir et al. (5). The validated Turkish version of the 15-item 5C Psychological Antecedents of Vaccination Scale was administered unchanged. The scale was used in accordance with the published Turkish adaptation and was cited accordingly. The scale evaluates five domains: confidence, complacency, constraints, calculation, and collective responsibility. Each domain consists of three items rated on a 7-point Likert scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”).

The designated reverse-scored item in the collective responsibility domain was recoded before analysis. Subscale scores were calculated as the mean of the corresponding items when at least two of the three items were completed. Higher scores indicate a higher level of the respective psychological antecedent. A total score was not calculated because the five domains represent conceptually distinct constructs.

Perceived Impact of the Infectious Diseases Course

Among students who reported taking an infectious diseases course, perceived course impact was assessed using six investigator-developed items rated on a 5-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The items assessed participants’ perceived positive effects of the course on vaccine-related attitudes, the ability to distinguish misinformation, the perceived professional responsibility to provide accurate vaccine information, confidence in discussing vaccines on a scientific basis, the perceived influence on personal vaccine decisions, and the belief that healthcare students should serve as role models regarding vaccination.

Open-Ended Question and Descriptive Thematic Categorization

The questionnaire included one optional open-ended question: “What factor makes you most hesitant about, or most convinced by, vaccines”? Responses were reviewed

after data collection and descriptively categorized according to their predominant content. Each response was assigned to one mutually exclusive category: adverse effects or safety concerns; protection from disease or societal benefit; trust in scientific evidence or official sources; distrust of vaccine manufacturers or perceived hidden motives; previous COVID-19 vaccination experience; social media or misinformation; other; no specific factor or no opinion stated.

This component was included to provide contextual information on the factors that students perceived as most influential in shaping their views on vaccination. The thematic categorization was summarized using frequencies and percentages; no inferential comparisons were planned for the open-ended responses.

A perceived course impact score was calculated as the mean of the six items when at least five items had been completed. Higher scores indicated a stronger perceived impact of the infectious diseases course on vaccine-related attitudes and professional perspectives.

Ethical Considerations

The study protocol was approved by the University of Health Sciences Türkiye, Hamidiye Non-Interventional Scientific Research Ethics Committee (decision number: 6/39; protocol number: 26/313; date: April 28, 2026). Electronic informed consent was obtained from all participants prior to participation in the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages. Continuous variables were summarized as mean ± standard deviation or median and interquartile range, as appropriate.

The internal consistency of the 5C subscales and the perceived course impact item set was assessed using Cronbach's alpha coefficient. The distribution of continuous variables was examined using visual inspection and the Shapiro-Wilk test.

For unadjusted comparisons of 5C subscale scores according to infectious diseases course status, Mann-Whitney U tests were used because the distributions of the raw subscale scores deviated from normality. Among students who reported taking the course, associations between perceived course impact scores and 5C subscale scores were assessed using Spearman correlation analysis.

As a secondary behavioral analysis, 5C subscale scores were compared between students who reported vaccine delay or non-vaccination and those who did not report vaccine delay or non-vaccination. Students who selected "I do not remember" were excluded from this analysis.

To evaluate the independent association between infectious diseases course status and each 5C subscale, multivariable general linear models were constructed. These analyses were restricted to first- and second-year students because few students were in the extension or other category. Each 5C subscale was analyzed as a separate dependent variable. Self-reported infectious-disease course status, class year, sex, academic program group, and graduation from a health vocational high school were entered as fixed factors, while age was included as a covariate. Adjusted estimated marginal means with 95% confidence intervals, F statistics, p-values, and partial eta-squared values were reported.

Because five primary 5C outcomes were evaluated, a Bonferroni-adjusted significance threshold of $p < 0.01$ was used for the primary multivariable analyses. All tests were two-sided. Missing data were not imputed; analyses were performed using available data for each variable.

Responses to the open-ended question were descriptively summarized as frequencies and percentages according to the assigned thematic categories.

Results

Participant Characteristics

A total of 427 questionnaire records were obtained during the study period. Records from participants who did not provide electronic informed consent were excluded (n = 37). After the removal of one duplicate record and one response from a programme outside the prespecified study population, 388 students were included in the final analysis.

The demographic, educational, and vaccine-related characteristics of the participants are presented in Table 1. Most participants were aged 18–20 years, female, and enrolled in the first or second year of their programme.

