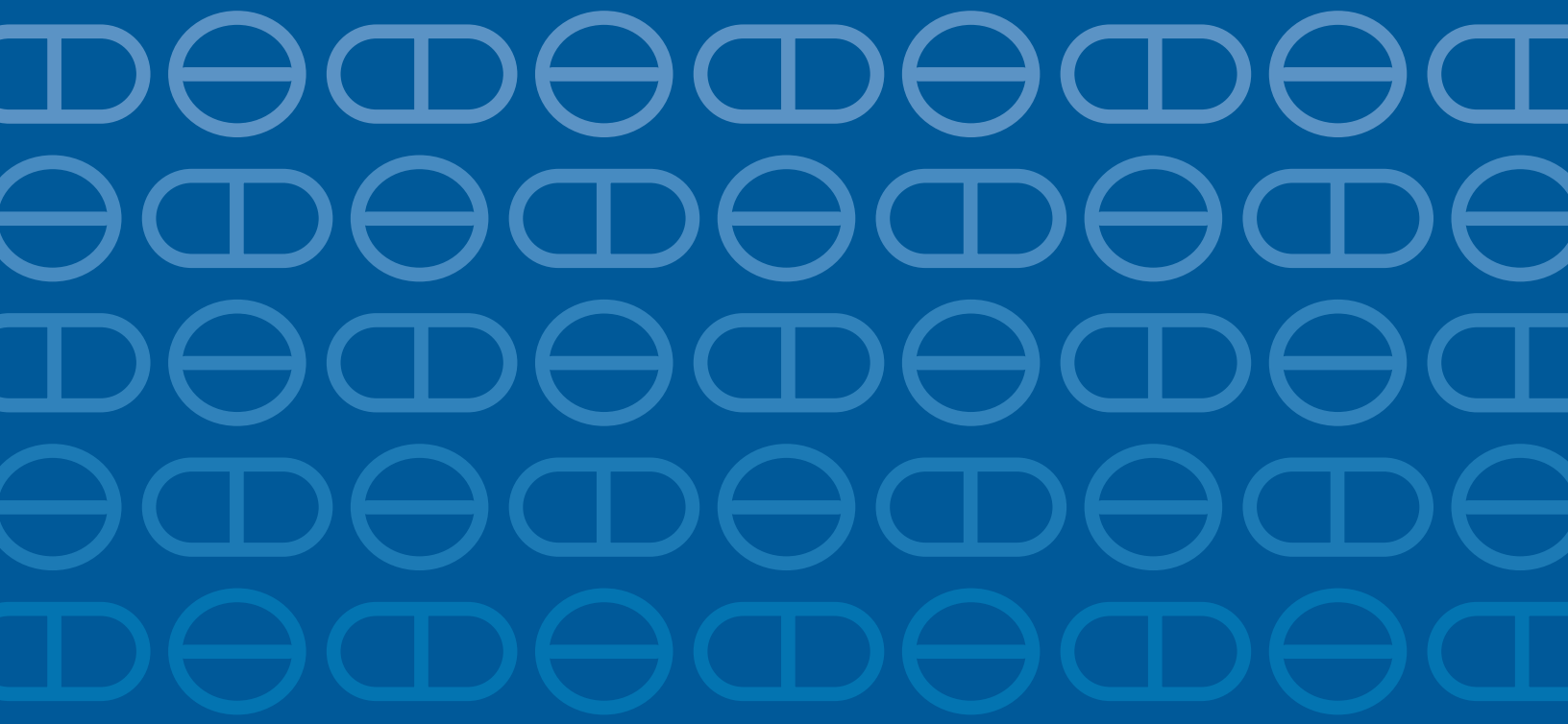
PACE Pharmaceutical Assistance Contract for the Elderly

Alosa Health
Balanced information for better care

Blocking preventable disease

Immunizations recommended for older adults



Blocking preventable disease

Recommended immunizations for older adults

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These are general recommendations only; specific clinical decisions should be made by the treating clinician based on an individual patient's clinical condition.

Alosa Health

Blocking preventable disease

Activity Overview:

The goal of this educational program is to provide primary care clinicians with a review of immunizations recommended by the Advisory Committee on Immunization Practices (ACIP) for older adults (age ≥65 years) to protect against: influenza, COVID-19, pneumococcal diseases, shingles, tetanus, pertussis, and diseases caused by respiratory syncytial virus (RSV).

With the continuing evolution of both viral serotypes and clinical recommendations for vaccines to address them, primary care clinicians need to understand current evidence and practice guidelines. COVID-19, flu, RSV, and other pathogens remain serious threats to the health and wellbeing of older adults, and much work remains to increase rates of vaccine uptake in this vulnerable population.

The education program has several components:

1. Written evidence report (print monograph)
2. Summary document of 4-5 key messages
3. “Academic detailing” educational sessions with trained outreach educators (pharmacists, nurses, physicians) who present the material interactively
4. Reference cards for easy access to key materials
5. Patient education information (brochure/tear off sheets)

Its goal is to critically review and synthesize the most current clinical information on these topics into accessible, non-commercial, evidence-based educational materials, to be taught interactively to providers by specially trained clinical educators.

Target Audience:

The educational program is designed for physicians practicing internal medicine, primary care, family medicine, and geriatrics, and nurses and other health care professionals who deliver primary care.

Learning Objectives:

Upon completion of this activity, participants will be able to:

- Discuss types of influenza vaccines and recommend an annual flu shot (high-dose or adjuvanted) for adults age 65 and over
- Identify adults who should receive a pneumococcal vaccine considering risk factors and prior vaccination history
- Identify adults who should receive respiratory syncytial virus vaccination
- Distinguish between recommended COVID immunization schedules based on vaccination history
- Use the recombinant zoster vaccine (Shingrix) to prevent shingles and postherpetic neuralgia
- Review recommendations for protection from tetanus with either Tdap or Td

Disclosure Policy:

All individuals in a position to control the content of this activity have been asked to disclose any relationship they have with ineligible companies whose primary business is producing, marketing, selling,

re-selling, or distributing healthcare products used by or on patients. All relevant financial relationships have been mitigated.

This material is provided by Alosa Health, a nonprofit organization which accepts no funding from any pharmaceutical company. No commercial support has been received for this activity. This program is supported by the PACE Program of the Department of Aging of the Commonwealth of Pennsylvania.

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Vaccination: a powerful way to prevent disease

Despite decades of advances in the science of vaccinations, infectious diseases remain a major worldwide cause of illness and death.[1] Older adults are more susceptible to these diseases due to age-related changes in their immune systems, changes that can sometimes render vaccinations less effective.[1] Deciding which vaccines to administer to older adults and when to provide them can be challenging because both the vaccines themselves and the pathogens they target evolve with time. Timely immunization of older adults, however, is one of the most powerful ways clinicians can help their patients avoid disabling disease and premature death. Vaccinating older adults also helps protect younger people with whom they interact (e.g., grandchildren) from exposure to potentially harmful pathogens.

Since 2020 the U.S. Centers for Disease Control and Prevention (CDC) has announced several important updates to its recommendations for older adults, all of which will be explored in detail later in this document (Table 1):

- Patients should be vaccinated against COVID-19 using vaccines updated to the 2024/25 formula
- For vaccination against respiratory syncytial virus (RSV):
  - One dose for anyone 75 years of age and older
  - One dose for adults aged 60-74 years of age at high risk for severe RSV disease
- Vaccination against pneumococcal disease with either PCV20 or PCV21, 1 dose based on prior vaccination history and risk factors for adults ages 50-64, and 1 dose regardless of risk factors for adults ages ≥65 years. PCV15 + PPSV23 is another option, although it requires more vaccinations.

Table 1: CDC 2024 recommendations for immunocompetent older adults[2]

	Vaccine	Age			
		50-59	60-64	65-74	≥ 75
New since 2020	**COVID-19**	1 dose of the most updated formula*			
	Respiratory syncytial virus (RSV)	Not indicated	1 dose, depending on risk factors**		1 dose
	Pneumococcus† Pneumococcal conjugate, PCV20 or PCV21	1 dose, depending on risk factors		1 dose	
Unchanged schedule	**Influenza**	1 dose annually			
	Zoster	2 doses, 2-6 months apart			
	Tetanus / Pertussis	1 dose, then Td or Tdap booster every 10 years			

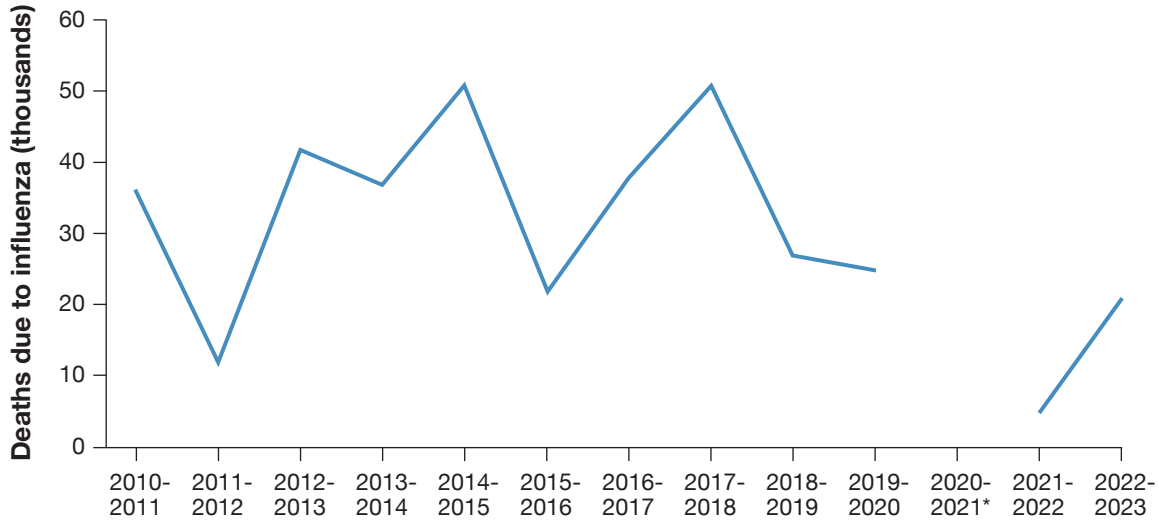
*Recommendations here are for Moderna and Pfizer/BioNTech products; one additional dose is required for the Novavax product if unvaccinated. **Risk factors described on page 4. †PCV15 and pneumococcal polysaccharide (PPSV23) can be used as an alternative if PCV20 or PCV21 are unavailable.

This Evidence Document summarizes the latest recommendations from the Advisory Committee on Immunization Practices (ACIP) of the CDC for the use of vaccines to prevent influenza, COVID, respiratory syncytial virus (RSV), pneumococcal disease, shingles, tetanus, and pertussis in older adults. It also provides evidence-based guidance for clinicians that goes beyond—but is consistent with—ACIP recommendations. (Note that for specific populations of older adults, a range of other vaccines is available [e.g., vaccines against hepatitis, meningococcal disease, or Mpox] but these vaccines, although important for the relevant populations, are not covered in this educational program).

