

COVID-19, influenza, and pneumococcal vaccination awareness and uptake in geriatric patients: a cross-sectional study

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ABSTRACT

Aims: Respiratory tract infections are leading causes of morbidity and mortality in the geriatric population. The COVID-19 pandemic has reinforced the critical importance of vaccination against preventable respiratory diseases in elderly individuals. This study aimed to assess awareness levels, vaccination rates, and factors influencing vaccine acceptance for COVID-19, influenza, and pneumococcal vaccines among individuals aged ≥ 65 years.

Methods: This cross-sectional study was conducted between January 08, 2025, and February 28, 2025, involving patients aged ≥ 65 years who presented to the hospital for any reason. Structured interviews assessed vaccination history and awareness levels. Unvaccinated participants received standardized educational information about vaccine benefits and risks, followed by assessment of vaccination willingness. Demographic characteristics, educational level, and reasons for vaccine hesitancy were recorded. Statistical analysis was performed using SPSS v30.0, with Chi-square tests for categorical variables and $p < 0.05$ considered significant.

Results: Among 168 participants (mean age 71.9 ± 6.3 years, 52.4% female), vaccination rates were 96.4% for COVID-19, 59.5% for influenza (past year), and 14.9% for pneumococcal vaccine (past five years). Primary reasons for non-vaccination included lack of risk group awareness for pneumococcal (62.0%) and influenza vaccines (39.4%), while perceived vaccine inefficacy dominated COVID-19 hesitancy (85.7%). However, the COVID-19 unvaccinated subgroup was very small ($n=6$), limiting the robustness of statistical analysis for this vaccine. Higher educational level significantly correlated with influenza ($p=0.032$) and pneumococcal vaccination ($p=0.018$). Post-education, willingness to be vaccinated increased substantially: influenza 64.1%, pneumococcal 74.2%, and COVID-19 100%. It should be noted that this study measured vaccination intention rather than actual vaccine uptake.

Conclusion: Significant disparities exist in vaccination awareness and uptake across different vaccines in the geriatric population. However, as a single-center study focusing only on hospital-attending elderly adults, the generalizability of findings may be limited. Targeted educational interventions demonstrate substantial potential for improving vaccine acceptance intention. These findings highlight the need for healthcare provider-led education programs and policy initiatives to address knowledge gaps and enhance preventive care in this high-risk population.

Keywords: Geriatrics, COVID-19 vaccine, influenza vaccine, pneumococcal vaccine, vaccination awareness, vaccine hesitancy

INTRODUCTION

The geriatric population, defined as individuals aged 65 years and older, represents a particularly vulnerable group to infectious diseases due to age-related immune system decline (immunosenescence) and increased prevalence of chronic comorbidities. Immunosenescence involves progressive deterioration of immune function, including decreased T-cell proliferation and differentiation, reduced B-cell antibody production, impaired antigen presentation, and diminished vaccine-induced antibody responses, all of which contribute to increased susceptibility to infections and reduced vaccine efficacy in elderly individuals.¹ This demographic faces

elevated risks from respiratory tract infections, including COVID-19, influenza, and pneumococcal diseases, which can result in significant morbidity and mortality.² These infections contribute to increased hospitalization rates, heightened complication risks, and impose substantial burdens on healthcare systems among elderly populations.³

Vaccination is recognized as one of the most effective evidence-based public health strategies for preventing these diseases, playing a critical role in establishing both individual and community immunity.⁴ However, maximizing the protective benefits of vaccines depends on adequate awareness among

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individuals, comprehensive understanding of sociocultural, economic, and psychological factors influencing vaccine acceptance, and development of targeted interventions addressing these factors.⁵ In Türkiye, vaccination services for the elderly are primarily delivered through family medicine practices as part of the national immunization program, with influenza and pneumococcal vaccines provided free of charge to individuals aged 65 and older. Family physicians play a crucial role in identifying at-risk populations, providing vaccination counseling, and maintaining immunization records through the national health information system.

