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Effectiveness of the 13-valent pneumococcal conjugate vaccine against medically attended pneumococcal lower respiratory tract infection among older adults: a case–control study

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The 13-valent pneumococcal conjugate vaccine (PCV13) has been recommended for more than a decade for older adults and individuals with chronic medical or immunocompromising conditions. However, real-world evidence on its vaccine effectiveness (VE) in this population especially Low- or Middle-Income Country (LMIC) is limited. This study aimed to evaluate the VE of PCV13 against pneumococcal lower respiratory tract infection (LRTI) among older and high-risk adults.

The study was a case–control design using data from a tertiary, university-affiliated hospital between Jan 2014 and Dec 2024. Adults aged ≥ 60 years with medically attended LRTI were included. Cases were defined as culture-confirmed pneumococcal LRTI. Controls were patients with LRTI in whom *Streptococcus pneumoniae* was not isolated, identified via ICD-10 codes. VE was estimated using logistic regression, comparing odds of PCV13 vaccination between cases and controls. Among 825 patients with LRTI, 39 (4.7%) had received PCV13 and 786 (95.3%) were unvaccinated. The crude VE of PCV13 against pneumococcal LRTI was 71.9% (95% CI: 27.3–89.1), and the adjusted VE was 73.3% (95% CI: 9.0–92.1). The requirement for mechanical ventilation at admission decreased among PCV13-vaccinated patients compared with unvaccinated patients with pneumococcal LRTI. VE appeared comparable among individuals aged ≥ 75 years compared to those < 75 years. In a sensitivity analysis restricted to controls with non-pneumococcal bacterial LRTI, the crude VE increased to 76.1% (95% CI: 34.3–91.3).

PCV13 demonstrated real-world effectiveness in preventing medically attended pneumococcal LRTI among older adults. The public health benefit of PCV13 in older adults in LMICs was clearly demonstrated.

Keywords Vaccine effectiveness, Pneumococcal conjugate vaccine, PCV13, Lower respiratory tract infection, Older adults

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Streptococcus pneumoniae remains a leading cause of hospitalized community-acquired pneumonia (CAP) among adults, accounting for approximately 10–12% of cases in this population[1,2]. In Thailand, the estimated incidence of pneumococcal pneumonia requiring hospitalization among adults is 30.5 per 100,000 persons per year[3]. Older adults, particularly those with underlying comorbidities, are at increased risk of pneumococcal pneumonia requiring hospitalization, as well as all-cause pneumonia leading to hospital admission[4].

The 13-valent pneumococcal conjugate vaccine (PCV13) has demonstrated substantial efficacy in preventing both overall and non-bacteremia vaccine-type CAP in older adults[5]. Its widespread implementation in many countries has led to significant reductions in pneumococcal disease burden across all age groups[6]. In real-world settings, the effectiveness of PCV13 against vaccine-type CAP among older adults has been estimated to range from 38.1% to 73.3%[7,8]. Additionally, PCV13 has been associated with a reduction in hospitalizations for all-cause pneumonia by approximately 4.7% to 10.0%, and a 9.4% reduction in hospitalizations due to lower respiratory tract infections[9,10]. More recently, higher-valency pneumococcal conjugate vaccines—such as the 15-valent (PCV15), 20-valent (PCV20), and 21-valent (PCV21) formulations—have been introduced in high-income countries to further expand serotype coverage and enhance disease prevention[11].

PCV has been recommended for children in the national guideline. However, it is recommended as an optional vaccine for high-risk adults by the Infectious Disease Association of Thailand (2025)[12], so the uptake of the PCV remains limited (17.4%)[13]. Consequently, circulating pneumococcal serotypes in both children and adults continue to be predominantly those covered by PCV13[14]. Moreover, recent economic evaluations have demonstrated that PCV13 is a cost-effective option for routine immunization in Thai older adults, offering greater value compared to either the 23-valent pneumococcal polysaccharide vaccine (PPSV23) or no vaccination[15]. Given this context, there is an urgent need to generate real-world evidence on the effectiveness of PCV13 to inform national vaccine policy. This study aimed to evaluate the effectiveness of PCV13 in preventing medically attended lower respiratory tract infection (LRTI) caused by *S. pneumoniae* in older adults, following its licensure in Thailand to strengthen the evidence supporting its inclusion in Thailand's NIP when appropriate as currently WHO has recommended to ensure PCV introduction with high coverage before moving to older age group.