5C Subscale Scores and Internal Consistency

Descriptive statistics and internal consistency coefficients for the five 5C subscales are shown in Table 2. The internal consistency estimates were acceptable for the confidence, complacency, constraints, and calculation subscales. The collective responsibility subscale showed a lower Cronbach's alpha coefficient than the other subscales.

Table 1. Demographic, educational, and vaccine-related characteristics of the participants (n = 388).

Characteristic	n (%)
Age group, years	
18–20	245 (63.1)
21–23	111 (28.6)
≥24	32 (8.2)
Sex	
Female	320 (82.5)
Male	68 (17.5)
Class year	
First year	164 (42.3)
Second year	215 (55.4)
Extension/other	9 (2.3)
Academic programme group*	
Laboratory and diagnostic programmes	141 (36.3)
Patient care and clinical-contact programmes	101 (26.0)
Emergency, operating room, and anaesthesia programmes	65 (16.8)
Oral health, dental, and pharmacy-related programmes	40 (10.3)
Administrative, technical, and other programmes	41 (10.6)
Graduated from a health vocational high school	
Yes	35 (9.0)
No	353 (91.0)
Vaccine-related education during high school	
Yes	139 (35.8)
No	164 (42.3)
Not sure	85 (21.9)
Previous clinical practice or internship experience	
Yes	248 (63.9)
No	140 (36.1)
Healthcare worker in the family	
Yes	123 (31.7)
No	265 (68.3)
Received a vaccine during the previous year	
Yes	256 (66.0)
No	110 (28.4)
I do not remember	22 (5.7)
Previously delayed or did not receive a recommended vaccine	
Yes	116 (29.9)
No	221 (57.0)
I do not remember	51 (13.1)
Previous formal/scientific vaccine-related education	
Yes	91 (23.5)
No	297 (76.5)
Encountered vaccine hesitancy or vaccine refusal during clinical practice/internship	
Yes	134 (34.5)
No	198 (51.0)
Not sure	56 (14.4)
Reported taking an infectious diseases course	
Yes	231 (59.5)
No	157 (40.5)

Percentages may not sum to 100 because of rounding. *Academic programme groups were categorized according to their predominant curricular and clinical focus as follows: laboratory and diagnostic programmes (Medical Laboratory Techniques, Pathology Laboratory Techniques, Autopsy Assistance, Medical Imaging Techniques, and Electroneurophysiology); patient care and clinical-contact programmes (Dialysis, Home Patient Care, Physiotherapy, Patient Care, and Elderly Care); emergency, operating room, and anaesthesia programmes (Operating Room Services, Anaesthesia, and First and Emergency Aid); oral health, dental, and pharmacy-related programmes (Oral and Dental Health, Dental Prosthesis Technology, and Pharmacy Services); and administrative, technical, and other programmes (Biomedical Device Technology, Opticianry, Health Institutions Management, Medical Promotion and Marketing, Medicinal and Aromatic Plants, and Occupational Health and Safety).

Table 2. Descriptive statistics and internal consistency of the 5C subscales (n = 388).

5C subscale	Mean ± SD	Median (IQR)	Cronbach's α
Confidence	4.91 ± 1.33	5.00 (2.00)	0.833
Complacency	2.81 ± 1.37	2.67 (1.67)	0.778
Constraints	2.69 ± 1.45	2.33 (1.67)	0.849
Calculation	5.40 ± 1.51	6.00 (2.00)	0.888
Collective responsibility	5.47 ± 1.28	5.67 (1.67)	0.593

All subscales were scored from 1 to 7. Higher scores indicate a higher level of the respective psychological antecedent of vaccination. The designated reverse-scored item was recoded before the calculation of the collective responsibility score. SD, standard deviation; IQR, interquartile range.

Infectious Diseases Course-Related Findings

Overall, 231 students reported having taken an infectious diseases course. The responses of these students regarding whether vaccines and vaccine hesitancy had been addressed during the course are presented in Table 3.

The perceived course impact item set was completed by 227 students. The distribution of responses to the six course-related statements, the mean perceived course impact score, and the internal consistency of the item set are presented in Table 3.

Association Between Infectious Diseases Course Status and 5C Scores

Multivariable general linear models were fitted to data from first- and second-year students (n = 379). After adjustment for age, class year, sex, academic programme group, and graduation from a health vocational high school, a self-reported history of having taken an infectious diseases course was associated with lower constraints scores and higher collective responsibility scores. Calculation scores were also higher among students who reported taking the course, although this association did not meet the Bonferroni-adjusted significance threshold. Confidence and complacency scores were not significantly associated with course status in the adjusted models (Table 4).