Influenza

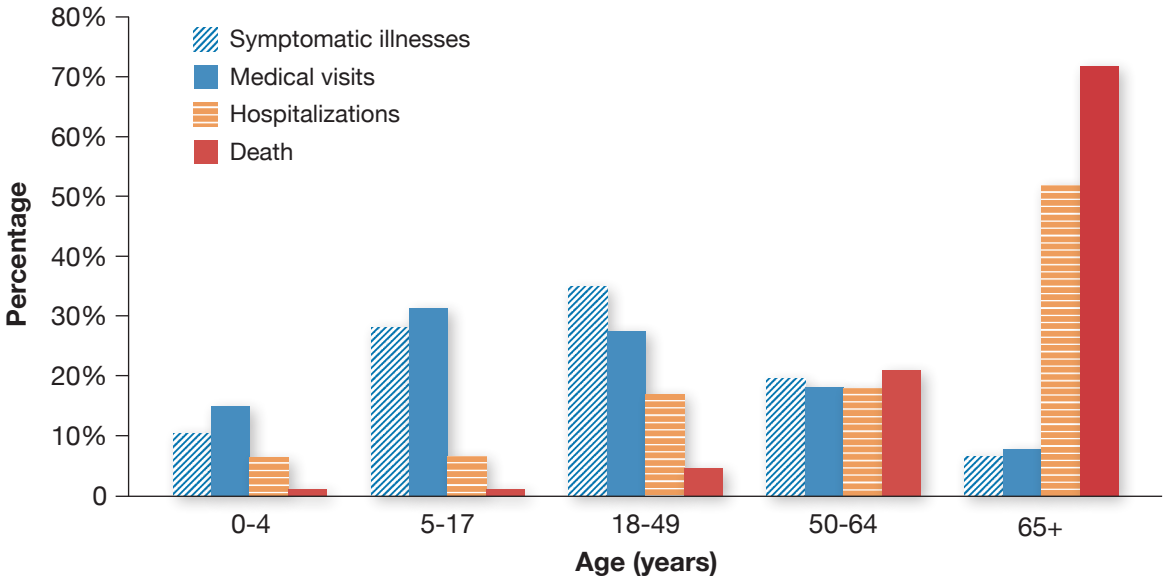
The severity and extent of seasonal influenza outbreaks vary considerably from year to year (Figure 1). This variation is driven by the virulence of the circulating viruses, the effectiveness of the vaccines developed each year against those viruses, and the extent and timing of mass influenza vaccinations.

Figure 1: Variability in influenza-related mortality in recent years[3]



In the 2023-2024 flu season, the CDC estimates that between 34 million and 63 million people in the U.S. became ill with the flu, between 380,000 and 790,000 people were hospitalized for the flu, and between 24,000 and 69,000 people died of the flu.[4] The morbidity and mortality burden falls heavily on older adults (i.e., age ≥ 65 years), as illustrated in Figure 2.

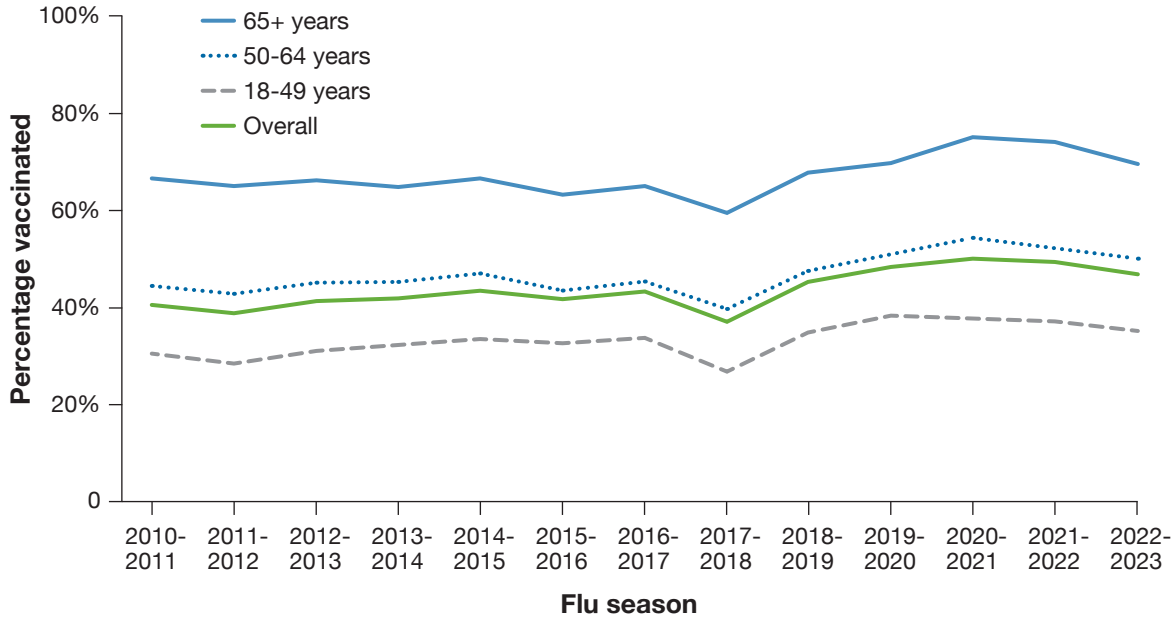
Figure 2: Influenza morbidity and mortality burden by age, 2022-2023[5]



Although the average flu vaccine effectiveness in the 2019-2020 season (the last season before the COVID-19 pandemic) was only 45%, the CDC estimates that it still prevented 7 million flu-related illnesses, 3 million medical visits, 100,000 hospitalizations, and 7,000 deaths in that flu season.[6] Its benefits also include reductions in cardiac events among people with heart disease, chronic lung disease, and hospitalizations among pregnant women.[6]

Despite the proven efficacy of flu vaccines and the risks of influenza, only 48.5% of adults in the U.S. received the flu vaccine in the 2023-2024 flu season.[7] The rate of flu vaccination varied by age, with nearly 74% of adults age ≥ 65 years getting a flu shot, but only 37.5% of adults age 18-49 years doing so (Figure 3).[7]

Figure 3: Flu vaccination coverage by age in U.S. adults age ≥ 18 years[7]



With the COVID-19 pandemic, influenza vaccination has become even more important, since concomitant spread of influenza and COVID can exacerbate disease severity,[8] cause additional burden of disease, and stretch limited health care resources. (Flu incidence in 2020-2021 was minimal because of precautions taken to reduce COVID transmission, according to the CDC, but flu incidence has risen since then, as illustrated above in Figure 1).

Influenza vaccine formulation

Influenza vaccines are manufactured using three different methods:

- **Egg-based** vaccines involve injecting hens' eggs with flu virus, then killing the virus and harvesting the purified antigen. Egg-based vaccines can also be made in a way that doesn't kill the virus, but, rather, weakens the virus (attenuation), which allows the vaccine to be given via a nasal spray. Live attenuated vaccines, however, are not recommended for adults age ≥50 years.[9] (These vaccines also should not be given to people who are pregnant, immunocompromised, asplenic, have cochlear implants or cerebrospinal fluid leaks, or who have recently received influenza antiviral medications.[10])
- **Cell-culture** vaccines were first approved by the U.S. Food and Drug Administration (FDA) in 2012 and involve injecting flu virus into cultured mammalian cells. The virus replicates, then fluid from the cells is harvested, the virus is killed, and the virus antigen is purified

- **Recombinant** vaccines were first approved by the FDA in 2013. DNA for making an antibody to a specific flu strain is injected into a cell line where it combines with the cell's existing DNA and directs the production of flu antigens, which are harvested and purified.

Standard-dose flu vaccines contain 15 mcg of flu antigen (i.e., hemagglutinin), whereas high-dose vaccines contain 45-60 mcg of antigen. Some vaccines also include an ingredient (an adjuvant) that boosts immune response.

ACIP recommends that patients with an egg allergy of any severity may receive any age-appropriate influenza vaccine.[11] A prior recommendation that patients who have previously experienced an allergic reaction to eggs more severe than hives be monitored after vaccination has been dropped for those receiving either cell culture-based or recombinant vaccines.[10] For patients who prefer to avoid an egg-derived vaccine, two influenza vaccines use egg-free technology: a standard-dose cell culture vaccine (Flucelvax) and a higher dose recombinant vaccine (Flublok).

Effectiveness

Flu vaccines are developed months in advance of flu seasons based on predictions about which viral strains are likely to emerge. Vaccines that protect against three influenza strains are termed "trivalent," while those that protect against four strains are known as "quadrivalent" vaccines. Starting with the 2024-2025 season, all influenza vaccines in the U.S. will be trivalent (they won't include components targeting B/Yamagata flu strains because these have not been observed since March 2020).[12] Average flu vaccine effectiveness, which varies across age groups, has ranged from 19% to 54% during the past decade (Table 2).

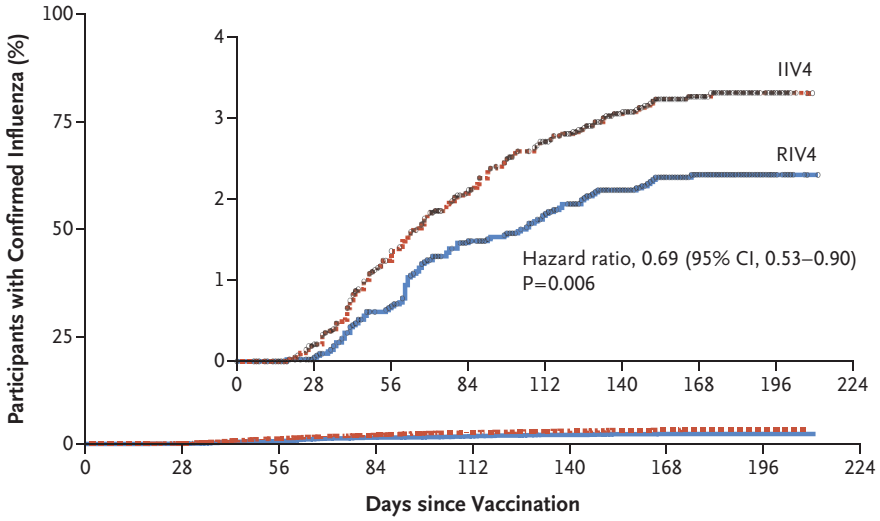
Table 2: Vaccine effectiveness in recent years[13]

Flu Season	Average Effectiveness
2013-2014	52%
2014-2015	19%
2015-2016	48%
2016-2017	40%
2017-2018	38%
2018-2019	29%
2019-2020	39%
2020-2021	(No estimate due to low flu incidence)
2021-2022	36%
2022-2023	54%
2023-2024	42%

The efficacy of high-dose vs. standard-dose vaccine was evaluated in a 2014 trial that randomized 31,989 adults age ≥65 years to Fluzone high-dose (trivalent inactivated 60 mcg hemagglutinin/dose) vs. Fluzone standard-dose (trivalent inactivated 15 mcg hemagglutinin/dose).[14] The primary efficacy outcome was flu symptoms plus lab-confirmed influenza. These occurred in 1.4% of patients who received the high-dose vaccine vs. 1.9% of those who received the standard-dose vaccine, giving a relative risk reduction of 24.2% (95% CI: 9.7%-36.5%). Mortality during the surveillance period was identical between the arms (0.5% in both groups), and the rate of hospitalization for respiratory illness, regardless of laboratory confirmation, was not significantly lower in the high-dose group (12.76 per 1000 subject-seasons) vs. the standard-dose group (14.69 per 1000 subject-seasons) (RR 0.87; 95% CI: 0.72-1.05).

The Flublok recombinant adjuvanted vaccine (45 mcg antigen) was evaluated in a randomized controlled trial (RCT) in 9,003 adults age 50 years and older during the 2014-2015 flu season (Figure 4).[15] Only 2.2% of patients randomized to the recombinant vaccine developed lab-confirmed influenza illness, compared to 3.2% in the standard-dose inactivated vaccine group (P=0.006). On pre-specified subgroup analysis, the recombinant vaccine was 42% more effective than the standard-dose inactivated vaccine among people ages 50-64 (95% CI: 15%-61%). However, in those 65 years of age and older, there was no statistically significant difference in the efficacy of the two vaccines (efficacy difference 17%; 95% CI: -20% to 43%), though the trial was not powered to detect a difference in this subgroup.

Figure 4: Recombinant adjuvanted vs. standard dose flu vaccine[15]



The efficacy of adjuvanted flu vaccine was evaluated in a 2014 trial that randomized 7,082 participants to an adjuvanted trivalent vaccine vs. a non-adjuvanted version of the same vaccine in adults age ≥65 years.[16] The adjuvanted group showed a significantly higher antibody response compared to the non-adjuvanted group, but clinical outcomes did not differ between the two groups. Influenza-like illness was reported by 322 participants in the adjuvant group vs. 314 in the standard group, a non-significant difference. No significant between-group differences were observed in rates of exacerbations of pre-existing chronic diseases, healthcare use, or mortality. Local adverse reactions, however, were reported by 32% of subjects in the adjuvanted group and by 17% in the standard group, and systemic adverse reactions occurred in 32% of subjects in the adjuvanted group compared to 26% in the standard group.

