

Evaluation of post-vaccination pneumonia incidence in patients receiving pneumococcal vaccine administered by home health care services

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ABSTRACT

Objective: Individuals receiving home health care services often constitute a group with multiple chronic conditions, limited physical mobility, and restricted access to healthcare facilities. Immunization services are therefore critical for preventing infections in this population. Therefore, this study aimed to evaluate the frequency of pneumonia and related hospitalization rates after pneumococcal vaccination in patients receiving home healthcare services.

Methods: A retrospective study was conducted at the Home Health Care Unit of Prof. Dr. Cemil Taşcıoğlu City Hospital, by reviewing the records of 125 patients who had received pneumococcal vaccination at home between June and September 2023. For each patient, the number of pneumonia episodes and hospitalization status before and after vaccination were compared.

Results: A total of 125 patients were included in the study, consisting of 85 (68.0%) females and 40 (32.0%) males. Regarding age stratification, 9 (7.2%) patients were under 65 years of age, while 116 (92.8%) patients were 65 years of age and older. The mean number of pneumonia episodes decreased significantly from 1.68 ± 1.42 before vaccination to 0.44 ± 0.66 after vaccination, corresponding to an approximately 73.5% reduction ($p < 0.001$). After vaccination, patients had substantially lower odds of developing pneumonia (matched OR 12.40). A similar improvement was observed in hospitalization rates, which decreased from 17.6% before vaccination to 7.2% afterward ($p = 0.019$). Hospitalization odds were about threefold lower after vaccination.

Conclusion: Our study shows that pneumococcal vaccination among home health care patients was associated with a significant reduction in pneumonia episodes and pneumonia-related hospitalizations. Given the uncontrolled pre-post design, these associations should not be interpreted as direct causal effects. The improvement observed after vaccination suggests that pneumococcal immunization is clinically important for high-risk individuals and should be expanded among similar risk groups. To maximize protection, healthcare providers should routinely screen the immunization status of home healthcare patients and integrate pneumococcal vaccination into standard homecare protocols as a priority preventive measure.

Keywords: Home care services, pneumococcal vaccine, pneumonia, immunization

Introduction

Pneumonia is a serious infection of the lower respiratory tract characterized by inflammation, exudation, and consolidation within the alveoli.^[1] Community-acquired pneumonia (CAP) is the most common form and represents a major cause of morbidity and mortality, particularly among older adults and individuals with chronic illnesses or immunosuppressive conditions.^[2,3] Most CAP cases are caused by *Streptococcus pneumoniae*, whose virulence depends on its ability to evade host immune defenses through mechanisms involving capsular polysaccharides, pneumolysin, and surface adhesins.^[4] Additionally, increasing antibiotic resistance and the age-related decline in immune response make pneumococcal infections more difficult to control.^[5,6]

Globally, pneumonia remains one of the leading causes of death due to infectious diseases. According to data from the World Health Organization, approximately 2.5 million people die from pneumonia each year.^[7] A significant proportion of these deaths occur in individuals aged 65 years and older, as well as in those with chronic comorbidities such as diabetes mellitus, chronic obstructive pulmonary disease (COPD), and heart failure.^[8,9] Pneumonia is not limited to an acute infectious episode; in the long term, it can lead to complications that decrease quality of life and increase health care costs.^[10,11]

Individuals receiving home health care services represent a specific risk group for pneumonia. Factors such as advanced age, limited mobility, swallowing disorders, malnutrition, and frequent antibiotic use increase the likelihood of developing pneumonia in this population. Furthermore, low vaccination rates and challenges in regular follow-up among home health care patients make infection control more complex. Therefore, preventive strategies and continuous monitoring

programs are essential to reduce pneumonia risk in this vulnerable group.^[12]

Vaccination is one of the most effective preventive strategies against pneumococcal infections. In adults, conjugate (PCV13, PCV20) and polysaccharide (PPV23) vaccines have been shown to reduce the incidence of severe pneumococcal infections and hospitalization rates, particularly in older adults and those with chronic diseases. Immunization not only provides individual protection but also contributes to reducing the overall pneumonia burden at the community level.^[13-15]

This study aimed to evaluate the frequency of pneumonia and related hospitalization rates after pneumococcal vaccination in patients receiving home healthcare services.

