

Review

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Review

Effects of Respiratory Vaccines in Older Adults with Cardiovascular Diseases: A Scoping Review

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Abstract

Background/Objectives: Vaccination against respiratory viruses—such as respiratory syncytial virus (RSV), pneumococcal disease, influenza, and COVID-19—may reduce the risk of adverse outcomes in older adults with cardiovascular disease. This study conducted a scoping review of the effects of respiratory vaccines in older adults with cardiovascular disease. **Methods:** We included studies evaluating adults aged ≥ 60 years with cardiovascular disease who received different types of respiratory vaccines. Eligible designs comprised clinical trials, observational cohort studies, and other relevant studies. Editorials, commentaries, and non-original publications were excluded. A comprehensive and targeted literature search was conducted in PubMed, Scopus, EMBASE, and Web of Science from database inception through January 2026. **Results:** A total of 26 studies were included, encompassing 1,782,787 adults aged ≥ 60 years with cardiovascular disease who received various respiratory vaccines. RSV vaccines were associated with a lower incidence of cardiorespiratory hospitalization and stroke among vaccinated individuals. Pneumococcal vaccines showed that sequential dual vaccination strategies were associated with a lower risk of cardiovascular events. Influenza vaccination was associated with improved cardiovascular outcomes, lower mortality, and reduced adverse events. COVID-19 vaccines were associated with reductions in mortality and hospitalizations. These benefits are particularly relevant in an older population with a high burden of comorbidities; therefore, complete vaccination schedules, including booster doses, should be considered a central strategy for prevention and comprehensive management in this high-risk group. **Conclusions:** Vaccination against respiratory viruses in older adults with cardiovascular disease demonstrates an overall favorable/acceptable profile of efficacy and safety, with reductions in mortality, hospitalizations, and cardiovascular events, without a significant increase in serious adverse events.

Keywords: vaccines; respiratory vaccines; cardiovascular disease; older adults; scoping review (Source: MeSH NLM)

1. Introduction

Cardiovascular diseases (CVD) are the leading cause of morbidity and mortality worldwide, with a disproportionately greater burden among older adults [1,2]. Aging is associated with profound remodeling of the immune system, characterized by immunosenescence and a chronic low-grade inflammatory state, which directly contributes to increased susceptibility to infections and to the severity of their complications in older adults [3,4]. In this context, acute respiratory infections represent an important trigger for cardiovascular events such as acute myocardial infarction, stroke, acute heart failure, and venous thromboembolism [5–7].

Respiratory pathogens including influenza virus, respiratory syncytial virus (RSV), *Streptococcus pneumoniae*, and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)—are highly

prevalent in the older adult population and are associated with substantial cardiovascular morbidity [7,8]. Infections caused by these pathogens may exacerbate CVD by inducing systemic inflammation, endothelial dysfunction, and a prothrombotic state, thereby promoting ischemia, thrombosis, and destabilization of atherosclerotic plaques. In addition, hypoxemia, sympathetic activation, and, in some cases, direct myocardial inflammation or infection may precipitate arrhythmias, heart failure, and acute cardiovascular events, particularly in patients with pre-existing disease [9,10].

Vaccination against respiratory pathogens has been widely implemented as a primary preventive strategy to reduce exacerbations, morbidity, and mortality associated with infections [11]. Current evidence also suggests that vaccines such as those for influenza, pneumococcus, RSV, and COVID-19 may confer additional cardiovascular benefits [12]. Several studies have reported reductions in cardiovascular events, hospitalizations, and all-cause mortality following vaccination; however, the magnitude and consistency of these effects vary according to vaccine type, platform, and the underlying cardiovascular condition [12–16]. Furthermore, standardization is lacking, and the impact of these vaccines in adult populations with cardiovascular disease remains under investigation.

Therefore, the present study conducted a scoping review to systematically map the available research on the efficacy, safety, and immunogenicity of respiratory vaccines in older adults with cardiovascular disease.

2. Materials and Methods

2.1. Protocol and Registration

The study protocol was developed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P 2015) guidelines [17]. The scoping review protocol was registered in the Open Science Framework database on January 11, 2026, and is available at (<https://osf.io/hrymx/files/fyevr>). This scoping review was conducted and reported in accordance with the PRISMA-ScR statement [18].

2.2. Eligibility Criteria

Eligibility criteria were based on the predefined PICO research question framework: P (population), I (intervention), C (comparator), and O (outcomes). The population included adults aged ≥ 60 years with cardiovascular diseases such as heart failure, coronary atherosclerosis, myocardial infarction, stroke, and atrial fibrillation. Interventions comprised all respiratory vaccines against influenza, respiratory syncytial virus, pneumococcal disease, and COVID-19, regardless of dose (first, second, third, and booster) and vaccine platform or technology. Comparators included placebo or control groups. Outcomes of interest were efficacy/effectiveness (measured by hospitalizations and all-cause mortality), safety (adverse events and/or side effects), and immunogenicity (humoral and cellular immune responses). Eligible study designs included randomized controlled trials, observational cohort studies (population-based or hospital-based), nested case-control studies, and secondary analyses.

Studies were excluded if they included: (i) populations younger than 60 years, including children and adolescents; (ii) older adults without cardiovascular disease and/or healthy individuals; or (iii) other types of vaccines or interventions. We also excluded letters to the editor, editorials, clinical images, comments, notes, correspondence, conference abstracts, reports, narrative reviews, systematic reviews, meta-analyses, in vivo and in vitro studies, books, book chapters, journalistic articles, and opinion pieces. Studies not published in English or without full-text availability were also excluded.

2.3. Information Sources

The preliminary search was conducted on October 1, 2025, and updated on December 15, 2025. The final search presented in this study was conducted on January 11, 2026. Electronic databases searched included PubMed, Scopus, and EMBASE, as well as the Web of Science platform. Gray literature was also explored through Google Scholar. In addition, reference lists of included studies were manually screened to ensure comprehensive coverage.

