BACKGROUND DOCUMENT

AIB Technical Meeting

Advancing vaccination strategies for the older adults: insights into epidemiology, immunity, and implementation

Warsaw, Poland
7 – 8 May 2025

Prepared by;
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Purpose of the background document

This meeting background document contains a list of, AIB secretariat selected, abstracts/ references from a PubMed Medline and grey literature search on older adult immunization related topic(s) of the technical meeting.

In addition, speakers from the different meeting sessions were asked to provide additional relevant and interesting references. The references are ranged by publication year (most recent first, search from earliest dates available to April 2025) and for each year in alphabetical order of the first author's name.

This document should guide you in the preparation of the meeting, it should not be considered as a complete literature review, but hopefully it will give an overview of what has been published on the topic of the technical meeting.

Inclusion of references in this document does not indicate that the AIB secretariat agrees with the content or correctness of the content.

Contents

Introduction

Meeting Objectives

1. Clarify the definition of older adults in the context of vaccination by considering factors such as chronological age, comorbidities, and biological markers like immunosenescence and frailty.
2. Review and discuss vaccines and vaccination programs targeting older adults across Europe.
3. Address the unique challenges and opportunities in conducting vaccination studies, and especially clinical trials, with older adults.
4. Explore the mechanisms and factors affecting the efficacy, effectiveness, safety and durability (including boosters) of vaccine responses in older adults and discuss strategies (like adjuvants and higher doses) to enhance immune responses. Discuss specific characteristics of different vaccines for older adults.
5. Discuss implementation of vaccination in older adults at the policymakers, organizational and population levels. Identify strategies, including best practices and successes, to increase vaccination coverage in both community and other care settings, and address communication and logistical challenges to ensure program sustainability and equity.

Intended Impact and Target Audience

The population in Europe is ageing rapidly, with the proportion of older adults increasing significantly. As a result, the need to protect this demographic group through tailored vaccination efforts has become more urgent within lifelong immunization programs across Europe. This meeting seeks to provide essential insights and strategies to improve vaccine effectiveness, immunity durability, and uptake among older adults. By gathering experts in immunology, vaccine development, geriatrics and public health, the meeting will address the unique challenges faced by older adults, such as frailty, comorbidities, and immunosenescence. The discussions will support National Immunization Programs by sharing the latest information and best practices to boost vaccination coverage, customize strategies, and ensure sustained protection against vaccine-preventable diseases for this growing segment of the population.

More information about the adult immunization board:

www.adultimmunizationboard.org // AIB introduction video

Part 1 Short meeting agenda

Sessions	Topics	Speaker(s)
Session 1: Opening, introduction and objectives	1.1 Opening remarks	Katarzyna Wieczorowska-Tobis
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	2.2 Clarifying the older adults population for vaccination strategies: exploring age, comorbidities, immunosenescence, frailty as factors	Claudio Franceschi
	2.3 Overview on current vaccines, recommendations and national vaccination plans in the older adults in Europe: insights from IFA	Jane Barratt
	2.4 Geriatric/GP perspectives from three different EU countries on their countries respective vaccination recommendations and strategic plans for older adults (barriers/opportunities for the future)	Filipe Froes Marcin Czech Jens Lundgren
Session 3: From clinical trials to real-world data: challenges and opportunities in the conduction of trials	3.1 Overview of the difficulties and opportunities of vaccine trials (e.g. pragmatic trials) targeting frail and older adults.	T.Biering-Sorensen
	3.2 Use of Real-World Data to complement experimental studies	Domnich Alexandr
Session 4: Understanding specific characteristics of different vaccines for older adults	4.1 Immunological mechanisms of vaccine-induced immune response in the older adults	Birgit Weinberger

	4.2 The effects of comorbidity on the vaccination response in older adults	Debbie van Baarle
	4.3 Herpes Zoster: Specific topic: duration in older adults	Javier Díez-Domingo
	4.4 Pneumococcal disease: Specific topic: future vaccines	Antoni Torres
	4.5 Tdap: Specific topic: boosters in older adults and differences between countries	Tino F Schwarz
	4.6 RSV: Specific topic: Need for revaccination? When and how to organize it?	Élisabeth Botelho-Nevers
	4.7 Influenza: Specific topic: High-dose and adjuvanted vaccines	Colin Russel
	4.8 COVID-19/SARS-CoV-2: Specific topic: Different platforms (e.g. mRNA)	Odile Launay
Session 5: Implementing vaccination in the older adults on multiple levels	5.1 The policymakers level: Vaccine impact assessment and economic value of vaccination in aging adults	Simon Brassel
	5.2 The organizational level: what are challenges in reaching older adults and opportunities (e.g. co-administration)	Sofia Duque
	5.3 The population level: communicating the importance of vaccination for healthy aging	Litjen Tan

Part 2 Article references by session

Meeting title definitions

Adult immunization	Adult immunization refers to the administration of vaccines (active immunization) or antibodies (passive immunization) to individuals who are 18 years of age or older in order to protect them against various infectious diseases, before or after exposition. *Source: AIB secretariat*
Older adults	The United Nations defines "older adults" as persons 60 years of age or older, although this age limit may vary from country to country. For the purposes of this meeting, we have defined "older adults" as those aged 50 and over to ensure the broadest possible inclusion. *Source: AIB secretariat*
Vaccines targeting older adults	This meeting will focus on the following 6 VPI: Influenza, shingles, pneumo, covid-19, RSV, Tdap An overview of the different vaccines is given below: *(Source: AIB adult vaccines tracker)*

Pathogen	Pathogen type	Manufacturer	Brand name (non-commercial nam	Platform	(Most common) route of ad	Antigen / active substance	Adjuvant
Diphtheria, Tetanus (Td)	Bacteria	AJ Vaccines	diTeBooster	Subunit (toxoid)	Intramuscular	Tetanus toxoid, Diphtheria toxoid	Alum-based
Diphtheria, Tetanus (Td)	Bacteria	Astro Pharma	Td-pur / DIFTETALL	Subunit (toxoid)	Intramuscular	Tetanus toxoid, Diphtheria toxoid	Alum-based
Diphtheria, Tetanus (Td)	Bacteria	Sanofi	Tenivac / dT-reduct "Merieux"	Subunit (toxoid)	Intramuscular	Tetanus toxoid, Diphtheria toxoid	Alum-based
Diphtheria, Tetanus, Pertussis (Tdap)	Bacteria	GSK	Boostrix	Subunit (toxoid)	Intramuscular	Diphtheria toxoid, Pertussis toxoid, a	Alum-based
Diphtheria, Tetanus, Pertussis (Tdap)	Bacteria	AJ Vaccines	diTekiBooster	Subunit (toxoid)	Intramuscular	Diphtheria toxoid, Pertussis toxoid, a	Alum-based
Diphtheria, Tetanus, Pertussis (Tdap)	Bacteria	Sanofi	Triaxis/Covaxis/Adacel	Subunit (toxoid)	Intramuscular	Diphtheria toxoid, Pertussis toxoid, a	Alum-based
Diphtheria, Tetanus, Pertussis, Polio (Tdap-IPV)	Bacteria / Virus	Sanofi	Adacel-Polio / Repevax	Inactivated / subunit (toxoid)	Intramuscular	Diphtheria toxoid, Pertussis toxoid, a	Alum-based
Diphtheria, Tetanus, Pertussis, Polio (Tdap-IPV)	Bacteria / Virus	GSK	Boostrix Polio	Inactivated / subunit (toxoid)	Intramuscular	Diphtheria toxoid, Pertussis toxoid, a	Alum-based
Diphtheria, Tetanus, Polio (Td-IPV)	Bacteria / Virus	Sanofi	Revaxis	Inactivated / subunit (toxoid)	Intramuscular	Diphtheria toxoid and Tetanus toxoi	Alum-based
Respiratory syncytial virus (RSV)	virus	GSK	Arexvy	Subunit (recombinant protein)	Intramuscular	F protein: RSVpreF (RSV A)	AS01E
Respiratory syncytial virus (RSV)	virus	Moderna	mRESVIA (mRNA-1345)	Nucleic acid (mRNA)	Intramuscular	Single-stranded 5' capped mRNA en	None
Respiratory syncytial virus (RSV)	virus	Pfizer	Abrysvo	Subunit (recombinant protein)	Intramuscular	F protein: RSVpreF (RSV A) and RSVp	None
Seasonal Influenza	Virus	Fluart Innovative Vaccines	3Fluart	Inactivated (egg-based)	Intramuscular	TIVs contain two A lineages (H1N1 a	Alum-based
Seasonal Influenza	Virus	CSL Seqirus	Fluad / Chiromas	Inactivated (egg-based)	Intramuscular	TIVs contain two A lineages (H1N1 a	MF59
Seasonal Influenza	Virus	CSL Seqirus	Fluad Tetra/Quad /Quadrivalent	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	MF59
Seasonal Influenza	Virus	CSL Seqirus	Flucelvax Tetra/Quadrivalent/Quad	Inactivated (cell-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	CSL Seqirus	Afluria Quadrivalent/Quad/Tetra	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	CSL Seqirus	Agrippal/Begripal/Fluazur/Sandovac/	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	Sanofi	Efluelda	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	GSK	Fluarix Tetra / Quadrivalent	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	GSK	Flulaval Quadrivalent	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	Abbott Biologicals B.V / Mylan	Influvac/Fluvaccinol/Grippe-Impfstoff	Inactivated (egg-based)	Intramuscular	TIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	Abbott Biologicals B.V / Mylan	Influvac Tetra	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	Sanofi	Vaxigrip	Inactivated (egg-based)	Intramuscular	TIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	Sanofi	Vaxigrip Tetra	Inactivated (egg-based)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Seasonal Influenza	Virus	Sanofi	Supemtek Tetra	Subunit (recombinant protein)	Intramuscular	QIVs contain two A lineages (H1N1 a	None
Severe acute respiratory syndrome coronavirus 2 (SARS-Co	Virus	Novavax	Nuvaxovid	Subunit (recombinant protein)	Intramuscular	Monovalent and Bivalent original an	Matrix-M
Severe acute respiratory syndrome coronavirus 2 (SARS-Co	Virus	Pfizer / BioNTech	Comirnaty	Nucleic acid (mRNA)	Intramuscular	Monovalent and Bivalent original an	None
Severe acute respiratory syndrome coronavirus 2 (SARS-Co	Virus	Moderna	Spikevax	Nucleic acid (mRNA)	Intramuscular	Monovalent and Bivalent original an	None
Severe acute respiratory syndrome coronavirus 2 (SARS-Co	Virus	Arcturus Therapeutics Europe B.V	Kostaive	Nucleic acid (self-amplyfing mRNA)	Intramuscular	Zapomeran, sa-mRNA,encapsulated	None
Severe acute respiratory syndrome coronavirus 2 (SARS-Co	Virus	Hipra Human Health	Bimervax	Subunit (recombinant protein)	Intramuscular	Monovalent and bivalent, alfa, beta,	SQBA
Streptococcus pneumoniae	Bacteria	Pfizer	Prevenar 20	Subunit (conjugate)	Intramuscular	Pneumococcal capsular polysacchar	Alum-based
Streptococcus pneumoniae	Bacteria	Pfizer	Prevenar 13	Subunit (conjugate)	Intramuscular	Pneumococcal capsular polysacchar	Alum-based
Streptococcus pneumoniae	Bacteria	MSD	Vaxneuvance	Subunit (conjugate)	Intramuscular	Pneumococcal capsular polysacchar	Alum-based
Streptococcus pneumoniae	Bacteria	MSD	Pneumovax 23	Subunit (polysaccharide)	Intramuscular	Polysaccharide antigen from 1, 2, 3,	None
Streptococcus pneumoniae	Bacteria	MSD	Capvaxive (PCV21)	Subunit (conjugate)	Intramuscular	Polysaccharide antigen from 3, 6A, 7	None
Varicella-zoster virus (VZV) - Herpes Zoster	Virus	GSK	Shingrix	Subunit (recombinant protein)	Intramuscular	Varicella Zoster Virus glycoprotein E	AS01B

Session 1: Opening, Introduction and Objectives

Session 1: Opening, introduction and objectives	1.1 Opening remarks	Katarzyna Wieczorowska-Tobis
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1.1 Introduction of Adult Immunization Board (AIB)

Potential questions/outcomes: What is the mission and objectives of the AIB? What is the operating procedure of the AIB? What is an AIB technical and country meeting? Who are the AIB advisors? How is the AIB funded?

1.1.1 AIB Technical meeting (April 2024) - Boccalini S, Bechini A, Del Riccio M, Weinberger B, Wysocki J, Martinelli D, Wichmann O, Likki T, Hendrickx G, Van Damme P, Wyndham-Thomas C, Bonanni P, Pattyn J. Strategies for introducing and implementing vaccines for adults into national immunization programs in Europe: Good practices and key insights of the adult immunization board meeting. Hum Vaccin Immunother. 2025 Dec;21(1):2451487.

In April 2024, the Adult Immunization Board convened a technical meeting to explore the latest strategies and identify exemplary approaches regarding the implementation of vaccines for adults into Europe's National Immunization Programmes (NIPs). The meeting was built around 3 pillars: decision making for introducing a new vaccine, implementation, monitoring and evaluation. The increasing number of new and improved vaccines available in a context of competing health priorities warrants transparent and evidence-based decision-making processes for vaccine introduction. In Europe, burden of disease, vaccine efficacy or effectiveness, and safety are universally used decision-making criteria. While economic evaluations and the quality of evidence are being increasingly considered, public acceptance, equity, and operational criteria remain underutilised. Vaccine implementation requires careful planning and coordination. Implementation activities discussed during the meeting were vaccine targets, target population identification, communication, training of healthcare professionals, and the involvement of pharmacists. Once operational, NIPs are to be monitored in terms of safety, effectiveness, and impact. Implementation science and behavioural and cultural insights can be used to identify tangible interventions to improve vaccine uptake. As vaccine programmes in Europe shift towards a life-long approach, success stories and problem-solving strategies should continue to be identified and leveraged.

1.1.2 AIB Country meeting Italy (December 2023) – Bechini, A., Boccalini, S., Del Riccio, M., Pattyn, J., Hendrickx, G., Wyndham-Thomas, C., … Bonanni, P. (2024). Overview of adult immunization in Italy: Successes, lessons learned and the way forward. Human Vaccines & Immunotherapeutics

The exchange of knowledge and best practices in adult immunization are essential to improve vaccination strategies across the European region. Italy has made groundbreaking progress in the field, being one of the first countries to propose a life-course vaccination schedule, broadening the traditional focus on childhood immunization to include adults. All vaccines included in Italy's vaccination schedule are free of charge. Moreover, the country's National Immunization Plan sets clear coverage targets, immunization priorities, and actions to reduce disparities. However, the fragmentation of its National Health System following the constitutional reform of 2001 has led to an increased complexity and regional inequalities regarding immunization. Other challenges the country faces include growing vaccine hesitancy, data gaps and underserved populations. This review describes Italy's adult immunization system, from policy to implementation. The successes, challenges and lessons learned were shared during the first Adult Immunization Board country meeting in Italy, where local experts, healthcare providers, public health representatives, and policymakers engaged in collaborative discussions and shared insights through case studies and presentations (December 2023). These insights are reviewed and discussed in this manuscript.

1.1.3 Pattyn J, Del Riccio M, Bechini A, Hendrickx G, Boccalini S, Van Damme P, Bonanni P. The Adult Immunization Board (AIB): A new platform to provide multidisciplinary guidelines for the implementation and optimization of adult immunization in Europe. Vaccine. 2024 Jan 1;42(1):1-3. doi: 10.1016/j.vaccine.2023.11.060. Epub 2023 Dec 3. PMID: 38044243.