To date, there have been no randomized studies comparing adjuvant and high-dose flu vaccines.[17] A retrospective cohort study, however, evaluated egg-based quadrivalent vaccines against both the egg-

based adjuvanted vaccine and the high-dose vaccine in 12,777,214 Medicare beneficiaries age ≥65 years during the 2018-2019 flu season.[18] The study found that the adjuvanted and high-dose vaccines were both slightly more effective in this population than the standard quadrivalent vaccines (relative vaccine effectiveness 7.7% [CI: 3.9%-11.4%] and 4.9% [CI: 1.7%-8.1%] higher, respectively.)

Adverse events

In general, standard-dose non-adjuvanted flu vaccines elicit rates of side effects comparable to those reported by participants receiving a placebo injection in clinical trials.[19] For example, a 1996 trial randomized 849 healthy adults to inactivated flu vaccine or placebo and assessed for symptoms of fever, myalgia, fatigue, malaise, and headaches.[20] 34.1% of those getting the vaccine reported at least one symptom vs. 35.2% of the placebo group, and 6.2% of the vaccine group reported fever vs. 6.1% of the placebo group (no significant differences). A comparison of high-dose vs. standard-dose vaccine also found no significant differences in adverse events.[14] As noted above, however, rates of adverse events appear higher with adjuvanted vaccines compared to non-adjuvanted vaccines, although severe reactions such as Guillain-Barre syndrome are rare.[16]

Selecting the right flu vaccine for older patients

Adjuvanted or high dose formulations (45-60 mcg) of flu vaccine are preferred for older adults whenever available (Table 3). Ideally, vaccination should occur in September or October, but the vaccine can be given at any time during the flu season. Flu vaccine can be given at the same time as other immunizations, if desired, at separate anatomical sites.

Table 3: ACIP recommendations for flu vaccines in older adults for 2024-2025[10]

	Trade name
First-line choices	Fluad Trivalent (adjuvanted)
	Fluzone High Dose Trivalent (60 mcg)
	Flublok Trivalent (45 mcg)
If first-line vaccines are unavailable	Fluarix Trivalent
	FluLaval Trivalent
	Fluzone Trivalent
	Flucelvax Trivalent

Patients who have a history of a severe allergic reaction to a specific flu vaccine should be given an alternative formulation and be monitored in a healthcare setting after vaccination. Caution is advised in patients with current moderate or severe illness, or who experienced Guillain-Barre syndrome within 6 weeks of a prior flu vaccination.

BOTTOM LINE: Influenza is a serious and often deadly infection in older adults. Vaccination rates among older adults, while higher than for younger adults, can nonetheless be improved. Adjuvanted or high dose formulations of flu vaccine are preferred for older adults whenever available, although any vaccine is better than no vaccine.

COVID vaccines

Although President Biden declared the end of the COVID-19 public health emergency on May 11, 2023, the World Health Organization has not declared the pandemic over and the CDC is still, as of May 2024, reporting more than 100 COVID-related deaths every week in the U.S. and thousands of positive COVID cases.[21] The virus continues to evolve, with more than a dozen variants (e.g., subtypes of Omicron) currently being monitored by the CDC.[22] Importantly, immunity against one Omicron strain does not convey immunity to other Omicron strains and reinfection with different strains is relatively common, particularly after more than 180 days have elapsed since the initial infection.[23] As with other infectious diseases, older adults are at higher risk for COVID-related severe illness or death, hence vaccination in this population remains a public health priority. In addition, COVID, as with other respiratory viruses, can display seasonal variability, with peaks in late fall and winter when people are spending more time indoors. This variability guides the preferred timing of vaccination with the goal of matching peak serologic response with the period of greatest risk.

Nationwide about 91% of the ≥65 population have had at least one COVID vaccine (89.3% in Pennsylvania), which suggests that most people are not categorically opposed to the vaccine.[24] However, only 38% nationwide are up to date with current COVID vaccine recommendations (42% in Pennsylvania), which is a gap in coverage that primary care clinicians can help close.

COVID vaccine formulations

As of May 2024, three COVID vaccines are available, summarized in Table 4. Two types of vaccine are available:

- **mRNA.** The Pfizer and Moderna vaccines both use messenger RNA (mRNA) technology to instruct a patient's cells to produce a COVID spike protein, triggering an immune response.
- **Protein subunit technology.** The Novavax vaccine uses a slightly older technology that directly delivers the spike protein to the patient's body (along with an adjuvant to boost the patient's immune response).

Table 4: Available COVID vaccines with the 2024-25 formula

	Pfizer (Comirnaty)	Moderna (Spikevax)	Novavax (Nuvaxovid, Covovax)
Type of vaccine	mRNA	mRNA	Protein, adjuvanted
Strain targeted	Monovalent, targets Omicron	Monovalent, targets Omicron	Monovalent, targets Omicron
Storage	Freezer	Freezer	Refrigerator
Approved for	6 months and older	6 months and older	12 years and older
FDA status	Fully licensed	Fully licensed	Emergency use authorization

A new vaccine will be released in fall 2024 that targets the monovalent JN1 lineage of COVID.

Effectiveness

A case-control study in 128,825 immunocompetent adults evaluated the effectiveness of the updated (2023-24) monovalent COVID vaccine against emergency department (ED) or urgent care (UC) encounters and hospitalization rates.[25] Among adults aged ≥65 years, effectiveness against ED/UC encounters was 49% (95% CI: 44%–54%) in the first 7–59 days after an updated dose and 37% (95% CI: 29%–44%) in the 60–119 days after an updated dose. In the same age group, effectiveness against COVID–associated hospitalization was 54% (95% CI: 47%–60%) in the first 7–59 days after an updated dose and 50% (95% CI: 39%–59%) in the 60–119 days after an updated dose.

Adverse effects

The safety of mRNA COVID vaccines has been demonstrated in a study of 6.2 million recipients of the vaccine, which showed no difference in rates of serious adverse effects up to 21 days after vaccine administration.[26] Adverse effects evaluated included myocardial infarction, cerebral venous sinus thrombosis, Guillain-Barre syndrome, pulmonary embolism, and stroke. An association between COVID vaccination and an increased risk of myocarditis and pericarditis in men age 12-39 years was observed (rate approximately 1/10,000).[27] The risk of myocarditis after COVID infection, however, is 7 times higher than after COVID vaccination.[28]

Recommended vaccination schedule

ACIP/CDC guidelines as of June 2024 for adult COVID vaccination:

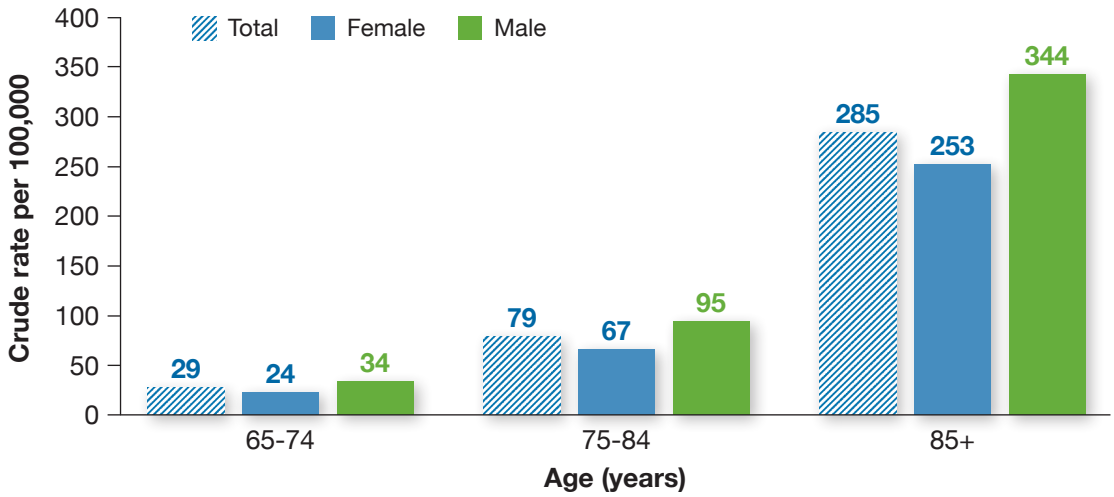
- Everyone ages 6 months and older should receive an updated 2024-2025 COVID-19 vaccine (Moderna, Novavax, or Pfizer) this fall or winter *whether or not they have ever previously been vaccinated* with a COVID-19 vaccine.[29]
- Ongoing review of vaccine effectiveness will be needed to determine if boosters are required.

BOTTOM LINE: COVID continues to pose a threat to older adults. Everyone age ≥6 months should get 1 dose of the updated COVID vaccine in the fall or winter of 2024/2025 regardless of their previous vaccine history.

Pneumococcal vaccines

Pneumococci (*Streptococcus pneumoniae*) inhabit the respiratory tract of roughly 90% of healthy people.[30] Pneumonia, which may occur from infection with either viruses or bacteria is a leading cause of morbidity and mortality (i.e., roughly 1.4 million emergency department visits and 41,00 deaths annually) (See Figure 5).[31] Pneumonia mortality is significantly higher among older adults compared to younger cohorts. Pneumococcal disease refers specifically to any disease caused by the *S. pneumoniae* bacteria.

Figure 5: Death from influenza and pneumonia in adults ≥65 years in 2022[32]



Pneumococcal vaccine formulations

The surfaces of pneumococci are composed of complex polysaccharides, which are one source for the organism's pathogenicity and are how the 100+ known serotypes are differentiated.[30] Antibodies to some pneumococcal polysaccharides may cross-react with related types as well as with other bacteria, which can provide protection against additional serotypes.

Two types of pneumococcal vaccines are available in the U.S.: conjugate vaccines, which chemically link (i.e., conjugate) the bacterial polysaccharide to a protein to enhance immune response, and the older polysaccharide vaccines, which react directly with the polysaccharides on the bacterial surfaces.[33] The vaccines cover varying numbers of bacterial serotypes:

Pneumococcal Conjugate Vaccines (PCVs)

- PCV15 (Vaxneuvance, Merck) covering 15 serotypes
- PCV20 (Prevnar 20, Pfizer) covering 20 serotypes
- PCV21 (Capvaxive, Merck) covering 21 serotypes

Pneumococcal Polysaccharide Vaccine (PPSV)

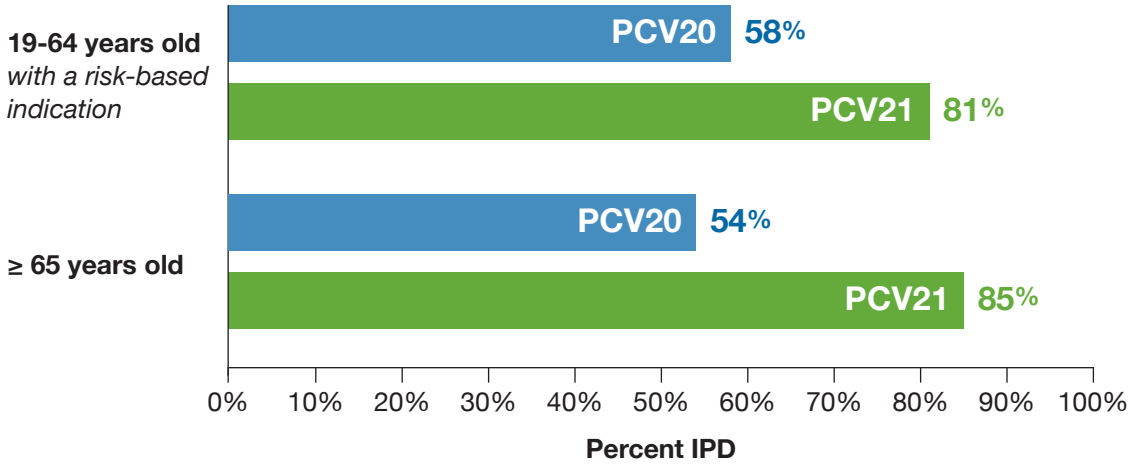
- PPSV23 (Pneumovax 23, Merck) covering 23 serotypes

Figure 6: Serotypes covered by each respective vaccine

	1	3	4	5	6A	6B	7F	9V	14	18C	19A	19F	23F	22F	33F	8	10A	11A	12F	15B	2	9N	17F	20	15A	15C	16F	23A	23B	24F	31	35B	16F	7C
PCV15																																		
PCV20																																		
PPSV23																																		
PCV21																																		

The burden of each of these serotypes varies based on what is circulating within a community. In general, PCV21 covers a greater proportion of the circulating serotypes compared to PCV20.