2.4. Search Strategy

A comprehensive search strategy was developed for each database using MeSH terms from the National Library of Medicine (NLM) and database-specific commands such as TIAB, MeSH, and TS=. The search terms included “Older adults,” “Aging,” “Elderly,” “Influenza Vaccines,” “Respiratory Syncytial Virus Vaccines,” “Pneumococcal Vaccines,” and “COVID-19 Vaccines,” combined using Boolean operators (AND, OR). The search was limited to English-language publications and to studies published between 2016 and 2026 to capture contemporary evidence. The full search strategies for each database are detailed in **Supplementary Material 1**.

2.5. Selection of Sources of Evidence

All retrieved records were imported into EndNote to remove duplicates and subsequently exported to the Rayyan QCRI web platform for screening. Two reviewers (NLGG and CCCH) independently screened titles and abstracts of potentially eligible studies. Full-text articles were then assessed for eligibility. Disagreements were resolved by consensus.

2.6. Data Charting Process

Two reviewers (NLGG and CCCH) developed a standardized data extraction form to collect key study characteristics, including first author, year of publication, country, study design, total population, age group, sex, cardiovascular condition, inclusion and exclusion criteria, vaccine type, number of doses, vaccine platform/technology, outcomes, and conclusions. Discrepancies were resolved by consensus, and when necessary, a third reviewer (FRMC) was consulted.

2.7. Data Items

Data were collected and synthesized on general study characteristics, including first author, year of publication, and study design. Population characteristics and contextual factors were also extracted, including age, sex, clinical history, risk factors, type of cardiovascular disease, and population size or setting. Regarding interventions, information on vaccine type, vaccine platform or technology, number of doses, and evaluated outcomes—specifically efficacy/effectiveness, safety, and immunogenicity—was collected.

2.8. Synthesis of Results

Quantitative descriptive measures, including frequencies (n) and percentages (%), were used for data analysis and synthesis, along with a qualitative synthesis of the available evidence. Data management and analysis were performed using STATANow, version 19 SE. A PRISMA 2020 flow diagram was used to transparently describe the study selection process. In accordance with PRISMA-ScR methodological guidance for scoping reviews, risk of bias assessment, study quality appraisal, and subgroup or sensitivity analyses were not conducted, as these procedures are not applicable to this type of review design.

3. Results

3.1. Selection of Sources of Evidence

Systematic bibliographic searches were conducted in the previously described databases. A total of 2,003 records were identified; after removing duplicates, 695 manuscripts remained for the

screening phase. Through title and abstract review, 115 studies were selected for eligibility assessment. Full-text evaluation led to the exclusion of 50 articles. Subsequently, the remaining 65 manuscripts were analyzed in detail, and 41 studies were excluded for not meeting the predefined inclusion criteria. In addition, the reference lists of the included studies were manually screened, and one additional relevant study was incorporated. Ultimately, a total of 25 studies were included in the review [19–43]. **Figure 1** presents the study selection process for the scoping review.

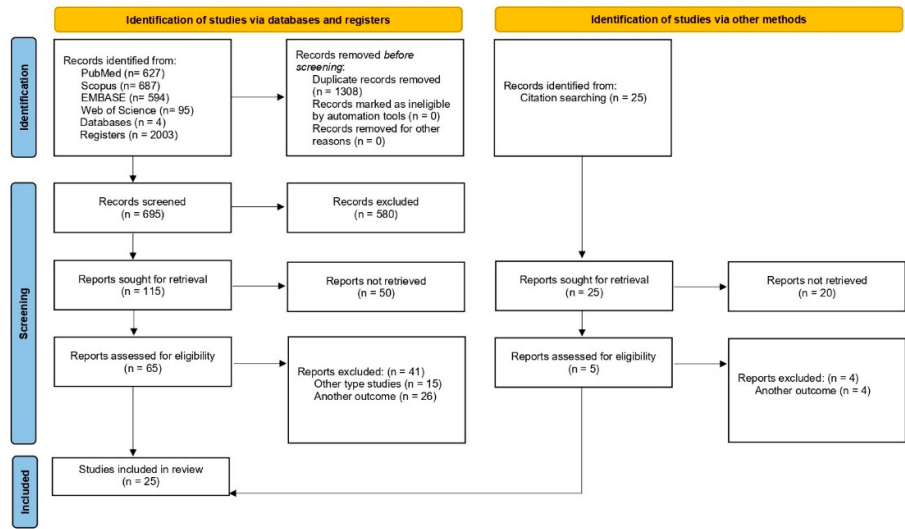


Figure 1. Selection of studies on respiratory vaccines in older adults with cardiovascular disease. Flow diagram “Preferred Reporting Items for Systematic Reviews and Meta-Analyses” PRISMA 2020.

3.2. Respiratory Syncytial Virus Vaccines

For the qualitative analysis of respiratory syncytial virus vaccines in patients with cardiovascular disease, two studies were included, both corresponding to prespecified secondary analyses of clinical trials published in 2025 and analyzed over follow-up periods spanning 2024–2025. Both studies were based on the Danish DAN-RSV network and included a total of 80,019 patients who received RSV vaccination, with a mean age above 70 years.

The study by Lassen et al. [19] evaluated the effectiveness of the bivalent prefusion F protein-based RSV vaccine (RSVpreF) in adults aged ≥60 years compared with unvaccinated individuals. The results demonstrated a lower incidence of all-cause cardiorespiratory hospitalization in the vaccinated group, with an absolute rate reduction of 2.90 and a vaccine effectiveness of 9.9%.

Similarly, the study by Pareek et al. [20] assessed the effectiveness of the same bivalent vaccine in adults aged ≥60 years with atherosclerotic cardiovascular disease. A lower incidence of stroke was observed in the RSVpreF group compared with the control group; however, effectiveness was similar between groups for most of the evaluated outcomes. **Table 1 and 2** present in detail the methodological characteristics and main results of the included studies.

Table 1. Characteristics and effects of Respiratory Syncytial Virus vaccines in older adults.