Materials and Methods

This study was designed as a retrospective cohort and conducted at the Home Health Care Unit of Prof. Dr. Cemil Taşcıoğlu City Hospital. Records of patients who received pneumococcal vaccination at home and met the inclusion criteria were reviewed. To evaluate post-vaccination pneumonia development, the inclusion criterion required at least six months to have passed since the date of vaccination. The pre-vaccination observation window was defined as the 24-month period preceding the vaccination date. The post-vaccination follow-up ranged from 6 to 15 months (median, 6 months). Pneumonia episodes occurring during this follow-up period were recorded.

Inclusion criteria

Patients were included if they met all of the following: (i) received pneumococcal (PCV13) vaccination at home by the Home Health Care Unit between June and September 2023; (ii) at least six months had elapsed since vaccination at the time

of data collection; (iii) complete medical records were available in the unit database and the Hospital Information System; and (iv) at least one documented clinical follow-up after vaccination. Patients with incomplete records or without any post-vaccination follow-up were excluded. In total, 125 vaccinated individuals met these criteria and were included in the analysis.

Data were obtained from the Home Health Care Unit's standard patient record forms and the Hospital Information System. Recorded variables included patients' demographic characteristics (age, sex), comorbidities, type of pneumococcal vaccine administered (all patients were vaccinated with PCV13), as well as all pneumonia diagnoses and hospital admissions due to pneumonia before and after vaccination. The diagnosis of pneumonia was based on physicians' documented diagnoses in home healthcare or hospital records and, when available, was confirmed by clinical and radiological findings.

The study was approved by the Ethics Committee of Prof. Dr. Cemil Taşcıoğlu City Hospital (Date: 03.12.2024, Decision No: 271). As this was a retrospective record review, no direct contact with patients occurred, and informed consent was not required.

Data analysis was performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as mean $\pm$ standard deviation, median (minimum-maximum), and interquartile range (IQR) for continuous variables, and as number (n) and percentage (%) for categorical variables. The distribution of continuous variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Nonparametric tests were applied for variables not normally distributed.

For within-subject comparisons of continuous variables before and after vaccination, the Wilcoxon Signed-Rank test was used. The McNemar

test was applied for paired categorical variables (such as presence of pneumonia or hospitalization due to pneumonia). Comparisons between two independent groups were made using the Mann-Whitney U test, and comparisons among three or more groups were analyzed using the Kruskal-Wallis H test. Differences between categorical variables were evaluated using the Chi-square test or Fisher's Exact test when appropriate. Correlations between continuous variables were assessed using Spearman correlation analysis.

No a priori sample-size or power calculation was performed; all patients meeting the inclusion criteria during the study period were enrolled (total sampling). A p-value < 0.05 was accepted as statistically significant for all tests.

Results

The study included 125 patients with a mean age of 80.91 ± 11.12 years (range: 33–103), and a median age of 82 years. As presented in Table 1, 7.2% of the participants (<65 years) were in the young-middle-aged group, while 92.8% (≥ 65 years) belonged to the elderly group. Among them, 68.0% (n = 85) were female and 32.0% (n = 40) were male.

Table 1. Descriptive characteristics of the patients (n = 125).

Variables		
Age (years) Median (Min–Max)	82.0 (33.0-103.0)	
	n	%
Age group (years)		
<65 (Young-Middle aged)	9	7.2
≥ 65 (Elderly)	116	92.8
Gender		
Female	85	68.0
Male	40	32.0
Survival Status		
Alive	94	75.2
Deceased	31	24.8

n = Number, = Frequency, Median = Midpoint, Min = Minimum, Max = Maximum.

Regarding survival status, 75.2% (n = 94) of the patients were alive, whereas 24.8% (n = 31) had died during the follow-up period after vaccination.

According to Table 2, the number of chronic diseases per patient ranged from 1 to 6, with a mean of 3.52 ± 1.56 and a median of 4.0. Among the 125 patients included in the study, a total of 444 chronic disease diagnoses were recorded. Hypertension was the most common condition, affecting 80.0% (n = 100) of patients, followed by diabetes mellitus (46.4%; n = 58), hyperlipidemia (24.8%; n = 31), Alzheimer's disease/dementia (25.6%; n = 32), cerebrovascular disease (23.2%; n = 29), arrhythmia (16.0%; n = 20), and heart failure (16.8%; n = 21). Among respiratory diseases, COPD was present in 19.2% (n = 24) and asthma in 8.0% (n = 10). Overall, these findings indicate a high burden of chronic comorbidities, particularly cardiovascular and neurological disorders.