Figure 7: Proportion of circulating serotypes covered by PCV20 and PCV21 by age



While PCV21 covers more serotypes, it does not cover serotype 4. In certain communities, serotype 4 is a significant cause of invasive pneumococcal disease. PCV20 would be preferred over PCV21 in these communities.

Efficacy and adverse effects

Pneumococcal conjugate vaccine

In 2011 the U.S. FDA approved Prevnar 13 (PCV13) for the prevention of pneumococcal pneumonia and invasive disease in persons 50 years of age and older. A newer version of Prevnar protecting against 20 serotypes is now available, as well as a 15-valent conjugate vaccine (Vaxneuvance).

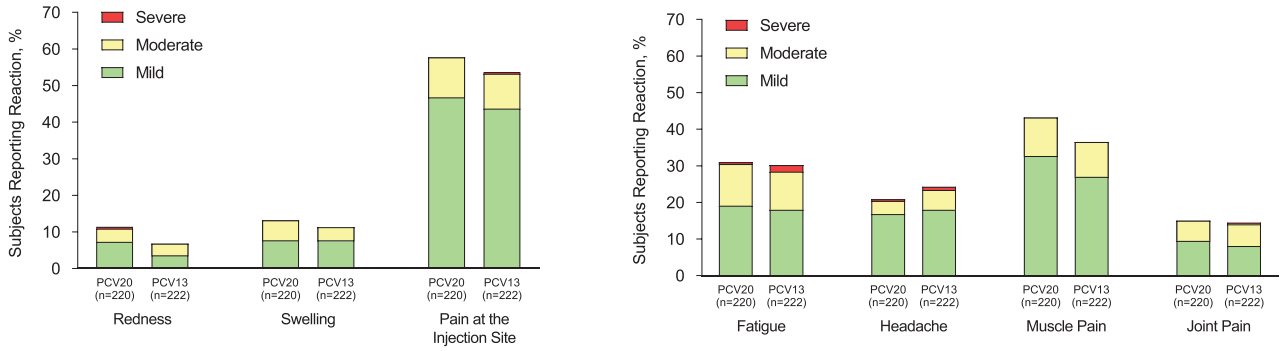
Several studies have shown that PCV20 is safe and has equivalent, or better, immunogenicity compared to PCV13 or PPSV23.[34-36] For example, an RCT of 1,421 older adults in Japan, South Korea, and Taiwan

compared PCV20 vs. PCV13 plus PPSV23.[37] PCV20 was noninferior to the earlier version of Prevnar for all 13 matched serotypes and to PPSV23 for 6 of 7 additional serotypes. The incidence of adverse events was generally similar after PCV20 and PCV13.

A study comparing PCV13 vs. PCV20 found similar rates of adverse events (Figure 8).[34] Commonly-reported adverse events include pain, redness, and swelling at the injection site, fatigue, and generalized muscle pain.

On June 17, 2024, the FDA approved a 21-valent conjugate vaccine (Capvaxive, Merck) for adults aged ≥ 18 years. The PCV21 vaccine includes 8 serotypes not currently covered by the PCV20 vaccine. It does not, however, cover serotype 4, which is included in currently-available vaccines. There has been a reported increase in the incidence of serotype 4 pneumococcal illness in adults experiencing homelessness (especially in the western U.S.) and in adults living in Alaska (especially Alaska Native adults).[38] The safety and efficacy of the PCV21 vaccine was evaluated in a trial that randomized 2663 participants from 11 countries, with or without stable chronic medical conditions to either PCV21 or PCV20.[39] The 21-valent vaccine was non-inferior to PCV20 for the ten serotypes common to both vaccines and superior to PCV20 for all serotypes unique to PCV21, except for 15C. Tolerability and safety outcomes were similar between the two vaccines.

Figure 8: Adverse event rates comparing PCV13 vs PCV20[34]



Pneumococcal polysaccharide vaccine

In 1977, a polysaccharide vaccine containing 14 serotypes was licensed in the U.S., and in 1983 a 23-valent polysaccharide vaccine (Pneumovax) replaced the 14-valent vaccine. Pneumovax is given by injection intramuscularly or subcutaneously. It contains 12 serotypes in common with Prevnar along with 11 additional serotypes.

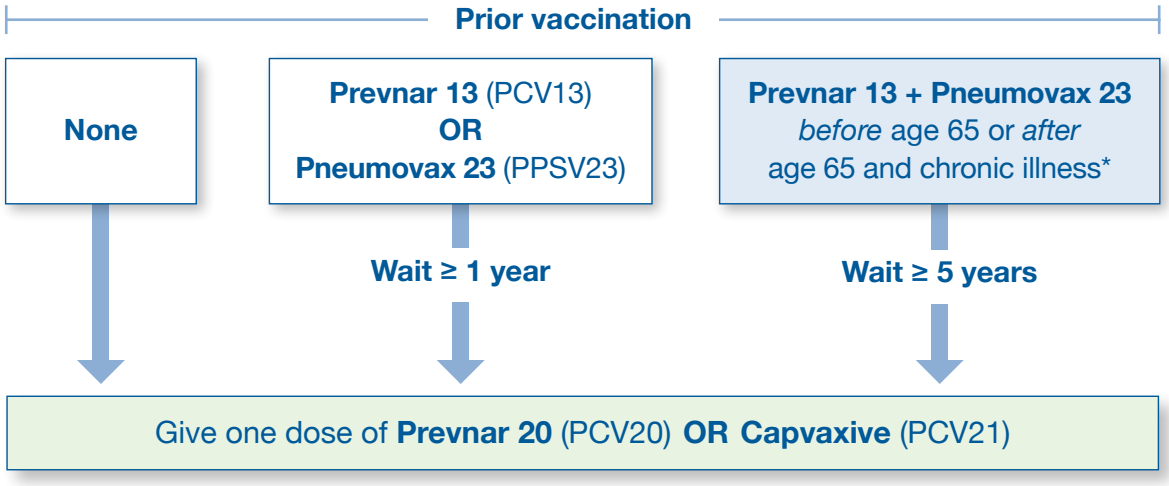
Most studies evaluating Pneumovax effectiveness have shown that it protects against invasive pneumococcal disease (IPD) in healthy younger adults and in older adults.[40] Effectiveness estimates for preventing IPD range from roughly 50% to 80% in immunocompetent older adults and those with a variety of chronic illnesses.[41] A Cochrane meta-analysis of 15 RCTs and seven nonrandomized observational studies of Pneumovax effectiveness suggested an overall vaccine efficacy of 74% against IPD (95% CI: 54%–85%), based on pooled results from 10 of the RCTs.[42]

Recommendations

The CDC has recommended the four products reviewed above for immunization against pneumococcal pneumonia, although one dose of PCV 20 or PCV21 is the easiest way to prevent infection. When to give it depends on prior vaccine history and patient risk factors (see Figure 9). If PCV20 or PCV21 are not

available, vaccination with Vaxneuvance (PCV 15) and Pneumovax (PPSV 23) is recommended as an alternative, with guidance for administration available from the CDC at:
cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf

Figure 9: When to give PCV20 or PCV21[33,43]



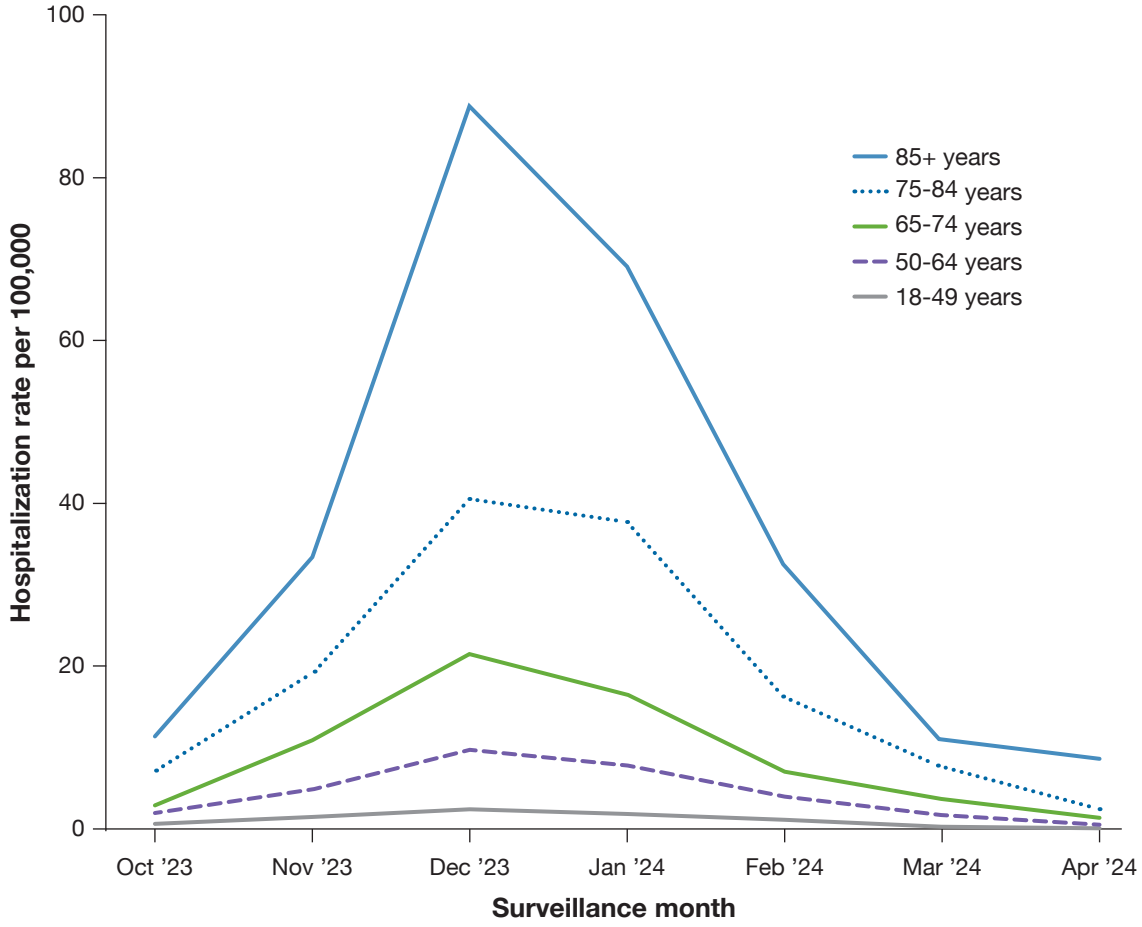
*Includes chronic heart, liver, and kidney disease, diabetes, living in a nursing home or assisted living, prior pneumonia, use of medications that increase pneumonia (e.g., antipsychotics, opioids, sedatives, proton pump inhibitors)

BOTTOM LINE: Although the CDC has approved three products for immunization against pneumococcal pneumonia, one dose of PCV20 or PCV21 is the easiest way to reduce infection.