1.1.4 Pattyn Jade, Bonanni Paolo, on behalf of the Adult Immunization Board working group. Assessing the health burden of vaccine-preventable infections in European adults: challenges and opportunities translated into action. Euro Surveill. 2023;28(48)

Abstract: Background - Accurate information on the health burden of vaccine-preventable infections (VPIs) is needed to support evidence-based vaccine policy recommendations and programs. The first technical meeting of the Adult Immunization Board (AIB) was dedicated to the assessment of health burden evidence of VPIs in European adults. Methods - The AIB technical meeting, held in Antwerp, Belgium, in April 2023, convened international experts on health burden of VPIs. Presentations by subject-matter experts and group discussions were held based on pre-defined meeting objectives, covering multiple topics on the availability and use of health burden evidence of adult VPIs in Europe. Results - Both opportunities and challenges were identified. Key points discussed included (1) the need for further harmonization of Burden of Disease (BoD) methodologies for cross-study and cross-country comparison, (2) the recognition that health burden studies require significant resources and high-quality data, and therefore improved infectious disease surveillance and collaborative efforts in Europe, (3) the important geographical differences and inequalities found at all levels of adult immunization in Europe that are to be considered when interpreting BoD results, and (4) the importance of tailored communication of VPI health burden data to each stakeholder for an effective translation into vaccine policy decisions. Conclusion - Several European initiatives promote health BoD harmonized methodologies and/or capacity building collaborations that are to be further built upon. Although VPI health burden data is available and is a key component in the evidence-based decision-making processes behind immunization strategies, data gaps remain, particularly for certain diseases and at-risk populations.

1.1.5 Adult Immunization Board website (link): www.adultimmunizationboard.org

All meeting materials (background document + slides + conclusions) are published on the AIB website. Summary meeting reports are published in peer-reviewed journals.

1.1.6 Adult Immunization Board video (link): https://www.youtube.com/watch?v=4lbpByoI6Ow

Session 2: Setting the scene: health prevention and vaccination strategies of older adults in Europe

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	2.2 Clarifying the older adults population for vaccination strategies: exploring age, comorbidities, immunosenescence, frailty as factors	Claudio Franceschi
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2.1 Enhancing health in an ageing population: WHO EURO's data-driven approach to prevention strategies (including vaccination) for older adults

Potential questions/outcomes: Give overview of aging population data in Europe. How to frame vaccination in disease prevention in older adults. What is next to vaccination also critical and are there potential complementary strategies? (e.g. regular health screenings (chronic disease management, cancer screening), healthy lifestyle (diet, exercise), infection control (hygiene, vaccination), mental and emotional health, education). Which vaccination related projects are ongoing in WHO Decade of Healthy Ageing 2021-2030? And which are planned in the future?

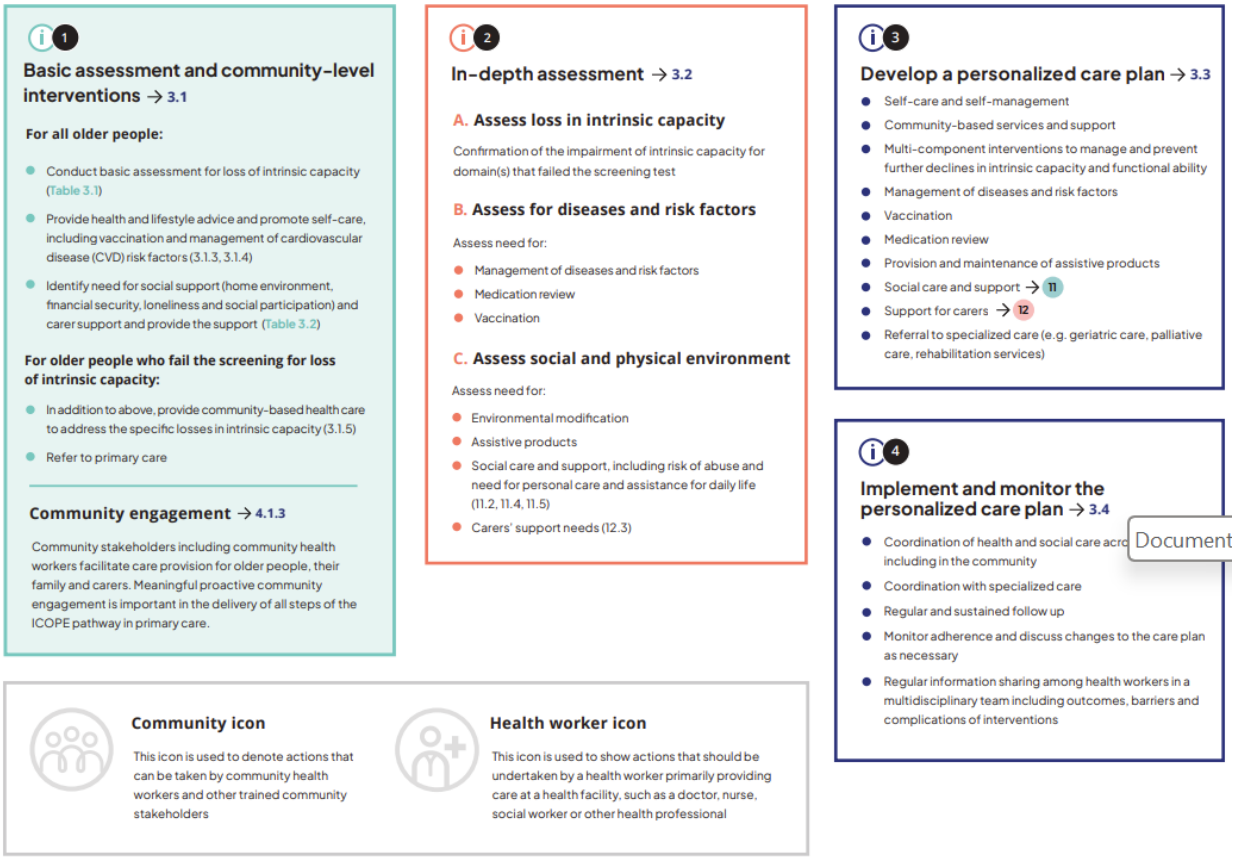
2.1.1 **The WHO Ageism Scale – A new way to measure ageism**

Ageism, which is how we think (stereotypes), feel (prejudices), and act (discrimination) towards others or ourselves based on age, is harmful for our health and well-being. The UN

Global report on ageism shows that ageism has serious consequences for our physical / mental health, impacts negatively on our social well-being, and takes a heavy economic toll on individuals and society. To stop the damage, urgent action is needed to address ageism around the world.

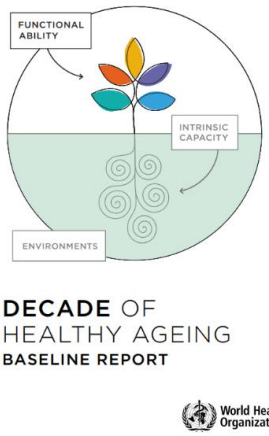
2.1.2 Integrated care for older people (ICOPE): guidance for person-centred assessment and pathways in primary care, 2nd ed December 2024

The ICOPE handbook supports health and care workers to put evidence- based recommendations into practice in primary care including community. The handbook describes practical care pathways to be adapted for the local context to detect declines in intrinsic capacity, identify social care and support needs, and develop a personalised care plan.



2.1.3 Progress report of the UN Decade of Healthy aging 2021-2023 – November 2023

The purpose of this report is to: assess the extent of progress made in the first phase of implementation of the UN Decade of Healthy Ageing, from 2021 to mid-2023; present contributions to the Decade being made by stakeholder groups, including Member States, UN agencies, civil society, academia, the private sector, community groups and older people themselves; and inspire and motivate stakeholders to collaborate in their continued efforts to implement the Decade at country level and scale up interventions to ensure healthy ageing.



Parts on vaccination in the report:

- Embarking on the United Nations (UN) Decade of Healthy Ageing (2021–2030) (9) – a concerted global effort related to healthy ageing – is urgently needed to improve the lives of older adults, their families and communities. The strategic plan for the decade addresses four areas of action, which include combatting ageism, creating age-friendly environments, delivering integrated care and primary health services oriented towards older adults and providing access to long-term care for older adults who need it
- A number of initiatives support access to pharmaceutical products for older people, and particularly vaccines. As part of Immunization Agenda 2030, WHO is working towards the goal that all people will benefit from recommended vaccines throughout the life-course. In order to achieve this goal, immunization policies and integrated service delivery are being strengthened. In the most recent data, 58% of countries have a vaccination policy for seasonal influenza, but only 13% have a policy for pneumococcal and 5% for herpes zoster vaccination.

2.1.4 Iburg KM, Charalampous P, Allebeck P, Stenberg EJ, O'Caoimh R, Monasta L, Peñalvo JL, Pereira DM, Wyper GMA, Niranjan V, Devleesschauwer B, Haagsma J. Burden of disease among older adults in Europe-trends in mortality and disability, 1990-2019. Eur J Public Health. 2023 Feb 3;33(1):121-126.

Background: It is important to understand the effects of population ageing on disease burden and explore conditions that drive poor health in later life to prevent or manage these. We examined the development of disease burden and its components for major disease groups among older adults in Europe over the last 30 years. Methods: Using data from the Global Burden of Disease 2019 Study, we analyzed burden of disease trends between 1990 and 2019 measured by years of life lost (YLL), years lived with disability (YLD) and disability-adjusted life years (DALYs) among older adults (65+ years) in Western, Central and Eastern Europe using cause groups for diseases and injuries. Results: Between 1990 and 2019, the crude numbers of DALYs for all causes increased substantially among older Western Europeans. In Eastern Europe, the absolute DALYs also increased from 1990 to 2005 but then decreased between 2006 and 2013. However, DALY rates declined for all European regions over time, with large differences in the magnitude by region and gender. Changes in the YLL rate were mainly driven by the contribution of cardiovascular diseases. Conclusions: This study found an increased overall absolute disease burden among older Europeans between 1990 and

2019. The demographic change that has taken place in Eastern European countries implies a potential problem of directed resource allocation to the health care sector. Furthermore, the findings highlight the potential health gains through directing resources to health promotion and treatment to reduce YLDs and to prevent YLLs, primarily from cardiovascular diseases.

2.1.5 WHO Decade of healthy ageing: baseline report – January 2021

The Global Strategy on Ageing and Health and its first action plan 2016–2020, mandate WHO to produce a baseline report in 2020 for the Decade of Healthy Ageing. A preliminary report was presented to the World Health Assembly in May 2020. The strategy's new action plan, the Decade, also calls for WHO and UN partners to produce status reports at baseline and confirms WHO's mandate to track progress during 2021–2030. This report is the baseline from WHO's perspective. This mandate recognizes that what is measured drives action. Action needs to be informed by evidence and aligned with older persons' expectations and the priorities that are negotiated with stakeholders and resourced by decision-makers.

The Baseline Report for the Decade of Healthy Ageing 2021–2030 addresses five issues:

1. Introduces Healthy Ageing, the Decade's actions and enablers, and a pathway to accelerate impact by 2030.
2. Where are we in 2020? The report provides a first-time baseline for healthy ageing worldwide.
3. What improvements could we expect by 2030? It documents progress and scenarios for improvement.
4. How can we accelerate impact on the lives of older people? It shows how older people and stakeholders can together optimize functional ability.
5. The next steps including opportunities to boost collaboration and impact by 2023, the next reporting period

2.1.6 Implementing the Immunization Agenda 2030 – 7 January 2021

The purpose of the IA2030 Framework for Action is to describe how four critical operational elements enable a successful translation of the strategy into its implementation phase to achieve the IA2030 vision. These include:

- regional and national strategies that prioritize actions for operational planning;
- mechanisms to ensure appropriate ownership and accountability (O&A);
- monitoring and evaluation (M&E) frameworks to guide and monitor country implementation;
- communication and advocacy to create the necessary messaging and reinforce the required actions by all stakeholders throughout the decade.

Implementation of IA2030 will initially focus on a comprehensive response to the COVID-19 pandemic. An urgent priority is the rapid and equitable scale-up of COVID-19 vaccines in all countries as well as collective action to catch up on missed vaccinations and rebuild essential services.

Rebuilding of immunization programmes will make a major contribution to the strengthening of primary health care systems. Effective childhood and adult immunization programmes, including COVID-19, will lie at the heart of resilient and sustainable primary health care systems that will be central to future global health security.

As a living document, the Framework for Action will be updated from time to time to reflect further input.

2.1.7 Decade of Healthy Ageing: Plan of Action – December 2020

This document describes the plan for a Decade of Healthy Ageing (2021–2030), which will consist of 10 years of concerted, catalytic, sustained collaboration. Older people themselves will be at the centre of this plan, which will bring together governments, civil society, international agencies, professionals, academia, the media and the private sector to improve the lives of older people, their families and their communities. It is the second action plan of the WHO *Global strategy on ageing and health*, building on the United Nations Madrid International Plan of Action on Ageing and aligned with the timing of the United Nations Agenda 2030 on Sustainable Development and the Sustainable Development Goals.

This proposal was endorsed by the 73rd World Health Assembly on 3 August 2020. It was also welcomed by the UN General Assembly on 14 December 2020 (Resolution 75/131), leading to the proclamation of a UN Decade of Healthy Ageing (2021–2030).

2.1.8 Immunization Agenda 2030. A global strategy to leave no one behind. Geneva: World Health Organization, IA2030; undated (https://www.who. int/docs/default-source/immunization/ strategy/ia2030/ia2030-documenten.pdf) – April 2020

The Immunization Agenda 2030 highlights the life course approach by recognizing that life-saving vaccines are of benefit across one's life span. Ideally, immunizations should be a fundamental part of integrated care available to older adults.

Ensuring immunization for all ages. Expanding the benefits of vaccination to all age groups offers tremendous opportunities, but it will require major shifts in immunization programmes. As more vaccines become available for older age groups, new methods will be necessary to deliver integrated, people-centred health services. Programmes will also have to respond to significant global demographic shifts. Regions such as Africa are undergoing rapid population growth and a resulting "youth bulge", while others are experiencing significant population ageing. These shifts will have a major impact on the design of immunization services

Figure 2. The seven strategic priorities of IA2030

2.2 Clarifying the older adults population for vaccination strategies: exploring age, comorbidities, immunosenescence, frailty as factors

Potential questions/outcomes: How to define older adults for vaccination strategies? What are important characteristics of this population to take into account for vaccination strategies, what can be learned from other fields? Which immunological responses are important to be checked in clinical trials involving old people, how can vaccine compositions (adjuvant, higher dose) and vaccination schedules be adapted accordingly?

2.2.1 Fulop T, Larbi A, Pawelec G, Cohen AA, Provost G, Khalil A, Lacombe G, Rodrigues S, Desroches M, Hirokawa K, Franceschi C, Witkowski JM. Immunosenescence and Altered Vaccine Efficiency in Older Subjects: A Myth Difficult to Change. Vaccines (Basel). 2022 Apr 13;10(4):607. doi: 10.3390/vaccines10040607. PMID: 35455356; PMCID: PMC9030923.

Organismal ageing is associated with many physiological changes, including differences in the immune system of most animals. These differences are often considered to be a key cause of age-associated diseases as well as decreased vaccine responses in humans. The most often cited vaccine failure is seasonal influenza, but, while it is usually the case that the efficiency of this vaccine is lower in older than younger adults, this is not always true, and the reasons for the differential responses are manifold. Undoubtedly, changes in the innate and adaptive immune response with ageing are associated with failure to respond to the influenza vaccine, but the cause is unclear. Moreover, recent advances in vaccine formulations and adjuvants, as well as in our understanding of immune changes with ageing, have contributed to the development of vaccines, such as those against herpes zoster and SARS-CoV-2, that can protect against serious disease in older adults just as well as in younger people. In the present article, we discuss the reasons why it is a myth that vaccines inevitably protect less well in older individuals, and that vaccines represent one of the most powerful means to protect the health and ensure the quality of life of older adults.

2.2.2 Batista MA, Calvo-Fortes F, Silveira-Nunes G, Camatta GC, Speziali E, Turroni S, Teixeira-Carvalho A, Martins-Filho OA, Neretti N, Maioli TU, Santos RR, Brigidi P, Franceschi C, Faria AMC. Inflammaging in Endemic Areas for Infectious Diseases. Front Immunol. 2020 Nov 12;11:579972.