In recent years, particularly following the emergence of the COVID-19 pandemic in late 2019, which evolved into a global health crisis, awareness and attitudes toward vaccination among the elderly population have become central topics in academic research.⁶ While influenza and pneumococcal vaccines have long been integral components of routine immunization programs for protecting older adults, the rapid development and implementation of COVID-19 vaccines has introduced new dimensions to awareness dynamics in this age group.^{7,8}

Despite years of established use of influenza and pneumococcal vaccines, awareness rates for these immunizations demonstrate significant variations across countries and regions, correlating with healthcare policy effectiveness and the reach of public information campaigns.⁹ Conversely, the emergency authorization of COVID-19 vaccines and intensive media attention during the pandemic have heightened awareness of these vaccines among elderly individuals, while simultaneously introducing new challenges including vaccine hesitancy and misinformation.^{10,11}

Awareness rates extend beyond individual health literacy limitations, being influenced by multifaceted factors including healthcare system accessibility, scope and effectiveness of information campaigns, misinformation disseminated through platforms such as social media, and individual trust perceptions.¹² These factors become more complex within the geriatric population. For instance, age-related cognitive decline, limited access to technological tools, difficulties accessing healthcare services in rural areas, and communication barriers between elderly individuals and healthcare providers can negatively impact vaccine awareness and subsequently vaccination rates.¹³

This study aims to evaluate awareness rates regarding COVID-19, influenza, and pneumococcal vaccination in the geriatric age group, identify reasons for non-vaccination, and examine changes in vaccine acceptance following educational intervention. Additionally, the study investigates the impact of sociodemographic factors on vaccine awareness.

METHODS

Ethics

This study was conducted in accordance with the Declaration of Helsinki and designed within the framework of ethical principles. Ethical approval was obtained from the Balıkesir University Rectorate Health Sciences Non-interventional Researches Ethics Committee (Date: 07.01.2025, Decision No:

2025/16). All data were anonymized to ensure patient privacy and confidentiality. Informed consent forms were obtained from all participants regarding the purpose, content, and possible risks of the study.

Study Design and Setting

This descriptive, cross-sectional study was conducted between January 8, 2025, and February 28, 2025, among patients aged 65 years and older who presented to the hospital for any reason.

Participants and Selection Criteria

Inclusion criteria were defined as: age ≥ 65 years, intact cognitive function, ability to communicate effectively, and consent to participate in the study. Exclusion criteria included: presence of cognitive impairment, communication difficulties, and refusal to participate in the study.

Data Collection

Demographic characteristics (age, gender, marital status, educational level, occupation) and comorbid conditions were recorded for all participants. During history-taking, patients were questioned about their vaccination status for COVID-19 vaccines, influenza vaccination within the past year, and pneumococcal vaccination after age 65 or within the past five years.

For patients who had not received vaccines, reasons for non-vaccination were classified as follows; lack of awareness of being in a risk group, considering vaccination unnecessary/disbelief in vaccine efficacy, fear of injections, fear of vaccine side effects, and other reasons.

Educational Intervention

Unvaccinated elderly participants received standardized educational information regarding the effects of influenza, pneumococcal, and COVID-19 infections in this age group, complication risks, vaccine efficacy, indications, and side effects. The educational content comprised three main components: epidemiology and clinical significance of the diseases in elderly populations, vaccine mechanisms of action, efficacy and safety, and potential post-vaccination side effects and their management. The educational intervention was delivered to each patient with identical content through approximately 10-minute individual consultations. Following the educational intervention, participants were asked whether they would accept vaccination, and their responses were recorded.

Statistical Analysis

Sample size calculation was performed using G*power (Version 3.1.9.4) software. Effect sizes reported in studies evaluating vaccine awareness and acceptance in geriatric populations were reviewed. Based on studies by Ciblak et al.¹⁴ and Gazibara et al.,¹⁵ which reported influenza vaccination rates of 30-60% in geriatric populations and medium effect sizes ($d=0.3-0.7$) for the relationship between educational level and vaccine acceptance, a medium effect size (Cohen's $d=0.5$) was adopted for this study. Statistical significance was evaluated with a 95% confidence interval (standard confidence

level), 5% margin of error ($\alpha=0.05$, type 1 error probability), and 0.80 power ($\beta=0.20$, type 2 error probability), targeting a minimum of 160 participants. With 168 participants included in the study, final power analysis yielded 82.4%.

Data were analyzed using Statistical Package for Social Sciences (IBM SPSS, Armonk, NY, USA) v30.0 software. Descriptive statistical analysis methods were employed. Categorical variables were expressed as numbers and percentages, normally distributed numerical variables as mean $\pm$ standard deviation, and non-normally distributed numerical variables as median (minimum-maximum). Normality distribution was assessed using the Kolmogorov-Smirnov test. Chi-square test was used to evaluate relationships between categorical variables. Fisher's exact test was applied when the proportion of cells with expected values less than 5 exceeded 20% or when any cell had an expected value less than 1. For comparison of vaccination willingness before and after educational intervention, McNemar's test was used as it involved repeated measurements of the same individuals. Statistical significance level was set at $p<0.05$.