Respiratory syncytial virus

Respiratory syncytial virus (RSV) is a relatively common seasonal virus that typically causes mild cold-like symptoms from which most people recover in a week or two (Figure 10).[44] In infants and older adults, however, symptoms can become severe or life-threatening. Every year in the U.S., 60,000 to 160,000 older adults are estimated to be hospitalized as a result of RSV infection, and 6,000 to 10,000 older adults are estimated to die from RSV-related complications.[45] RSV bronchiolitis is caused by the sloughing of small airway epithelial cells and increased mucous secretion, resulting in wheezing and asthma-like symptoms.[46]

Figure 10: Monthly rates of RSV-associated hospitalizations by age group[47]



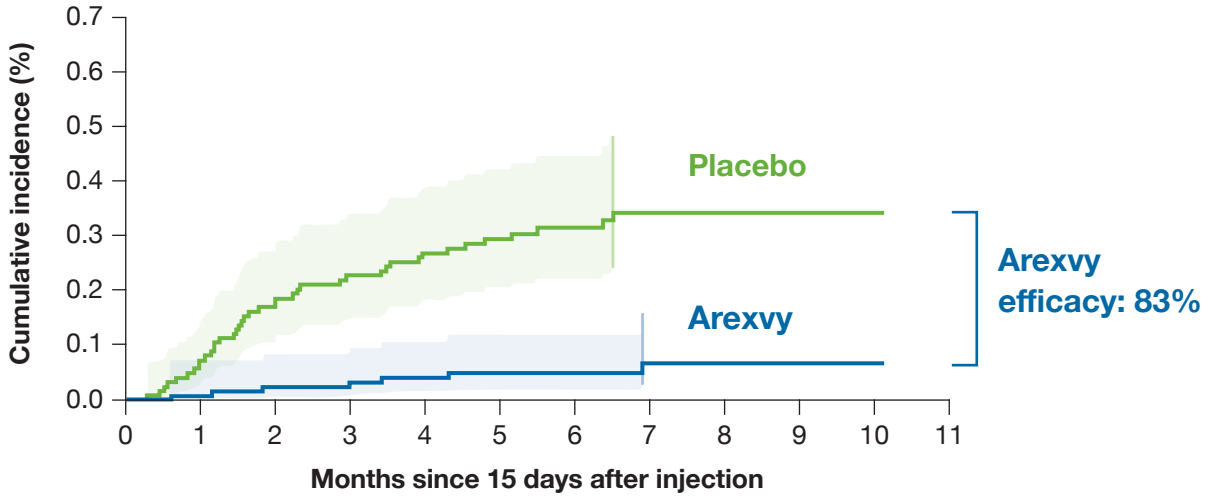
Three RSV vaccines are FDA-approved in the U.S. and are recommended by the CDC for adults age ≥60 years:

- Arexvy (GSK) an adjuvanted vaccine
- Abrysvo (Pfizer) a bivalent vaccine without an adjuvant
- mRESVIA (Moderna) an mRNA-based prefusion F glycoprotein vaccine

Efficacy

Arexvy was evaluated in a double-blind RCT among 24,966 adults age ≥60 years given either a single dose of the vaccine or a placebo.[48] Efficacy against RSV-related lower respiratory tract disease was 82.6% (7 cases in vaccine group vs. 40 in placebo group, Figure 11), and efficacy against severe RSV-related lower respiratory tract disease was 94.1%.

Figure 11: RSV-related lower respiratory tract disease incidence, Arexvy vs. placebo[48]



Abrysvo was evaluated in an RCT that randomized 34,284 adults age ≥60 years to either a single dose of the vaccine or placebo prior to RSV season.[49] Efficacy against RSV-related lower respiratory tract disease was 66.7% (11 cases in vaccine group vs. 33 in placebo group), and efficacy against RSV-related acute respiratory illness was 62.1% (22 cases in vaccine group vs. 58 in placebo group).

The mRESVIA vaccine was tested in 35,541 adults age ≥60 years who received either the vaccine or placebo with a median follow-up of 112 days.[50] Efficacy against RSV-associated lower respiratory tract disease with at least two signs or symptoms was 83.7% (95% CI: 66%-92.2%) representing 9 events in the vaccine group vs. 55 events in the control group.

Adverse effects

In the clinical trials for the three vaccines, the incidence of adverse events was higher in the treatment arms than in the placebo arms, although the rates of serious adverse events for all three vaccines were generally similar to placebo.

For Arexvy, mild adverse reactions were more common in the vaccine group (pain at the injection site 61% vs. 9%, fatigue 34% vs. 16%, and headache 27% vs. 12%).[48] No significant difference was observed in the rate of serious adverse events between groups (4.2% in vaccine group vs. 4% in placebo group) although atrial fibrillation occurred in a higher number of vaccine recipients (10) than placebo recipients (4).

For Abrysvo, among the 7,169 participants evaluated in the safety population of the pivotal trial, those in the vaccine group reported more local reactions than those in the placebo group (12% vs. 7%).[49] The incidence of and kind of systemic event (e.g., fever, fatigue, headache, or muscle pain) was similar between groups (27% vs. 26%). Severe events occurred in ≤0.7% in each group.

In the mRESVIA trial, local adverse reactions were reported by 58.7% of those in the vaccine group vs. 16.2% in the placebo group. More serious (i.e., grade 3) events were reported in 3.2% and 1.7% of

participants, respectively. The rate of systemic adverse reactions was 47.7% in the vaccine group vs. 32.9% in the placebo group, with serious systemic reactions reported in 4.0% and 2.9%, respectively. The most common systemic adverse reactions were fatigue, headache, myalgia, and arthralgia.

A review of data from the Vaccine Adverse Event Reporting System (VAERS) evaluated 3,200 reports of adverse events among people receiving an RSV vaccine (not including mRESVIA, which had not been approved yet): 2,193 events (68.5%) with Arexvy, 919 events (28.7%) for Abrysvo, and 88 (2.8%) unknown vaccine.[51] Among all reported adverse events 8.8% were classified as serious, including 6.8% for hospitalization, 2.5% for a life-threatening illness, 2.1% for a permanent disability, and 1.1% for death. The serious events included stroke or transient ischemic attack (24), Guillain-Barre syndrome (GBS), atrial fibrillation, other thromboembolic event, encephalitis or aseptic meningitis, and immune thrombocytopenia. The rate of GBS was 4.4 per million doses for Abrysvo vs. 1.8 per million doses for Arexvy, both of which were higher than the expected background rates in a vaccinated population.[52]

Guidance for RSV vaccination in older adults

The available vaccines reduce the occurrence of RSV lower respiratory tract infections and severe infections, although Arexvy and mRESVIA have greater efficacy (and also greater side effects) than Abrysvo. The trials were not powered to demonstrate reductions in RSV-associated hospital admissions and results have only been published with data from a single RSV season (although the studies are ongoing and longer-term data are expected).[53]

At its meeting in June, 2024, the ACIP announced the following guidance for RSV vaccination, citing as rationale rising rates of RSV-associated hospitalizations in adults aged 60 years and older, with a steep rise at age 75:[54]

- One dose for anyone age 75 and older
- One dose for adults aged 60-74 years at high risk for severe RSV disease (see below)

Adults aged 60-74 years with the following conditions are considered at high risk for RSV because of documented associations between the conditions and higher incidences of RSV-associated hospitalizations, hence, are candidates for vaccination:

- Immune system compromise*
- Frailty*
- Advanced age*
- Residence in nursing home or long-term care facility*
- Prior hospitalization for RSV*
- Lung diseases
- Cardiovascular disease
- Obesity
- Diabetes mellitus
- Neurologic or neuromuscular conditions
- Kidney disease
- Liver disease
- Hematologic disorder

* These groups were either excluded or had minimal representation in clinical trials testing the RSV vaccines.

RSV vaccines should ideally be given prior to RSV season (i.e., in the fall) although they can be given at any time. The vaccines can be co-administered with other vaccines, such as flu vaccine. Contraindications to RSV vaccination are current moderate or severe acute illness (with or without fever) or a history of severe allergic reaction to any component of the vaccine.

BOTTOM LINE: Three RSV vaccines are available and all lower the risk of RSV lower respiratory tract infections and severe infections. Discuss offering the vaccine to all adults age 75 and older, and for adults aged 60-74 at high risk for RSV, such as those with lung disease, frailty, diabetes, or who live in extended care facilities.

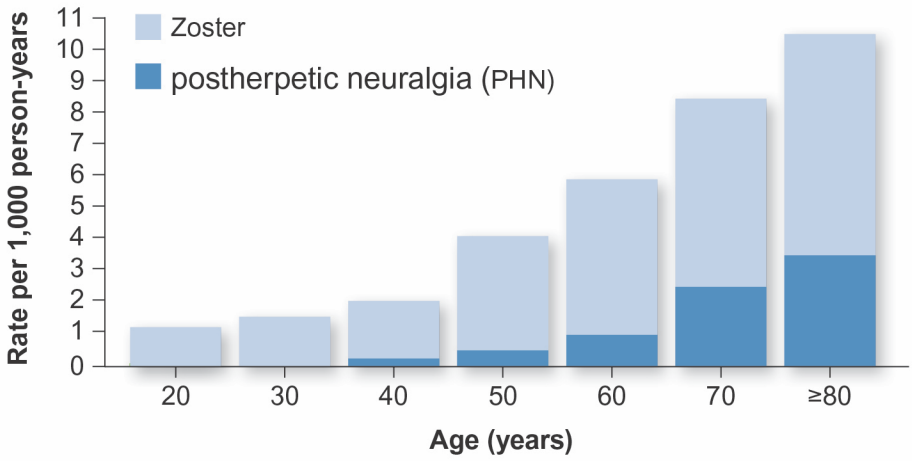
Zoster vaccine

Shingles is an often painful disease caused by the varicella zoster virus (VZV). Until the 1990s, nearly all people developed a primary infection with VZV (i.e., chicken pox) in childhood. A two-dose vaccine series for preventing primary VZV infection has been available in the U.S. since 1995 and is recommended for all children.[55] Varicella cases declined 97% between 1995 and 2010, when vaccination coverage among children 19-35 was estimated to be 95%.[56] More than 99% of people age 50 years and older, however, have been infected with VZV.[57]

After primary infection, the zoster virus remains latent in dorsal sensory or cranial nerve ganglia.[58] Reactivation of VZV later in life can cause shingles, a localized cutaneous eruption that occurs most frequently in older adults. The individual lifetime risk of shingles is about 30%,[59] and approximately 1 million new cases of shingles occur in the U.S. annually.[60] The prevalence of shingles increases with advancing age (Figure 12).

While shingles is self-limited and can be mild in some cases, it can also be intensely painful and can lead to severe complications. The most common is persistent pain following the initial episode, known as postherpetic neuralgia (PHN). PHN can be very burdensome for patients, with pain lasting months to years; it occurs in 10%-18% of those who develop shingles.[61] Ophthalmic involvement can be severe and potentially sight-threatening. Other rare but severe neurologic complications include meningitis, encephalitis, transverse myelitis, and Guillain-Barre syndrome.[58]

Figure 12: Rate of zoster and postherpetic neuralgia by age in the United States[55]



Effectiveness

The first vaccine to prevent shingles was a live vaccine (Zostavax), which was recommended for all adults over age 60 starting in 2006. The live zoster vaccine was 51% effective in preventing shingles and 66% effective in preventing PHN. However, the vaccine is less effective among older adults, and longer-term follow-up data revealed that its effect waned substantially within 5-10 years.[56] Zostavax was taken off the market starting July 1, 2020, and all existing doses were removed from pharmacies when those doses expired on November 18, 2020.[62]

The recombinant zoster vaccine Shingrix was approved in 2017 and is recommended for all patients over age 50.[63] Two doses of Shingrix are more than 90% effective at preventing shingles and PHN. Protection stays above 85% for at least the first four years after vaccination,[63] and was 82% effective 11 years after vaccination in a 2024 conference abstract reporting end-of-trial data.[64]

Table 5: Zoster vaccine summary[65]

Recombinant zoster vaccine	
Brand name	Shingrix
Mechanism	Recombinant, adjuvanted
FDA approval	2017
Dose schedule	Two doses, at least 2 months apart, age ≥50
Herpes zoster efficacy	97% (≥50 years old) 90% (≥70 years old)
Postherpetic neuralgia efficacy	89%
Longevity	No waning immunity within first 3-4 years

The efficacy of Shingrix was evaluated in two RCTs, **ZOE-50** (N=5,411) and **ZOE-70** (N=13,900), both of which showed the vaccine to be highly effective (pooled effectiveness 91.3%) (Table 6).[66,67]

Table 6: Efficacy of recombinant zoster vaccine[66,67]

	ZOE-50 trial	ZOE-70 trial
Population	5,411 adults, age ≥50	13,900 adults, age ≥70
Mean follow-up	3.2 years	3.7 years
Pooled herpes zoster efficacy	91.3% (95% CI: 86.8-94.5%) 9.3 → 0.8 cases per 1000 person-years	
Pooled postherpetic neuralgia efficacy	91.2% (95% CI: 75.9-97.7%) 0.9 → 0.1 cases per 1000 person-years	

Adverse effects

In the clinical trials for Shingrix, some degree of risk for complications was observed. In a subgroup analysis of the 2016 ZOE-70 trial (participants contacted up to 7 days after injection), 53% of participants in the vaccine group had a systemic reaction (e.g., fatigue, myalgia, headache, fever, and shivering) compared to 25.1% in the placebo group, and 74.1% had an injection-site reaction compared to 9.9% of the placebo group.[67] Only 11.9% of the vaccine group, however, had a moderate-to-severe (Grade 3) reaction, vs. 2% of the placebo group. The rates of other serious adverse events, potential immune-mediated diseases, and deaths were not significantly different between the two groups.