Author /year	Country	Design	Network	Period	Vaccine type	Total sample	Vaccinated sample	Age (Mean/ Female Median)	Unvaccinated sample	Age Female	Outcomes	Follow-up
Lassen et al. 2025 [19]	Denmark	Prespecified secondary analysis of a trial	DAN-RSV	2024-2025	RSV Vaccine	28 662	14 377	71.8 5 186	14 285	71.8 5 038	Hospitalizations Mortality	1 year

Pareek et al. 2025 [20]	Prespecified secondary analysis of a trial	DAN-RSV 2025 Vaccine	131 276	65 642	71.5	21 268	65 634	69.2	21 265	Effectivity	1 year
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MACE: Major adverse cardiovascular events; RSV: Respiratory syncytial virus.

Table 2. Effects of Respiratory Syncytial Virus vaccines in older adults.

Author /year	Vaccinated sample	Cardiovascular disease	Efficacy All-cause mortality	Hospitalizations	Safety/ MACE	Conclusions
Lassen et al. 2025 [19]	14 377	AF: 10 126 (70.5%) IHD: 9 746 (67.8%) HF: 2 973 (20.7%)	VE: -56.5%	VE: -4.7%, HF VE: 1.8%, MI VE: 19.4%, Stroke VE: -2.4%, AF	-	Lower hospitalizations rate in the vaccinated group
Pareek et al. 2025 [20]	65 642	Prespecified secondary analysis of a trial	DAN-RSV	2024-2025	VE: 9.3%, MACE	The effectiveness of the vaccines was similar to that of the controls

AF: Atrial fibrillation; ARR: Absolute risk reduction; HF: Heart failure; IHD: Ischemic heart disease; MACE: Major adverse cardiovascular events; MI: Myocardial infarct; VE: Vaccine effectiveness.

3.3. Pneumococcal Vaccines

For the qualitative analysis of the 23-valent pneumococcal polysaccharide vaccine (PPSV23) and the 13-valent pneumococcal conjugate vaccine (PCV13) in older adults with cardiovascular disease, a single study was identified, published in 2024 with a follow-up period from 2012 to 2020.

The study by Tong et al. [21], a retrospective cohort conducted in Hong Kong, evaluated the protective effect of a sequential pneumococcal vaccination strategy compared with single-vaccine administration in 262,421 older adults with cardiovascular disease (single dose: 157,244; sequential vaccination: 72,875). The findings demonstrated that dual sequential vaccination was associated with a lower risk of cardiovascular events compared with either PCV13 alone or PPSV23 alone. These results suggest that a sequential strategy may provide additional benefits in reducing cardiovascular risk and should be considered in clinical decision-making regarding pneumococcal vaccination in this high-risk population.

3.4. Influenza Vaccines

For the qualitative analysis of influenza vaccines in older adults with cardiovascular disease, 18 studies were included, encompassing cohort designs, cohort analyses, case–control studies, self-controlled case series, secondary analyses of trials, and trial emulations. The publication period ranged from 2016 to 2025, with follow-up intervals spanning from 2000 to 2022. Most studies were conducted in Taiwan, followed by China, the United States, and Spain. Overall, 1,501,735 vaccinated older adults (≥60 years) were included.

The study by Hsu et al. [22] evaluated the effect of influenza vaccination on reducing the risk of infarction in older adults, showing that the risk of myocardial infarction may decrease—particularly in men—when there is a good match between the vaccine and circulating strains in individuals older than 65 years. Chiang et al. [23] demonstrated that influenza vaccination is associated with a reduction in major adverse cardiovascular events, myocardial infarction, and stroke. Liu et al. [24] reported dose–response and synergistic protective effects against hemorrhagic stroke in high-risk patients with atrial fibrillation, as well as a reduction in its incidence.

In patients with chronic heart failure, Mohseni et al. [25] found that influenza vaccination is associated with a reduced risk of hospitalization, particularly for cardiovascular causes. Christiansen et al. [26] analyzed survivors of intensive care units and found that vaccinated patients had a lower risk of stroke and one-year mortality compared with unvaccinated individuals. Lam et al. [27]

demonstrated that, in older adults with a history of stroke, vaccination was associated with lower risks of post-stroke pneumonia, septicemia, urinary tract infection, and 30-day in-hospital mortality.

Wu et al. [28] evaluated influenza vaccination for secondary prevention of cardiovascular disease, showing significant reductions in all-cause mortality, myocardial infarction or cardiovascular death, and hospitalization for heart failure. Gotsman et al. [29] reported that vaccination in patients with heart failure is associated with improved clinical prognosis, including greater survival and fewer deaths and hospitalizations. Pang et al. [30] showed that vaccination reduces hospitalizations in older adults with cardiovascular or respiratory diseases; additionally, in a cardiovascular subtype analysis, they observed a 15% reduction in in-hospital mortality—more pronounced among patients with stroke—as well as a 6% reduction in the risk of recurrent hospitalization for ischemic heart disease [31].

Regarding dose comparison, Saade et al. [32] found that the high-dose vaccine does not provide additional protection against major cardiovascular events compared with the standard dose. Consistently, Christensen et al. [33] and NajafZadeh et al. [34] reported comparable effectiveness between both doses in terms of hospitalizations for pneumonia or influenza and all-cause mortality. Miró et al. [35] showed that, in patients with heart failure, seasonal influenza vaccination is associated with less severe decompensations and lower one-year mortality. Guo et al. [36] reported that vaccination may reduce the risk of major adverse cardiovascular events and acute coronary syndromes. Lei et al. [37] documented that, in critically ill patients with atrial fibrillation, vaccination is associated with improved survival. Finally, Yang et al. [38] observed that influenza vaccination is associated with a lower risk of ischemic stroke in older adult stroke survivors. **Tables 3 and 4** present in detail the methodological characteristics and main results of the included studies.

Table 3. Characteristics and effects of Influenza Vaccines in older adults.