RESULTS

A total of 168 patients aged ≥ 65 years were included in the study. The mean age was 71.9 ± 6.3 years (range: 65-91), with 88 (52.4%) participants being female. Sociodemographic characteristics of the participants are presented in [Table 1](#). Regarding educational status, 82 (48.8%) participants were primary school graduates, 27 (16.0%) were high school graduates, 22 (13.0%) were university graduates, 22 (13.0%) were middle school graduates, and 10 (5.9%) were illiterate. In terms of marital status, 132 (78.6%) participants were married, 25 (14.9%) were widowed, and 11 (6.5%) were single.

Analysis of comorbid conditions revealed that the most frequently observed comorbidities were hypertension (47.6%, $n=80$), diabetes mellitus (30.3%, $n=51$), coronary artery disease (15.5%, $n=26$), hyperlipidemia (7.1%, $n=12$), chronic obstructive pulmonary disease (6.0%, $n=10$), and history of cancer (4.8%, $n=8$). Other chronic conditions such as renal failure and rheumatoid arthritis were observed at lower rates (3.0%, $n=5$ each).

Vaccination status analysis demonstrated that 162 (96.4%) patients had received COVID-19 vaccination, 100 (59.5%) had received influenza vaccination within the past year, while only 25 (14.9%) had received pneumococcal vaccination within the past five years ([Figure 1](#)).

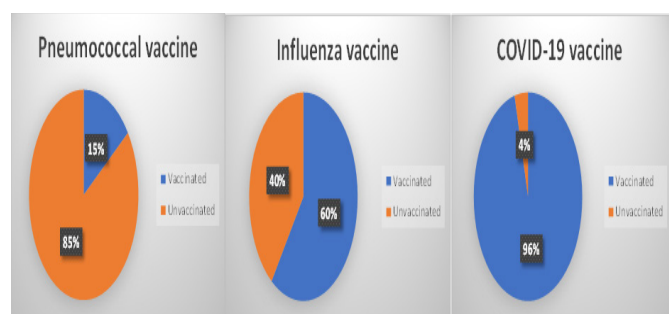


Figure 1. Vaccination rates for pneumococcal, influenza, and COVID-19 vaccines among patients

Table 1. Sociodemographic characteristics, occupational distribution, comorbidities, and educational status of participants ($n=168$)

Category	Number (n)	Percentage (%)
Age (years)		
Mean $\pm$ SD	71.9 $\pm$ 6.3	
Range	65-91	
Gender		
Female	88	52.4
Male	80	47.6
Marital status		
Married	132	78.5
Single	11	6.5
Divorced/widowed	25	14.8
Occupation		
Housewife	66	39.3
Farmer	17	10.1
Teacher	14	8.3
Civil servant	13	7.7
Tradesperson	11	6.6
Retired	9	5.4
Worker	7	4.2
Other	31	18.4
Comorbidities		
Hypertension	80	47.6
Diabetes mellitus	51	30.3
Coronary artery disease	26	15.5
Hyperlipidemia	12	7.1
COPD	10	6.0
Cancer	8	4.8
Renal failure	5	3.0
Rheumatoid arthritis	5	3.0
Educational level		
Illiterate	10	5.9
Primary school	82	48.8
Middle school	22	13.0
High school	27	16.0
University	27	16.0

SD: Standard deviation, COPD: Chronic obstructive pulmonary disease

When reasons for non-vaccination were examined, the most common reason among patients who had not received influenza vaccination was lack of awareness of being in a risk group (39.4%, $n=30$), followed by disbelief in vaccine efficacy/considering it unnecessary (30.0%, $n=23$), and concern about vaccine side effects (9.2%, $n=7$). For patients who had not received pneumococcal vaccination, the most frequent reason was also lack of awareness of being in a risk group (62.0%, $n=92$). Other reasons included disbelief in vaccine efficacy/considering it unnecessary (16.9%, $n=25$), concern about vaccine side effects (7.4%, $n=11$), and fear of injections (0.6%, $n=1$). Among patients who had not received COVID-19

vaccination, 85.7% (n=6) cited disbelief in vaccine efficacy/considering it unnecessary, while 14.2% (n=1) cited concern about vaccine side effects (Figure 2). However, it should be noted that the COVID-19 unvaccinated subgroup was extremely small (n=6), which significantly limits the statistical robustness of these findings.