Among students who reported taking an infectious diseases course, perceived course impact scores were correlated with all five 5C subscales. The correlation coefficients are presented in Table 5.

Table 3. Infectious diseases course-related findings and perceived course impact

Variable	n/N (%) or mean ± SD
Overall sample (n = 388)	
Reported taking an infectious diseases course	231/388 (59.5)
Among students reporting an infectious diseases course	
Reported vaccine-related content in the course (n = 230)	
Yes	198/230 (86.1)
No	2/230 (0.9)
Not sure	30/230 (13.0)
Reported vaccine hesitancy-related content in the course (n = 229)	
Yes	193/229 (84.3)
No	5/229 (2.2)
Not sure	31/229 (13.5)
Perceived course impact score (n = 227)	4.14 ± 0.65
Cronbach's α for the perceived course impact item set	0.888
Perceived course impact statements	**Agree/strongly agree, n/N (%)**
The infectious diseases course positively influenced my views on vaccines.	180/227 (79.3)
The course improved my ability to distinguish vaccine-related misinformation.	188/226 (83.2)
As a future healthcare professional, I consider providing accurate vaccine information to patients a professional responsibility.	200/227 (88.1)
I would like to have sufficient knowledge to discuss vaccine hesitancy with individuals on a scientific basis.	194/227 (85.5)
What I learned in the course influences my personal vaccine-related decisions.	190/227 (83.7)
Students in health-related programmes should serve as role models for the public regarding vaccination.	200/227 (88.1)

The perceived course impact score was based on six investigator-developed items, each scored from 1 to 5. Higher scores indicate a stronger perceived impact of the course. Scores were calculated if at least five items were completed. SD, standard deviation.

Table 4. Association between self-reported infectious diseases course status and 5C subscale scores in multivariable general linear models.

5C subscale	No course: adjusted mean (95% CI)	Course: adjusted mean (95% CI)	F (1,369)	p-value	Partial η^2
Confidence	4.755 (4.409–5.100)	5.061 (4.759–5.363)	3.006	0.084	0.008
Complacency	3.118 (2.755–3.482)	2.829 (2.512–3.147)	2.430	0.120	0.007
Constraints	3.433 (3.063–3.802)	2.666 (2.343–2.988)	16.544	<0.001	0.043
Calculation	5.193 (4.797–5.589)	5.669 (5.323–6.015)	5.547	0.019	0.015
Collective responsibility	5.125 (4.797–5.453)	5.661 (5.374–5.947)	10.206	0.002	0.027

Analyses were restricted to first- and second-year students (n = 379). Each 5C subscale was analysed in a separate model. Age was entered as a covariate; self-reported infectious diseases course status, class year, sex, academic programme group, and health vocational high school graduation were entered as fixed factors. Adjusted means are estimated marginal means. A Bonferroni-adjusted threshold of $p < 0.01$ was used for the five primary outcomes. CI, confidence interval.

Table 5. Correlations between perceived infectious diseases course impact and 5C subscale scores among students reporting an infectious diseases course (n = 227).

5C subscale	Spearman's ρ	p value
Confidence	0.483	<0.001
Complacency	-0.275	<0.001
Constraints	-0.224	<0.001
Calculation	0.308	<0.001
Collective responsibility	0.404	<0.001

Perceived course impact was assessed using the six-item investigator-developed questionnaire. Higher scores indicate a stronger perceived impact of the infectious diseases course.

Open-Ended Responses

The thematic distribution of students' responses to the optional open-ended question regarding factors influencing their views on vaccination is shown in Figure 1. Responses were categorized into eight mutually exclusive themes.

Vaccine Delay or Non-Vaccination

In the secondary behavioral analysis, students who reported previous vaccine delay or non-vaccination were compared with those who did not report these behaviors. Students who selected "I do not remember" were excluded from this analysis. Differences were observed in scores for confidence and constraints, whereas no statistically significant differences were identified in scores for complacency, calculation, or collective responsibility (Supplementary Table 1).

Discussion

This study provides a multidimensional assessment of the psychological antecedents of vaccination among students in health vocational schools. The findings should be interpreted not only in relation to self-reported exposure to an infectious-disease course, but also to the broader context of students' vaccine-related experiences, reported behaviors, information needs, and professional roles as future healthcare personnel.