Author /year	Countr y	Design	Networ k	Period	Vaccin e type	Total samp le	Vaccinat ed sample	Age (Mean / Median)	Fema le	Unvaccina ted sample	Ag e	Fema le	Outcomes	Follo w-up
Hsu et al. 2016 [22]	Taiwan	Retrospect ive cohort	LHID 2005	2007-2008	Influen za vaccine	202 058	93 051	75.91	46 243	109 007	74.5 5	54 069	Risk of AMI	9 mont hs
Chiang et al. 2017 [23]	Taiwan	Retrospect ive case-control	NHIRD	2000-2013	Influen za vaccine	160 726	Case: 29 046 Controls: 33 285	76.8	-	Case: 51 317 Controls: 47 078	76.8	-	MACE	-
Liu et al. 2017 [24]	Taiwan	Cohort	NHIRD	2005-2012	Influen za vaccine	6 570	2 547	74.33	1 187	4 023	72.7 9	1 913	Risk of HS	-
Mohseni et al. 2017 [25]	UK	Self-controlled case series	CPRD	-	Influen za vaccine	59 202	59 202	74.7	29 553	-	-	-	Hospitalizatio ns	-
Christians en et al. 2019 [26]	Denma rk	Cohort	NHIRD	2005-2015	Influen za vaccine	31 108	11 866	-	5 192	19 242	-	67 043	Hospitalizatio n All-cause mortality	1 year
Lam et al. 2019 [27]	Taiwan	Cohort	NHIRD	2000 -2009	Influen za vaccine	50 496	25 248	-	11 332	25 248	-	11 332	In-hospital mortality Hospitalizatio ns	30 days
Wu et al. 2019 [28]	Taiwan	Retrospect ive PM-cohort	NHIRD	2000-2013	Season al influen za vaccine	8 700	4 350	76.3	1527	4 350	76.2	1 505	All-cause mortality Hospitalizatio ns	1 year

Gotsman et al. 2020 [29]	Israel	Retrospective cohort	Clalit Health Services	2017-2018	Influenza vaccine	6 435	4 440	77	2 056	1 995	74	970	All-cause mortality	1 year
Pang et al. 2021 [30]	China	Retrospective cohort	UEBMI	January 2013–December 2016	Influenza vaccine	139 506	17 655	74	-	121 851	72.9	-	In-hospital death	-
Pang et al. 2022 [31]	China	Retrospective cohort	UEBMI	January 2013–December 2019	Influenza vaccine	713 488	95 060	74.1	53 788	618 428	72.9	343 227	In-hospital death	-
Saade et al. 2022 [32]	USA	Post-hoc analysis	CMS	-	Influenza vaccine	49 175	49 175	83.8	35 674	-	-	-	Hospitalizations	-
Miró et al. 2023 [35]	Spain	Secondary analysis of cohort	EAHFE	January 2018–February 2019	Influenza vaccine	6 147	1 339	85	654	5 008	84	2 756	All-cause mortality	1 year
Christensen et al. 2024 [33]	Denmark	Prespecified analysis of randomized clinical trial	DANFLU-1	2021-2022	Influenza vaccine	2 540	2 540	72.6	909	-	-	-	Decompensations	1 year
NajafZadeh et al. 2024 [34]	USA	Emulator Clinical Trial	Medicare claims data	2016-2019	Influenza vaccine	106 786	106 786	79.96	60 634	-	-	-	All-cause mortality	-
Guo et al. 2025 [36]	USA	Target trial emulation	YRHCD	2020–2022	Influenza vaccine	339 976	169 988	72	90 414	169 988	72	91 138	Hospitalizations	2 years
Lei et al. 2025 [37]	China	Retrospective PM-cohort	MIMIC-IV	NR	Influenza vaccine	9 500	4 758	75.44	-	4 742	75.76	-	All-cause mortality	1 year
Miró et al. 2025 [39]	Spain	Secondary analysis of cohort	EAHFE	November - December 2022	Influenza vaccine	4 243	1 841	86	1 039	2 402	84	1 359	All-cause mortality	1 year
Yang et al. 2025 [38]	China	Retrospective cohort	RHIP	2021-2022	Influenza vaccine	76 747	31 729	75	15 326	45 018	76	21 851	Decompensations	1 year

AMI: Acute myocardial infarction; HS: hemorrhagic stroke; MACE: Major adverse cardiovascular disease.

Table 4. Characteristics and effects of Influenza Vaccines in older adults.

Author /year	Vaccinated sample	Cardiovascular disease	Efficacy All-cause mortality	Hospitalizations	Severe decompensations	Safety/MACE	Conclusions
		Hypertension: 41 371 (44.5%)					
Hsu et al. 2016 [22]	93 051	IHD: 15 904 (17.1%) MI: 313 (0.34%) IS: 6 350 (6.8%) HF: 3 928 (4.2%)	-	-	-	HR= 0.681, AMI	Vaccination was associated with a reduced risk of AMI