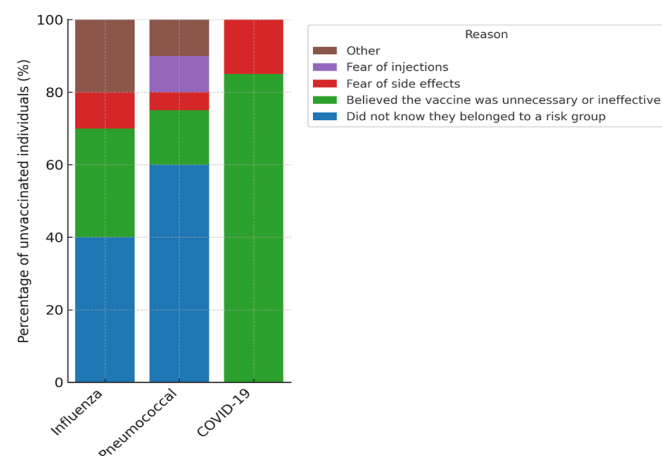


Figure 2. Reasons for not receiving influenza, pneumococcal, and COVID-19 vaccines among unvaccinated participants

Analysis of the relationship between educational level and vaccination status revealed that 55.2% (n=37) of those who had not received influenza vaccination, 47.8% (n=68) of those

who had not received pneumococcal vaccination, and 50.0% (n=3) of those who had not received COVID-19 vaccination were primary school graduates (Table 1, 2). A statistically significant association was found between educational level and influenza vaccination ($p=0.032$). Similarly, a significant relationship was observed between educational level and pneumococcal vaccination ($p=0.018$). Higher educational levels were associated with increased vaccination rates. The relationship between educational level and COVID-19 vaccination was not statistically significant ($p=0.094$) (Table 2).

When evaluating the relationship between presence of comorbid conditions and vaccination status, individuals with chronic diseases, particularly those with diabetes ($p=0.029$) and COPD ($p=0.007$), had significantly higher rates of influenza vaccination. A similar trend was observed for pneumococcal vaccination, although statistical significance was not reached ($p=0.058$). Detailed analysis of vaccination status according to comorbidity subgroups is presented in Table 3.

Following provision of information about vaccine effects, indications, and side effects, 64.1% (n=43) of those who had not received influenza vaccination, 74.2% (n=106) of those who had not received pneumococcal vaccination, and 100% (n=6) of those who had not received COVID-19 vaccination expressed willingness to be vaccinated.

Table 2. Association between educational level and vaccination status for influenza, pneumococcal, and COVID-19 vaccines

Educational level	Influenza vaccination		Pneumococcal vaccination		COVID-19 vaccination	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Illiterate (n: 10)	7 (70.0)	3 (30.0)	0 (0.0)	10 (100)	10 (100)	0 (0.0)
Primary school (n: 82)	45 (54.9)	37 (45.1)	14 (17.1)	68 (82.9)	79 (96.3)	3 (3.7)
Middle school (n: 22)	13 (59.1)	9 (40.9)	7 (31.8)	15 (68.2)	20 (90.9)	2 (9.1)
High school (n: 27)	17 (63.0)	10 (37.0)	2 (7.4)	25 (92.6)	26 (96.3)	1 (3.7)
University (n: 27)	19 (70.4)	8 (29.6)	3 (11.1)	24 (88.9)	27 (100)	0 (0.0)
Total (n: 168)	100 (59.5)	68 (40.5)	25 (14.9)	143 (85.1)	162 (96.4)	6 (3.6)
p-value	p: 0.032*		p: 0.018*		p: 0.094	

*Chi-square test; $p<0.05$ was considered statistically significant

Table 3. Association between comorbidities and vaccination status for influenza, pneumococcal, and COVID-19 vaccines