Table 3 presents the distribution of pneumonia episodes before vaccination. The mean number of pneumonia cases was 1.68 ± 1.42 (range: 0–8), with a median of 1.0. Overall, 18.4% (n = 23) of the patients had no history of pneumonia, whereas 64.0% (n = 80) had experienced pneumonia managed on an outpatient basis. Additionally, 10.4% (n = 13) had both outpatient and hospitalization-requiring pneumonia, and 7.2% (n = 9) had pneumonia requiring hospitalization only. Before vaccination, 17.6% (n = 22) of patients had been hospitalized due to pneumonia.

Table 4 summarizes the distribution of pneumonia episodes after vaccination. The mean number of pneumonia cases was 0.44 ± 0.66 (range: 0–3), with a median of 0.0. Following vaccination, 64.0% (n = 80) of patients did not develop pneumonia, 28.8% (n = 36) experienced outpatient-treated pneumonia, 3.2% (n = 4) had both outpatient and

Table 2. Distribution of chronic diseases observed in patients (n = 125).

Chronic diseases*	n	Responses (%)	Cases (%)
Hypertension	100	22.5	80
Diabetes Mellitus	58	13.1	46.4
Heart Failure	21	4.7	16.8
Coronary Artery Disease	10	2.3	8
Arrhythmia	20	4.5	16
Hyperlipidemia	31	7	24.8
COPD	24	5.4	19.2
Asthma	10	2.3	8
Chronic Kidney Disease	14	3.2	11.2
Cerebrovascular Disease	29	6.5	23.2
Alzheimer's Disease/Dementia	32	7.2	25.6
Parkinson's Disease	6	1.4	4.8
Epilepsy	9	2	7.2
Depression	4	0.9	3.2
Rheumatologic Diseases (RA, AS, SLE)	6	1.4	4.8
Osteoporosis	2	0.5	1.6
Urinary Incontinence	11	2.5	8.8
Cancers (colon, breast, lung, stomach)	9	2	7.2
Other Rare Diagnoses	20	4.5	16
Total	444	100	355.2

n = Number, = Frequency. *Since multiple responses were allowed, the total n exceeds the sample size.

hospitalization-requiring pneumonia, and 4.0% (n = 5) had pneumonia requiring hospitalization only. Regarding post-vaccination hospitalizations, 92.8% (n = 116) of patients were not admitted, while 7.2% (n = 9) required hospitalization.

Table 5 presents a significant reduction in pneumonia episodes after vaccination. The mean

number of pneumonia cases decreased from 1.68 ± 1.42 before vaccination to 0.44 ± 0.66 afterward, and this difference was statistically significant ($p < 0.001$). The median number declined from 1.0 (IQR = 1.0) to 0.0 (IQR = 1.0). Additionally, the number of patients who experienced pneumonia episodes significantly decreased from 102 (81.6%)

Table 3. Characteristics of patients regarding pneumonia and hospitalization before vaccination (n = 125).

Variables		
Numbers of pneumonias (pre-vaccine) Mean $\pm$ SD	1.68 $\pm$ 1.42	
	n	%
Pneumonia status (pre-vaccine)		
No Pneumonia	23	18.4
Outpatient	80	64.0
Outpatient + Hospitalization	13	10.4
Hospitalization	9	7.2
Hospitalization (pre-vaccine)		
No	103	82.4
Yes	22	17.6

n = Number, = Frequency, Mean = Average, SD = Standard Deviation.

Table 4. Post-vaccination pneumonia and hospitalization characteristics of patients (n = 125).

Variables		
Numbers of pneumonias (post-vaccine) Mean $\pm$ SD	0.44 $\pm$ 0.66	
	n	%
Pneumonia status (post-vaccine)		
No Pneumonia	80	64.0
Outpatient	36	28.8
Outpatient + Hospitalization	4	3.2
Hospitalization	5	4.0
Hospitalization (post-vaccine)		
No	116	92.8
Yes	9	7.2

n = Number, = Frequency, Mean = Average, SD = Standard Deviation.

Table 5. Comparison of the number of pneumonia episodes before and after vaccination (n = 125).