Chiang et al. 2017 [23]	62 331	Stroke: 46 704 (74.9%) MI: 15 627 (25.1%)	-	-	-	aOR= 0.80, Stroke aOR= 0.80, MI	Vaccination is associated with a reduced risk of MACE
Liu et al. 2017 [24]	2 547	AF: 2 547 (100%) Hypertension: 1 939 (76.13%) CHF: 1 298 (50.96%) HF: 59 202 (100%)	-	-	-	aHR= 0.72, HS	Vaccination reduces the incidence of hemorrhagic stroke
Mohseni et al. 2017 [25]	59 202	Hypertension: 38 753 (46%) MI: 41 502 (49.2%) Stroke: 14 522 (17.2%)	-	Overall IRR= 0.73	-	-	Vaccination is associated with a lower risk of hospitalizations
Christiansen et al. 2019 [26]	11 866	MI: 4 067 (11.7%) Stroke: 5 080 (14.6%) CHF: 4 847 (13.9%) Hypertension: 12 773 (36.6%) AF/Flutter: 6 234 (17.9%)	1 year (aHR= 0.92)	1 year (aHR= 0.93, MI) 1 year (aHR= 0.98, HF) 1 year (aHR= 0.84, Stroke)	-	-	Vaccination was associated with a lower risk of stroke and mortality
Lam et al. 2019 [27]	25 248	Stroke: 25 248 (100%) Hypertension: 9 735 (38.6%) IHD: 1 017 (4.0%) HF: 276 (1.1%)	30 days (OR= 0.60)	30 days (OR = 0.91, ICU admission)	-	-	Vaccination associated with reduced post-stroke complications and mortality
Wu et al. 2019 [28]	4 350	MI: 4 350 (100%) Hypertension: 3 918 (90.07%) HF: 2 062 (47.4%) AF: 660 (15.17%)	1 year (HR= 0.82)	HR= 0.83, HF	-	-	Vaccination was associated with a reduced risk of CVD, all-cause mortality and hospitalizations
Gotsman et al. 2020 [29]	4 440	HF: 4 440 (100%) Hypertension: 3 745 (84%) CHD: 2 992 (67%) MI: 1 904 (43%) AF: 1 743 (39%) Stroke: 1 053 (24%)	HR= 0.80	HR=0.83, CVD	-	-	Vaccination was associated with a reduction in deaths and hospitalizations
Pang et al. 2021 [30]	17 655	NR	aOR= 0.55	-	-	-	Vaccination was associated with a lower risk of in-hospital death
Pang et al. 2022 [31]	95 060	IS: 95 060 (100%) IHD: 95 060 (100%)	aOR= 0.85	OR= 0.92, IHD OR= 1.04, IS	-	-	Vaccination was associated with a lower risk of in-hospital death in patients with fewer comorbidities
Saade et al. 2022 [32]	49 175	HF: 10 160 (20.7%)	-	HR= 0.92, MACE HR= 0.96, ACS	-	-	Similar reductions in hospitalizations

		Hypertension: 39 009 (79.3%) Stroke: 9 813 (20%)	HR= 0.84, Stroke HR= 0.96, HF				were observed with both doses
Miró et al. 2025 [35]	1 841	AHF: 1 841 (100%) Hypertension: 1 603 (87.1%) AF: 993 (54%) CAD: 440 (23.9%)	90 days (HR= 0.831) 1 year (HR= 0.885)	OR= 0.746, HFD	OR= 0.926	-	Vaccination is associated with less severe decompensation and lower all- cause mortality
Christensen et al. 2024 [33]	2 540	Hypertension: 961 (37.8%) IHD: 913 (35.9%) AF: 822 (32.4%)	IRR= 0.51	IRR: 0.87, CVD	-	-	All-cause mortality declined in a dose-response pattern
NajafZadeh et al. 2024 [34]	106 786	Hypertension: 105 315 (98.6%) AF: 63 986 (59.9%) IS: 28 621 (26.8%) AMI: 17 547 (16.4%)	HR= 0.92	HR= 0.97	-	-	All-cause mortality and hospitalizations declined in a dose-response pattern
Guo et al. 2025 [36]	169 988	Hypertension: 141 085 (83%) HF: 18 441 (10.8%) Stroke: 38 919 (22.9%) ACS: 14 019 (8.2%)	-	-	-	1 year (IRR= 0.86, MACE) 1 year (IRR= 0.87, ACS)	Vaccination was associated with a reduction in MACE and ACS
Lei et al. 2025 [37]	4 758	AF: 4 758 (100%) Hypertension: 4 084 (76.05%) CHF: 2 447 (45.57%) MI: 1 229 (22.89%)	1 year (HR= 0.83)	-	-	-	Vaccination was associated with a reduction in all- cause mortality
Miró et al. 2023 [39]	1 339	AHF: 1 339 (100%) HVD: 274 (31.5%)	90 days (HR= 0.885)	aOR= 0.823	aOR= 0.934	-	Vaccination is associated with less severe decompensations and fewer hospitalizations
Yang et al. 2025 [38]	31 729	Stroke: 31 729 (100%) Hypertension: 17 169 (54.1%) CAD: 2 486 (7.8%) AF: 3 262 (10.3%)	-	-	-	sHR= 0.84, Stroke recurrence sHR= 0.75, HS sHR= 0.86, IS	Vaccination associated with reduced ischemic stroke risk

ACS: Acute coronary syndrome; AHF: Acute heart failure; aHR: Adjusted Hazard Ratio; AF: Atrial fibrillation; AMI: Acute myocardial infarction; aOR: adjusted Odds ratio; CABG: Coronary artery bypass grafting; CAD: Coronary artery disease; CHD: Coronary heart disease; CV: Cardiovascular; CVD: Cardiovascular Disease; CHF: Congestive heart failure; HF: Heart failure; HFD: Heart failure decompensation; HR: Hazard Ratio; HS: Hemorrhagic stroke; HVD: Heart valve disease; ICU: Intensive Care Unit; IHD: Ischemic heart disease; IRR: Incidence rate ratio; IS: Ischemic stroke; MACE: Major adverse cardiovascular events; MI: Myocardial infarct; NR: Not reported; OR: Odds Ratio; sHR: subdistribution Hazard ratio.

3.5. COVID-19 Vaccines

For the analysis of COVID-19 vaccines in adult patients with cardiovascular disease, five studies were included, comprising cohort designs, secondary cohort analyses, and self-controlled case series. The publication period ranged from 2022 to 2025, with follow-up intervals between 2019 and 2022. Overall, 128,158 vaccinated patients were included across the analyzed studies, with a mean age above 70 years.

The study by Akbar et al. [40] showed that COVID-19 vaccination was associated with a dose-dependent reduction in all-cause mortality, as well as lower rates of hospitalization and revascularization procedures. In contrast, Miró et al. [39] observed that COVID-19 vaccination in older adults with acute heart failure was associated with an increase in hospitalizations. Conversely, Johnson et al. [41] reported a significant reduction in all-cause hospitalization rates and mortality in vaccinated older adults with heart failure.