Comorbidity	Influenza vaccination		Pneumococcal vaccination		COVID-19 vaccination	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Hypertension (n: 80)	52 (65.0)	28 (35.0)	14 (17.5)	66 (82.5)	78 (97.5)	2 (2.5)
Diabetes mellitus (n: 51)	35 (68.6)	16 (31.4)	9 (17.6)	42 (82.4)	50 (98.0)	1 (2.0)
Coronary artery disease (n: 26)	18 (69.2)	8 (30.8)	5 (19.2)	21 (80.8)	26 (100)	0 (0.0)
Hyperlipidemia (n: 12)	8 (66.7)	4 (33.3)	2 (16.7)	10 (83.3)	12 (100)	0 (0.0)
COPD (n: 10)	9 (90.0)	1 (10.0)	3 (30.0)	7 (70.0)	10 (100)	0 (0.0)
Cancer (n: 8)	5 (62.5)	3 (37.5)	1 (12.5)	7 (87.5)	8 (100)	0 (0.0)
Renal failure (n: 5)	3 (60.0)	2 (40.0)	1 (20.0)	4 (80.0)	5 (100)	0 (0.0)
Rheumatoid arthritis (n: 5)	4 (80.0)	1 (20.0)	1 (20.0)	4 (80.0)	5 (100)	0 (0.0)
p-value (diabetes mellitus)	p: 0.029*		p: 0.058		p: 0.814	
p-value (COPD)	p: 0.007*		p: 0.112		p: 0.905	

*Chi-square test; $p<0.05$ was considered statistically significant, COPD: Chronic obstructive pulmonary disease

The difference between pre- and post-educational intervention vaccination willingness was evaluated using McNemar's test and found to be statistically significant for all three vaccine types (influenza: $p<0.001$; pneumococcal: $p<0.001$; COVID-19: $p=0.031$). Statistical analysis of vaccination status and associated factors in the geriatric age group is presented in **Table 4**. Regarding COVID-19 vaccination specifically, while the small number of unvaccinated patients ($n=6$) may limit statistical interpretation, the willingness to accept vaccination by all patients following educational intervention represents a clinically meaningful development. However, it is important to note that this study measured vaccination intention rather than actual vaccine uptake, and the intention-behavior gap documented in health behavior literature may result in lower actual vaccination rates.

DISCUSSION

This study presents significant findings regarding awareness levels and reasons for non-vaccination against COVID-19, influenza, and pneumococcal vaccines in the geriatric population. Our results demonstrate substantial differences in awareness and acceptance rates among vaccine types, significant improvement in vaccine acceptance following educational intervention, and the influential role of educational level on vaccination behavior. However, several limitations should be acknowledged. This single-center study focused exclusively on hospital-attending elderly adults, which may limit the generalizability of findings to the broader geriatric population, particularly those without regular healthcare access or residing in rural areas. Additionally, socioeconomic status and urban-rural residence patterns were not assessed, which may have provided additional insights into vaccination disparities.

In our study, COVID-19 vaccination was administered at a remarkably high rate of 96.4%, while influenza vaccination reached 59.5%, and pneumococcal vaccination was administered to only 14.9% of participants. The high COVID-19 vaccination rate can be attributed to the global urgency perception created by the pandemic, intensive media campaigns, government prioritization of vaccination programs, and facilitated vaccine access.¹⁶ Particularly during 2020-2023, the high mortality rate of COVID-19 in the elderly population may have increased this group's motivation toward vaccination.¹⁷ This finding is significant in demonstrating the impact of global health crises on vaccine acceptance and provides lessons for future vaccination campaigns.

The 59.5% influenza vaccination rate suggests that despite long-standing routine recommendations for this vaccine, complete acceptance has not been achieved and awareness gaps persist. Similarly, studies conducted in Türkiye and worldwide report influenza vaccination rates ranging between

30-60% in the geriatric population.^{14,15} These rates fall below the World Health Organization's target vaccination rate of 75% for individuals over 65 years.¹⁸ This situation indicates that national health policies should more strongly promote influenza vaccination for the elderly.

The low pneumococcal vaccination rate of 14.9% suggests that this vaccine is not adequately promoted in the geriatric population or is not integrated as a routine practice in healthcare systems. Although literature has proven that pneumococcal polysaccharide and conjugate vaccines are effective in preventing invasive pneumococcal disease and pneumonia in the elderly,¹⁹ the low rates in this study reveal the gap between awareness and implementation. Similarly, a study conducted in Türkiye reported pneumococcal vaccination rates of 7.9% in individuals over 65 years.²⁰ Pooled PPSV23 effectiveness against VT-IPD was 45% (95% CI: 37%, 51%; $I^2=0\%$) in older adults.²¹ The low implementation rate of such an effective preventive measure should be considered a significant public health concern.