While these side effects should not prohibit giving the vaccination, adequate counseling is important so that patients know what to expect. Additionally, for patients who express skepticism about vaccine side effects, it may be reasonable to separate this vaccine from other vaccines, especially the influenza

vaccine, so that patients do not associate the systemic side effects with the flu vaccine, thereby reducing their readiness to get the flu vaccine in future years.[68]

Recommendations

For adults age ≥50 years, give Shingrix in 2 doses spaced 2-6 months apart.[69] If the second dose is given less than 4 weeks after the first, it should be repeated after an appropriate amount of time has passed (i.e., after at least 2 months). If the second dose is given >6 months after the first, there is no need to re-start the series. Patients who were previously vaccinated with Zostavax should still receive the Shingrix vaccine, due to the waning efficacy of Zostavax over time.

Counsel patients about expected adverse effects of Shingrix (i.e., fatigue, myalgia, headache, fever, and shivering). Although Shingrix can be administered at the same time as other vaccines, consider giving Shingrix separately from other shots, as mentioned above, to reduce the chances of patients being disincentivized to have future vaccinations.

The ACIP recommends Shingrix for patients with previous shingles infections to prevent recurrent infections.[70] Wait to administer Shingrix until after an acute shingles infection resolves. There is no specific waiting period, but experts suggest waiting 3-6 months after infection.

Shingrix should not be given to those with a history of severe allergic reactions to the vaccine or those with acute herpes zoster. The vaccine may be given to those with a minor acute illness (e.g., a cold).

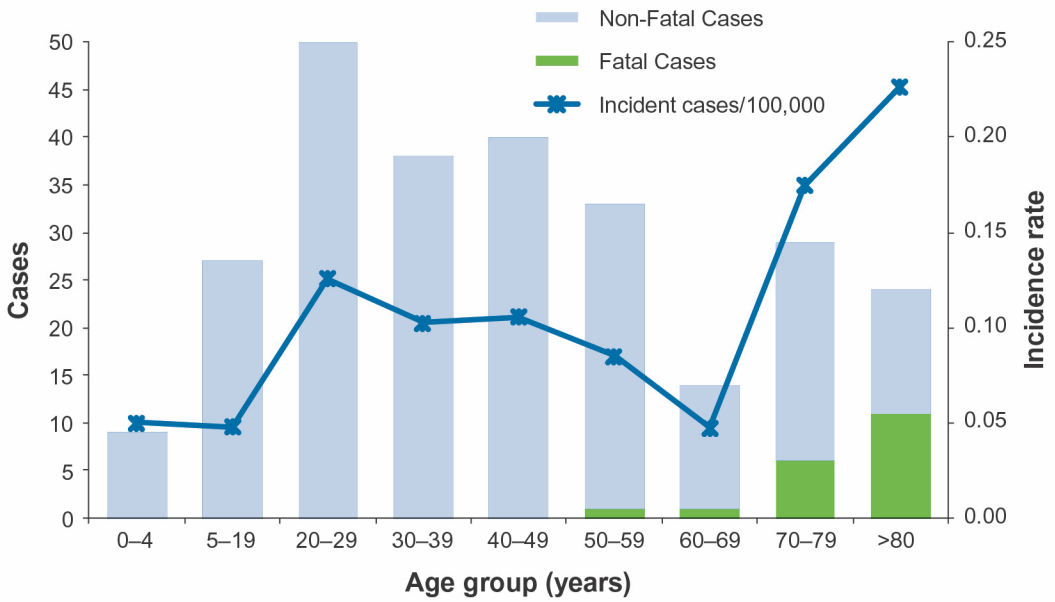
BOTTOM LINE: Shingles is a painful, potentially disabling condition that is largely preventable with vaccination. The recombinant vaccine Shingrix is recommended for all adults over 50 in a 2-dose series separated by 2-6 months.

Tetanus and pertussis vaccination

Tetanus is a severe, life-threatening neurologic disease caused by the bacteria *Clostridium tetani.* While tetanus is not contagious, the *C. tetani* spores are widespread and commonly found in soil, dust, and manure and enter the body through a wound or breach in the skin.[71] In the presence of anaerobic conditions, the spores germinate and produce potent toxins, which act at several sites within the central nervous system, including peripheral nerves, spinal cord, brain, and the sympathetic nervous system. Tetanus toxin causes the typical clinical manifestations of tetanus by interfering with the release of neurotransmitters and blocking inhibitor impulses. This leads to unopposed muscle contraction and spasm. These spasms lead to the disease's common name – lockjaw – but the results can be more severe, including seizures, paralysis, and death.

In the post-vaccination era, tetanus is uncommon in the U.S., with approximately 50 reported cases each year.[71] Elderly adults remain at risk for tetanus, however, and all fatal cases in recent years have occurred in adults over 50 (Figure 13).[72] Nearly all cases of tetanus are among people who were not up-to-date on their tetanus vaccinations.

Figure 13: Cases, survival status, and incidence rates of tetanus by age group 2009-2017.[73]



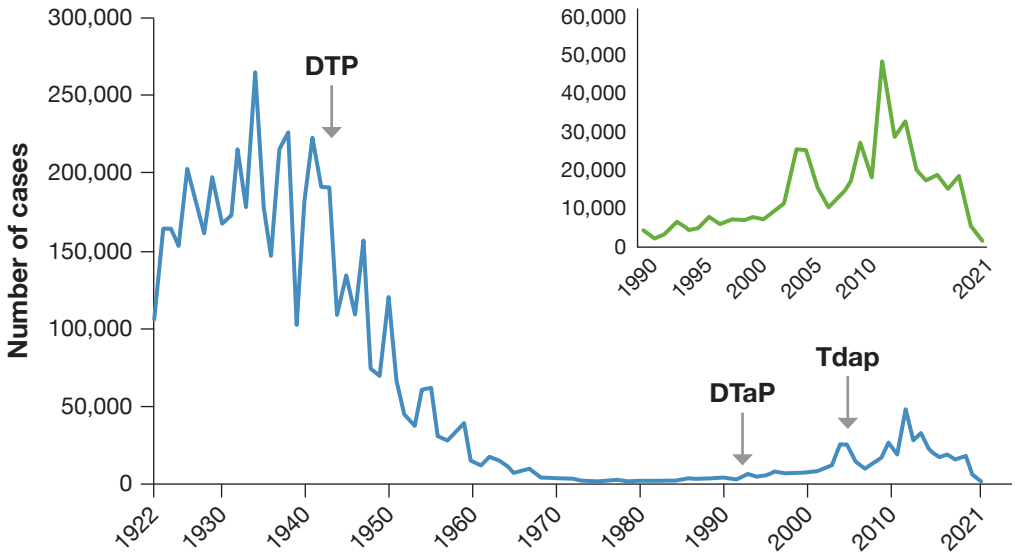
*Incidence rate is calculated as cases per 100,000 population.

Pertussis, also known as whooping cough, is a contagious disease caused by the bacterium *Bordetella pertussis*. Pertussis can affect people of all ages but is particularly dangerous for newborns and infants under age 1. In the U.S. in 2012, during a significant spike in pertussis cases, 15 of 18 pertussis deaths were among infants <1 year old.[74]

Despite nearly universal childhood vaccination, pertussis incidence climbed in the past decade (Figure 14) reaching 48,277 cases in 2012, the highest number since 1955, but the incidence has since declined.[75]

Evidence suggests that the protection provided by pertussis vaccination wanes over time and that many cases of pertussis among infants and children may be linked to transmission from an adult or adolescent.[76] These two facts have raised concern that adults should be vaccinated against pertussis in addition to children.

Figure 14: Incidence of pertussis 1922-2021[77]



DTP = diphtheria, tetanus toxoid, whole-cell pertussis; DTaP = diphtheria, tetanus toxoid, acellular pertussis (for infants and young children); Tdap = tetanus toxoid, diphtheria, acellular pertussis (for older children and adults, contains lower doses of diphtheria and pertussis compared to DTaP)

Tetanus vaccination – for which boosters are recommended every 10 years – can be provided two ways:

- Tetanus and diphtheria toxoid vaccine (Td)
- Tetanus and diphtheria toxoid and acellular pertussis (Tdap)

Two RCTs found similar levels of safety and efficacy between Td and Tdap vaccines.[78,79] For example, a 2019 trial randomized 1,330 adults to either Tdap (n=1,002) or Td (n=328) vaccine 8 to 12 years after a dose of Tdap vaccine administered previously.[78] Adverse events were monitored for six months. Postvaccination concentrations of tetanus and diphtheria antibodies were similar in the Tdap and Td groups, and the rates of seroprotection against tetanus and diphtheria were >99% in both groups. Adverse events were mostly mild, although at least one adverse event was reported by 87.7% of the Tdap group and 88.0% of Td vaccine recipients. No significant between-group differences were found in the rates of injection-site reactions, systemic reactions, or serious adverse events.

Recommendations

ACIP recommends a boosting dose of Tdap for all individuals age ≥11 years.[80] A tetanus toxoid containing vaccine (Td or Tdap) should be given every 10 years. If a pertussis vaccine is due, adults should receive it at least 2 weeks before meeting infants. If a patient's vaccine history is unknown, Tdap may be preferred over Td to assure adequate protection against both pertussis and tetanus. ACIP currently recommends Tdap vaccination in women at each pregnancy to reduce risk to infants.[80]

Recommendations about tetanus and diphtheria vaccination may change in coming years given newer research about the durability of these vaccines. A study of antibody titers in 546 people showed that the half-lives of tetanus and diphtheria antibodies were 14 years (95% CI 11-17 years) and 27 years (95% CI 18-51 years), respectively, suggesting that people have protective levels of antibodies for more than 30 years.[81] The World Health Organization does not currently recommend routine adult Td boosters.[82]

Table 7: Tetanus/diphtheria/pertussis vaccines[76]

Vaccine	Brand	Dose	Comments
Tdap	Adacel	0.5 mL	Not approved for adults ≥65 (but can be given to this group if no other vaccine is available)
Tdap	Boostrix	0.5 mL	
Td	Tenivac	0.5 mL	

BOTTOM LINE: Immunization against tetanus and pertussis can be provided in a single injection of Tdap, and immunization against tetanus can be provided with either Td or Tdap vaccines. If Tdap vaccination status is unknown, choose Tdap over Td. A Tdap booster is recommended for all adults age ≥11 years.

Encouraging immunization

Although vaccinations are routinely recommended, individual counseling by a clinician may increase use. Patient reminders, such as phone calls or emails, as well as postcards and leaflets increased flu vaccination rates in one study by 11%.[83] Outreach efforts by pharmacists, nurses, and receptionists to encourage vaccination more than doubled the likelihood of patients getting vaccinated — not just for flu but other adult immunizations as well.[84]

Several clinical trials have tested behavioral science interventions that can be readily implemented in primary care settings to increase vaccine uptake. While each of these recommendations makes only a small difference, they are relatively simple and cost-effective.