The study by Sindet-Pedersen et al. [42] evaluated the risk of adverse events following vaccination and found that messenger RNA (mRNA)-based vaccines were not associated with an increased risk of heart failure worsening, myocarditis, venous thromboembolism, or all-cause mortality. Similarly, Ye et al. [43] investigated the safety of COVID-19 vaccines and found no increased risk of hospitalization for heart failure, major adverse cardiovascular events, or all-cause hospitalization after administration of BNT162b2 or CoronaVac vaccines in older adults with heart failure. **Tables 5 and 6** provide detailed methodological characteristics and the main findings of the included studies.

Table 5. Characteristics and effects of Influenza Vaccines in older adults.

Author /year	Country	Design	Network	Period	Vaccine type	Total sample	Vaccinated sample	Age (Mean/Median)	Female	Unvaccinated sample	Age	Female	Outcomes	Follow-up
Akbar et al. 2025 [40]	USA	Retrospective PM-cohort	TriNet X US	December 2020-2022	COVID-19 vaccine	148 472	74 236	73.90	25 601	74 236	74.30	25 428	All-cause mortality	1-2 years
Miró et al. 2025 [39]	Spain	Secondary analysis of cohort	EAHFE	November - December 2022	COVID-19 vaccine	4 243	3 139	85	1 769	1 104	85	629	All-cause mortality Decompensations	1 year
Johnson et al. 2022 [41]	USA	Retrospective cohort	-	January 2021 – January 2022	COVID-19 vaccine	7 094	3 898	73.9	1 877	3 196	-	-	All-cause mortality Hospitalizations	-
Sindet-Pedersen et al. 2023 [42]	Denmark	Secondary analysis of cohort	-	2019 – 2021	COVID-19 vaccine	87 734	43 850	-	15 612	43 884	-	15 624	All-cause mortality Worsening Safety	-
Ye et al. 2023 [43]	China	Self-controlled case series	-	February 2021 – March 2022	COVID-19 vaccine	8 201	3 035	-	1 523	5 166	-	2 901	Hospitalizations MACE	-

MACE: Major adverse cardiovascular events.

Table 4. Characteristics and effects of Influenza Vaccines in older adults.

Author /year	Vaccinated sample	Dose	Cardiovascular disease	Efficacy All-cause mortality	Hospitalizations	Revascularization rates	Safety/ MACE	Conclusions
Akbar et al. 2025 [40]	74 236	1st: 28	CAD: 67 327 (90.70%) HF: 38 017 (51.12%) Hypertension: 57 591 (77.58%)	1 year (HR= 0.65, 3rd dose) 2 year (HR= 0.40, 3rd dose)	1 year (HR= 0.85, HF) 2 year (HR= 0.90, HF) 1 year (HR= 0.94, AF) 2 year (HR= 0.93, AF)	1 year: PCI (HR= 0.86, CAD) 2 year: PCI (HR= 0.87) 1 year: CABG (HR= 0.83) 2 year: CABG (HR= 0.80)	1 year (HR= 1.43, Myocarditis) 2 year (HR= 1.36, Myocarditis)	All-cause mortality declined in a dose-response pattern
		2nd: 3						
		2000						
		3rd: 13						
		736						
Miró et al. 2025 [39]	3 139	-	HF: 3 139 (100%) Hypertension: 2 713 (86.5%) AF: 1 663 (53%) CAD: 717 (22.8%)	90 days (aHR= 0.829) 1 year (aHR= 0.91)	aOR= 1.215	-	-	Vaccination was associated with increased hospitalizations and lower in-hospital mortality
Johnson et al. 2022 [41]	3 898	1st: 3	HF: 3 898 (100%) Hypertension: 2 529 (64.9%)	HR= 0.87, 1st dose HR= 0.36, 2nd dose	HR= 0.68	-	-	Vaccination was associated with a lower likelihood of all-cause hospitalizations and mortality
		2nd: 3 253						
		3rd: 1						
		053						
Sindet-Pedersen et al. 2023 [42]	43 850	-	HF: 43 850 (100%) Hypertension: 37 712 (86%) AF: 19 401 (44.2%) IHD: 21 055 (48%) AMI: 10 266 (23.4%) Stroke: 5498 (12.5%)	90 days (Standardized risk= 2.23%)	-	-	90 days (Standardized risk= 0.01%, Myocarditis)	Vaccination was associated with a slight reduction in mortality. It was not associated with worsening HF or an increased risk of myocarditis
Ye et al. 2023 [43]	3 035	-	HF: 3 035 (100%) Hypertension: 1 791 (59%) MI: 341 (11.2%) IS: 40 (1.3%)	-	0-13 days (IRR= 0.60, HF) 14-27 days (IRR= 0.60, HF)	-	0-13 days (IRR= 0.19, MACE) 14-27 days (IRR= 0.10, MACE)	Hospitalizations and MACE declined in a dose-response pattern

aHR: Adjusted Hazard Ratio; AF: Atrial fibrillation; AMI: Acute myocardial infarction; aOR: adjusted Odds ratio; CABG: Coronary artery bypass grafting; CAD: Coronary artery disease; HF: Heart failure; HR: Hazard Ratio; IHD: Ischemic heart disease; IRR: Incidence rate ratio; IS: Ischemic stroke; MACE: Major adverse cardiovascular events; MI: Myocardial infarct; OR: Odds Ratio.

4. Discussion

4.1. Respiratory Syncytial Virus Vaccines

Respiratory syncytial virus vaccines in older adults with cardiovascular disease are associated with a lower incidence of all-cause cardiorespiratory hospitalization and a reduction in stroke incidence compared with unvaccinated patients. RSV is an important cause of acute respiratory infections during the fall and winter months and is the leading cause of lower respiratory tract infections in children [44]. However, RSV also significantly affects older adults and can lead to exacerbation of underlying diseases, hospitalization, and death [45]. RSV is identified in 6% to 11% of outpatient visits for respiratory tract infection in older adults and in 6% to 15% of hospitalized patients admitted to intensive care units; moreover, between 1% and 12% of all adults hospitalized with RSV respiratory tract infection die [46]. Epidemiologic studies estimate an RSV disease burden of 5.2 million cases, 470,000 hospitalizations, and 33,000 in-hospital deaths among adults aged ≥ 60 years in high-income countries [47]. These findings are likely related to deficient RSV F-specific T-cell responses in older adults, contributing to increased susceptibility to severe RSV disease [48].