Immunosenescence is marked by a systemic process named inflammaging along with a series of defects in the immunological activity that results in poor responses to infectious agents and to vaccination. Inflammaging, a state of low-grade chronic inflammation, usually leads to chronic inflammatory diseases and frailty in the elderly. However, some elderly escape from frailty and reach advanced age free of the consequences of inflammaging. This process has been called immunological remodeling, and it is the hallmark of healthy aging as described in the studies of centenarians in Italy. The biological markers of healthy aging are still a matter of debate, and the studies on the topic have focused on inflammatory versus remodeling processes and molecules. The sub-clinical inflammatory status associated with aging might be a deleterious event for populations living in countries where chronic infectious diseases are not prevalent. Nevertheless, in other parts of the world where they are, two possibilities may occur. Inflammatory responses may have a protective effect against these infectious agents. At the same time, the long-term consequences of protective immune responses during chronic infections may result in accelerated immunosenescence in these individuals. Therefore, the biological markers of healthy aging can vary according to environmental, cultural, and

geographical settings that reflect worldwide, and in a non-biased, non-westernized perspective, the changes that we experience regarding our contacts with microorganisms and the outcomes of such contacts.

2.2.3 Ciabattini A, Garagnani P, Santoro F, Rappuoli R, Franceschi C, Medaglini D. Shelter from the cytokine storm: pitfalls and prospects in the development of SARS-CoV-2 vaccines for an elderly population. Semin Immunopathol. 2020 Oct;42(5):619-634.

The SARS-CoV-2 pandemic urgently calls for the development of effective preventive tools. COVID-19 hits greatly the elder and more fragile fraction of the population boosting the evergreen issue of the vaccination of older people. The development of a vaccine against SARS-CoV-2 tailored for the elderly population faces the challenge of the poor immune responsiveness of the older population due to immunosenescence, comorbidities, and pharmacological treatments. Moreover, it is likely that the inflammaging phenotype associated with age could both influence vaccination efficacy and exacerbate the risk of COVID-19-related "cytokine storm syndrome" with an overlap between the factors which impact vaccination effectiveness and those that boost virulence and worsen the prognosis of SARS-CoV-2 infection. The complex and still unclear immunopathological mechanisms of SARS-CoV-2 infection, together with the progressive age-related decline of immune responses, and the lack of clear correlates of protection, make the design of vaccination strategies for older people extremely challenging. In the ongoing effort in vaccine development, different SARS-CoV-2 vaccine candidates have been developed, tested in pre-clinical and clinical studies and are undergoing clinical testing, but only a small fraction of these are currently being tested in the older fraction of the population. Recent advances in systems biology integrating clinical, immunologic, and omics data can help to identify stable and robust markers of vaccine response and move towards a better understanding of SARS-CoV-2 vaccine responses in the elderly.

2.2.4 Ciabattini A, Nardini C, Santoro F, Garagnani P, Franceschi C, Medaglini D. Vaccination in the elderly: The challenge of immune changes with aging. Semin Immunol. 2018 Dec;40:83-94. doi: 10.1016/j.smim.2018.10.010. PMID: 30501873.

The unprecedented increase of life expectancy challenges society to protect the elderly from morbidity and mortality making vaccination a crucial mean to safeguard this population. Indeed, infectious diseases, such as influenza and pneumonia, are among the top killers of elderly people in the world. Elderly individuals are more prone to severe infections and less responsive to vaccination prevention, due to immunosenescence combined with the progressive increase of a proinflammatory status characteristic of the aging process (inflammaging). These factors are responsible for most age-related diseases and correlate with poor response to vaccination. Therefore, it is of utmost interest to deepen the knowledge regarding the role of inflammaging in vaccination responsiveness to support the development of effective vaccination strategies designed for elderly. In this review we analyse the impact of age-associated factors such as inflammaging, immunosenescence and immunobiography on immune response to vaccination in the elderly, and we consider systems biology approaches as a mean for integrating a multitude of data in order to rationally design vaccination approaches specifically tailored for the elderly.

2.2.5 Franceschi C, Salvioli S, Garagnani P, de Eguileor M, Monti D, Capri M. Immunobiography and the Heterogeneity of Immune Responses in the Elderly: A Focus on Inflammaging and Trained Immunity. Front Immunol. 2017 Aug 15;8:982.

Owing to its memory and plasticity, the immune system (IS) is capable of recording all the immunological experiences and stimuli it was exposed to. The combination of type, dose, intensity, and temporal sequence of antigenic stimuli that each individual is exposed to has been named "immunobiography." This immunological history induces a lifelong continuous adaptation of the IS, which is responsible for the capability to mount strong, weak or no response to specific antigens, thus determining the large heterogeneity of immunological responses. In the last years, it is becoming clear that memory is not solely a feature of adaptive immunity, as it has been observed that also innate immune cells are provided with a sort of memory, dubbed "trained immunity." In this review, we discuss the main characteristics of trained immunity as a possible contributor to inflammaging within the perspective of immunobiography, with particular attention to the phenotypic changes of the cell populations known to be involved in trained immunity. In conclusion, immunobiography emerges as a pervasive and comprehensive concept that could help in understanding and interpret the individual heterogeneity of immune responses (to infections and vaccinations) that becomes particularly evident at old age and could affect immunosenescence and inflammaging.

2.2.6 Franceschi C, Bonafè M, Valensin S, Olivieri F, De Luca M, Ottaviani E, De Benedictis G. Inflamm-aging. An evolutionary perspective on immunosenescence. Ann N Y Acad Sci. 2000 Jun;908:244-54.

In this paper we extend the "network theory of aging," and we argue that a global reduction in the capacity to cope with a variety of stressors and a concomitant progressive increase in proinflammatory status are major characteristics of the aging process. This phenomenon, which we will refer to as "inflamm-aging," is provoked by a continuous antigenic load and stress. On the basis of evolutionary studies, we also argue that the immune and the stress responses are equivalent and that antigens are nothing other than particular types of stressors. We also propose to return macrophage to its rightful place as central actor not only in the inflammatory response and immunity, but also in the stress response. The rate of reaching the threshold of proinflammatory status over which diseases/disabilities ensue and the individual capacity to cope with and adapt to stressors are assumed to be complex traits with a genetic component. Finally, we argue that the persistence of inflammatory stimuli over time represents the biologic background (first hit) favoring the susceptibility to age-related diseases/disabilities. A second hit (absence of robust gene variants and/or presence of frail gene variants) is likely necessary to develop overt organ-specific age-related diseases having an inflammatory pathogenesis, such as atherosclerosis, Alzheimer's disease, osteoporosis, and diabetes. Following this perspective, several paradoxes of healthy centenarians (increase of plasma levels of inflammatory cytokines, acute phase proteins, and coagulation factors) are illustrated and explained. In conclusion, the beneficial effects of inflammation devoted to the neutralization of dangerous/harmful agents early in life and in adulthood become detrimental late in life in a period largely not foreseen by evolution, according to the antagonistic pleiotropy theory of aging.

2.3 Overview on current vaccines, recommendations and national vaccination plans in the older adults in Europe

Expected outcome: An overview of vaccines recommended for older adults, along with their implementation strategies and guidelines across different countries, highlighting diverse approaches and stages in adopting a life course vaccination framework.

2.3.1 Vilajeliu, A.; Vega, V.; Gibson, R.; Nogareda, F.; Wang, X.; Brooks, D.; Wiysonge, C. S.; Cakmak, O. N.; Mere, O.; Marti, M.; Lambach, P.; Shendale, S.; Contreras, M.; Njambe, E.; Sparrow Jones, E. G.; Hombach, J.; Lindstrand, A. Global Status of Adult Immunization Post COVID-19 Pandemic. Preprints 2025, 2025030348.

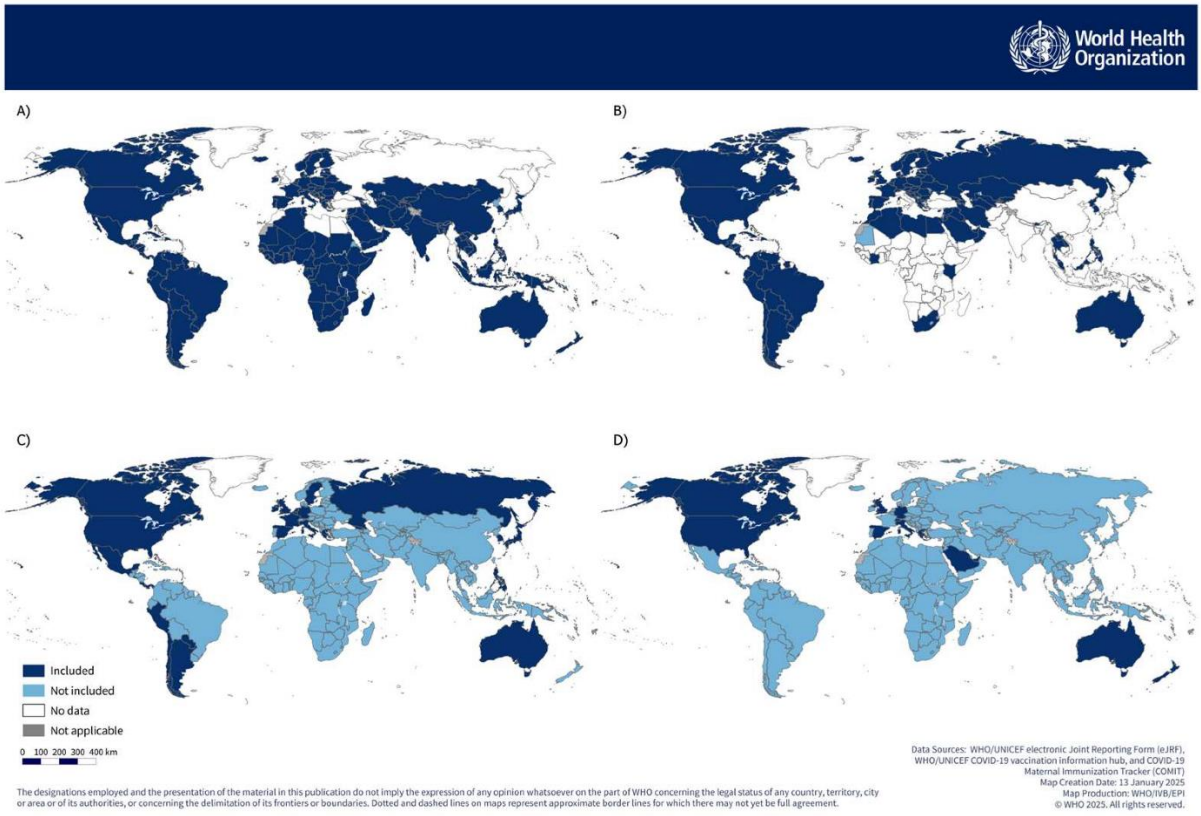
Background: Historically, immunization programmes have focused on infants, children, and women of reproductive age. COVID-19 vaccination prompted countries to vaccinate adults. This manuscript provides a global overview of adult immunization post COVID-19 pandemic. Methods: We summarized WHO Strategic Advisory Group of Experts on Immunization (SAGE) recommendations by adult group and analyzed the data reported in 2024 (2023) by WHO Member States (MS) via the WHO/UNICEF electronic Joint Reporting Form on Immunization (eJRF) on national immunization schedules, and from other sources by WHO region and income group. Results: WHO policy recommendations exist for most of the licensed vaccines targeting adults; however, the inclusion in national immunization schedules is higher in high-income (HICs) and middle-income (MICs) countries. For pregnant women, 90% of MS reported vaccination against COVID-19 (65% in low-income countries [LICs]), 63% against tetanus-containing vaccines (73% in LICs), 57% against influenza (4% in LICs), and 21% against pertussis-containing vaccines (all MICs and HICs). For health workers, 91% against COVID-19 (92% in LICs), 59% against influenza (4% in LICs), and 25% against hepatitis B (10% in LICs). For adults with chronic diseases, COVID-19 vaccination data were not available, 58% against influenza, and 23% against pneumococcal disease. For older adults, more than 90% of MS across all income groups reported COVID-19 vaccination, 59% against influenza (8% of LICs versus 89% of HICs), 17% against pneumococcal, and 7% against herpes zoster. Conclusion: The disparities in adult immunization policies across income groups highlight the need to improve access and strengthen vaccination efforts. A life course approach is essential to maximize the full potential of immunization across all ages.

Table 6. Status of immunization policies for older adults by WHO Region and country income-group.

		Number of Member States (MS)	COVID-19 (%)	Seasonal Influenza (%)	Pneumococcal** (%)	HZ (%)
Number of reporting countries		194	184 (95%)	118 (61%)	194 (100%)	194 (100%)
WHO Region	Africa	47	46 (98%)	5 (11%)	0	0
	Americas	35	35 (100%)	32 (91%)	12 (34%)	2 (6%)
	Eastern Mediterranean	21	15 (71%)	15 (71%)	1 (5%)	2 (10%)
	Europe	53	50 (94%)	49 (92%)	16 (30%)	7 (13%)
	South East Asia	11	9 (82%)	4 (36%)	0	0
	Western Pacific	27	27 (100%)	9 (33%)	4 (15%)	2 (7%)
Country-income group	HIC	63	58 (94%)	55 (89%)	25 (40%)	13 (21%)
	UMIC	53	51 (96%)	40 (75%)	7 (13%)	0
	LMIC	50	46 (92%)	15 (30%)	1 (2%)	0
	LIC	25	24 (92%)	2 (8%)	0	0
	Not classified*	3	3	2	0	0
	All regions	194	182 (94 %)	114 (59%)	33 (17%)	13 (7%)

Notes: *Not included in the WB classification: Niue and Cook Islands. Not classified by WB due to unavailability of data: Venezuela. **Includes those countries reporting use of PCV13, PCV15, PCV20, and/or PPV23.

Figure. Geographical distribution of countries that reported vaccination in 2024 (2023 data) for older adults against A) COVID-19, B) seasonal influenza, C) pneumococcal disease, and D) HZ.



2.3.2 ECDC - Interim COVID-19 vaccination coverage in the EU/EEA during the 2023–24 season campaigns

In September 2023, ECDC updated its COVID-19 vaccination coverage data analysis process, in view of the evolving timing and objective of the 2023–24 season vaccination campaigns in the European Union/European Economic Area (EU/EEA). This report presents an interim description of COVID-19 vaccine coverage in the EU/EEA between 1 September 2023 and 15 April 2024. During the reporting period, 27 of 30 EU/EEA countries reported data on COVID-19 vaccination coverage for at least one target group (people aged 60 years and above, people aged 80 years and above, healthcare workers, individuals with chronic conditions, pregnant women). During this period, approximately 28.1 million people aged 60 years and above received one COVID-19 vaccine dose. Approximately seven million people aged 80 years and above received one COVID-19 vaccine dose. Among the 27 reporting countries, six countries reported a vaccination coverage ≥50% for the age group 60 years and above, while nine countries reported a vaccination coverage ≥50% for the age group 80 years and above. **The median COVID-19 vaccination coverage among people aged 60 years and above was 12.0% (range: 0.01–66.1%), with high variation among countries. For people aged 80 years and above, the median coverage was 17.1% (range: 0.01–89.3%), with high variation among countries.** Most of the approximately 31 million COVID-19 vaccine doses administered in the EU/EEA during this period in the overall population were the Comirnaty Omicron XBB.1.5 (Pfizer BioNTech) vaccine (around 25.5 million doses; 82.1% of the total doses administered); for 14.5% of the doses, the product was reported as unknown. These preliminary results must be interpreted with caution. Higher degrees of data consolidation and data completeness are expected in the coming months.