In the overall sample, confidence, calculation, and collective responsibility scores were relatively high, whereas complacency and constraints scores were lower. This pattern suggests that most participants perceived vaccination as a relevant preventive health behavior and recognized its potential social value. However, 29.9% of the students reported having previously delayed or not received a recommended vaccine. This proportion should not be interpreted as the prevalence of vaccine hesitancy because the questionnaire did not identify the vaccine involved, the reason for the decision, or the timing of the event. Nevertheless, it indicates that vaccine-related concerns and barriers may persist even among students receiving health-related education.

The present findings support the relevance of the 5C framework in this population. Students who reported a history of vaccine delay or non-vaccination had lower confidence scores and higher constraint scores than students without such a history. Confidence reflects trust in vaccine safety, effectiveness, and the health system that

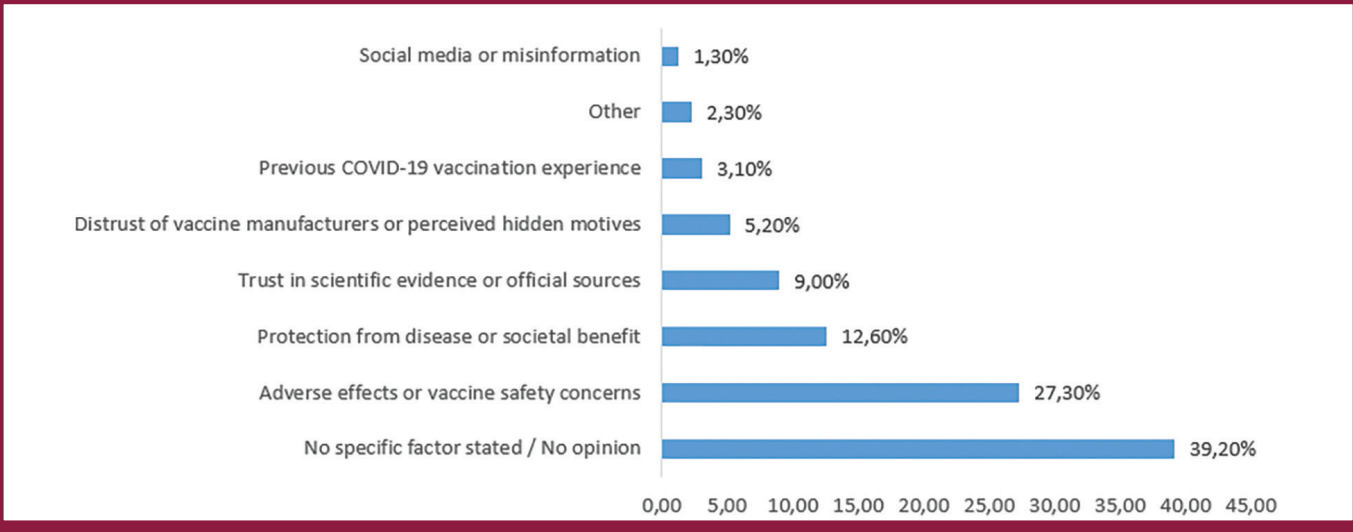


Figure 1. Factors influencing students' views on vaccination.
COVID-19, Coronavirus Disease-2019.

delivers vaccination, whereas constraints refer to perceived practical or psychological barriers that may interfere with vaccination behavior (4,5). Therefore, the observed pattern is conceptually consistent with the 5C model and suggests that reduced trust and perceived barriers may be particularly important targets for intervention among students at health vocational schools.

Studies among university students in other countries have similarly shown that confidence and collective responsibility are closely associated with vaccination intention. In a multicountry study of university students from the Netherlands, Belgium, and Portugal, confidence and collective responsibility were the 5C dimensions most strongly related to COVID-19 vaccination intention (9). Although that study focused on a specific vaccine during the pandemic and should not be directly compared numerically with the present findings, it supports the relevance of psychological antecedents beyond factual knowledge.

The findings should also be interpreted within the Turkish context. Vaccine hesitancy and vaccine refusal have received increasing public health attention in Türkiye, particularly during and after the COVID-19 pandemic. A pre-pandemic study by Yörük (6) among healthcare students in Türkiye reported childhood vaccine hesitancy in 10.0% of participants and measles vaccine hesitancy in 11.8% of participants. Negative beliefs regarding vaccine safety, including concerns about possible chronic health effects and mandatory vaccination, were associated with hesitancy (6). Although a direct numerical comparison is not appropriate because the present study assessed self-reported prior vaccine delay or non-vaccination rather than hesitancy toward specific childhood or measles vaccines, both studies indicate that vaccine-related concerns may persist among students preparing for healthcare professions.