Method

Study design and settings

The study was a case–control study. The retrospective data of adults aged ≥ 60 years were retrieved and collected from the medical records of the Siriraj Hospital (a major tertiary, university-affiliated hospital in Bangkok, Thailand). The inform consent was exempted as the data were coded and anonymous. The study was conducted in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committees of the Faculty of Tropical Medicine and Faculty of Medicine, Siriraj Hospital, Mahidol University (Protocol Number COA: MUTM 2023-083-01, MUTM 2023-083-02). The study was registered with the Clinical Trials.gov (Clinical trial.gov NCT06279624).

Cases, controls, and vaccine exposure definition

Cases were defined as patients with medically attended LRTI and microbiologically confirmed all serotyped *Streptococcus pneumoniae* infection. LRTI was defined based on clinical criteria consistent with community-acquired pneumonia (CAP) as established in previous studies[16,17], with or without radiographic evidence. Patients with pneumococcal bacteremia were excluded. In cases of prolonged or frequent hospitalization, only the first episode of infection was considered for analysis. Confirmed cases were identified by culture at the Department of Microbiology from January 2014 to December 2024. Controls were patients who met the study's inclusion criteria but in whom *S. pneumoniae* was not isolated from culture, similar to some recent published test-negative design (TND) studies[7,18]. These were diagnosed with pneumonia of any cause, identified using ICD-10 codes J12 and J14–J18. Control patients were randomly selected which were stratified by year from the same period and PCV13 vaccination status. Pneumococcal vaccination status was determined based on documentation of a single dose of PCV13, ascertained from the hospital's electronic medical records. Case patients were classified as vaccinated if they had received PCV13 more than 14 days prior to the date of medical attendance for LRTI. Similarly, control patients were considered vaccinated if the vaccine was administered more than 14 days before the date of hospital admission.

Statistical analysis

Based on previous literature, the prevalence of pneumococcal vaccination in the control group was reported to range from 10 to 20%[13]. The effectiveness of PCV13 against vaccine-type CAP in older adults has been estimated to range from 38.1% to 73.3%[7,8]. Assuming a vaccine effectiveness of 50% and a vaccine coverage of 15% among controls, with a case-to-control ratio of 1:2, we calculated the required sample size using Stata/MP version 17 (StataCorp, College Station, TX), with a Type I error (α) of 0.05 and a power (1–β) of 80%. The estimated total sample size was approximately 280 cases and 560 controls, allowing for a 10% margin.

Logistic regression was employed to estimate crude and adjusted odds ratios (ORs) for the association between PCV13 vaccination status and case or control status. Odds of vaccinated PCV13 for pneumococcal and non-pneumococcal LRTI were constructed and compared using ORs and 95% confidence intervals (CIs). Adjusted ORs (aORs) were derived to control for prespecified confounders—specifically, age, sex, and recent vaccination—identified a priori using causal diagrams. Variables that altered the estimated OR for PCV13 by ≥ 10% or *P*-value < 0.10 were considered confounders and included in the final model. The fully adjusted model was simultaneously adjusted for all potential confounder. Vaccine effectiveness (VE) and adjusted vaccine effectiveness (aVE) against pneumococcal LRTI were calculated using the formula: VE or aVE (%) = (1 – OR or aOR) × 100. Stratified logistic regression analyses were performed to control for potential confounding by age group (< 75 and ≥ 75 years). Median survival time and corresponding 95% CIs were calculated using survival

analysis, with age group comparisons performed by the log-rank test. Sensitivity analyses were performed using two alternative control groups. Given that recent test-negative design (TND) studies[7,18] involving non-pneumococcal LRTIs may include both bacterial and viral etiologies, we stratified the VE analysis accordingly. The first control group comprised patients with non-pneumococcal bacterial LRTIs, while the second included patients with LRTIs in whom respiratory viruses were identified. All statistical analyses were performed using SAS software, version 9.4 for Windows (SAS Institute Inc., Cary, NC, USA). All *P*-values were two-sided, with statistical significance defined as $P < 0.05$.