2.3.3 ECDC - Survey report on national seasonal influenza vaccination recommendations and coverage rates in EU/EEA countries

The 2024 ECDC influenza survey on national vaccination recommendations and coverage used and adapted the previous ECDC-funded survey conducted by the Vaccine European New Integrated Collaboration Effort (VENICE) project. The aim of the survey was to describe the evolution of seasonal influenza vaccine recommendations in European Union/European Economic Area (EU/EEA) countries during the 2023−24 influenza season, and to describe trends in national influenza vaccination coverage rates (VCRs) during the 2021−22, 2022−23 and 2023−24 influenza seasons. Out of the 30 EU/EEA countries invited to participate in the survey, 29 completed the questionnaire (97% response rate). For the country that did not participate in the survey, we performed a desk review of its national public health agency website to collect the relevant recommendations. Vaccination in children and adolescents – Twenty EU/EEA countries reported age-based recommendations for children and/or adolescents, regardless of underlying medical conditions, for the 2023–24 season. This is a notable increase from the 2020–21 season, when only 14 countries had recommendations, and a significant increase from the 2017–18 season, when only five countries had recommendations. Of the 20 countries with recommendations, 13 reported VCRs during the 2023–24 season (range: 0.9%–38.9%), with Finland (38.9%), Spain (36.1%) and Denmark (16%) reporting the highest VCRs. Comparison with data collected in the previous survey is not possible because different countries reported data and there was heterogeneity in the age groups reported, which at times did not reflect the age cut-off of the recommendation. Vaccination in older adults – All EU/EEA countries reported recommendations for older adults for the 2023–24 season. There was some variation in the lower age limit, ranging from 50 years old to 65 years old. Overall, vaccination coverage over the three seasons showed a relatively stable trend (<3% change), but some downward fluctuations were observed in the 2023–24 season compared with the previous two seasons (range: 3%–10% for 17 countries reporting data for the overall period). The median VCR for 2023–24 was 45.7%, compared with 59% in the 2020–21 season. While data should be interpreted carefully, there is an indication that seasonal influenza vaccination programmes in older adults may be in decline following several years of stagnant uptake in the pre-COVID-19 pandemic period. Such trends must be carefully investigated and validated, as older adults are the primary target of seasonal influenza vaccination programmes. Vaccination in individuals with chronic medical conditions – All EU/EEA countries had specific recommendations for adults with chronic medical conditions in the 2023–24 season. Although there were minor variations in the conditions covered, all countries recommended the vaccine for chronic pulmonary, cardiovascular, renal and metabolic conditions, as well as immunosuppression. As most countries did not have VCR data available for this group, no such data are presented in this report. Vaccination in pregnancy – All EU/EEA countries except one had national recommendations for influenza vaccination during pregnancy in the 2023–24 season. Compared with the 2020–21 season, two countries expanded their programmes to include all pregnant women regardless of medical conditions. Of these 29 countries, eight reported VCRs (range: 1%–58%) in the 2023–24 season. Vaccination in healthcare workers – Twenty-three EU/EEA countries had recommendations for all healthcare workers for the 2023–24 season. Six additional countries recommended the vaccine for specific medical staff, such as those in close contact with patients or contaminated materials. Ten countries reported VCRs for healthcare workers (range: 5%–58%). The median VCR in the 2023–24 season was 22.1%, down from 25% in 2022–23 and 28% in 2021–22. Most countries reported a decrease in VCRs for healthcare workers compared with the 2020–21 season, when a median of 52% was reported. In general,

EU/EEA countries continue to recommend influenza vaccination for the primary target groups (older adults, individuals with chronic medical conditions, pregnant women and healthcare workers). Some countries have expanded recommendations for seasonal influenza vaccination in recent years in children. This signals important public health efforts to strengthen the prevention of seasonal influenza by making the vaccine more widely available to the groups that could benefit most from the programme. Nonetheless, when looking at the performance of such programmes through the reported national vaccination coverage data, it is evident that policies still fall short of meeting sufficient levels of uptake across key target groups.VCRs varied across target groups and countries during the three seasons included in this report. A limited number of countries showed slight increases in coverage but the majority experienced a decline. Although comparison across countries and years must be done with caution, the decline since the 2020–21 season appears to be more substantial for critical target groups such as older adults and healthcare workers. Most countries are still far from reaching adequate levels of protections for key target groups. Seasonal influenza vaccination remains a key public health intervention, making it essential to implement targeted strategies to increase vaccine uptake and address barriers to vaccination. Efforts to expand recommendations must be bolstered by efforts to improve implementation and increase the benefits of seasonal influenza vaccination programmes. At the same time, there is an important need to develop a new generation of equally safe yet more effective influenza vaccines, which may help fight complacent attitudes and increase trust in this fundamental vaccination programme.

2.3.4 ECDC vaccine scheduler

https://vaccine-schedule.ecdc.europa.eu/

2.3.5 Summary of WHO SAGE recommendations for older adults

Vaccine types	Recommendations
Influenza (2022)	**Position paper with specific recommendation**: 1 dose, annual revaccination. All of the currently available inactivated and recombinant seasonal influenza vaccines have demonstrated benefits over no vaccination and should therefore be considered for older adults. High-dose, recombinant and adjuvanted vaccines have demonstrated a higher vaccine efficacy or effectiveness against symptomatic disease, with a slightly increased reactogenicity than standard inactivated vaccines in older adults, although there are some limitations in the data. Should these vaccines be available and affordable to countries, they should be recommended as long as their use does not jeopardize the ability to provide influenza vaccination to other target groups. The use of these products for older adults in congregate living settings may offer additional protection to this particularly vulnerable group. **Coadministration:** Despite the lack of comprehensive data on the immunogenicity, effectiveness and safety of all possible combinations of influenza vaccine products with other routine vaccines, ***coadministration for programme reasons is acceptable.*** WHO considers that coadministration of a seasonal IIV and any dose of a COVID-19 vaccine is acceptable and may increase programme efficiency, given that the known risk of serious illness for adults infected with influenza virus or SARS-CoV-2 is substantial.

	All live vaccines (MMR, varicella, yellow fever and oral typhoid) may be given with seasonal IIV at the same visit, if indicated.
Pneumococcal (2020)	**Concept note with general recommendation:** *This is because, while data were being collected for a position paper, it became evident that there was an inadequate evidence base, especially in low- and middle-income countries, specifically related to burden of disease and serotype distribution.* WHO recommends that the introduction of PCV into national childhood immunization programmes and measures to sustain high coverage in children should be prioritized over initiating a pneumococcal vaccination programme for older adults. In countries that have a mature childhood pneumococcal immunization programme, decisions about initiating such a programme in adults, using either PPV23 or PCV13, should take into account the local disease burden and cost-effectiveness considerations. The broad issues that should be considered when making decisions about vaccine introduction are outlined in a WHO guidance document titled "Principles and Considerations for Adding a Vaccine to a National Immunization Programme" also apply to adult pneumococcal vaccination. In addition, the following issues also merit consideration: • population structure and demographics among older adults in the country to guide the selection of the target age for introduction; • enhanced surveillance to monitor serotypes responsible for the residual disease in older adults, and the serotype composition of PPV23, PCV13 and other PCV products under development; and • operational factors, including cost and cost-effectiveness, to ensure that optimal coverage can be consistently achieved in the target population **Coadministration:** no information
Pertussis (2015) Diphteria Tetanus	*As diphtheria toxoid is almost exclusively available in fixed combinations with other antigens, immunization programmes need to harmonize immunization schedules between diphtheria, tetanus and pertussis*. **Pertussis**: A decision to introduce adolescent and/or adult boosters should only be taken after careful assessment of local epidemiology, estimation of the contribution of adolescents as source of infections of young infants, and selection of adolescents and/or adults as target groups for vaccination. Decisions concerning such programmes should be based on the incidence and cost–effectiveness data. High coverage of routine immunization in infants must be in place prior to the intro-duction of vaccination of adolescents and adults. Reactivation of the protection of older children or adults against symptomatic pertussis requires periodic boosting with the less reactogenic aP vaccines. **Diphtheria:** Opportunities should be taken to provide or complete the 3-dose diphtheria toxoid-containing vaccine series for those who were not vaccinated, or incompletely vaccinated, during infancy. Schedule: 3 doses with a minimum interval of 4 weeks between the first and the second dose, and an interval of at least 6 months between the second

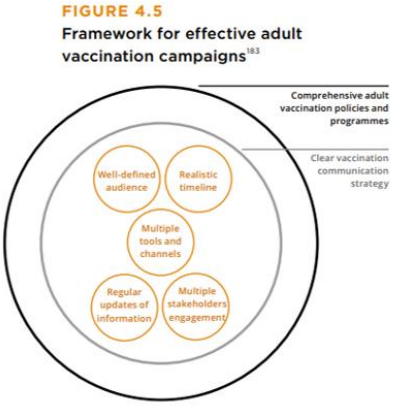
	and a third dose. Two subsequent booster doses using Td or Tdap combination vaccines are needed with an interval of at least 1 year between doses *(Given the increasing life expectancy worldwide, it remains to be determined whether a booster dose later in life may be necessary to ensure life-long protection)* **Tetanus:** Opportunities should be taken to provide or complete the full TTVC series for those who were not vaccinated, or incompletely vaccinated, during childhood. If tetanus vaccination is started during adolescence or adulthood, a total of only 5 appropriately spaced doses are required to obtain lifelong protection. **Coadminstration:** **Pertussis**: In general, co-administration of inactivated vaccines is acceptable. **Diphtheria**: Co-administration of diphtheria toxoid-containing vaccines with BCG, conjugate pneumococcal vaccine (PCV), IPV and oral polio vaccine (OPV) and measles, mumps and rubella vaccine, conjugate meningococcal meningitis vaccine, hepatitis B vaccine, rotavirus vaccine, varicella vaccine and Hib vaccine is safe and does not result in decreased immunogenicity. Also, Tdap alone or Tdap in combination with IPV may be administered concomitantly without causing clinically relevant immunological interference between any of the included antigens. Human papilloma virus (HPV) vaccines can be co-administered with diphtheria-containing vaccines. Adult diphtheria vaccine booster formulations could be administered concomitantly with trivalent inactivated influenza vaccine. Conjugate vaccines that contain diphtheria toxoid or diphtheria toxin cross-reactive materials (CRM) as a protein carrier may induce a booster response to diphtheria in persons previously immunized against diphtheria. Animal studies have demonstrated that CRM protein carriers do not induce sufficient diphtheria-protective antibody levels in naive recipients. Simultaneous administration of diphtheria toxoid with CRM protein carrier-containing vaccines does not seem to impact negatively on the immunogenicity of either vaccine.7 Concomitant administration of CRM-conjugated vaccines can in fact increase the immune response to diphtheria and its persistence after diphtheria vaccination.Tdap can induce significantly higher and more persistent anti-diphtheria responses than when administered after Tdap.58 Tdap vaccination before administration of PCV13 significantly reduced the response to 7 of the 13 pneumococcal serotypes in adults.59 This has been attributed to carrier-induced epitope suppression, i.e.the presence of pre-existing antibody to a carrier protein has the potential to suppress the subsequent immune response to an antigen conjugated to the same carrier. **Tetanus**: Co-administration of multiple inactivated and live-attenuated vaccines is safe and acceptable. Data on simultaneous administration of the first 3 doses of TTCVs with other childhood vaccines such as PCV, IPV, OPV, MCV and meningococcal conjugate, rotavirus and varicella vaccines indicate no interference with response to any of these other antigens or with the immune response to the TT antigen, either during the administration of the primary series or the booster doses. Evidence also supports co-administration of TTCV booster doses with other vaccines administered during adolescence such as HPV and meningococcal conjugate vaccines.

COVID-19 (2023)	1 dose primary series for those that have never received a COVID-19 vaccine and revaccination 6-12 months later **Coadministration:** WHO recommends that countries consider co-administration of COVID-19 vaccines (including variant-containing vaccines) with seasonal influenza vaccines or other respiratory vaccines, whenever epidemiologically justified.
Shingles (LZV) (2014)	**Live-zoster vaccine:** Due to the unknown burden of HZ in most countries and insufficient data concerning the use of this relatively new vaccine, WHO does not offer any recommendation concerning the routine use of HZ vaccine at this time. Currently, data on the duration of protection provided by HZ vaccination are insufficient and there is initial evidence of waning of protection over time, as well as uncertainty regarding the optimal age for vaccination and the potential role of a booster dose. However, countries, especially those with an aging population and demographic shift towards older ages, may decide to introduce routine HZ vaccination if they have an important burden of disease and consider the programme beneficial. For those countries deciding to proceed with a HZ vaccination programme, the optimal age and dosing schedule of HZ vaccination should take into consideration the age-dependent burden of disease, vaccine effectiveness, duration of protection, and cost-effectiveness. WHO has not provided a recommendation concerning the routine use of the **recombinant HZ vaccine yet** (expected recommendation in 2025). However, countries with an ageing population and demographic shift towards older ages, may decide to introduce routine HZ vaccination if they have an important burden of disease and consider the programme beneficial **Coadministration:** no information
RSV	Despite the availability of RSV vaccine for older adults, there is not yet a WHO SAGE recommendation for use in this group.

2.3.6 **Vaccines4Life /**

Vaccines4Life is a program of work aimed to mobilize knowledge on the importance of a life course approach to vaccination, developed and led by the International Federation on Ageing.

The International Federation on Ageing established the Vaccines4Life programme to increase awareness of the importance of a life-course approach to vaccination. The goal is to increase the rates of adult vaccination globally.



The main initiatives related to older adult immunization are listed below:

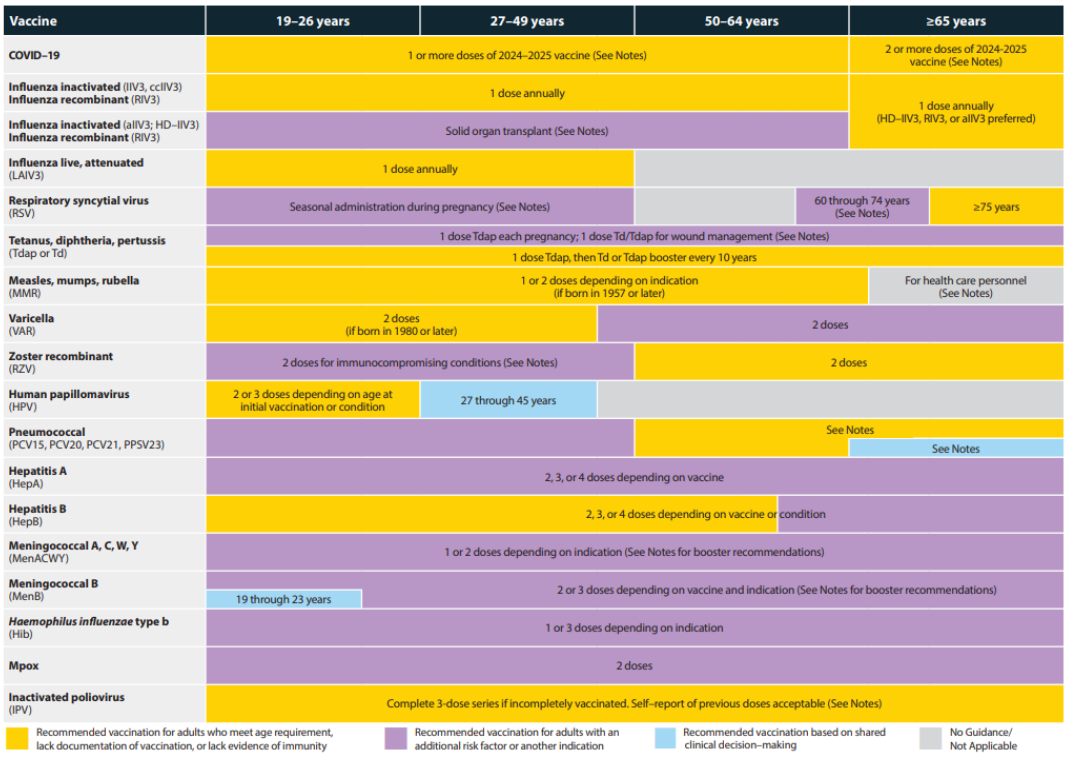
- IFA and EuGMS Statement of Action
- Virtual workshop Informing National Adult Immunization Strategies and Action in Germany and France.
- Report: Advancing Immunization Through the Decade of Healthy Ageing
- Policy brief: Addressing Adult Immunisation Inequity and Improving the Uptake Rates of Adult Vaccination Among Older People

- Adult Vaccination Healthcare Providers Education ECHO Series
- Driving Policy Change through the Targeted Accelerated Implementation of the Adult Vaccination Advocacy Toolkit (AVAT)
- Shingles Atlas for Adult Vaccination (SAAV)
- Adult Vaccination Advocacy toolkit (AVAT)