Variables	Pre-vaccine	Post-vaccine	p
Patients with Pneumonia episodes, n(%)	102(81.6)	45(36.0)	
Numbers of Pneumonia, Mean $\pm$ SD	1.68 $\pm$ 1.42	0.44 $\pm$ 0.66	<0.001
Numbers of Pneumonia, Median (IQR)	1.0 (1.0)	0.0 (1.0)	

Wilcoxon Signed Ranks Test, $p < 0.05$. According to the mean values, a 73.5% reduction in pneumonia frequency after vaccination was calculated (Reduction (%) = [(Pre-vaccination mean - Post-vaccination mean) / Pre-vaccination mean] $\times$ 100).

before vaccination to 45 (36%) afterward. Overall, the frequency of pneumonia decreased by approximately 73.5% following vaccination.

The comparison of pneumonia cases and hospitalizations before and after vaccination was performed using the McNemar test (Table 6). Among the 102 patients who had pneumonia prior to vaccination, 62 (60.8%) did not experience recurrence afterward, while pneumonia developed in 5 (21.7%) of the 23 patients without a previous history. This decrease was statistically significant ($p < 0.001$), with a matched odds ratio of 12.40 (95% CI: 4.99–30.84), corresponding to markedly lower odds of pneumonia in the post-vaccination period; because of the observational design, this should not be read as a causal risk reduction. Regarding hospitalizations, 20 of the 22 patients (90.9%) who had been hospitalized previously did not require readmission, whereas 7 of 103 patients (6.8%) without prior hospitalization were admitted later. This difference was also significant ($p = 0.019$). The matched odds ratio was 2.86 (95% CI: 1.21–6.76), suggesting that the

odds of hospitalization decreased nearly threefold post-vaccination. Overall, all variables showed OR values greater than 1, confirming a statistically significant decline in both pneumonia incidence and hospitalization frequency after vaccination.

In Table 7, patients who developed pneumonia after vaccination ($n = 45$) and those who did not ($n = 80$) were compared in terms of clinical characteristics. The mean number of comorbidities was 3.45 ± 1.52 in patients without pneumonia and 3.62 ± 1.62 in those with pneumonia, and this difference was not statistically significant ($p = 0.610$). Regarding COPD, in the non-pneumonia group, 70 (87.5%) patients did not have COPD, while 10 (12.5%) did; in the pneumonia group, 31 (68.9%) patients did not have COPD, whereas 14 (31.1%) did. The difference between the two groups was statistically significant ($p = 0.011$), indicating that despite the overall protective effect of vaccination, patients with COPD continued to have a higher risk of developing pneumonia compared to those without COPD.

Table 6. Comparison of patients' pneumonia and hospitalization status before and after vaccination ($n = 125$).

Post-Vaccination Pneumonia	Pre-Vacc. No ($n=23$)	Pre-Vacc. Yes ($n=102$)	p	Matched OR (95% CI)
No ($n=80$)	18 (78.3)	62 (60.8)	<0.001	12.40 (4.99–30.84)
Yes ($n=45$)	5 (21.7)	40 (39.2)		
Post-Vaccination Hospitalization	Pre-Vacc. No ($n=103$)	Pre-Vacc. Yes ($n=22$)		
No ($n=116$)	96 (93.2)	20 (90.9)	0.019	2.86 (1.21–6.76)
Yes ($n=9$)	7 (6.8)	2 (9.1)		

McNemar test, $p < 0.05$. Values are n (%).

Table 7. Comparison of clinical characteristics of patients according to post-vaccination pneumonia status ($n = 125$).

Variables	No pneumonia ($n=80$)	Pneumonia ($n=45$)	p
Numbers of Comorbidities, Mean $\pm$ SD	3.45 $\pm$ 1.52	3.62 $\pm$ 1.62	0.610a
Numbers of Comorbidities, Median (IQR)	3.5 (3.0)	4.0 (3.0)	
COPD, n (%)			
No	70 (87.5)	31 (68.9)	0.011b
Yes	10 (12.5)	14 (31.1)	

a = Mann-Whitney U test, b = Pearson Chi-Square test.

Discussion

A significant reduction in pneumonia frequency was observed following vaccination in the present study population. Among the 125 patients analyzed, only 23 (18.4%) had never experienced pneumonia before vaccination, whereas after vaccination, the number of patients without pneumonia increased to 80 (64%). The mean number of pneumonia episodes decreased from 1.68 to 0.44, corresponding to an approximately 73.5% reduction, which was statistically significant. When compared with the literature, the CAPiTA study conducted in the Netherlands reported that PCV13 reduced pneumococcal pneumonia caused by vaccine serotypes by 45.56% and provided 75% protection against invasive pneumococcal disease.^[16]

Another study found that PCV13 provided 61.5% protection against invasive pneumococcal diseases caused by all PCV13 serotypes, and although the effectiveness was lower against more resistant serotypes such as serotype 3 (46.3%), it still demonstrated a protective effect.^[17] The findings of the present study are consistent with these results.