Results

Between January 2014 and December 2024, adults aged ≥ 60 years identified from electronic medical record. A total of 7674 patients were identified with a discharge diagnosis of pneumonia of any etiology (Fig. 1), based on ICD-10 codes J12 and J14–J18 (supplementary file). Among them, 550 (7.2%) were included in analysis after missing values and uncertain clinically confirmed infection exclusion. A total of 292 samples yielded *Streptococcus pneumoniae* on sputum samples during the same period. After exclusion, of 275 (94.2%) case patients were included in analysis.

Characteristics of cases and controls

Of the 825 patients included in the study, 39 (4.7%) had received the PCV13 vaccine, whereas 786 (95.3%) were unvaccinated (Table 1). Among pneumococcal LRTI cases (n = 275), only 5 patients (1.8%) had been vaccinated, indicating that cases were less likely to have received PCV13 than controls (1.8% vs. 6.2%; $P = 0.008$). Among cases, the mean age was higher among vaccinated patients compared to their unvaccinated counterparts (76.6 vs. 72.2 years). Among controls (n = 550), vaccinated individuals (6.2%) were also older (80.6 vs. 75.6 years) and exhibited a balanced sex distribution (50% male). Both cases and controls, those vaccinated with PCV13 were significantly more likely to have received prior influenza and COVID-19 vaccinations than those who were unvaccinated. The prevalence of underlying medical conditions was notably higher among cases than controls (91.6% vs. 58.4%), although the proportion classified as high-risk or immunocompromised was similar between groups (36.0% vs. 32.7%). Among patients with non-pneumococcal LRTI, viral pathogens were slightly more common than bacterial causes (267/550 [48.5%] vs. 236/550 [42.9%]) (Table S1). The predominant viral etiology was SARS-CoV-2, accounting for 88.8% of viral LRTIs. The leading bacterial pathogens identified were *Klebsiella pneumoniae* (28.0%), *Pseudomonas aeruginosa* (25.4%), and *Acinetobacter baumannii* (17.4%).

Characteristics of pneumococcal LRTI

In terms of disease severity, ICU admissions were observed in 20.5% of PCV13 vaccinated patients, compared to 35.2% of those unvaccinated (Table 1). The requirement for mechanical ventilation at admission was greatly lower among PCV13 vaccinated than unvaccinated pneumococcal LRTI (20.0% vs. 54.1%). All PCV13 vaccinated patients with pneumococcal LRTI were discharged without in-hospital mortality, whereas the mortality rate