More information: www.vaccines4life.com

2.3.7 CDC recommended adult immunization schedule by age group 2025

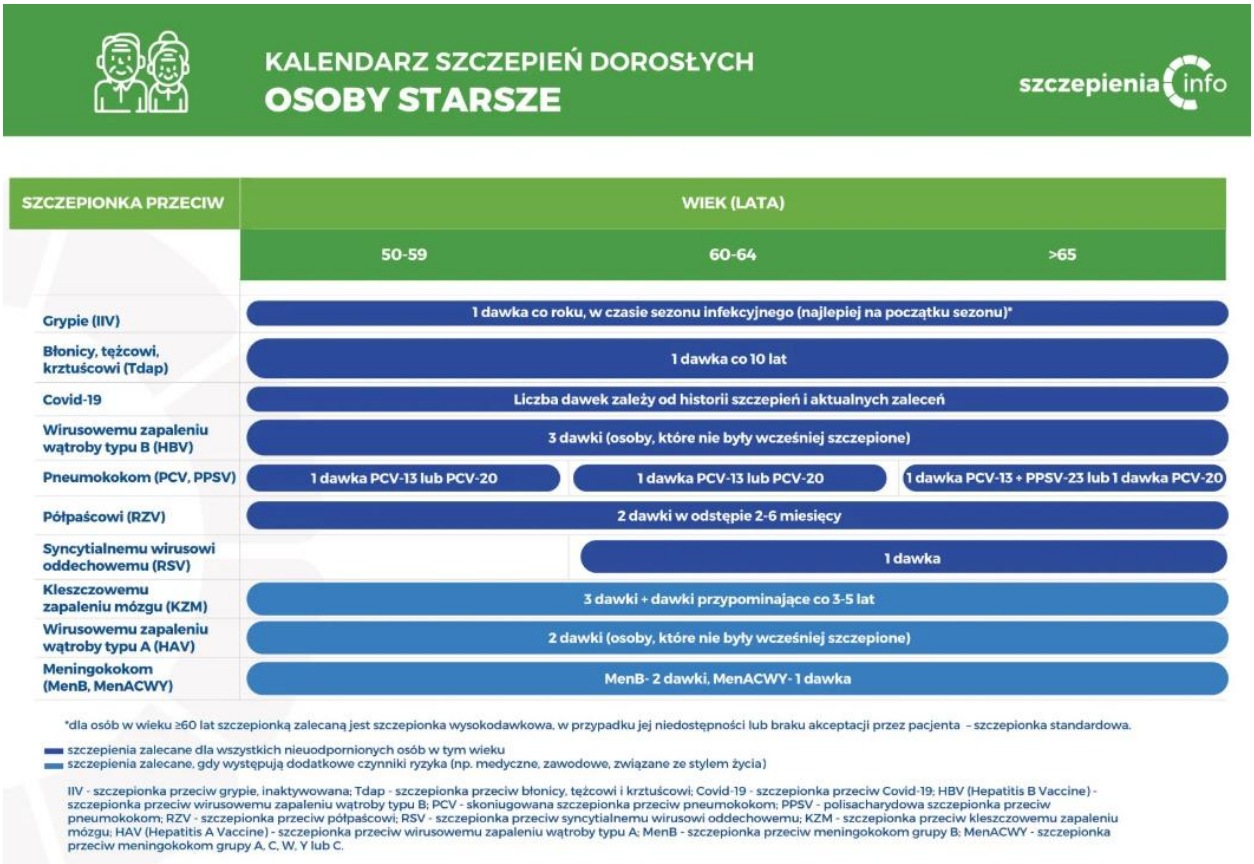
Table 1 Recommended Adult Immunization Schedule by Age Group, United States, 2025



2.3.8 Immunisation for old adults in Europe: scientific and social strategies **https://www.feam.eu/wp-content/uploads/Report Immunisation-for-old-adults-in-Europe.pdf**

2.4 Geriatric/GP perspectives from three different EU countries on their countries respective vaccination recommendations and strategic plans for older adults (barriers/opportunities for the future)

2.4.1 Link to Polish vaccination schedule https://szczepienia.pzh.gov.pl/kalendarz-szczepien-osob-starszych-2/



2.4.2 Add information on Portugal

2.4.3 Add information on Denmark

Session 3: From clinical trials to real-world data: challenges and opportunities in the conduction of trials

Session 3: From clinical trials to real-world data: challenges and opportunities in the conduction of trials	3.1 Overview of the difficulties and opportunities of vaccine trials (e.g. pragmatic trials) targeting frail and older adults.	T.Biering-Sorensen
	3.2 Use of Real-World Data to complement experimental studies	Domnich Alexandr

3.1 Overview of the difficulties and opportunities of vaccine trials (e.g. pragmatic trials) targeting frail and older adults.

Potential questions/outcomes: Expected outcome: How can vaccine trials effectively include frail and older adults despite the challenges of recruitment and retention? What adaptive designs and pragmatic approaches can enhance data quality and relevance for this population? What measures are necessary to ensure ethical standards and regulatory frameworks support inclusive research?

3.1.1 Troxel AB, Hade EM. The Registry-Based Randomized Trial - A Pragmatic Study Design. NEJM Evid. 2024 Feb;3(2):EVIDe2300310.

Randomized controlled trials are the gold standard of clinical research for comparing therapies in well-defined groups of participants.1 Randomization avoids confounding due to unmeasured variables or to treatment selection and enables a causal interpretation of the estimated treatment effect. It has long been recognized, however, that standard explanatory clinical trials are slow, costly, and subject to participant selection. To preserve the strengths of randomized trials while mitigating their weaknesses, pragmatic randomized clinical trials emerged; these trials aim to facilitate decision-making rather than explicate a mechanism of action and enroll a diverse set of participants using existing structures and data sources.

3.1.2 Denkinger M, Knol W, Cherubini A, Simonds A, Lionis C, Lacombe D, Petelos E, McCarthy M, Ouvrard P, Van Kerrebroeck P, Szymański P, Cupelli A, Laslop A, Koch A, Sepodes B, Torre C, Rönnemaa E, Bałkowiec-Iskra E, Herdeiro MT, Rosa MM, Trauffler M, Mirošević Skvrce N, Mayrhofer S, Berntgen M, Silva I, Cerreta F. Inclusion of functional measures and frailty in the development and evaluation of medicines for older adults. Lancet Healthy Longev. 2023 Dec;4(12):e724-e729.

The International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) E7, the guidance for the conduct of clinical trials in people older than age 65 years, dates from 1994. Since then, the inclusion of older people in clinical trials has hardly improved, particularly for the oldest old age group (individuals older than age 75 years), which is the fastest growing demographic bracket in the EU. Even though most medications are taken by this group, relevant endpoints and safety outcomes for this cohort are rarely included and reported, both in clinical trials and regulatory approval documents. To improve the critical appraisal and the regulatory review of medicines taken by frail older adults, eight recommendations are presented and discussed in this Health Policy. These recommendations are brought together from different perspectives and experience of the treatment of older patients. On one side, the perspective of medical practitioners from various clinical disciplines, with their direct experience of clinical decision making; on the other, the perspective of regulators assessing the data submitted in medicine registration dossiers, their relevance to the risk-benefit balance for older patients, and the communication of the findings in the product information. Efforts to improve the participation of older people in clinical trials have been in place for more than a decade, with little success. The recommendations presented here are relevant for stakeholders, authorities, pharmaceutical companies, and researchers alike, as the implementation of these measures is not under the capacity of a single entity. Improving the inclusion of frail older adults requires awareness, focus, and action on the part of those who can effect a much needed change.

3.1.3 Johansen ND, Modin D, Nealon J, Samson S, Salamand C, Larsen CS, Claggett BL, Solomon SD, Landray MJ, Gislason GH, Køber L, Jensen JUS, Sivapalan P, Vestergaard LS, Valentiner-Branth P, Krause TG, Biering-Sørensen T. Feasibility of randomizing Danish citizens aged 65-79 years to high-dose quadrivalent influenza vaccine vs. standard-dose

quadrivalent influenza vaccine in a pragmatic registry-based setting: rationale and design of the DANFLU-1 Trial. Pilot Feasibility Stud. 2022 Apr 21;8(1):87.

Background: High-dose influenza vaccines provide better protection against influenza infection than standard-dose in persons aged 65 years and above; however, in most countries, high-dose vaccines are not widely implemented. Assessing the relative effectiveness of high-dose compared to standard-dose vaccines on hospitalizations and mortality would enable more robust public health and cost-effectiveness estimates. This study aims to investigate the feasibility of conducting a pragmatic randomized clinical trial in Denmark comparing high-dose to standard-dose vaccines utilizing existing vaccination infrastructure and the Danish nationwide health registries for data collection. **Methods:** The DANFLU-1 trial (NCT05048589) is a pragmatic, open-label, active-controlled randomized trial randomizing Danish citizens aged 65-79 years to either high-dose quadrivalent influenza vaccine or standard-dose quadrivalent influenza vaccine. The study utilizes the infrastructure of a private vaccination provider (Danske Lægers Vaccinations Service) for recruitment, inclusion, randomization, and vaccination. All collection of baseline and follow-up data including safety monitoring is performed centrally by the Department of Cardiology at Herlev and Gentofte Hospital, Copenhagen, Denmark using the Danish nationwide health registries. The study aims to include 40,000 participants during the 2021/2022 influenza season. The primary endpoints address feasibility and include the number of participants enrolled, randomization balance, and representativeness compared to the Danish general population. Relative vaccine effectiveness will also be assessed, however, this feasibility study is not powered for clinical outcomes and may be affected by the COVID-19 pandemic. **Discussion:** The DANFLU-1 study is investigating the feasibility of conducting a large-scale pragmatic clinical trial in Denmark utilizing existing infrastructure and the Danish nationwide registries. This will provide valuable insight, especially for potential future fully powered vaccine trials, but also for trials wishing to investigate other interventions.

3.1.4 Veronese N, Petrovic M, Benetos A, Denkinger M, Gudmundsson A, Knol W, Marking C, Soulis G, Maggi S, Cherubini A; special interest group in Systematic Reviews and Meta-analyses and the task force on Pharmaceutical strategy of the European Geriatric Medicine Society (EuGMS). Underrepresentation of older adults in clinical trials on COVID-19 vaccines: A systematic review. Ageing Res Rev. 2021 Nov;71:101455.

During the COVID-19 pandemic older subjects have been disproportionately affected by the disease. Vaccination is a fundamental intervention to prevent the negative consequences of COVID-19, but it is not known if the needs and vulnerabilities of older people are adequately addressed by their inclusion in randomized clinical trials (RCTs) evaluating the efficacy of vaccines for COVID-19. Given this background, we aimed to evaluate if current and ongoing phase II-III RCTs evaluating the efficacy of COVID-19 vaccines included a representative sample of older people. A systematic literature search in PubMed and Clinicaltrials.gov was performed until May 01st, 2021. Among 474 abstracts initially retrieved, 20 RCTs (ten already published, ten ongoing) were included. In the ten studies already published, the mean age of participants was 45.2 ± 11.9 years and only 9.83% of the participants were more than 65 years, 1.66% more than 75 years and less than 1% (0.55%) more than 85 years. In the ten ongoing RCTs, many of the studies aimed at including participants older than 18 years, with one study including participants between 18 and 84 years, and two between 21 and 100 years. In conclusion, our systematic review demonstrates that in published and ongoing phase II-III randomized clinical trials evaluating the efficacy of COVID-19 vaccines only a tiny fraction of the most vulnerable group of older people was included, although they clearly were the first population that had to be vaccinated.

3.2 Use of Real-World Data to complement experimental studies

Potential questions/outcomes: Expected outcome: How can real-world data fill gaps left by experimental studies in older adult vaccination research? In the absence of clinical trial data for older adults, can a large body of consistent real-world data be considered sufficient, even for regulatory purposes? Finally, how should real-world data and clinical trial findings be integrated to inform vaccination policies for older adults?

3.2.1 Hameed SS, Robertson C, Morrison K, McQueenie R, McMenamin J, Ghebrehewet S, Marsh K. Early evidence of RSV vaccination impact on hospitalisation rates of older people in Scotland. Lancet Infect Dis. 2025 Mar;25(3):256-258.

3.2.2 Domnich A, Panatto D, Pariani E, Napoli C, Chironna M, Manini I, Rizzo C, Orsi A, Icardi G; IT-BIVE-HOSP Network Study Group. Relative effectiveness of the adjuvanted vs non-adjuvanted seasonal influenza vaccines against severe laboratory-confirmed influenza among hospitalized Italian older adults. Int J Infect Dis. 2022 Dec;125:164-169.

Objectives: In this study, we aimed to investigate the relative vaccine effectiveness (rVE) of the MF59-adjuvanted trivalent (aTIV) and non-adjuvanted quadrivalent (QIVe) egg-based standard-dose vaccines against severe laboratory-confirmed influenza. Methods: This test-negative case-control study was conducted in a hospital setting during four recent Italian influenza seasons (from 2018/19 to 2021/22). The clinical outcome was severe acute respiratory infection (SARI) with laboratory confirmation diagnosed among subjects aged ≥65 years. rVE of aTIV versus QIVe was estimated through propensity score matching followed by logistic regression. Results: The influenza virus circulated to a significant extent only during the 2018/19 and 2019/20 seasons. The final population included 512 vaccinated older adults, of which 83 were cases and 429 were test-negative controls. aTIV and QIVe users differed substantially from the point of view of several baseline characteristics. The propensity score adjusted rVE of aTIV vs QIVe was 59.2% (95% CI: 14.6%, 80.5%), 54.7% (95% CI: -28.7%, 84.0%) and 56.9% (95% CI: -7.8%, 82.8%) against any influenza, A(H1N1)pdm09 and A(H3N2), respectively. Conclusion: aTIV was more effective than QIVe in preventing laboratory-confirmed SARI. The benefits of aTIV may be obscured by confounding indication. Keywords: Adjuvanted influenza vaccine; Influenza; Influenza vaccines; Older adults; Vaccine effectiveness.

Session 4: Understanding specific characteristics of different vaccines for adults

Session 4: Understanding specific characteristics of different vaccines for older adults	4.1 Immunological mechanisms of vaccine-induced immune response in the older adults	Birgit Weinberger
	4.2 The effects of comorbidity on the vaccination response in older adults	Debbie van Baarle
	4.3 Herpes Zoster: Specific topic: duration in older adults	Javier Díez-Domingo
	4.4 Pneumococcal disease: Specific topic: future vaccines	Antoni Torres

	4.5 Tdap: Specific topic: boosters in older adults and differences between countries	Tino F Schwarz
	4.6 RSV: Specific topic: Need for revaccination? When and how to organize it?	Élisabeth Botelho-Nevers
	4.7 Influenza: Specific topic: High-dose and adjuvanted vaccines	Colin Russel
	4.8 COVID-19/SARS-CoV-2: Specific topic: Different platforms (e.g. mRNA)	Odile Launay

4.1 Immunological mechanisms of vaccine-induced immune response in the older adults

Potential questions/outcomes: Expected outcome: reviewing latest research on immunological mechanisms (e.g. immunosenescence) and its impact on vaccine-induced immunity/protection in older adults. Discuss strategies to improve vaccination potency in elderly individuals

4.1.1 Doherty TM, Weinberger B, Didierlaurent A, Lambert PH. Age-related changes in the immune system and challenges for the development of age-specific vaccines. Ann Med. 2025 Dec;57(1):2477300.

Background: A better understanding of how the immune system evolves with age and how vaccines work in older people has led to increasing focus on the development of vaccines aimed specifically at older age groups. We discuss strategies used to improve vaccine immunogenicity for older adults, focusing on licensed adjuvants. Findings: With age-related immune decline (immunosenescence), older adults face increased vulnerability to infections and severe complications. Immunosenescence affects T-cell and B-cell populations and innate immunity, leading to reduced chemotaxis, cytotoxicity, and altered cytokine production. This contributes to inflammaging-low-grade, chronic inflammation linked to aging. However, immune responses vary due to genetics and life-long exposures, making chronological age an imperfect indicator of immune health. Vaccination remains key to prevention, yet immune dysfunction complicates vaccine efficacy. Strategies to enhance responses in older adults include mRNA vaccines, high-antigen content vaccines, intradermal administration, and adjuvants. mRNA COVID-19 vaccines generated strong immune responses in older adults, though lower than in younger groups. High-antigen content influenza vaccines have shown superior efficacy compared to standard vaccination. Adjuvants offer a well-established approach to boosting vaccine responses by enhancing innate immunity. Conclusions: Of various strategies used to improve immunogenicity of vaccines for older adults, adjuvants have been the most consistently effective and practical. More recently, mRNA vaccines have also shown great promise.