Hospitalizations following pneumonia episodes significantly increase morbidity, particularly in older adults and those with multiple comorbidities, and impose a financial burden on healthcare systems.^[18] Before vaccination, 22 of the 125 patients (17.6%) in this study were hospitalized due to pneumonia, whereas after vaccination, this number decreased to 9 (7.2%), representing a statistically significant reduction, indicating a measurable protective effect of vaccination. Similar findings have been reported in the literature. In Taiwan, Tsai et al. reported a 60% reduction in pneumonia-related hospitalizations among older adults vaccinated with PPV23 under the national immunization program.^[19] In a large U.S. cohort study of individuals aged ≥ 65 years, Hsiao et al. found a significant 10% decrease in all-

cause pneumonia-related hospitalizations and a 9.4% reduction in lower respiratory tract infection hospitalizations following PCV13 vaccination.^[20] In Italy, Baldo et al. reported that one-year survival rates among individuals aged ≥ 65 years hospitalized for community-acquired pneumonia were 83.6% in the unvaccinated group, 85.9% in the PPV23 group, and 89.3% in the PCV13 group.^[21] Therefore, our findings are consistent with studies suggesting that pneumococcal vaccination in comparable populations is associated with lower pneumonia frequency and fewer hospitalizations.

Although the patients in our study had a mean of 3.5 chronic diseases, no significant correlation was found between the number of comorbidities and the frequency of pneumonia. However, the literature reports varying results on this issue. In a population-based cohort study conducted by Ochoa-Gondar et al. in Spain among individuals aged ≥ 50 years, the incidence of pneumococcal pneumonia increased progressively with the number of comorbidities: 42.1 per 100,000 person-years in those with no comorbidities, 89.9 in those with one, 201.1 in those with two, 350.9 in those with three, 594.3 in those with four, and 761.2 in those with five or more. These findings indicate that as the comorbidity burden increases, the risk of developing pneumococcal pneumonia rises proportionally, and that individuals with multiple diseases should be prioritized for vaccination.^[22] Similarly, in a retrospective cohort study conducted by Campling et al. in the United Kingdom, individuals with comorbid diseases were shown to have a significantly higher likelihood of developing community-acquired pneumonia requiring hospitalization compared to those without underlying conditions. The risk of pneumonia was markedly higher among individuals with chronic respiratory, cardiac, hepatic, and renal diseases as well as diabetes; the odds ratios ranged from 1.18 for diabetes up to 5.48 for chronic respiratory disease. These findings demonstrate that the presence of comorbid diseases has a strong impact

on pneumonia development.^[23] It is plausible that the vaccine reduced pneumonia incidence across all comorbidity groups, thereby diminishing any observable association. Additionally, since all patients had at least one chronic disease, the absence of a non-comorbid control group may have limited the ability to distinguish differences in pneumonia risk related to comorbidity status. Therefore, although our study did not identify a statistically significant relationship, existing evidence supporting comorbidity as an independent risk factor must be acknowledged, and these patient groups should remain a priority in vaccination programs.

Chronic obstructive pulmonary disease (COPD) was present in 24 of the 125 patients (19.2%) included in the study. The presence of COPD was found to be more common among those who developed pneumonia after vaccination (12.5% in patients without pneumonia vs. 31.1% in those with pneumonia), and this difference was statistically significant. However, the literature presents varying results on this issue. Ignatova et al. reported that the PCV13 vaccine significantly reduced the incidence of community-acquired pneumonia among COPD patients in a cohort of 483 males, with lower rates of pneumonia, exacerbations, and hospitalizations observed over a ten-year follow-up period compared to unvaccinated individuals. Moreover, higher survival rates were reported in the vaccinated group.^[24] Likewise, Walters et al., in a Cochrane systematic review, found that the likelihood of developing community-acquired pneumonia was significantly lower in vaccinated COPD patients compared to unvaccinated individuals, although no significant difference was observed for pneumococcal pneumonia specifically.^[25] In contrast, Granger et al. concluded that evidence from randomized controlled trials did not demonstrate a significant impact of pneumococcal vaccination on morbidity or mortality among

COPD patients.^[26] These differing results suggest that while COPD remains a strong risk factor for the development of pneumonia, vaccination can reduce, but not completely eliminate this risk. In our study and in some others, the persistence of higher pneumonia rates among COPD patients even after vaccination may reflect the advanced pulmonary impairment in this population; however, the protective effect of vaccination remains evident.