Analysis of reasons for non-vaccination reveals different dynamics for each of the three vaccines. While the most common reason for influenza and pneumococcal vaccines was "lack of awareness of being in a risk group" (39.4% and 62%, respectively), the most frequent reason for COVID-19 vaccine was "disbelief in vaccine efficacy/considering it unnecessary" (85.7%). However, this finding for COVID-19 vaccine hesitancy should be interpreted with extreme caution given the very small sample size ($n=6$) of unvaccinated individuals, which may not be representative of broader hesitancy patterns. This finding may reflect the impact of widespread misinformation and anti-vaccine rhetoric during the pandemic, despite intensive information campaigns about COVID-19 vaccines.²² MacDonald and colleagues' study emphasized that vaccine hesitancy is a complex phenomenon influenced by contextual, individual, and vaccine-specific factors.²³ Hesitancy toward COVID-19 vaccines may be related to the rapid development process of the vaccine, use of new technologies, and unfounded claims spread on social media.

The high rate of lack of awareness of being in a risk group for pneumococcal vaccination (62%) suggests that this vaccine is not adequately promoted in the geriatric population and is not routinely recommended by healthcare professionals.²⁴ This finding indicates that healthcare workers should routinely assess vaccination status in geriatric patient evaluations and provide necessary recommendations. Nagata and colleagues' study demonstrated that direct recommendations by healthcare professionals play a decisive role in acceptance of less well-known vaccines, particularly pneumococcal vaccines.²⁵

Table 4. Change in willingness to be vaccinated before and after educational intervention

Vaccine type	Vaccinated before intervention n (%)	Willing to be vaccinated after intervention n (%)	Change n (%)	p-value
Influenza	100 (59.5)	143 (85.1)	43 (25.6)	$p<0.001^*$
Pneumococcal	25 (14.9)	131 (78.0)	106 (63.1)	$p<0.001^*$
COVID-19	162 (96.4)	168 (100.0)	6 (3.6)	$p=0.031^*$

*McNemar's test; $p<0.05$ was considered statistically significant

The relationship between educational level and vaccination status is noteworthy. For all three vaccine types, the majority of those who did not receive vaccination were primary school graduates (influenza: 55.2%, pneumococcal: 47.8%, COVID-19: 50%). This finding emphasizes the impact of low educational level on health literacy and access to healthcare services.²⁶ As education level increases, individuals' access to health information, comprehension capacity, and critical evaluation skills improve, which can positively influence vaccine acceptance.²⁷ Lorini and colleagues' systematic review confirmed the effect of health literacy on vaccine acceptance and noted that interventions aimed at improving health literacy could enhance vaccine coverage.²⁸ This finding highlights the importance of developing comprehensible and accessible educational materials for the geriatric population with low educational levels.

The effect of chronic disease presence on vaccination behavior is particularly noteworthy. Patients diagnosed with diabetes mellitus were found to receive influenza vaccination at significantly higher rates ($p=0.029$). Similarly, patients with COPD also received influenza vaccination at higher rates compared to other patients ($p=0.007$). This situation can be explained by more effective education of individuals with chronic diseases, particularly those with respiratory and metabolic diseases, by healthcare professionals regarding vaccination, and these patients' greater awareness of the risks that respiratory tract infections pose to them.^{22,24} Interestingly, similar increases in pneumococcal vaccination rates were not observed in the same chronic disease groups, suggesting that education regarding pneumococcal vaccination is more inadequate compared to influenza vaccination. Recent studies have shown that pneumococcal vaccination in COPD patients reduces acute exacerbations and hospitalizations.²⁹ Therefore, stronger emphasis on pneumococcal vaccination in clinical guidelines prepared for COPD patients and increasing healthcare professionals' awareness on this topic is important.

One of the most striking findings of our study was the significant increase in vaccine acceptance rates following educational intervention. Following education, 64.1% of those who had not received influenza vaccination, 74.2% of those who had not received pneumococcal vaccination, and 100% of those who had not received COVID-19 vaccination decided to accept vaccination. This result demonstrates that accurate and comprehensive education by healthcare professionals is an effective strategy in overcoming vaccine hesitancy.³⁰ The particularly high conversion rate for pneumococcal vaccination (74.2%) reveals that the low initial acceptance rate for this vaccine largely stems from lack of awareness and that this gap can be closed through targeted education. Jarrett and colleagues' systematic review noted that personalized, face-to-face education is one of the most effective methods for increasing vaccine acceptance.³¹ In light of these findings, it is recommended that vaccination programs for the geriatric population prioritize active participation of healthcare professionals and personalized education strategies.