4.1.2 van der Heiden M, Shetty S, Bijvank E, Beckers L, Cevirgel A, van Sleen Y, Tcherniaeva I, Ollinger T, Burny W, van Binnendijk RS, van Houten MA, Buisman AM, Rots NY, van Beek J, van Baarle D. Multiple vaccine comparison in the same adults reveals vaccine-specific and age-related humoral response patterns: an open phase IV trial. Nat Commun. 2024 Aug 4;15(1):6603.

Vaccine responsiveness is often reduced in older adults. Yet, our lack of understanding of low vaccine responsiveness hampers the development of effective vaccination strategies to reduce the impact of infectious diseases in the ageing population. Young-adult (25–49 y), middle-aged (50-64 y) and older-adult (≥ 65 y) participants of the VITAL clinical trials (n = 315, age-range: 28-98 y), were vaccinated with an annual (2019–2020) quadrivalent influenza (QIV) booster vaccine, followed by a primary 13-valent pneumococcal-conjugate (PCV13) vaccine (summer/autumn 2020) and a primary series of two SARS-CoV-2 mRNA-1273 vaccines (spring 2021). This unique setup allowed investigation of humoral responsiveness towards multiple vaccines within the same individuals over the adult age-range. Booster QIV vaccination induced comparable H3N2 hemagglutination inhibition (HI) titers in all age groups, whereas primary PCV13 and mRNA-1273 vaccination induced lower antibody concentrations in older as compared to younger adults (primary endpoint). The persistence of humoral responses, towards the 6 months timepoint, was shorter in older adults for all vaccines (secondary endpoint). Interestingly, highly variable vaccine responder profiles overarching multiple vaccines were observed. Yet, approximately 10% of participants, mainly comprising of older male adults, were classified as low responders to multiple vaccines. This study aids the identification of risk groups for low vaccine responsiveness and hence supports targeted vaccination strategies. Trial number: NL69701.041.19, EudraCT: 2019-000836-24.

4.1.3 Hou, Y., Chen, M., Bian, Y. et al. Insights into vaccines for elderly individuals: from the impacts of immunosenescence to delivery strategies. npj Vaccines 9, 77 (2024). https://doi.org/10.1038/s41541-024-00874-4

Immunosenescence increases the risk and severity of diseases in elderly individuals and leads to impaired vaccine-induced immunity. With aging of the global population and the emerging risk of epidemics, developing adjuvants and vaccines for elderly individuals to improve their immune protection is pivotal for healthy aging worldwide. Deepening our understanding of the role of immunosenescence in vaccine efficacy could accelerate research focused on optimizing vaccine delivery for elderly individuals. In this review, we analyzed the characteristics of immunosenescence at the cellular and molecular levels. Strategies to improve vaccination potency in elderly individuals are summarized, including increasing the antigen dose, preparing multivalent antigen vaccines, adding appropriate adjuvants, inhibiting chronic inflammation, and inhibiting immunosenescence. We hope that this review can provide a review of new findings with regards to the impacts of immunosenescence on vaccine-mediated protection and inspire the development of individualized vaccines for elderly individuals.

4.1.4 van der Heiden M, Shetty S, Bijvank E, Beckers L, Cevirgel A, van Sleen Y, Tcherniaeva I, Ollinger T, Burny W, van Binnendijk RS, van Houten MA, Buisman AM, Rots NY, van Beek J, van Baarle D. Multiple vaccine comparison in the same adults reveals vaccine-specific and age-related humoral response patterns: an open phase IV trial. Nat Commun**.** 2024 Aug 4;15(1):6603.

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towards multiple vaccines within the same individuals over the adult age-range. Booster QIV vaccination induced comparable H3N2 hemagglutination inhibition (HI) titers in all age groups, whereas primary PCV13 and mRNA-1273 vaccination induced lower antibody concentrations in older as compared to younger adults (primary endpoint). The persistence of humoral responses, towards the 6 months timepoint, was shorter in older adults for all vaccines (secondary endpoint). Interestingly, highly variable vaccine responder profiles overarching multiple vaccines were observed. Yet, approximately 10% of participants, mainly comprising of older male adults, were classified as low responders to multiple vaccines. This study aids the identification of risk groups for low vaccine responsiveness and hence supports targeted vaccination strategies. Trial number: NL69701.041.19, EudraCT: 2019-000836-24.

4.1.5 Weinberger B, Herndler-Brandstetter D, Schwanninger A, Weiskopf D, Grubeck-Loebenstein B. Biology of immune responses to vaccines in elderly persons. Clin Infect Dis. 2008 Apr 1;46(7):1078-84. doi: 10.1086/529197. PMID: 18444828.

With increasing age, the human immune system undergoes characteristic changes, termed immunosenescence, which lead to increased incidence and severity of infectious diseases and to insufficient protection following vaccination. Functional defects and altered frequencies of innate and adaptive immune cells impair local responses at the site of vaccine injection, hamper the generation of primary responses to neoantigens, prevent the effective induction of memory lymphocytes, and decrease the effect of booster vaccination. As a result, antibody responses of elderly vaccinees are weaker and decline faster, and long-term protective effects of vaccination cannot be taken for granted in elderly persons. Improved vaccination strategies, new adjuvants, and new vaccines that specifically target the aged immune system will help to overcome the limitations of immunosenescence and ensure a better protection of the vulnerable elderly population.

4.2 The effects of comorbidity on the vaccination response in older adults

Potential questions/outcomes: How do comorbidities influence immune system dynamics in aging individuals, and what insights can this provide for optimizing the design and implementation of vaccination programs? What practical steps can be taken to integrate comorbidity considerations into vaccine efficacy studies and immunization policies for older adults?

4.2.1 Kwetkat A, Heppner HJ. Comorbidities in the Elderly and Their Possible Influence on Vaccine Response. Interdiscip Top Gerontol Geriatr. 2020;43:73-85.

The following chapter is focused on the impact of comorbidities on the effectiveness of vaccination in older persons. Relevant comorbidities are cardiovascular diseases like hypertension, coronary artery disease or congestive heart failure, which lead to reduction of vaccine immunogenicity; or chronic obstructive pulmonary disease with a decline in lung function and a higher risk for pneumonia or infections due to influenza. End-stage renal disease has a high impact on developing infections and causes immune dysfunction over all parts of the immune system. Depression and dementia as well as psychological stress are associated with poor antibody response and a higher range of inflammation markers. Chronic inflammatory processes like rheumatoid arthritis also alter the immune system. In addition, geriatric syndromes and lowered functional status have implications for the vaccination response. Malnutrition is characterized by depletion of structural and functional proteins. This leads to a low antibody response. Negative immunomodulatory effects are also observed in

vitamin D insufficiency. Frailty as well is associated with immunological changes and lowered performance in the activities of daily living, but moderate physical activity improves immune function.

4.3 Specific characteristics of different vaccines for older adults: **Herpes zoster: duration in older adults**

Potential questions/outcomes: What vaccines are available against herpes zoster, and how do they perform in older adults (first general slide)? What is the last evidence regarding the duration of immunity in older adults? What factors are thought to influence its duration? Are boosters currently being considered?

4.3.1 Duque, S., Marinho, A., Almeida, P. et al. Expanding the coverage of herpes zoster vaccination recommendations in European countries: the example of Portugal. Drugs Ther Perspect 41, 34–43 (2025).

Herpes zoster (HZ) is caused by the reactivation of latent varicella zoster virus and is a disease with a high incidence and great morbidity. Risk factors for HZ and its most common complication, postherpetic neuralgia (PHN), include age ≥ 50 years, immunosuppression, and chronic disorders. Vaccination is an effective strategy to prevent HZ and PHN. In Europe, two HZ vaccines are available: the live attenuated vaccine and the recombinant vaccine. The latter of these has greater efficacy against HZ and its complications, particularly in populations at higher risk, such as older adults. The recombinant vaccine is the only one indicated for immunocompromised patients. In some European countries, HZ vaccination is not included in national immunization programs, and recommendations for immunization are lacking. This was the case in Portugal until 2023, when the guidelines for HZ vaccination issued by the Portuguese Society of Internal Medicine and the Portuguese Association of General and Family Medicine filled this gap. Such recommendations reflect a paradigm shift toward a broader definition of HZ high-risk groups, including individuals with chronic diseases, along with immunocompromised patients and older adults. This article summarizes the availability and reimbursement of HZ vaccines across European countries with recommendations for HZ immunization and aims to provide evidence for HZ vaccination of special populations and expand the coverage of immunization programs to prevent HZ and complications in people at higher risk. We also aim to inspire other countries to follow the example of Portugal regarding vaccination against HZ and other diseases for which vaccines have been developed but recommendations do not yet exist.

4.3.2 Strezova A, Diez-Domingo J, Al Shawafi K, Tinoco JC, Shi M, Pirrotta P, Mwakingwe-Omari A; Zoster-049 Study Group. Long-term Protection Against Herpes Zoster by the Adjuvanted Recombinant Zoster Vaccine: Interim Efficacy, Immunogenicity, and Safety Results up to 10 Years After Initial Vaccination. Open Forum Infect Dis. 2022 Oct 23;9(10):ofac485.

Approximately 10 years after vaccination with the recombinant zoster vaccine (RZV), an interim analysis of this follow-up study of the ZOE-50/70 trials demonstrated that efficacy against herpes zoster remained high. Moreover, the safety profile remained clinically acceptable, suggesting that the clinical benefit of the RZV in ≥50-year-olds is sustained up to 10 years.

4.3.3 Boutry C, Hastie A, Diez-Domingo J, Tinoco JC, Yu CJ, Andrews C, Beytout J, Caso C, Cheng HS, Cheong HJ, Choo EJ, Curiac D, Di Paolo E, Dionne M, Eckermann T, Esen M, Ferguson M, Ghesquiere W, Hwang SJ, Avelino-Silva TJ, Kosina P, Liu CS, Markkula J, Moeckesch B, Murta de Oliveira C, Park DW, Pauksens K, Pirrotta P, Plassmann G, Pretswell C, Rombo L, Salaun B, Sanmartin Berglund J, Schenkenberger I, Schwarz T, Shi M, Ukkonen B, Zahaf T, Zerbini C, Schuind A, Cunningham AL; Zoster-049 Study Group. The Adjuvanted Recombinant Zoster Vaccine Confers Long-Term Protection Against Herpes Zoster: Interim Results of an Extension Study of the Pivotal Phase 3 Clinical Trials ZOE-50 and ZOE-70. Clin Infect Dis. 2022 Apr 28;74(8):1459-1467.

Background: This ongoing follow-up study evaluated the persistence of efficacy and immune responses for 6 additional years in adults vaccinated with the glycoprotein E (gE)-based adjuvanted recombinant zoster vaccine (RZV) at age ≥50 years in 2 pivotal efficacy trials (ZOE-50 and ZOE-70). The present interim analysis was performed after ≥2 additional years of follow-up (between 5.1 and 7.1 years [mean] post-vaccination) and includes partial data for year (Y) 8 post-vaccination. Methods: Annual assessments were performed for efficacy against herpes zoster (HZ) from Y6 post-vaccination and for anti-gE antibody concentrations and gE-specific CD4[2+] T-cell (expressing ≥2 of 4 assessed activation markers) frequencies from Y5 post-vaccination. Results: Of 7413 participants enrolled for the long-term efficacy assessment, 7277 (mean age at vaccination, 67.2 years), 813, and 108 were included in the cohorts evaluating efficacy, humoral immune responses, and cell-mediated immune responses, respectively. Efficacy of RZV against HZ through this interim analysis was 84.0% (95% confidence interval [CI], 75.9-89.8) from the start of this follow-up study and 90.9% (95% CI, 88.2-93.2) from vaccination in ZOE-50/70. Annual vaccine efficacy estimates were >84% for each year since vaccination and remained stable through this interim analysis. Anti-gE antibody geometric mean concentrations and median frequencies of gE-specific CD4[2+] T cells reached a plateau at approximately 6-fold above pre-vaccination levels. Conclusions: Efficacy against HZ and immune responses to RZV remained high, suggesting that the clinical benefit of RZV in older adults is sustained for at least 7 years post-vaccination. Clinical Trials Registration. NCT02723773.

4.3.4 Parikh R, Widenmaier R, Lecrenier N. A practitioner's guide to the recombinant zoster vaccine: review of national vaccination recommendations. Expert Rev Vaccines. 2021 Sep;20(9):1065-1075. doi: 10.1080/14760584.2021.1956906. Epub 2021 Sep 1. PMID: 34311643.

Introduction: The adjuvanted recombinant zoster vaccine (RZV) is currently licensed in over 30 countries for the prevention of herpes zoster (HZ) in adults aged ≥50 years. We conducted a review of available national guidelines or recommendations on RZV use to identify the similarities and differences and highlight any potential gaps. Areas covered: National recommendations from ten countries (Austria, Canada, the Czech Republic, Germany, Ireland, Italy, Spain, the Netherlands, the UK and the USA) are summarized under the following seven topics: HZ vaccine preference, age group recommendations, considerations prior to vaccination, dose schedule, co-administration with other vaccines, vaccination of special populations, and vaccine safety profile. In seven of these countries, RZV is the preferred or the only recommended HZ vaccine. There were some differences in age group recommendations, reflecting evaluations dependent on public funding. There were also differences with respect to use in immunocompromised and other special populations. Expert opinion: The high efficacy and anticipated public health impact of RZV led to expanded national recommendations for RZV vaccination compared to previous HZ recommendation in

many countries. Possible areas that could be considered in future revisions of national recommendations, including use in immunocompromised adults ≥18 years, are also highlighted. Keywords: Recombinant zoster vaccine; Shingrix; adjuvanted zoster vaccine; guideline; herpes zoster; national immunization plan; national recommendation; shingles; shingles vaccine.

4.4 Specific characteristics of different vaccines for older adults: **Pneumococcal disease: future vaccines**

Potential questions/outcomes: What pneumococcal vaccines are available, and how do they perform in older adults (first general slide)? What are the most recently developed pneumococcal vaccines, such as PCV20 and PCV21, and how do they improve protection for older adults? How do these vaccines address gaps in coverage by targeting additional serotypes associated with invasive disease? What evidence supports their effectiveness, durability, and safety in older populations, including those with comorbidities? Should these newer vaccines replace older formulations in immunization programs, and how can implementation strategies be optimized for older adults?

4.4.1 Ramos B, Vadlamudi NK, Han C, Sadarangani M. Future immunisation strategies to prevent Streptococcus pneumoniae infections in children and adults. The Lancet Infectious Diseases. March 17, 2025

Streptococcus pneumoniae is a major respiratory pathogen, causing 1·2 million deaths and 197 million pneumonia episodes globally in 2016. The spread of S pneumoniae to sterile sites, such as the blood and brain, leads to invasive pneumococcal disease. The best approach available for prevention of invasive pneumococcal disease in children and, more recently, adults is the use of pneumococcal conjugate vaccines (PCVs). PCVs are also highly effective at preventing colonisation and, thus, transmission, offering indirect protection to non-target immunisation groups such as adults—a characteristic that has been crucial in their success. However, PCVs only include and protect up to 20 of the 100 serotypes that can cause disease. The rise in adult cases of invasive pneumococcal disease from serotypes included in PCVs suggests indirect protection might be limited. Additionally, non-vaccine serotypes and some vaccine types that persist, some linked to antibiotic resistance, continue to cause disease. Future vaccine strategies include increasing the number of serotypes covered in PCVs for use in children and adults, broader vaccine use in adults, the development of adult-specific conjugate vaccines containing serotypes different from those covered in PCVs used in children, and protein vaccines, all of which will be explored in this Review. These strategies are expected to help mitigate the global burden of invasive pneumococcal disease in future years.