As a protein-conjugate vaccine, PCV13 elicits a T-cell-dependent immune response with immunological memory and higher, more durable opsonophagocytic antibody titers than plain polysaccharide vaccines.^[27] This advantage is particularly relevant in frail older adults, in whom vaccine responses are attenuated by immunosenescence.^[28] By reducing nasopharyngeal carriage of vaccine-type pneumococci, conjugate vaccination may also limit the reservoir for mucosal spread and subsequent lower-respiratory infection.^[27] In a home-care population marked by multimorbidity, impaired mucociliary clearance, swallowing dysfunction, and recurrent antibiotic exposure, these mechanisms plausibly contribute to the lower pneumonia burden observed after vaccination, although the observational design precludes attributing the effect solely to the vaccine.

All patients received PCV13, the conjugate vaccine available through the national program during the study period. Higher-valency conjugate vaccines—PCV15 and PCV20—have since been licensed, and current guidance now recommends these broader-coverage conjugate vaccines (PCV20 alone, or PCV15 followed by PPV23) for older and at-risk adults to expand serotype coverage, including serotypes linked to residual disease and antimicrobial resistance.^[29] As serotype distribution shifts under vaccine pressure, the protection observed here with PCV13 may be further improved by these broader-coverage

vaccines; confirming this in home-care populations is an important direction for future work.

A distinctive feature of this study is that vaccination was delivered in the patient's home. For individuals with limited mobility, cognitive impairment, or caregiver dependence, in-clinic immunization is a substantial barrier; home delivery removes transport needs, reduces caregiver burden and exposure to crowded healthcare settings, and can be integrated into routine home-care visits—potentially improving coverage and timeliness. Although we did not perform a formal economic evaluation, the averted pneumonia episodes and hospitalizations suggest that home-based pneumococcal vaccination may be cost-effective in this high-risk group. From a health-planning perspective, embedding immunization within home-health programs offers a practical, scalable model for reaching an otherwise under-vaccinated population.

Regarding the evaluation of our findings, several limitations of this study should be noted. First, it was a retrospective, single-center study with a relatively small sample, which limits generalizability. Second, the uncontrolled pre-post design without a concurrent control group precludes causal inference; the observed reduction cannot be attributed to vaccination alone. Third, because patients are often vaccinated after a recent infection, the elevated pre-vaccination episode counts may partly reflect regression to the mean and confounding by indication, both of which would exaggerate an apparent post-vaccination decline. Fourth, the pre- and post-vaccination observation windows were of unequal length, which may bias the comparison of raw episode counts. Fifth, pneumonia was defined from documented clinical (and, where available, radiological) diagnoses rather than uniform microbiological confirmation, introducing possible misclassification and dependence on record completeness. Sixth, all patients had at

least one chronic disease, so no non-comorbid comparator was available. Finally, no a priori power calculation was performed. Prospective, multicenter studies with defined, equal follow-up periods and control groups are needed to confirm these findings.

In conclusion, home health care services represent an essential component of preventive medicine for individuals with multiple chronic conditions and limited access to healthcare facilities. This study is among the few field-based investigations evaluating the clinical effectiveness of pneumococcal vaccination in this population. Our findings suggest an association between pneumococcal vaccination and lower pneumonia frequency and pneumonia-related hospitalizations among patients receiving home health care services. These results highlight the clinical importance of maintaining and expanding pneumococcal immunization among frail individuals within home health care programs. Moreover, the findings suggest that vaccination practices implemented through home health care units can serve as an effective, applicable model in similar settings, contributing to public health improvement. Future prospective, multicenter studies are warranted to further assess the long-term effectiveness of pneumococcal vaccination in patients receiving home health care services.

Ethical approval

This study has been approved by the İstanbul Prof. Dr. Cemil Taşcıoğlu City Hospital Ethics Committee (approval date: 02.12.2024, number: 271). Written informed consent was obtained from the participants.

Author contribution

The authors declare contribution to the paper as follows: Study conception and design: OB, AB; data collection: OB; analysis and interpretation of

results: OB, AB, SA; draft manuscript preparation: OB, AB, SA. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest to disclose.

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