- Describe to patients that flu vaccination prevents heart attacks, especially in patients with heart disease.[85]
- Use vaccine reminder letters or emails highlighting benefits and dispelling myths about flu vaccination.[83]
- Frame vaccine reminders as the flu shot already being "reserved" for the patient.[86]

Vaccine related myths & realities

Ill-founded beliefs about vaccines may prevent some patients from getting the protection they need. Talk to patients about concerns they may have, bearing in mind the following common myths and possible responses.

Myth: "*I don't get the [flu, COVID, RSV].*"
Reality: Anyone can get sick in a given year. Talking points:

- Just because you haven't had a car accident before doesn't mean you shouldn't wear a seatbelt today.
- In addition to reducing the risk of death, this vaccine can prevent major complications, like pneumonia, especially in older adults.

Myth: *"The vaccine gives you a case of the flu."*
Reality: Flu shots don't give you the flu. Talking points:

- Most patients have very minor local injection site reactions, and that's all.
- Injectable vaccines for older adults are made from inactivated whole virus or just portions of virus particles and do not contain live virus, so they can't "cause the flu."
- The vaccine is given at the beginning of cold and flu season, so many people contract viral upper respiratory infections around the time they get their vaccination This is not a result of the shot, but of other circulating viral illness in the community.

Myth: *"The vaccine doesn't work well at all."*
Reality: Vaccines benefit patients, even though they are not 100% effective at preventing illness. Talking points:

- For flu vaccine: The efficacy of the flu vaccine varies year to year based on the composition of the vaccine and the strain of virus circulating in the community.
- Patients may be skeptical of the reported efficacy being perceived as low. But even at this level, the vaccine really reduces the risk of death, severity of illness, and length of hospitalization.
- Studies have shown that even if someone who was vaccinated gets influenza, the disease is likely to be less severe than it would be otherwise.[87]

Myth: *"The [flu, COVID, RSV] isn't that serious; it's just like a bad cold."*
Reality: Infectious diseases can be a severe (requiring hospitalization) and sometimes fatal, especially in people over 65. For example, in the 2023-2024 flu season, between 24,000 and 69,000 people died from flu.[4] Annually 6,000 to 10,000 people die from RSV-related complications,[45] and over 25,000 have died from COVID-19 in 2024 through the end of July.[88]

Safe vaccine administration

Many vaccines for adults are given via intramuscular injection into the deltoid. Safe vaccine practice includes the selection of appropriate needle length for muscle penetration and using anatomic landmarks to determine the location of vaccination. Although seemingly routine, a survey of 100 physicians and nurses found that half could not name any structure at risk from improper deltoid vaccination technique and many used inappropriate depths of injection.[89]

Safe IM vaccine administration can be assured by using the midpoint of the deltoid muscle, located between the acromion and deltoid tuberosity with the arm abducted to 60 degrees.[90]

Vaccine coverage

These vaccinations are generally covered by Medicare and other insurance plans, although Medicare coverage is divided between Part B (clinic coverage) and Part D (pharmacy coverage) (Table 8). Patients pay nothing out-of-pocket regardless of whether the coverage is through Part B or Part D.

Table 8: Medicare coverage of vaccinations

Vaccine	Clinician office (Medicare Part B)	Pharmacy (Medicare Part D)
Influenza	✓	✓
Respiratory syncytial virus (RSV)	✗	✓
Pneumococcal • PCV15 • PCV20 • PCV21 • PPSV23	✓	✗
COVID-19	✓	✓
Tetanus / pertussis	✗	✓
Zoster	✗	✓

Newly FDA approved and ACIP recommended vaccines may not be immediately available nor covered by insurance. For younger patients on commercial insurance, different coverage rules may apply. Patients can check with their insurer if there are questions about vaccine coverage and where to receive the immunization.

Summary and conclusions

Vaccinating older adults is one of the most powerful, cost-effective, and direct ways to prevent a range of disabling, painful, or lethal illnesses and help reduce disease transmission to others. This evidence document has detailed the latest evidence-based recommendations from the ACIP, which can be summarized as:

- Recommend an annual flu shot for older adults with a high-dose or adjuvanted vaccine
- Vaccinate against COVID-19 using 1 dose of any of the vaccines updated for the 2024/25 season for everyone older than 6 months
- Protect against RSV by using either of the available vaccines: 1 dose for all adults aged 75 and older, and 1 dose for adults aged 60-74 who are at high risk for RSV
- Reduce risk of pneumococcal disease with PCV20 or PCV21, 1 dose based on prior vaccination history and risk factors
- Prevent shingles and postherpetic neuralgia with the recombinant zoster vaccine Shingrix.
- Boost tetanus protection with either Tdap or Td every 10 years.

References

1. Coll PP, Costello VW, Kuchel GA, Bartley J, McElhaney JE. The Prevention of Infections in Older Adults: Vaccination. *J Am Geriatr Soc.* 2020;68(1):207-214.
2. Centers for Disease Control and Prevention. Adult immunization schedule by Age (Addendum updated February 29, 2024). https://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed June 5, 2024.
3. Centers for Disease Control and Prevention. Past Seasons Estimated Influenza Disease Burden. https://www.cdc.gov/flu/about/burden/past-seasons.html. Accessed May 28, 2024.
4. Centers for Disease Control and Prevention. 2023-2024 U.S. flu season: preliminary in-season burden estimates. https://www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm. Accessed May 28, 2024.
5. Centers for Disease Control and Prevention. Preliminary Estimated Influenza Illnesses, Medical visits, Hospitalizations, and Deaths in the United States — 2022–2023 Influenza Season. https://www.cdc.gov/flu/about/burden/2022-2023.htm. Accessed May 28, 2024.
6. Centers for Disease Control and Prevention. What are the benefits of flu vaccination? https://www.cdc.gov/flu/prevent/vaccine-benefits.htm. Accessed May 28, 2024.
7. Centers for Disease Control and Prevention. Flu vaccination coverage, United States, 2022-23 influenza season. https://www.cdc.gov/flu/fluvaxview/coverage-2223estimates.htm. Accessed May 28, 2024.
8. Stowe J, Tessier E, Zhao H, et al. Interactions between SARS-CoV-2 and influenza, and the impact of coinfection on disease severity: a test-negative design. *Int J Epidemiol.* 2021;50(4):1124-1133.
9. Centers for Disease Control and Prevention. Live attenuated influenza vaccine [LAIV] (The nasal spray flu vaccine). https://www.cdc.gov/flu/prevent/nasalspray.htm. Accessed May 28, 2024.
10. Grohskopf LA, Alyanak E, Broder KR, et al. Prevention and Control of Seasonal Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices - United States, 2020-21 Influenza Season. *MMWR Recomm Rep.* 2020;69(8):1-24.
11. Centers for Disease Control and Prevention. Recommended Adult Immunization Schedule for ages 19 years or older, United States, 2020. https://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html#table-age. Accessed October 20, 2020.
12. Centers for Disease Control and Prevention. Information for the 2024-3025 Flu Season. https://www.cdc.gov/flu/season/faq-flu-season-2024-2025.htm. Accessed July 2, 2024.
13. Centers for Disease Control and Prevention. Past seasons' vaccine effectiveness estimates. https://www.cdc.gov/flu/vaccines-work/past-seasons-estimates.html. Accessed May 28, 2024.
14. DiazGranados CA, Dunning AJ, Kimmel M, et al. Efficacy of high-dose versus standard-dose influenza vaccine in older adults. *N Engl J Med.* 2014;371(7):635-645.
15. Dunkle LM, Izikson R, Patriarca P, et al. Efficacy of Recombinant Influenza Vaccine in Adults 50 Years of Age or Older. *N Engl J Med.* 2017;376(25):2427-2436.
16. Frey SE, Reyes MR, Reynales H, et al. Comparison of the safety and immunogenicity of an MF59(R)-adjuvanted with a non-adjuvanted seasonal influenza vaccine in elderly subjects. *Vaccine.* 2014;32(39):5027-5034.
17. Centers for Disease Control and Prevention. Adjuvanted Flu Vaccine. https://www.cdc.gov/flu/prevent/adjuvant.htm. Accessed November 2, 2020.
18. Izurieta HS, Chillarige Y, Kelman J, et al. Relative Effectiveness of Influenza Vaccines Among the United States Elderly, 2018-2019. *J Infect Dis.* 2020;222(2):278-287.
19. Allsup SJ, Gosney M, Regan M, Haycox A, Fear S, Johnstone FC. Side effects of influenza vaccination in healthy older people: a randomised single-blind placebo-controlled trial. *Gerontology.* 2001;47(6):311-314.
20. Nichol KL, Margolis KL, Lind A, et al. Side effects associated with influenza vaccination in healthy working adults. A randomized, placebo-controlled trial. *Arch Intern Med.* 1996;156(14):1546-1550.
21. Centers for Disease Control and Prevention. COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#trends_weeklydeaths_testpositivity_00. Accessed May 29, 2024.
22. Centers for Disease Control and Prevention. COVID Data Tracker, Monitoring Variant Proportions. https://covid.cdc.gov/covid-data-tracker/#variant-proportions. Accessed May 29, 2024.

23. Wei J, Stoesser N, Matthews PC, et al. Risk of SARS-CoV-2 reinfection during multiple Omicron variant waves in the UK general population. *Nat Commun.* 2024;15(1):1008.
24. Centers for Disease Control and Prevention. https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/interactive/adults.html. Accessed May 29, 2024.
25. DeCuir J, Payne AB, Self WH, et al. Interim Effectiveness of Updated 2023-2024 (Monovalent XBB.1.5) COVID-19 Vaccines Against COVID-19-Associated Emergency Department and Urgent Care Encounters and Hospitalization Among Immunocompetent Adults Aged >/=18 Years - VISION and IVY Networks, September 2023-January 2024. *MMWR Morb Mortal Wkly Rep.* 2024;73(8):180-188.
26. Klein NP, Lewis N, Goddard K, et al. Surveillance for Adverse Events After COVID-19 mRNA Vaccination. *JAMA.* 2021;326(14):1390-1399.
27. Gargano JW, Wallace M, Hadler SC, et al. Use of mRNA COVID-19 Vaccine After Reports of Myocarditis Among Vaccine Recipients: Update from the Advisory Committee on Immunization Practices - United States, June 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70(27):977-982.
28. Voleti N, Reddy SP, Ssentongo P. Myocarditis in SARS-CoV-2 infection vs. COVID-19 vaccination: A systematic review and meta-analysis. *Front Cardiovasc Med.* 2022;9:951314.
29. Centers for Disease Control & Prevention. CDC Recommends Updated 2024-2025 COVID-19 and flue vaccines for Fall/Winter Virus Season. https://www.cdc.gov/media/releases/2024/s-t0627-vaccine-recommendations.html. Accessed July 5, 2024.
30. Centers for Disease Control and Prevention. Pneumococcal Disease. https://www.cdc.gov/vaccines/pubs/pinkbook/pneumo.html. Accessed November 3, 2020.
31. Centers for Disease Control and Prevention. Pneumonia. https://www.cdc.gov/nchs/fastats/pneumonia.htm. Accessed May 28, 2024.
32. Centers for Disease Control and Prevention. CDC WONDER online database. wonder.cdc.gov/ Accessed May 30, 2024.
33. Kobayashi M, Pilishvili T, Farrar JL, et al. Pneumococcal Vaccine for Adults Aged >/=19 Years: Recommendations of the Advisory Committee on Immunization Practices, United States, 2023. *MMWR Recomm Rep.* 2023;72(3):1-39.
34. Hurley D, Griffin C, Young M, et al. Safety, Tolerability, and Immunogenicity of a 20-Valent Pneumococcal Conjugate Vaccine (PCV20) in Adults 60 to 64 Years of Age. *Clin Infect Dis.* 2021;73(7):e1489-e1497.
35. Essink B, Sabharwal C, Cannon K, et al. Pivotal Phase 3 Randomized Clinical Trial of the Safety, Tolerability, and Immunogenicity of 20-Valent Pneumococcal Conjugate Vaccine in Adults Aged >/=18 Years. *Clin Infect Dis.* 2022;75(3):390-398.
36. Cannon K, Elder C, Young M, et al. A trial to evaluate the safety and immunogenicity of a 20-valent pneumococcal conjugate vaccine in populations of adults >/=65 years of age with different prior pneumococcal vaccination. *Vaccine.* 2021;39(51):7494-7502.
37. Haranaka M, Young Song J, Huang KC, et al. A phase 3 randomized trial of the safety and immunogenicity of 20-valent pneumococcal conjugate vaccine in adults >/= 60 years of age in Japan, South Korea, and Taiwan. *Vaccine.* 2024;42(5):1071-1077.
38. Centers for Disease Control & Prevention. Pneumococcal Vaccines, June 2024 ACIP Meeting. https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2024-06-26-28/01-Pneumococcal-Loehr-508.pdf. Accessed July 5, 2024.
39. Platt HL, Bruno C, Buntinx E, et al. Safety, tolerability, and immunogenicity of an adult pneumococcal conjugate vaccine, V116 (STRIDE-3): a randomised, double-blind, active comparator controlled, international phase 3 trial. *Lancet Infect Dis.* 2024.
40. Nuorti JP, Whitney CG. Updated recommendations for prevention of invasive pneumococcal disease among adults using the 23-valent pneumococcal polysaccharide vaccine. *MMWR Morb Mortal Wkly Rep.* 2010;59(34):1102-1106.
41. World Health Organization. 23-valent pneumococcal polysaccharide vaccine. WHO position paper. *Wkly Epidemiol Rec.* 2008;83(42):373-384.
42. Moberley SA, Holden J, Tatham DP, Andrews RM. Vaccines for preventing pneumococcal infection in adults. *Cochrane Database Syst Rev.* 2008(1):CD000422.
43. Centers for Disease Control and Prevention. Pneumococcal vaccine timing for adults. https://www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf. Accessed June 5, 2024.