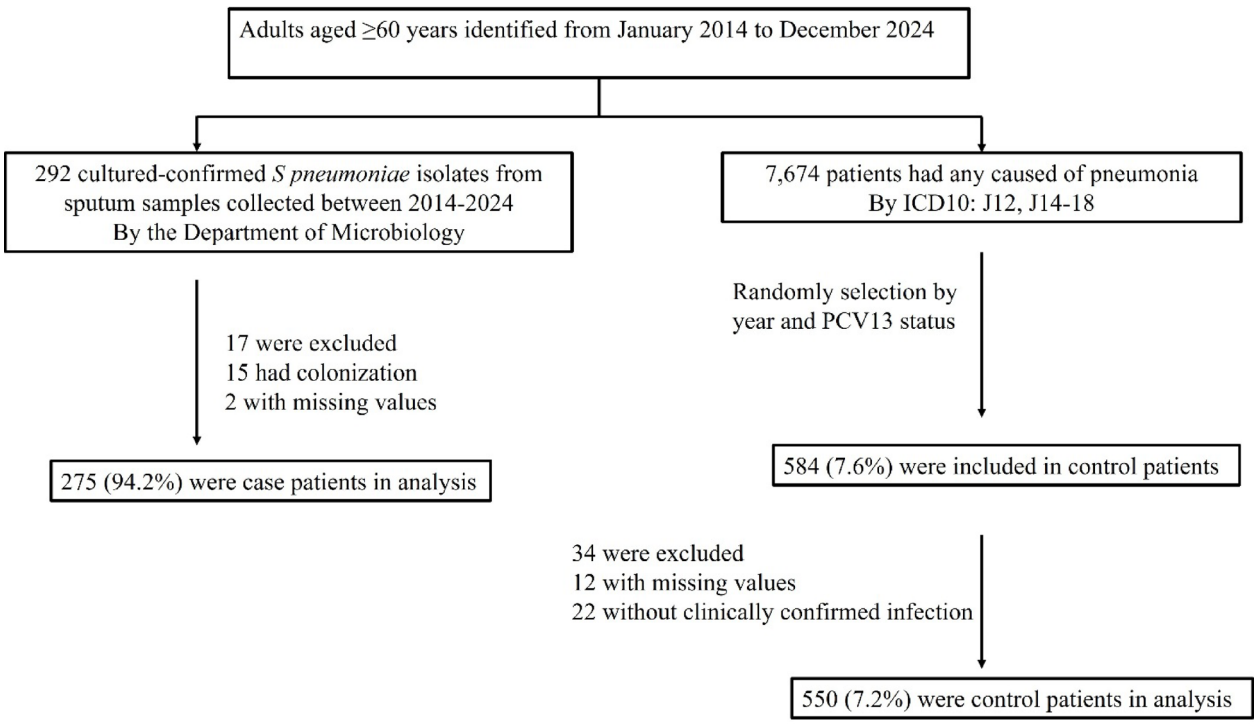

Fig. 1. Flowchart of the screening of the study population for analysis. PCV13, 13-valent pneumococcal conjugate vaccine.

Characteristics	Pneumococcal LRTI (N = 275)		Non-Pneumococcal LRTI (N = 550)		All	
	PCV13 (N = 5)	No PCV13 (N = 270)	PCV13 (N = 34)	No PCV13 (N = 516)	PCV13 (N = 39)	No PCV13 (N = 786)
Sex, n (%)						
Male	5 (100.0)	172 (63.7)	17 (50.0)	257 (49.8)	22 (56.4)	429 (54.6)
Female	0 (0.0)	98 (36.3)	17 (50.0)	259 (50.2)	17 (43.6)	357 (45.4)
Age, (years)						
Mean (SD)	76.6 (8.5)	72.2 (9.9)	80.6 (10.0)	75.6 (9.3)	80.1 (9.8)	74.4 (9.6)
Median (Q1, Q3)	76.0 (71.0, 84.0)	71.0 (65.0, 80.0)	82.0 (72.0, 90.0)	74.5 (68.0, 83.0)	81.0 (72.0, 89.0)	73.00 (67.0, 82.0)
BMI, (kg/m2)						
Mean (SD)	21.9 (5.2)	22.1 (4.9)	23.0 (5.2)	23.1 (5.4)	22.8 (5.1)	22.85 (5.3)
Smoking, n (%)						
No	1 (20.0)	91 (33.7)	20 (58.8)	309 (59.9)	21 (53.9)	400 (50.9)
Yes	4 (80.0)	116 (43.0)	9 (26.5)	133 (25.8)	13 (33.3)	249 (31.7)
Alcohol consumption, n (%)						
No	3 (60.0)	101 (37.4)	20 (58.8)	335 (64.9)	23 (59.0)	436 (55.5)
Yes	2 (40.0)	83 (30.7)	9 (26.5)	100 (19.4)	11 (28.2)	183 (23.3)
Recent vaccination +						
1. Influenza vaccine, n (%)						
Yes	5 (100.0)	69 (25.6)	30 (88.2)	181 (35.1)	35 (89.7)	250 (31.8)
2. COVID-19 vaccine, n (%)						
Yes	2 (40.0)	23 (8.5)	14 (41.2)	95 (18.4)	16 (41.0)	118 (15.0)
3. PPSV23 vaccine, n (%)						
Yes	0 (0.0%)	4 (1.5%)	0 (0.0%)	6 (1.2%)	0 (0.0%)	10 (1.3%)
Risk level[a]						
Without medical history (Healthy)	0 (0.0)	23 (8.5)	13 (38.2)	216 (41.9)	13 (33.3)	239 (30.4)
With medical history (Any medical history)	5 (100.0)	247 (91.5)	21 (61.8)	300 (58.1)	26 (66.7)	547 (69.6)
At risk	3 (60.0)	150 (55.6)	7 (20.6)	134 (26.0)	10 (25.6)	284 (36.1)
High risk/immunocompromised	2 (40.0)	97 (35.9)	14 (41.2)	166 (32.2)	16 (41.0)	263 (33.5)
Severity during admission, n (%)						
OPD	1 (20.0)	61 (22.6)	4 (11.8)	73 (14.2)	5 (12.8)	134 (17.1)
IPD	4 (80.0)	209 (77.4)	30 (88.2)	443 (85.9)	34 (87.2)	652 (83.0)
General	4 (80.0)	147 (54.4)	22 (64.7)	228 (44.2)	26 (66.7)	375 (47.7)
ICU	0 (0.0)	62 (23.0)	8 (23.5)	215 (41.7)	8 (20.5)	277 (35.2)
The need for mechanical ventilation at initial admission, n (%)						
Yes	1 (20.0)	146 (54.1)	15 (44.1)	210 (40.7)	16 (41.0)	356 (45.3)
No	4 (80.0)	124 (45.9)	19 (56.0)	306 (59.3)	23 (59.0)	430 (54.7)
Without oxygen therapy	2 (40.0)	48 (17.8)	2 (5.9)	78 (15.12)	4 (10.3)	126 (16.0)
Oxygen supplement	2 (40.0)	70 (25.9)	11 (32.4)	153 (29.7)	13 (33.3)	223 (28.4)
High flow nasal canula	0 (0.0)	6 (2.2)	6 (17.7)	75 (14.5)	6 (15.4)	81 (10.3)
Outcomes, n (%)						
Discharge	5 (100.0)	198 (73.3)	23 (67.7)	323 (62.6)	28 (71.8)	521 (66.3)
Transferal	0 (0.0)	19 (7.0)	0 (0.0)	37 (7.2)	0 (0.0)	56 (7.1)
Death	0 (0.0)	52 (19.3)	11 (32.4)	154 (29.8)	11 (28.2)	206 (26.2)