A

Previously covered serotypes covered by each pneumococcal conjugate vaccine New serotypes covered by each pneumococcal conjugate vaccine

Conjugate vaccine	Serotype																														
	4	6B	9V	14	18C	19F	23F	1	5	7F	3	6A	19A	22F	33F	8	10A	11A	12F	15B	9N	15A	16F	17F	20	23A	23B	24F	31	35B	2	20B
PCV7 (infants)																															
PCV10 (infants)																															
PCV13 (infants and adults)																															
PCV15 (infants and adults)																															
PCV20 (infants and adults)																															
PCV21 (infants and adults)																															
PCV21-alt (adults)																															
PCV24 (adults)																															

4.5 Specific characteristics of different vaccines for older adults: **Tdap: boosters in older adults and differences between countries**

Expected outcome: What Tdap vaccines are available, and how do they perform in older adults (first general slide)? Why do booster interval recommendations differ between countries, and what evidence supports these variations? Should harmonization of booster schedules be considered, and what data would guide such changes?

4.5.1 See KC. Pertussis Vaccination for Adults: An Updated Guide for Clinicians. Vaccines (Basel). 2025 Jan 11;13(1):60. doi: 10.3390/vaccines13010060. PMID: 39852839; PMCID: PMC11768464.

Pertussis, or whooping cough, is a highly contagious respiratory infection caused by the Gram-negative bacterium Bordetella pertussis. Although traditionally associated with children, pertussis is increasingly prevalent among adults, particularly those with comorbidities or weakened immune systems, where it can lead to severe complications. Diagnosing pertussis in adults can be challenging due to its nonspecific symptoms, underreporting, and the limited sensitivity of available diagnostic tests. While treatment with macrolides is generally effective, it may not significantly alter the clinical course of the disease, and growing concerns about macrolide resistance are emerging. Vaccination remains the cornerstone of prevention, offering proven immunogenicity, efficacy, and safety. However, vaccination uptake remains low, partly due to limited patient awareness and insufficient prioritization by healthcare professionals. This review aims to provide clinicians with critical insights into pertussis epidemiology, vaccination strategies, and the latest guideline recommendations, empowering them to engage in meaningful discussions with adult patients and advocate for increased vaccination to combat this often-overlooked infection.

4.5.2 Lecce M, Perrone PM, Castaldi S. Tdap Booster Vaccination for Adults: Real-World Adherence to Current Recommendations in Italy and Evaluation of Two Alternative Strategies. Int J Environ Res Public Health. 2022 Mar 29;19(7):4066.

Background: While the effectiveness of tetanus-diphtheria-pertussis childhood immunization programs is unquestionable, the actual need for a periodic boosting vaccination in adults is controversial. In Italy, the Ministry of Health recommends a Tdap booster vaccination every 10 years. The aim of this study is to assess the real-world adherence of Italian regional healthcare services to national recommendations and to evaluate two alternative strategies. Methods: Annual Tdap vaccine requirements by the 21 Italian regions were retrieved from related tender announcements, and regional and national vaccination coverage rates (VCRs) were estimated for three scenarios, namely the currently recommended 10-year booster vaccination, a single booster shot at age 50 and at age 65. Results: In Scenario 1, no region reached a VCR > 30%, and the national VCR was 10.6%; in Scenario 2, five regions achieved the optimal vaccination coverage of ≥95%, but the vast majority continued to have inadequate VCRs, with a national VCR of 54.4%; in Scenario 3, five regions reached VCRs exceeding 100%, with VCRs from other regions significantly improving and a national VCR of 74.8%. Conclusions: A substantial lack of adherence by Italian regional healthcare services to current national recommendations on tetanus-diphtheria-pertussis adult vaccination was shown. Scenario 3 is the most feasible, i.e., a single booster shot at age 65, possibly administrable along with other already-recommended, age-specific vaccines.

4.5.3 Weinberger B. Vaccination of Adults and the Older Population against Tetanus, Diphtheria, Pertussis, and Tick-Borne Encephalitis: The Importance of Booster Vaccinations throughout Life. Interdiscip Top Gerontol Geriatr. 2020;43:146-157.

Immunization strategies for the elderly are frequently perceived as comprising only vaccines against influenza, Streptococcus pneumoniae, and herpes zoster. However, besides these vaccines, which are recommended specifically for the elderly, regular booster vaccinations against tetanus, diphtheria, and in some cases pertussis and polio, are recommended in many countries for adults including the elderly. Vaccination recommendations for adults differ greatly between individual countries and coverage data are scarce. A substantial proportion of adults, and particularly of the older age groups, do not have protective antibody concentrations against diphtheria, whereas tetanus-specific antibody concentrations are generally higher. Protection against pertussis is unsatisfactory in all adults, and development of improved vaccines is ongoing. Future vaccination strategies should include regular and well-documented booster shots throughout life, as post-booster antibody concentrations correlate with pre-booster antibody concentrations.

4.5.4 Weinberger B, Keller M, Putzer C, Breitenberger D, Koller B, Fiegl S, Moreno-Villanueva M, Bernhardt J, Franceschi C, Voutetakis K, Gonos ES, Hurme M, Sikora E, Toussaint O, Debacq-Chainiaux F, Grune T, Breusing N, Bürkle A, Grubeck-Loebenstein B. Protection against Tetanus and Diphtheria in Europe: The impact of age, gender and country of origin based on data from the MARK-AGE Study. Exp Gerontol. 2018 May;105:109-112.

Due to the successful implementation of vaccination strategies early-life morbidity and mortality due to infectious disease has been reduced dramatically. Vaccines against tetanus and diphtheria are among the most frequently used vaccines worldwide, but various studies in different European countries have shown that protection against tetanus and particularly against diphtheria is unsatisfactory in adults and older persons. In this study we analyzed tetanus- and diphtheria-specific antibody concentrations in 2100 adults of different age from 6 selected European countries (Austria, Belgium, Germany, Greece, Italy, Poland) in order to investigate differences in the level of protection against tetanus and diphtheria across Europe. Our data reveal that tetanus- and diphtheria-specific antibody concentrations vary greatly between countries, which is also reflected in the percentage of persons with antibody concentrations below the protective level (0.1IU/ml), which ranged from 2 to 31% percent for tetanus and 28-63% for diphtheria. In most countries, tetanus- and diphtheria-specific antibody concentrations decrease with age. This phenomenon is more pronounced in countries with generally low antibody levels, such as Italy, Poland and Greece. Interestingly, tetanus-specific antibody concentrations are generally higher in males than in females, which is probably due to vaccination during their military service or more frequent booster vaccinations after injuries, whereas no gender-related differences were found for diphtheria-specific antibodies. In conclusion, our study demonstrates that the European population is not fully protected against tetanus and diphtheria. Measures to improve protection should include a life-long perspective on vaccination, more education to increase awareness of and compliance with vaccination guidelines, and a harmonization of recommendations and incentives across Europe.

4.5.5 Weinberger B. Adult vaccination against tetanus and diphtheria: the European perspective. Clin Exp Immunol. 2017 Jan;187(1):93-99.

Besides immunizations against influenza, Streptococcus pneumoniae and herpes zoster, which are recommended specifically for elderly people, regular booster vaccinations against tetanus, diphtheria and in some cases pertussis and polio are recommended in many European countries for adults, including elderly people. Vaccination recommendations for adults differ greatly between individual countries and coverage data is scarce. Tetanus-specific antibody concentrations are generally higher than diphtheria-specific antibodies, and a substantial proportion of adults, and particularly of elderly people, do not have protective antibody concentrations against diphtheria. Antibody levels increase upon booster vaccination in all age groups, but diphtheria-specific antibody concentrations remain below protective levels in some older individuals, even immediately after vaccination and long-term protection is frequently not achieved. Future vaccination strategies should therefore include regular and well-documented booster shots, e.g. against tetanus and diphtheria, throughout life.

4.6 Specific characteristics of different vaccines for older adults: **RSV: Specific topic: Need for revaccination? When and how to organize it?**

Expected outcome: Expected outcome: What RSV vaccines are available, and what are their efficacy and safety profiles in older adults (first general slide)? Is revaccination need after first one supported by evidence, and if so, what timing and frequency are recommended (will RSV become a seasonal vaccination)? How can revaccination programs be organized to ensure high coverage and compliance, particularly in frail populations, especially if they are not seasonal but (e.g.) every two years?

4.6.1 Kelleher K, Subramaniam N, Drysdale SB. The recent landscape of RSV vaccine research. Ther Adv Vaccines Immunother. 2025 Jan 10;13:25151355241310601.

Respiratory syncytial virus (RSV) causes a significant burden of acute respiratory illness across all ages, particularly for infants and older adults. Infants, especially those born prematurely or with underlying health conditions, face a high risk of severe RSV-related lower respiratory tract infections (LRTIs). Globally, RSV contributes to millions of LRTI cases annually, with a disproportionate burden in low- and middle-income countries (LMICs). The RSV virion outer capsule contains glycoproteins G and F which are essential for viral entry into respiratory epithelial cells and represent key targets for therapeutics development. The F-glycoprotein has several highly conserved antigenic sites that have proven useful targets for the development of monoclonal antibodies (mAbs) against RSV. Historically, prevention in infants was limited to the mAb palivizumab, which, despite its efficacy, was costly and inaccessible in many regions. Recent advancements include nirsevimab, a long-acting mAb that has shown substantial efficacy in reducing medically attended RSV-related disease in infants, in phase III clinical trials, early regional and national real-world data. In addition, three new vaccines have been approved: two protein subunit vaccines and a messenger RNA vaccine. The vaccines are all licenced for use in older adults, with one also approved as a maternal vaccine. Promising candidates in development include the mAb clesrovimab, which has an extended half-life and high levels in the nasal epithelial lining and high safety and efficacy profiles in late-stage trials. There are also a wide range of vaccine candidates currently in late-stage clinical trials. These developments signify a major advancement in RSV prevention strategies, offering improved protection for high-risk populations. With the ongoing rollout of the recently licenced vaccines and mAbs internationally, the landscape of RSV care is rapidly changing. We also must ensure these advances reach those in LMICs who need these therapies most.

4.6.2 Walsh EE, Falsey AR, Zareba AM, Jiang Q, Gurtman A, Radley D, Gomme E, Cooper D, Jansen KU, Gruber WC, Swanson KA, Schmoele-Thoma B. Respiratory Syncytial Virus Prefusion F Vaccination: Antibody Persistence and Revaccination. J Infect Dis. 2024 Oct 16;230(4):e905-e916.

Background: Respiratory syncytial virus (RSV) causes substantial respiratory disease. Bivalent RSV prefusion F (RSVpreF) vaccine is licensed in ≥60-year-olds. RSVpreF was well tolerated and immunogenic in a phase 1/2 study. We evaluated antibody persistence after initial vaccination and safety and immunogenicity after revaccination from this study.

Methods: Healthy adults were randomized to receive initial vaccination and revaccination 12 months later with either placebo or RSVpreF (240 µg with or without aluminum hydroxide). RSV-A and RSV-B geometric mean neutralizing titers (GMTs) were measured through 12 months after both vaccinations. Tolerability and safety were assessed.

Results: There were 263 participants revaccinated (18-49 years old, n = 134; 65-85 years old, n = 129). Among 18- to 49-year-olds and 65- to 85-year-olds, geometric mean fold rises (GMFRs) for both RSV subgroups (RSV-A, RSV-B) 1 month after initial RSVpreF vaccination were 13.3 to 20.4 and 8.9 to 15.5, respectively, as compared with levels before initial vaccination; corresponding GMFRs 12 months after initial vaccination were 4.1 to 5.0 and 2.6 to 4.1. GMFRs 1 month after revaccination vs levels before revaccination were 1.4 to 2.3 and 1.4 to 2.2 for 18- to 49-year-olds and 65- to 85-year-olds. Peak GMTs after revaccination were lower than those after initial vaccination. GMTs 12 months after initial vaccination and revaccination were similar, with GMFRs ranging from 0.7 to 1.6. No safety signals occurred.

Conclusions: RSVpreF revaccination was immunogenic and well tolerated among adults. Clinical Trials Registration. NCT03529773 (ClinicalTrials.gov).

4.6.3 Payne AB, Watts JA, Mitchell PK, Dascomb K, Irving SA, Klein NP, Grannis SJ, Ong TC, Ball SW, DeSilva MB, Natarajan K, Sheffield T, Bride D, Arndorfer J, Naleway AL, Koppolu P, Fireman B, Zerbo O, Timbol J, Goddard K, Dixon BE, Fadel WF, Rogerson C, Allen KS, Rao S, Mayer D, Barron M, Reese SE, Rowley EAK, Najdowski M, Ciesla AA, Mak J, Reeves EL, Akinsete OO, McEvoy CE, Essien IJ, Tenforde MW, Fleming-Dutra KE, Link-Gelles R. Respiratory syncytial virus (RSV) vaccine effectiveness against RSV-associated hospitalisations and emergency department encounters among adults aged 60 years and older in the USA, October, 2023, to March, 2024: a test-negative design analysis. Lancet. 2024 Oct 19;404(10462):1547-1559.

Background: Respiratory syncytial virus vaccines first recommended for use during 2023 were efficacious against lower respiratory tract disease in clinical trials. Limited real-world data regarding respiratory syncytial virus vaccine effectiveness are available. To inform vaccine policy and address gaps in evidence from the clinical trials, we aimed to assess the effectiveness against respiratory syncytial virus-associated hospitalisations and emergency department encounters among adults aged at least 60 years. Methods: We conducted a test-negative design analysis in an electronic health records-based network in eight states in the USA, including hospitalisations and emergency department encounters with respiratory syncytial virus-like illness among adults aged at least 60 years who underwent respiratory syncytial virus testing from Oct 1, 2023, to March 31, 2024. Respiratory syncytial virus vaccination status at the time of the encounter was derived from electronic health record

documentation, state and city immunisation registries, and, for some sites, medical claims. Vaccine effectiveness was estimated by immunocompromise status, comparing the odds of vaccination among respiratory syncytial virus-positive case patients and respiratory syncytial virus-negative control patients, and adjusting for age, race and ethnicity, sex, calendar day, social vulnerability index, number of underlying non-respiratory medical conditions, presence of respiratory underlying medical conditions, and geographical region. Findings: Among 28 271 hospitalisations for respiratory syncytial virus-like illness among adults aged at least 60 years without immunocompromising conditions, vaccine effectiveness was 80% (95% CI 71-85) against respiratory syncytial virus-associated hospitalisations, and vaccine effectiveness was 81% (52-92) against respiratory syncytial virus-associated critical illness (ICU admission or death, or both). Among 8435 hospitalisations for respiratory syncytial virus-like illness among adults with immunocompromising conditions, vaccine effectiveness was 73% (48-85) against associated hospitalisation. Among 36 521 emergency department encounters for respiratory syncytial virus-like illness among adults aged at least 60 years without an immunocompromising condition, vaccine effectiveness was 77% (70-83) against respiratory syncytial virus-associated emergency department encounters. Vaccine effectiveness estimates were similar by age group and product type. Interpretation: Respiratory syncytial virus vaccination was effective in preventing respiratory syncytial virus-associated hospitalisations and emergency department encounters among adults aged at least 60 years in the USA during the 2023-24 respiratory syncytial virus season, which was the first season after respiratory syncytial virus vaccine was approved.

4.6.4 Shaw CA, Essink B, Harper C, Mithani R, Kapoor A, Dhar R, Wilson L, Guo R, Panozzo CA, Wilson E, Simorellis AK, Reuter C, Stoszek SK, Chen GL, Das R, Goswami J. Safety and Immunogenicity of an mRNA-Based RSV Vaccine Including a 12-Month Booster in a Phase 1 Clinical Trial in Healthy Older Adults. J Infect Dis. 2024 Sep 23;230(3):e647-e656. doi: 10.1093/infdis/jiae081. PMID: 38385566; PMCID: PMC11420773.