In the present study, 29.9% of participants reported previously delaying or not receiving a recommended vaccine. This finding should not be interpreted as indicating the prevalence of vaccine hesitancy, because the specific vaccine, the reason for delay, and the timing of the decision were not assessed. However, lower confidence scores and higher constraints scores among these students support the relevance of trust- and barrier-related determinants of vaccination behavior in this population.

Previous Turkish studies among nursing and medical students have reported vaccine-related uncertainty, hesitancy, and concerns regarding vaccine safety, side effects, effectiveness, and trust (10). These studies frequently focused on COVID-19 vaccines, whereas the present study assessed psychological antecedents related to vaccination in general. Therefore, direct prevalence comparisons should be avoided. Nevertheless, the similarities in the themes identified are important, particularly because future healthcare personnel may influence vaccination decisions through communication with patients, informal counselling, and their own vaccination-related behaviors.

Comparable findings have also been reported internationally. In a recent Italian study of nursing, pediatric nursing, and midwifery students, 20.6% of participants reported having refused at least one recommended vaccine and 18.4% reported delaying vaccination for non-medical reasons (7). Although the Italian study used the Vaccination Attitudes Examination scale and assessed programme-specific groups of students, its findings are broadly consistent with the observation that vaccine-related concerns may persist among future healthcare professionals despite receiving health-related training. Similar to the present sample, the Italian cohort was predominantly female, reflecting the demographic composition of nursing- and midwifery-related educational programmes. The authors also observed higher vaccine knowledge and confidence among students at more advanced academic stages, supporting the potential importance of longitudinal educational exposure (7).

Direct numerical comparison with our study should nevertheless be made cautiously. Our outcome combined self-reported previous vaccine delay or non-vaccination and did not assess the specific vaccine, the medical indication, or the reason for the decision. The present study used the multidimensional 5C framework, whereas Buonomo et al. evaluated vaccine attitudes using the VAX scale. Despite these methodological differences, both studies indicate that health-related education alone may not eliminate vaccine-related concerns and that programme-specific and stage-specific educational approaches may be warranted.

The open-ended responses provide additional context for the quantitative findings. Among students who identified a specific factor influencing their views on vaccination, concerns regarding adverse effects or vaccine safety were the most frequently reported themes. This finding is consistent with international literature among university students and healthcare-related populations, in which vaccine safety concerns, misinformation, uncertainty about effectiveness, and accessibility barriers have repeatedly been identified as important determinants of vaccine hesitancy (11,12). The predominance of safety-related concerns in the present study suggests that vaccine education should include clear discussion of expected post-vaccination reactions, rare serious adverse events, vaccine safety-monitoring systems, and the balance between vaccine-related risks and the risks of vaccine-preventable diseases.

Although social media and misinformation were less frequently identified as the single most influential factors

in the open-ended responses, this should not be interpreted as evidence that misinformation plays a limited role. Participants were asked to identify one dominant factor; however, misinformation may indirectly contribute to safety concerns, distrust, and distorted risk perceptions. Vaccine communication training should therefore include the evaluation of online information, recognition of misleading claims, and use of reliable national and international scientific sources.

The demographic composition of the sample should also be considered. Female students constituted 82.5% of the participants. This predominance reflects the sex distribution of the programs represented at the institution rather than an unexpected sampling imbalance. Sex was included as a covariate in the adjusted analyses; however, the relatively small number of male students precluded robust sex-stratified analyses. Existing literature suggests that sex-related differences in vaccine attitudes may vary across populations, vaccine types, study periods, and sociocultural contexts (13). Therefore, the findings should not be generalized as evidence of sex-specific attitudes toward vaccination.

The course-related findings should be interpreted within this broader student profile. After adjustment for age, class year, sex, academic programme group, and graduation from a health vocational high school, a self-reported history of taking an infectious diseases course was associated with lower constraint scores and higher collective responsibility scores. Calculation scores were also higher among students reporting course exposure, although this association did not remain significant after correction for multiple comparisons. No independent association was observed between course status and either confidence or complacency.