Table 1. Participant Demographic and Clinical Characteristics by 13-Valent Pneumococcal Conjugate Vaccination Status (n = 825). [a]Risk level was based on Centers for Disease Control and Prevention classifications[19] of risk for pneumococcal disease using information about chronic medical conditions collected from the medical record. "High-risk" patients were defined as having certain immunocompromising conditions. "At-risk" patients were defined as the absence of immunocompromising conditions but the presence of = 1 chronic medical condition. "Healthy patients" were defined as participants without any immunocompromising or chronic medical conditions listed above. + history of vaccination within 1 year. The 13-valent pneumococcal conjugate vaccine: PCV13, lower respiratory tract infection: LRTI.

among unvaccinated pneumococcal LRTI patients was 19.3%. The most commonly prescribed antibiotics for pneumococcal LRTI were ceftriaxone (58.9%), azithromycin (41.5%), levofloxacin (22.5%), and amoxicillin/clavulanate (19.3%) (Table S2). The median duration of ceftriaxone therapy was 3.5 days (interquartile range [IQR], 1.5–6.0). No complications during hospitalization were observed among PCV13-vaccinated patients with pneumococcal LRTI (Table S3). Among the 48 patients who developed nosocomial infections, the most common

Logistic regression model[+]	Crude/adjusted		VE (%) (95% CI)
	OR (95% CI)	*P*-value	
Fully adjusted model[++]	0.27 (0.08–0.91)	0.035	73.3 (9.0–92.1)
Crude model	0.28 (0.11–0.73)	0.009	71.9 (27.3–89.1)
Univariable adjustment			
Sex	0.27 (0.11–0.71)	0.008	72.7 (29.1–89.5)
Age group (< 75 vs ≥ 75 years)	0.30 (0.11–0.77)	0.013	70.2 (22.7–88.5)
Recent influenza vaccination	0.36 (0.14–0.95)	0.040	63.9 (4.7–86.3)
Recent COVID-19 vaccination	0.33 (0.13–0.87)	0.025	66.6 (12.6–87.2)

Table 2. Vaccine Effectiveness of the 13-Valent Pneumococcal Conjugate Vaccine Against Medically Attended Pneumococcal Lower Respiratory Tract Infection. Variables from univariate analysis that showed *P*-value ≤ 0.1 were considered as potential confounders. [+]Vaccine effectiveness (VE) was calculated as: VE = 100%*(1 − OR), the odds ratio from the logistic regression model of PCV13 vs no PCV13. [++]The fully adjusted model was simultaneously adjusted for all covariates listed in the table.