Recent studies have shown that hospitalization due to RSV respiratory disease is complicated by cardiovascular events in 14% to 22% of adult patients, including worsening congestive heart failure, acute coronary syndrome, and arrhythmias. Furthermore, underlying cardiovascular disease is associated with hospitalization in 45% to 63% of adults with confirmed RSV infection [9]. Adults with RSV infection and underlying cardiovascular disease have a higher risk of experiencing an acute cardiac event compared with those without cardiovascular disease (33.0% vs 8.5%) [7]. These outcomes may be explained by the fact that RSV infections can induce a hypercoagulable state and increased thrombotic risk, driven by higher levels of fibrinogen and thrombin and enhanced platelet binding [9]. From this perspective, RSV vaccination emerges as a potential preventive strategy to reduce cardiovascular risk; however, the specific protective mechanisms in patients with cardiovascular disease have not yet been fully elucidated.

Several clinical trials have demonstrated acceptable efficacy and safety of a single dose of the prefusion RSV F protein-based vaccine adjuvanted with AS01E for preventing acute respiratory infection, lower respiratory tract disease, and severe RSV-related illness in adults aged ≥ 60 years, regardless of viral subtype and the presence of comorbidities [49–51]. These findings are consistent with the results presented. Nevertheless, given the high vulnerability of this population, vaccination decisions should always be made using an individualized risk–benefit assessment framework.

4.2. Pneumonia Vaccines

Pneumococcal vaccines administered sequentially may exert a protective effect by reducing the risk of cardiovascular disease. Pneumonia is an acute respiratory infection of major clinical relevance, with severity ranging from mild illness to life-threatening conditions across all age groups. Pneumococcal infections remain a significant cause of pneumonia and mortality in older adults and have been linked to an increased risk of acute cardiovascular events both during the infectious phase and in the post-infection period [52–56]. Systemic inflammation, platelet activation, and endothelial dysfunction induced by pneumococcal infection are considered key mechanisms in the precipitation of cardiovascular events [9]. In this context, pneumococcal vaccination has been shown to significantly reduce the incidence of invasive pneumococcal disease and all-cause mortality in older adults, with a favorable safety profile [57,58].

Older adults are at high risk for both pneumonia and cardiovascular disease; therefore, preventing both conditions could reduce two of the main sources of disease burden in this population. In this setting, vaccines targeting respiratory pathogens may reduce cardiovascular risk by attenuating the systemic inflammatory response triggered by respiratory infections [21].

Several epidemiological studies have demonstrated that, in patients with cardiovascular disease, influenza vaccination is associated with a reduction in cardiovascular mortality and the incidence of composite cardiovascular events [59]. A meta-analysis reported that vaccination with PPSV23 is

associated with a reduced risk of cardiovascular events and acute myocardial infarction (AMI), with a greater effect observed in the older adult population [60]. Consistently, cohort studies have reinforced these findings, showing that sequential vaccination with PCV13 and PPSV23 is associated with an additional reduction in cardiovascular risk compared with single vaccination, an effect that appears to be mediated, at least in part, by a reduction in pneumonia episodes [21]. Overall, these findings are consistent with the results presented and support the potential cardiovascular benefit of pneumococcal vaccination, particularly when sequential strategies are used in high-risk populations.

4.3. Influenza Vaccines

Influenza vaccination in older adults with cardiovascular disease is consistently associated with improved cardiovascular clinical outcomes, reduced mortality, and a lower incidence of adverse events, constituting a safe and clinically relevant intervention in this high-risk population. Influenza, a highly contagious viral respiratory illness, disproportionately affects older individuals and those with chronic conditions. Its clinical spectrum is broad; however, severe cases often progress to pneumonia, acute respiratory distress syndrome, and multiorgan failure [61]. Influenza vaccination is one of the most widely used and studied respiratory vaccines worldwide [62]. It is estimated that more than 500 million doses are administered annually, making it the respiratory vaccine with the highest global coverage and extensive accumulated experience in terms of safety and effectiveness [62]. Its effectiveness may vary according to several factors, including the recipient's age and immune status, the type of vaccine administered, the circulating influenza virus types, subtypes, and lineages, and the degree of antigenic match between circulating strains and those included in the vaccine [63]. In older adults, the relevance of influenza vaccination is supported by multiple pathophysiological and clinical factors [64].

Older adults, particularly those aged ≥ 65 years, are at increased risk due to immunosenescence, the presence of chronic comorbidities, and a reduced immune response to vaccination [61]. Aging is associated with immunosenescence, a process characterized by diminished immune responsiveness that increases susceptibility to severe infections and their complications [3,4]. In addition, this population has a higher prevalence of cardiovascular diseases, which may decompensate in the context of acute respiratory infections [7,8,65]. Epidemiological studies report mortality rates ranging from 2.9 to 44.0 per 100,000 individuals among those aged 65–74 years, and from 17.9 to 223.5 per 100,000 among those aged ≥ 75 years [66]. In this context, influenza vaccines have demonstrated high effectiveness in preventing severe infection-related outcomes [67,68].

The impact of influenza vaccination in older adults with cardiovascular disease is particularly relevant for optimizing coverage in this vulnerable population. Although the underlying biological mechanisms are not fully elucidated, meta-analytic evidence demonstrates cardioprotective effects, reflected in reductions in all-cause mortality, cardiovascular mortality, and the incidence of stroke [69]. A meta-analysis of randomized controlled trials reported that influenza vaccination is associated with a significant reduction in the risk of major adverse cardiovascular events, including a lower incidence of myocardial infarction and cardiovascular mortality [70]. Consistently, other studies have observed significant reductions in all-cause mortality, mortality, and major cardiovascular events in patients with cardiovascular disease [70]. Furthermore, a randomized clinical trial demonstrated that the high-dose influenza vaccine is superior to the standard-dose formulation in reducing hospitalizations due to cardiovascular, respiratory, and heart failure-related causes [71]. These findings are consistent with individual observational evidence in older adults with cardiovascular disease, reinforcing the role of vaccination as a key preventive strategy in this high-risk group.