The association between course exposure and lower constraints may be educationally relevant. Constraints include perceived barriers that may prevent individuals from translating favorable vaccine attitudes into vaccination behavior. Infectious diseases education may contribute to students' understanding of vaccine indications, access pathways, expected adverse effects, vaccine safety surveillance, and the rationale for national immunization recommendations. Similarly, higher collective responsibility scores among students reporting course exposure may reflect greater awareness of vaccination as a means of protecting vulnerable individuals and supporting community health.

Findings from the questionnaire suggest that structured vaccine-related education may not be uniformly available across the educational pathway. Only 23.5% of participants reported previous formal or scientific vaccine-related education outside the infectious diseases course, while approximately one-third reported encountering individuals with vaccine hesitancy or vaccine refusal during clinical practice or internship. These findings indicate that students may encounter vaccine-related questions before graduation and before receiving structured training in vaccine communication.

Health vocational high schools may represent an important setting for earlier vaccine-related education. Basic concepts related to vaccine-preventable diseases, immunization, vaccine safety, expected adverse effects, and reliable health information could be incorporated into biology and health-related courses. At this stage, the aim should not be limited to increasing factual knowledge. Students should also learn how to interpret risk-benefit information, recognize misinformation, distinguish expected post-vaccination reactions from serious adverse events, and understand the societal benefits of vaccination.

At the postsecondary level, vaccine-related content may be revisited longitudinally within infectious diseases courses, preventive health teaching, and clinical placements. Educational interventions should avoid relying solely on a knowledge-deficit approach. Reviews of vaccine hesitancy education among medical students suggest that more effective approaches combine knowledge, communication skills, and attitudes through interactive and practice-based methods (8). Case-based discussions, analysis of common misinformation narratives, simulated communication with hesitant individuals, and risk-benefit counselling exercises may therefore be more useful than lecture-based teaching alone.

Study Limitations

The study has several limitations. First, it was conducted at a single institution and relied on voluntary participation, which may limit generalizability. Although 427 questionnaire records were obtained from a target population of approximately 2,500 students, the final analytic sample represented 15.5% of the target population. Therefore, participation bias cannot be excluded; students with stronger opinions about vaccination, greater interest in infectious diseases or vaccine-related topics, or higher engagement with online surveys may have been more likely to participate. Second, the predominance of female students reflects the institutional student population but limits the precision of conclusions regarding male students. Third, the cross-sectional design precludes causal inference about the potential effect of infectious disease education. Fourth, vaccine delay or non-vaccination, course exposure and content, and clinical encounters with hesitant individuals were self-reported and may have been affected by recall bias. Fifth, the perceived course impact items

were developed by the investigators and should not be interpreted as constituting a fully validated scale. Finally, the collective responsibility subscale showed lower internal consistency than the other 5C subscales, and the open-ended responses were descriptively categorized rather than evaluated through a formal qualitative methodology.

Conclusion

Vaccine-related concerns and behaviors indicative of vaccine hesitancy were observed among students in health vocational schools. Lower confidence and higher perceived constraints were associated with self-reported vaccine delay or non-vaccination. Self-reported exposure to an infectious diseases course was associated with lower constraints and higher collective responsibility. Educational strategies addressing vaccine safety, adverse-event communication, misinformation, practical barriers to vaccination, and collective responsibility may help strengthen vaccination-related competencies among future healthcare personnel.

Ethics

Ethics Committee Approval: The study protocol was approved by the University of Health Sciences Türkiye, Hamidiye Non-Interventional Scientific Research Ethics Committee (decision number: 6/39; protocol number: 26/313; date: April 28, 2026).

Informed Consent: Electronic informed consent was obtained from all participants prior to participation in the study.

Footnotes

Authorship Contributions

Concept: Y.D., Design: Y.D., Data Collection or Processing: Y.D., R.A.D., Analysis or Interpretation: Y.D., R.A.D., Literature Search: Y.D., R.A.D., Writing: Y.D., R.A.D.

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Supplementary File 1 Link: https://d2v96fxpocvxx.cloudfront.net/beb8919b-f013-4ea1-b1c8-40332e840fe1/content-images/bb3f95f5-ad8b-4c90-b555-a68865012eb4.pdf

Supplementary File 2 Link: https://d2v96fxpocvxx.cloudfront.net/beb8919b-f013-4aef-879d-904e277bab5c.pdf

Supplementary Table Link: https://d2v96fxpocvxx.cloudfront.net/f942abf9-a73b-4057-b48b-c3a4b7d0c2a5/content-images/71b615ee-580f-428e-a812-99a5d25f7dd4.pdf

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