Cases/Controls	Age < 75 years (N = 424)			Age ≥ 75 years (N = 401)		
Pneumococcal LRTI, No	156			119		
Non-pneumococcal LRTI, No	268			282		
Logistic regression model	Crude/adjusted OR (95% CI)	*P*-value	VE[+] (%) (95% CI)	Crude/adjusted OR (95% CI)	*P*-value	VE[+] (%) (95% CI)
Crude model	0.34 (0.07–1.55)	0.16	66.5 (− 54.9–92.8)	0.28 (0.08–0.94)	0.040	72.2 (5.8–91.8)
Fully adjusted model[++]	0.43 (0.09–2.08)	0.29	57.4 (− 107.9–91.3)	0.40 (0.11–1.43)	0.158	59.9 (− 42.6–88.7)

Table 3. Vaccine Effectiveness of the 13-Valent Pneumococcal Conjugate Vaccine Against Medically Attended Pneumococcal Lower Respiratory Tract Infection, stratified analyses by age group. [+]Vaccine effectiveness (VE) was calculated as: VE = 100%*(1 − OR), the odds ratio from the logistic regression model of PCV13 vs no PCV13. [++]The fully adjusted model was simultaneously adjusted for all covariates listed in the Table 2 except age group.

was hospital-acquired or ventilator-associated pneumonia (87.5%), followed by urinary tract infections (20.8%). In contrast, respiratory complications were identified in 13 unvaccinated patients with pneumococcal LRTI, including empyema thoracis (23.1%), lung abscess (15.4%), and complicated parapneumonic effusion (7.7%). Additionally, neurological complications were observed in 3.7% of unvaccinated cases. The overall median survival time among all patients was 54.0 days (IQR, 44.0–122.0) (Tables S4–S5). There was no significant difference in median survival between patients aged < 75 years and those ≥ 75 years (68.0 vs. 47.0 days; *P* = 0.968).

Vaccine effectiveness analyses

PCV13 vaccination was associated with a statistically significant reduction in the odds of medically attended pneumococcal LRTI in crude analysis (OR = 0.28; 95% CI: 0.11–0.73), corresponding to an estimated VE of 71.9% compared to unvaccinated individuals (Table 2). After adjustment for potential confounders, the association remained statistically significant (aOR = 0.27; 95% CI: 0.08–0.91), yielding an adjusted VE of 73.3%. The fully adjusted model is the most appropriate final model, as it accounts for all potential confounders.

To further explore potential effect modification, we conducted stratified analyses to assess interaction by age group. Stratified analyses suggested that VE against pneumococcal LRTI was comparable among individuals aged ≥ 75 years (VE = 59.9%; 95% CI: − 42.6 to 88.7) compared to those aged < 75 years (VE = 57.4%; 95% CI: − 107.9 to 91.3) (Table 3). In sensitivity analyses using alternative control group by etiologies, PCV13 remained statistically protective when controls were limited to patients with non-pneumococcal bacterial LRTI, yielding a crude VE of 76.1% (95% CI: 34.3–91.3) and an aVE of 74.9% (95% CI: 30.3–90.9). Therefore, the crude model was retained as the final model, as no evidence of confounding (age and sex) was observed in either univariable or multivariable analyses. Recent influenza and COVID-19 vaccinations were not included as prespecified confounders in the analysis of bacterial LRTI and were therefore marked as not applicable (NA) in Table 4. However, the protective association was not statistically significant when controls were defined as patients with viral LRTI (aVE = 42.6%; 95% CI: − 79.5 to 81.6) (Table 4).

Discussion

In the context of PCV13 being considered as an alternative vaccine for high-risk adults, the VE against medically attended pneumococcal LRTI among adults aged ≥ 60 years ranged from 71.9% to 73.3%. This effectiveness was observed even in populations with a moderate prevalence of high-risk or immunocompromising conditions. The VE observed in our study was notably higher than that reported in the CAPiTA trial[5], which demonstrated a vaccine efficacy of 17.4–24.1% against non-bacteremic pneumococcal CAP of any serotype. However, the study was a randomized, double-blind, placebo-controlled trial, and its methodology and interpretation differed

Logistic regression model	Sensitivity analysis Control defined as bacterial LRTI (n = 511)	Sensitivity analysis Control defined as viral LRTI(n = 542)
Pneumococcal LRTI, No	275	275
Non-pneumococcal LRTI, No	236	267
VE[+], % (95% CI)		
Crude model	76.1 (34.3–91.3)	60.6 (– 13.3–86.3)
Univariable adjustment		
Sex	75.9 (33.4–91.3)	69.1 (9.7–89.4)
Age group (< 75 vs ≥ 75 years)	75.0 (30.8–90.9)	58.6–19.7–85.7
Recent influenza vaccination	NA	43.6 (– 66.9–80.9)
Recent COVID-19 vaccination	NA	42.3 (– 74.4–80.9)
Fully adjusted model	74.9[++](30.3–90.9)	42.6[+++] (– 79.5–81.6)