44. Centers for Disease Control and Prevention. Respiratory Syncytial Virus Infection (RSV). https://www.cdc.gov/rsv/index.html. Accessed May 29, 2024.
45. Centers for Disease Control and Prevention. Older Adults Are at High Risk for Severe RSV Illness. https://www.cdc.gov/rsv/factsheet-older-adults.pdf. Accessed May 29, 2024.
46. Hall CB. Respiratory syncytial virus and parainfluenza virus. *N Engl J Med.* 2001;344(25):1917-1928.
47. Centers for Disease Control and Prevention. RSV-NET Interactive Dashboard. https://www.cdc.gov/rsv/research/rsv-net/dashboard.html. Accessed May 29, 2024.
48. Papi A, Ison MG, Langley JM, et al. Respiratory Syncytial Virus Prefusion F Protein Vaccine in Older Adults. *N Engl J Med.* 2023;388(7):595-608.
49. Walsh EE, Perez Marc G, Zareba AM, et al. Efficacy and Safety of a Bivalent RSV Prefusion F Vaccine in Older Adults. *N Engl J Med.* 2023;388(16):1465-1477.
50. Wilson E, Goswami J, Baqui AH, et al. Efficacy and Safety of an mRNA-Based RSV PreF Vaccine in Older Adults. *N Engl J Med.* 2023;389(24):2233-2244.
51. Hause AM, Moro PL, Baggs J, et al. Early Safety Findings Among Persons Aged >/=60 Years Who Received a Respiratory Syncytial Virus Vaccine - United States, May 3, 2023-April 14, 2024. *MMWR Morbidity and mortality weekly report.* 2024;73(21):489-494.
52. Centers for Disease Control and Prevention. Erratum, Vol. 73, No. 21. https://www.cdc.gov/mmwr/volumes/73/wr/pdfs/mm7327a4-H.pdf. Accessed August 2, 2024.
53. Centers for Disease Control and Prevention. Evidence to Recommendations Framework (EtR): RSV Vaccination in Adults Ages 50-59 years, 60-74 years, and 75 years and older. https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2024-06-26-28/11-RSV-Adult-Melgar-Roper-Britton-508.pdf. Accessed July 15, 2024.
54. Centers for Disease Control and Prevention. ACIP Presentation Slides: June 26-28, 2024 Meeting. https://www.cdc.gov/vaccines/acip/meetings/slides-2024-06-26-28.html. Published 2024. Accessed July 2, 2024.
55. Harpaz R, Ortega-Sanchez IR, Seward JF, Advisory Committee on Immunization Practices Centers for Disease C, Prevention. Prevention of herpes zoster: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2008;57(RR-5):1-30; quiz CE32-34.
56. Centers for Disease Control and Prevention. Varicella. https://www.cdc.gov/vaccines/pubs/pinkbook/varicella.html. Accessed November 9, 2020.
57. Centers for Disease Control and Prevention. Shingrix Recommendations. https://www.cdc.gov/vaccines/vpd/shingles/hcp/shingrix/recommendations.html. Accessed December 19, 2020.
58. Schmader K. Herpes Zoster. *Clin Geriatr Med.* 2016;32(3):539-553.
59. Yawn BP, Saddier P, Wollan PC, St Sauver JL, Kurland MJ, Sy LS. A population-based study of the incidence and complication rates of herpes zoster before zoster vaccine introduction. *Mayo Clin Proc.* 2007;82(11):1341-1349.
60. Johnson BH, Palmer L, Gatwood J, Lenhart G, Kawai K, Acosta CJ. Annual incidence rates of herpes zoster among an immunocompetent population in the United States. *BMC Infect Dis.* 2015;15:502.
61. Centers for Disease Control and Prevention. Shingles Burden and Trends. https://www.cdc.gov/shingles/surveillance.html. Accessed November 7, 2020.
62. CEnters for Disease Control and Prevention. What everyone should know about Zostavax. https://www.cdc.gov/vaccines/vpd/shingles/public/zostavax/index.html. Accessed November 17, 2020.
63. Centers for Disease Control and Prevention. Shingles Vaccination. https://www.cdc.gov/vaccines/vpd/shingles/public/shingrix/index.html. Accessed November 7, 2020.
64. Diez-Domingo J, et al. Adjuvanted recombinant zoster vaccine (RZV) is the first vaccine to provide durable protection against herpes zoster (HZ) in all age ranges >50 years: final analysis of efficacy and safety after 11 years of follow-up. European Society of Clinical Microbiology and Infectious Diseases; 2024; Barcelona, Spain.
65. Neuzil KM, Griffin MR. Preventing Shingles and Its Complications in Older Persons. *N Engl J Med.* 2016;375(11):1079-1080.
66. Lal H, Cunningham AL, Godeaux O, et al. Efficacy of an adjuvanted herpes zoster subunit vaccine in older adults. *N Engl J Med.* 2015;372(22):2087-2096.

67. Cunningham AL, Lal H, Kovac M, et al. Efficacy of the Herpes Zoster Subunit Vaccine in Adults 70 Years of Age or Older. *N Engl J Med.* 2016;375(11):1019-1032.
68. Rome BN, Feldman WB, Fischer MA, Desai RJ, Avorn J. Influenza Vaccine Uptake in the Year After Concurrent vs Separate Influenza and Zoster Immunization. *JAMA Netw Open.* 2021;4(11):e2135362.
69. Centers for Disease Control and Prevention. Immunization Schedules. https://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed November 7, 2020.
70. Dooling KL, Guo A, Patel M, et al. Recommendations of the Advisory Committee on Immunization Practices for Use of Herpes Zoster Vaccines. *MMWR Morb Mortal Wkly Rep.* 2018;67(3):103-108.
71. Centers for Disease Control and Prevention. Tetanus Surveillance and Trends. https://www.cdc.gov/tetanus/php/surveillance/index.html. Accessed May 29, 2024.
72. Blain A, Tiwari TSP. Tetanus. Manual for the Surveillance of Vaccine-Preventable Diseases Web site. cdc.gov/vaccines/pubs/surv-manual/chpt16-tetanus.html#f2. Published 2020. Accessed October 20, 2020.
73. Centers for Disease Control and Prevention. Chapter 16: Tetanus. https://www.cdc.gov/vaccines/pubs/surv-manual/chpt16-tetanus.html. Accessed November 17, 2020.
74. Hartzell JD, Blaylock JM. Whooping cough in 2014 and beyond: an update and review. *Chest.* 2014;146(1):205-214.
75. Centers for Disease Control and Prevention. Pertussis Fast Facts. https://www.cdc.gov/pertussis/fast-facts.html. Accessed November 7, 2020.
76. Centers for Disease Control and Prevention. About Diphtheria, Tetanus, and Pertussis Vaccines. https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/about-vaccine.html. Accessed August 2, 2024.
77. Centers for Disease Control and Prevention. Pertussis Surveillance and Trends. https://www.cdc.gov/pertussis/php/surveillance/index.html. Accessed May 29, 2024.
78. Halperin SA, Donovan C, Marshall GS, et al. Randomized Controlled Trial of the Safety and Immunogenicity of Revaccination With Tetanus-Diphtheria-Acellular Pertussis Vaccine (Tdap) in Adults 10 Years After a Previous Dose. *J Pediatric Infect Dis Soc.* 2019;8(2):105-114.
79. Kovac M, Kostanyan L, Mesaros N, Kuriyakose S, Varman M. Immunogenicity and safety of a second booster dose of an acellular pertussis vaccine combined with reduced antigen content diphtheria-tetanus toxoids 10 years after a first booster in adolescence: An open, phase III, non-randomized, multi-center study. *Hum Vaccin Immunother.* 2018;14(8):1977-1986.
80. Havers FP, Moro PL, Hunter P, Hariri S, Bernstein H. Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccines: Updated Recommendations of the Advisory Committee on Immunization Practices - United States, 2019. *MMWR Morb Mortal Wkly Rep.* 2020;69(3):77-83.
81. Hammarlund E, Thomas A, Poore EA, et al. Durability of Vaccine-Induced Immunity Against Tetanus and Diphtheria Toxins: A Cross-sectional Analysis. *Clin Infect Dis.* 2016;62(9):1111-1118.
82. World Health Organization. WHO Recommendations for Routine Immunization. https://www.who.int/publications/m/item/table1-summary-of-who-position-papers-recommendations-for-routine-immunization. Accessed June 12, 2024.
83. Thomas RE, Lorenzetti DL. Interventions to increase influenza vaccination rates of those 60 years and older in the community. *Cochrane Database Syst Rev.* 2018;5(5):Cd005188.
84. Jacobson Vann JC, Jacobson RM, Coyne-Beasley T, Asafu-Adjei JK, Szilagyi PG. Patient reminder and recall interventions to improve immunization rates. *Cochrane Database Syst Rev.* 2018;1(1):Cd003941.
85. Johansen ND, Vaduganathan M, Bhatt AS, et al. Electronic nudges to increase influenza vaccination uptake in Denmark: a nationwide, pragmatic, registry-based, randomised implementation trial. *Lancet.* 2023;401(10382):1103-1114.
86. Milkman KL, Patel MS, Gandhi L, et al. A megastudy of text-based nudges encouraging patients to get vaccinated at an upcoming doctor's appointment. *Proc Natl Acad Sci U S A.* 2021;118(20).
87. Thompson MG, Pierse N, Sue Huang Q, et al. Influenza vaccine effectiveness in preventing influenza-associated intensive care admissions and attenuating severe disease among adults in New Zealand 2012-2015. *Vaccine.* 2018;36(39):5916-5925.
88. Centers for Disease Control and Prevention. COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#datatracker-home. Accessed August 2, 2024.
89. McGarvey MA, Hooper AC. The deltoid intramuscular injection site in the adult. Current practice among general practitioners and practice nurses. *Ir Med J.* 2005;98(4):105-107.

90. Szari S, Belgard A, Adams K, Freiler J. Shoulder Injury Related to Vaccine Administration: A Rare Reaction. *Fed Pract.* 2019;36(8):380-384.

About this publication

These are general recommendations only; specific clinical decisions should be made by the treating clinician based on an individual patient's clinical condition.

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