While developing strategies to increase vaccine awareness in the post-pandemic period, lessons can be learned from factors that ensured high acceptance rates for COVID-19 vaccination.

Consideration should be given to how elements such as emergency perception, media campaigns, ease of access, and social solidarity can be integrated into other vaccination programs. Particularly, making pneumococcal vaccination part of routine elderly health checkups, developing vaccine reminder systems, and organizing community-based awareness campaigns could be effective strategies.

Special approaches should be developed for elderly individuals with low educational levels. Visual materials, brochures prepared in simple and understandable language, short videos, and education through community leaders may be more effective for this group. Additionally, technological solutions such as mobile health applications and telemedicine services may help reach elderly individuals, particularly those living in rural areas.

The strengths of this study include its comparative evaluation of three different vaccine types, direct measurement of the effect of educational intervention, and examination of the impact of sociodemographic factors on vaccine awareness. Our study is among those that quantitatively evaluate the effect of education on vaccine acceptance using a standardized educational protocol. However, the study has several limitations. First, the study was conducted at a single center, and findings may not be generalizable to the entire geriatric population. Patients included in our study were individuals who already had access to healthcare services and had presented to a healthcare institution; therefore, vaccine awareness and acceptance levels of elderly individuals without access to healthcare services or those who do not present to healthcare facilities may differ. Second, whether the decision to vaccinate following education translated into actual vaccine administration was not followed up. This situation, known as the intention-behavior gap, refers to the difference between individuals stated intentions and actual behaviors, and examination of this relationship is recommended in future studies. Finally, psychological, cultural, and social aspects of vaccine hesitancy were not examined in depth. In future studies, more comprehensive evaluation of these factors using qualitative research methods would be beneficial.

Future studies should be designed to encompass broader and more heterogeneous populations, evaluate long-term effects of interventions aimed at increasing vaccine awareness, and examine the multidimensional nature of vaccine hesitancy more deeply. Additionally, evaluation of the effectiveness of innovative intervention strategies such as mobile health applications, remote education modules, and community-based approaches is recommended. Particularly, increasing awareness of pneumococcal vaccination is critically important in reducing morbidity and mortality due to pneumococcal infections in the geriatric population.

Limitations

In subgroup analyses, particularly for comorbidity groups with small sample sizes (Chronic obstructive pulmonary disease (COPD) $n=10$, cancer $n=8$, renal failure $n=5$, rheumatoid arthritis $n=5$), analyses were considered exploratory and results were interpreted cautiously. Similarly, due to the small number of patients who had not received COVID-19

vaccination (n=6), statistical analyses for this group may have limited power, and findings were interpreted carefully.

CONCLUSION

This study demonstrates that awareness levels regarding COVID-19, influenza, and pneumococcal vaccination in the geriatric population vary significantly by vaccine type, with the primary reasons for vaccine refusal being lack of knowledge, distrust in vaccine efficacy, and fear of side effects. Patient education emerges as an effective strategy for overcoming these barriers, while low educational level shows a strong association with vaccine hesitancy. However, it is important to note that this study measured vaccination intention rather than actual vaccine uptake, and the single-center design limits generalizability to the broader geriatric population. Based on our findings, the following recommendations can be developed: Routine assessment of vaccination status and recommendation of necessary vaccines during geriatric health checkups should become standard practice for healthcare professionals. Awareness campaigns should be organized specifically for pneumococcal vaccination, emphasizing the importance of this vaccine. Elderly individuals with chronic diseases, particularly those with diabetes and COPD, should receive specialized education regarding regular vaccination. Comprehensible and accessible educational materials should be developed for the geriatric population with low educational levels. In the post-pandemic period, similar strategies should be applied to other vaccination programs by leveraging factors that ensured high acceptance rates for COVID-19 vaccination. In conclusion, efforts to increase vaccine awareness and acceptance intention in the geriatric population should be prioritized in public health initiatives for protecting elderly health and reducing morbidity and mortality from infectious diseases. In this vulnerable population where immunosenescence and comorbidities are prevalent, vaccination should be positioned as an indispensable component of healthcare services, representing the most effective means of protection against vaccine-preventable diseases.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Balıkesir University Rectorate Health Sciences Non-interventional Researches Ethics Committee (Date: 07.01.2025, Decision No: 2025/16).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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