Table 4. Sensitivity Analyses of Vaccine Effectiveness of 13-Valent Pneumococcal Conjugate Vaccine Against Medically Attended Pneumococcal Lower Respiratory Tract Infection Based on Alternative Definitions of Controls. [+]Vaccine effectiveness (VE) was calculated as: VE = 100%*(1 – OR), the odds ratio from the logistic regression model of PCV13 vs no PCV13. [++]The fully adjusted model was simultaneously adjusted for sex and age listed in the table. [+++]The fully adjusted model was simultaneously adjusted for all covariates listed in the table. NA not applicable.

from those of our study. Therefore, our findings were comparable to the 72.8% VE previously reported against vaccine-type CAP[7]. Although our study did not distinguish between vaccine-type and non-vaccine-type pneumococcal LRTI, the comparable VE may be explained by the predominance of serotypes covered by PCV13 among circulating pneumococcal strains in Thailand[14].

Given the potential for misclassification bias in test-negative designs, additionally due to the unavailability of urinary antigen testing in Thailand, we designed our study as a traditional case–control study. Cases and controls were identified from the same hospital database to minimize selection bias. As an observational study, our study is potentially subject to confounding and imbalances in baseline characteristics. Recent influenza and COVID-19 vaccination emerged as potential confounders, given the established viral–pneumococcal interactions[20]. Pneumococcal LRTI often occurs following viral respiratory infections such as influenza and COVID-19[21].

Due to the small number of PPSV23 vaccination, logistic regression analysis could not be conducted. Regarding age-specific trends, the annual incidence of LRTI increases with age[22]; however, our study observed a comparableVE among individuals aged ≥ 75 years (aVE 59.9%) compared to those aged < 75 years (aVE 54.4%). However, the previous evidence showed the reduced VE against invasive pneumococcal disease (IPD) in older adults or immunocompromised populations[23].

Our study differs from previous observational studies[7,8,22] particularly in terms of PPSV23 vaccination history among participants. First, only a small proportion of participants in our study had previously received PPSV23, whereas approximately 21% of individuals aged ≥ 65 years had received PPSV23 within the past five years in prior studies[7]. However, this factor was not accounted for in our analysis, as PPSV23 has demonstrated a lower immunologic response compared to PCV13, especially in high-risk or immunocompromised individuals—who comprised nearly 40% of our study population. Furthermore, our study was conducted including the COVID-19 pandemic, during which control selection may have introduced confounding due to the increased incidence of LRTIs caused by SARS-CoV-2. To address this, we performed sensitivity analyses using patients with bacterial or viral LRTIs as alternative control groups. The VE estimates remained robust in the sensitivity analysis restricted to bacterial LRTI controls. This restriction likely demonstrated the robustness of results under varying assumptions, particularly from factors associated with both vaccination status and disease risk.

This study has several limitations. First, due to limited data on PCV13 coverage among adults in Thailand, actual vaccination uptake may be lower than previously reported estimates[14]. This could influence the disease risk among the unvaccinated population in ways unrelated to vaccination itself but driven by individual-level factors[24]. Second, the uptake of PCV13 in our study was lower than anticipated: therefore, ongoing surveillance of pneumococcal disease and reevaluation of VE after PCV13 is included in the NIP are warranted. Lastly, information bias may be present due to incomplete vaccination records in the hospital database, as some individuals may have received PCV13 at other healthcare facilities. Additionally, some patients may have been admitted to hospitals outside our network under different health insurance schemes.

Conclusions

PCV13 demonstrated real-world effectiveness ranging from 71.9 to 73.3% in preventing medically attended pneumococcal LRTI among older adults in Thailand. Notably, the effectiveness was comparable among individuals aged ≥ 75 years compared to those < 75 years. These findings support the use of PCV13 for older adults to help reduce the burden of pneumococcal disease where the data of cost effectiveness and some known data of circulating serotypes are available. Continued disease surveillance and re-evaluation of vaccine effectiveness are essential especially in countries where the introduction in children is already existed and have achieved high coverage.

Data availability

The study datasets could be made available from the corresponding author and first author on reasonable request.

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Declarations

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The authors declare no competing interests.

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