4.4. COVID-19 Vaccines

The available evidence indicates that COVID-19 vaccination in older adults with cardiovascular disease demonstrates an overall favorable profile of clinical benefit and safety, reflected in reductions in mortality, hospitalizations, and revascularization procedures, without a significant increase in major adverse cardiovascular events associated with mRNA-based or inactivated vaccine platforms.

However, the heterogeneity of results—particularly in subgroups such as patients with acute heart failure—highlights the need for individualized assessment and further research to more precisely define the clinical impact in specific high cardiovascular risk settings.

Coronavirus disease 2019, caused by SARS-CoV-2, has led to a major global pandemic over the past four years and is currently behaving as an endemic disease. With the ongoing emergence of new viral variants, COVID-19 remains a relevant public health threat despite the widespread availability of vaccines, which were rapidly approved worldwide to mitigate SARS-CoV-2 infection [72]. The cardiotropic mechanisms of SARS-CoV-2 and its exacerbating effects in older adults are largely related to extrapulmonary processes. Viral entry into cardiomyocytes and endothelial cells via the angiotensin-converting enzyme 2 receptor induces direct myocardial injury and vascular dysfunction, while the systemic inflammatory response promotes a prothrombotic state [73,74]. Additionally, hypoxemia and increased hemodynamic stress favor myocardial ischemia and acute heart failure, along with autonomic and electrolyte disturbances that predispose to arrhythmias [75,76]. In later stages, persistent inflammation, endothelial dysfunction, and myocardial fibrosis contribute to an increased risk of heart failure, arrhythmias, and thromboembolic or cerebrovascular events [75].

Older adults represent a particularly vulnerable group with a high need for vaccine protection, although they may also have increased susceptibility to vaccine-related adverse events [77]. This phenomenon may be partially explained by age-related immunosenescence, in which humoral immunity tends to increase after vaccination, whereas cellular immune responses are often attenuated, potentially limiting the durability and breadth of vaccine-induced protection [78]. Several studies have suggested that COVID-19 vaccination significantly reduces all-cause mortality and disease severity in older adults, including those with underlying cardiovascular disease [40,79]. One study showed that the incidence of thrombotic and venous events, such as myocardial infarction and stroke, is lower following vaccination, and that the risk of cardiovascular complications after SARS-CoV-2 infection is substantially reduced in vaccinated individuals [80]. Additionally, a cohort study in older adults with ischemic heart disease or heart failure demonstrated that COVID-19 vaccination is associated with a dose-dependent reduction in mortality, as well as lower rates of hospitalization for heart failure and coronary revascularization procedures, without a significant increase in major adverse cardiovascular events [40]. In this context, these favorable findings support the incorporation of complete vaccination schedules, including booster doses, as an essential component of secondary prevention strategies in older adults with pre-existing cardiovascular disease and high clinical risk [40].

4.5. Limitations

This study has several limitations that should be considered when interpreting its findings. First, although a comprehensive literature search was conducted across multiple databases, it was restricted to English-language publications; therefore, relevant studies published in other languages may have been excluded. Second, the marked methodological heterogeneity among the included studies, as well as the diversity of observational and experimental designs, limited the feasibility of conducting a robust quantitative analysis and deriving reliable and comparable statistical estimates. Third, detailed stratification by age groups (e.g., 60–69, 70–79, 80–89, and ≥90 years) was not possible, as many primary studies reported aggregated results or focused on specific populations, thereby precluding more precise comparative analyses. Fourth, the methodology and reporting framework inherent to scoping reviews do not support quantitative synthesis due to the substantial heterogeneity among studies. Finally, several studies did not provide complete information on key clinical variables—such as comorbidities, functional status, nutritional status, or degree of frailty—which may significantly influence both the magnitude and quality of the immune response, particularly in older adults with cardiovascular disease.

4.6. Recommendations

Based on the findings of this scoping review, the development and implementation of large-scale clinical trials that explicitly include older adults with different types of cardiovascular disease are recommended, ensuring adequate representation of advanced age subgroups and patients with multimorbidity. These studies should standardize the assessment of efficacy, safety, and immunogenicity outcomes, while also incorporating relevant geriatric variables such as frailty, functional status, nutritional status, and immunosenescence, in addition to the evaluation, control, and monitoring of relevant biomarkers.

Furthermore, it is a priority to promote the development and updating of specific clinical practice guidelines that integrate the available evidence on the effects of respiratory vaccines in older adults with cardiovascular disease, with tailored recommendations according to cardiovascular and geriatric risk profiles. Additionally, public health strategies should be implemented to improve vaccine acceptance, access, and adherence in this population, as well as to evaluate their real-world impact on clinically relevant outcomes such as hospitalizations, cardiovascular events, and mortality. These actions could contribute to optimizing the prevention of respiratory infections and reducing the disease burden in one of the most vulnerable population groups.

5. Conclusions

Vaccination against respiratory viruses in older adults with cardiovascular disease is consistently associated with a favorable profile of clinical efficacy and safety, as evidenced by reductions in all-cause and cardiovascular mortality, lower incidence of hospitalizations, cerebrovascular events, and revascularization procedures, without a significant increase in serious adverse events attributable to the different vaccine platforms. These benefits are particularly relevant in a population characterized by high biological vulnerability, immunosenescence, and a substantial burden of comorbidities, in whom respiratory viral infections act as triggers for cardiovascular decompensation. The systematic implementation of complete vaccination schedules, including booster doses, should be considered a central strategy for both primary and secondary prevention in older adults with cardiovascular disease, with direct implications for public health policies and the optimization of comprehensive care in this high-risk population.

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Abbreviations

The following abbreviations are used in this manuscript:

AMI	Acute myocardial infarction
CVD	Cardiovascular diseases
RSVpreF	Prefusion F protein-based RSV vaccine
RSV	Respiratory syncytial virus
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2

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