Background: An mRNA-based respiratory syncytial virus (RSV) vaccine, mRNA-1345, is under clinical investigation to address RSV disease burden in older adults. Methods: Based on a randomized, observer-blind, placebo-controlled design, this phase 1 dose-ranging study evaluated the safety, reactogenicity, and immunogenicity of mRNA-1345 in adults aged 65 to 79 years. Participants were randomized to receive 1 dose of mRNA-1345 (12.5, 25, 50, 100, or 200 µg) or placebo and matched mRNA-1345 booster or placebo at 12 months. Results: Overall, 298 participants received the first injection and 247 received the 12-month booster injection. mRNA-1345 was generally well tolerated after both injections, with the most frequently reported solicited adverse reactions being injection site pain, fatigue, headache, arthralgia, and myalgia. Reactogenicity was higher after the booster injection but with severity, time to onset, and duration similar to the first injection. A single mRNA-1345 injection boosted RSV-A and RSV-B neutralizing antibody titers and prefusion F binding antibody (preF bAb) concentrations at 1 month (geometric mean fold rises: RSV-A, 10.2-16.5; RSV-B, 5.3-12.5; preF bAb, 7.2-12.1). RSV antibody levels remained above baseline through 12 months, indicating immune persistence. A 12-month booster injection also increased RSV-A and RSV-B neutralizing antibody titers and preF bAb concentrations; titers after booster injection were numerically lower than those after the first dose, with overlapping 95% CIs. Conclusions: mRNA-1345 was well tolerated and immunogenic following a single injection and a 12-month booster.

4.6.5 Ison MG, Papi A, Athan E, Feldman RG, Langley JM, Lee DG, Leroux-Roels I, Martinon-Torres F, Schwarz TF, van Zyl-Smit RN, Verheust C, Dezutter N, Gruselle O, Fissette L, David MP, Kostanyan L, Hulstrøm V, Olivier A, Van der Wielen M, Descamps D; AReSVi-006 Study Group. Efficacy and Safety of Respiratory Syncytial Virus (RSV) Prefusion F Protein Vaccine

(RSVPreF3 OA) in Older Adults Over 2 RSV Seasons. Clin Infect Dis. 2024 Jun 14;78(6):1732-1744. doi: 10.1093/cid/ciae010. PMID: 38253338; PMCID: PMC11175669..

Background: The adjuvanted RSV prefusion F protein-based vaccine (RSVPreF3 OA) was efficacious against RSV-related lower respiratory tract disease (RSV-LRTD) in ≥60-years-olds over 1 RSV season. We evaluated efficacy and safety of 1 RSVPreF3 OA dose and of 2 RSVPreF3 OA doses given 1 year apart against RSV-LRTD over 2 RSV seasons post-dose 1. Methods: In this phase 3, blinded trial, ≥60-year-olds were randomized (1:1) to receive RSVPreF3 OA or placebo pre-season 1. RSVPreF3 OA recipients were re-randomized (1:1) to receive a second RSVPreF3 OA dose (RSV_revaccination group) or placebo (RSV_1dose group) pre-season 2; participants who received placebo pre-season 1 received placebo pre-season 2 (placebo group). Efficacy of both vaccine regimens against RSV-LRTD was evaluated over 2 seasons combined (confirmatory secondary objective, success criterion: lower limits of 2-sided CIs around efficacy estimates >20%). Results: The efficacy analysis comprised 24 967 participants (RSV_1dose: 6227; RSV_revaccination: 6242; placebo: 12 498). Median efficacy follow-up was 17.8 months. Efficacy over 2 seasons of 1 RSVPreF3 OA dose was 67.2% (97.5% CI: 48.2-80.0%) against RSV-LRTD and 78.8% (95% CI: 52.6-92.0%) against severe RSV-LRTD. Efficacy over 2 seasons of a first dose followed by revaccination was 67.1% (97.5% CI: 48.1-80.0%) against RSV-LRTD and 78.8% (95% CI: 52.5-92.0%) against severe RSV-LRTD. Reactogenicity/safety of the revaccination dose were similar to dose 1. Conclusions: One RSVPreF3 OA dose was efficacious against RSV-LRTD over 2 RSV seasons in ≥60-year-olds. Revaccination 1 year post-dose 1 was well tolerated but did not seem to provide additional efficacy benefit in the overall study population.

4.6.6 Leroux-Roels I, Van Ranst M, Vandermeulen C, Abeele CV, De Schrevel N, Salaun B, Verheust C, David MP, Kotb S, Hulstrøm V. Safety and Immunogenicity of a Revaccination With a Respiratory Syncytial Virus Prefusion F Vaccine in Older Adults: A Phase 2b Study. J Infect Dis. 2024 Feb 14;229(2):355-366.

Background: In the previous (parent) study, 2 doses of different formulations of an investigational vaccine against respiratory syncytial virus (RSVPreF3 OA) were well tolerated and immunogenic in older adults. This multicenter phase 2b extension study assessed safety and immunogenicity of a revaccination (third) dose of the 120 µg RSVPreF3-AS01E formulation. Methods: In total, 122 older adults (60-80 years), previously vaccinated with 2 doses of RSVPreF3-AS01E formulations (containing 30, 60, or 120 µg RSVPreF3 antigen), received an additional 120 µg RSVPreF3-AS01E dose 18 months after dose 2. Vaccine safety was evaluated in all participants up to 6 months and immunogenicity in participants who received 120 µg RSVPreF3-AS01E doses until 1 month after dose 3. Results: Similar to the parent study, mostly mild-to-moderate solicited adverse events and no vaccine-related serious adverse events or potential immune-mediated disorders were reported. Neutralizing titers and cell-mediated immune responses persisted for 18 months after 2-dose vaccination. Dose 3 increased RSV-specific neutralizing titers against RSV-A and RSV-B and median CD4+ T-cell frequencies. After dose 3, RSV-specific neutralizing titers but not CD4+ T-cell frequencies were below levels detected 1 month after dose 1. Conclusions: Revaccination with 120 µg RSVPreF3-AS01E 18 months after dose 2 is well tolerated and immunogenic in older adults.

4.7 Specific characteristics of different vaccines for older adults: **Influenza: Specific topic: High-dose and adjuvanted vaccines**

Expected outcome: Expected outcome: What influenza vaccines are available, and what are their efficacy and safety profiles in older adults (first general slide)? What are the key differences between high-dose (HD) and adjuvanted influenza vaccines, and which are most effective in older adults (evidence-based)? Do comorbidities influence vaccine choice, and what data support their use?

4.7.1 Emborg Hanne-Dorthe, Valentiner-Branth Palle, Trebbien Ramona, Bolt Botnen Amanda, Grove Krause Tyra, Søborg Bolette. Enhanced influenza vaccines impact effectiveness in individuals aged 65 years and older, Denmark, 2024/25 influenza season up to 4 March 2025. Euro Surveill. 2025;30(12):pii=2500174.

During the 2024/25 influenza season, enhanced and standard-dose influenza vaccines were available for individuals aged 65 and older. Compared with the standard-dose quadrivalent influenza vaccine (QIV), the adjuvanted QIV was significantly more effective, with an overall vaccine effectiveness (VE) of 48% (95% CI: 42–52) vs 33% (95% CI: 24–41) when considering both non-hospitalised and hospitalised patients. The high-dose QIV demonstrated similar effectiveness to the adjuvanted QIV. These findings support the inclusion of enhanced influenza vaccines in future vaccination programmes.

4.7.2 Rose AM, Lucaccioni H, Marsh K, Kirsebom F, Whitaker H, Emborg HD, et al. Interim 2024/25 influenza vaccine effectiveness: eight European studies, September 2024 to January 2025. Euro Surveill. 2025;30(7):2500102. https://doi.org/10.2807/1560-7917.ES.2025.30.7.2500102 PMID: 39980423

The 2024/25 influenza season in Europe is currently characterised by co-circulation of influenza A(H1N1)pdm09, A(H3N2) and B/Victoria viruses, with influenza A(H1N1)pdm09 predominating. Interim vaccine effectiveness (VE) estimates from eight European studies (17 countries) indicate an all-age influenza A VE of 32-53% in primary care and 33-56% in hospital settings, with some signals of lower VE by subtype and higher VE against influenza B (≥ 58% across settings). Where feasible, influenza vaccination should be encouraged and other prevention measures strengthened.

4.7.3 Separovic L, Zhan Y, Kaweski SE, Sabaiduc S, Carazo S, Olsha R, et al. Interim estimates of vaccine effectiveness against influenza A(H1N1)pdm09 and A(H3N2) during a delayed influenza season, Canada, 2024/25. Euro Surveill. 2025;30(4):2500059.

The Canadian Sentinel Practitioner Surveillance Network (SPSN) reports interim 2024/25 vaccine effectiveness (VE) against acute respiratory illness due to laboratory-confirmed influenza during a delayed season of predominant A(H1N1)pdm09 and lower A(H3N2) co-circulation. Through mid-January, the risk of outpatient illness due to influenza A is reduced by about half among vaccinated vs unvaccinated individuals. Adjusted VE is 53% (95% CI: 36-65) against A(H1N1)pdm09, comprised of clades 5a.2a and 5a.2a.1, and 54% (95% CI: 29-70) against A(H3N2), virtually all clade 2a.3a.1.

4.7.6 Ferdinands JM, Blanton LH, Alyanak E, Chung JR, Trujillo L, Taliano J, Morgan RL, Fry AM, Grohskopf LA. Protection against influenza hospitalizations from enhanced influenza vaccines among older adults: A systematic review and network meta-analysis. J Am Geriatr

Soc. 2024 Dec;72(12):3875-3889. doi: 10.1111/jgs.19176. Epub 2024 Sep 4. PMID: 39230284; PMCID: PMC11637296.

Background: Influenza vaccines are available to help protect persons aged ≥65 years, who experience thousands of influenza hospitalizations annually. Because some influenza vaccines may work better than others, we sought to assess benefit of high-dose (HD), adjuvanted (ADJ), and recombinant (RIV) influenza vaccines ("enhanced influenza vaccines") compared with standard-dose unadjuvanted influenza vaccines (SD) and with one another for prevention of influenza-associated hospitalizations among persons aged ≥65 years. Methods: We searched MEDLINE, Embase, CINAHL, Scopus, and Cochrane Library to identify randomized or observational studies published between January 1990 and October 2023 and reporting relative vaccine effectiveness (rVE) of HD, ADJ, or RIV for prevention of influenza-associated hospitalizations among adults aged ≥65 years. We extracted study data, assessed risk of bias, and conducted random-effects network meta-analysis and meta-regression. Results: We identified 32 studies with 90 rVE estimates from five randomized and 27 observational studies (71,459,918 vaccinated participants). rVE estimates varied across studies and influenza seasons. Pooled rVE from randomized studies was 20% (95% CI -54 to 59) and 25% (95% CI -19 to 53) for ADJ and HD compared with SD, respectively; rVE was 6% (95% CI -109 to 58) for HD compared with ADJ; these differences were not statistically significant. In observational studies, ADJ, HD, and RIV conferred modestly increased protection compared with SD (rVE ranging from 10% to 19%), with no significant differences between HD, ADJ, and RIV. With enhanced vaccines combined, rVE versus SD was 18% (95% CI 3 to 32) from randomized and 11% (95% CI 8 to 14) from observational evidence. Meta-regression of observational studies suggested that those requiring laboratory confirmation of influenza reported greater benefit of enhanced vaccines. Conclusions: HD, ADJ, and RIV provided stronger protection than SD against influenza hospitalizations among older adults. No differences in benefit were observed in comparisons of enhanced influenza vaccines with one another.

4.7.5 Summary of Product Characteristics (SmPC) of the high dose (Efluelda) and adjuvanted (Fluad) influenza vaccines used in Europe

- Fluad influenza vaccine (surface antigen, inactivated, adjuvanted): link to EMA SmPC
- Efluelda (split virion, inactivated), 60 micrograms HA / strain: link to HPRA SmPC

The regulatory documents contain comprehensive efficacy and safety data that formed the basis for approval of these vaccines.

4.8 Specific characteristics of different vaccines for older adults: **COVID-19/SARS-CoV-2: Specific topic: Different platforms (e.g. mRNA)**

Expected outcome: How effective were the different vaccine platforms used during the pandemic in older adults? Was there a difference in effectiveness by age for the mRNA platforms still in use today?

4.8.1 Nunes B, Humphreys J, Nicolay N, Braeye T, Van Evercooren I, Holm Hansen C, Moustsen-Helms IR, Sacco C, Fabiani M, Castilla J, Martínez-Baz I, Meijerink H, Machado A, Soares P, Ljung R, Pihlström N, Nardone A, Bacci S, Monge S; VEBIS-EHR working group. Monovalent XBB.1.5 COVID-19 vaccine effectiveness against hospitalisations and deaths

during the Omicron BA.2.86/JN.1 period among older adults in seven European countries: A VEBIS-EHR network study. Expert Rev Vaccines. 2024 Jan-Dec;23(1):1085-1090.

Background: We aimed to estimate XBB.1.5 vaccine effectiveness (VE) against COVID-19-related hospitalizations and deaths during BA.2.86/JN.1 predominance, among EU/EEA individuals with ≥65-years. Research design and methods: We linked electronic health records to create historical cohorts in Belgium, Denmark, Italy, Navarre (Spain), Norway, Portugal and Sweden. We included individuals aged ≥65-years eligible for the autumnal 2023 COVID-19 vaccine. Follow-up started when ≥80% of country-specific sequenced viruses were BA.2.86/JN.1 (4/dec/23 to 08/jan/24) and ended 25 February 2024. At study site level, we estimated the vaccine confounder-adjusted hazard ratio (aHR) of COVID-19 hospitalizations and deaths between individuals with ≥14 days after vaccination versus unvaccinated in autumn 2023, overall, by time since vaccination and age groups. VE was estimated as (1-pooled aHR)x100 with a random-effects model. Results: XBB.1.5 VE against COVID-19 hospitalizations was 50% (95%CI: 45 to 55) and 41% (95%CI: 35 to 46) in 65-79-year-olds and in ≥80-year-olds, respectively. VE against COVID19-related-death was 58% (95%CI: 42 to 69) and 48% (95%CI: 38 to 57), respectively, in both age groups. VE estimates against each outcome declined in all age groups over time. Conclusion: Monovalent XBB.1.5 vaccine had a moderate protective effect against severe and fatal COVID-19 likely caused by BA.2.86/JN.1 during the 2023/2024 winter, among persons aged ≥65. Keywords: COVID-19; SARS-CoV-2; cohort design; electronic health records; hospitalization; multi-country study; vaccine effectiveness.

4.8.2 Laniece Delaunay C, Mazagatos C, Martínez-Baz I, Túri G, Goerlitz L, Domegan L, Meijer A, Rodrigues AP, Sève N, Ilic M, Latorre-Margalef N, Lazar M, Maurel M, Melo A, Andreu Ivorra B, Casado I, Horváth JK, Buda S, Bennett C, de Lange M, Guiomar R, Enouf V, Mlinaric I, Samuelsson Hagey T, Dinu S, Rumayor M, Castilla J, Oroszi B, Dürrwald R, O'Donnell J, Hooiveld M, Gomez V, Falchi A, Kurecic Filipovic S, Dillner L, Popescu R, Bacci S, Kaczmarek M, Kissling E; VEBIS Primary Care Vaccine Effectiveness Group. COVID-19 Vaccine Effectiveness in Autumn and Winter 2022 to 2023 Among Older Europeans. JAMA Netw Open. 2024 Jul 1;7(7):e2419258.

Importance: In the context of emerging SARS-CoV-2 variants or lineages and new vaccines, it is key to accurately monitor COVID-19 vaccine effectiveness (CVE) to inform vaccination campaigns. Objective: To estimate the effectiveness of COVID-19 vaccines administered in autumn and winter 2022 to 2023 against symptomatic SARS-CoV-2 infection (with all circulating viruses and XBB lineage in particular) among people aged 60 years or older in Europe, and to compare different CVE approaches across the exposed and reference groups used. Design, setting, and participants: This case-control study obtained data from VEBIS (Vaccine Effectiveness, Burden and Impact Studies), a multicenter study that collects COVID-19 and influenza data from 11 European sites: Croatia; France; Germany; Hungary; Ireland; Portugal; the Netherlands; Romania; Spain, national; Spain, Navarre region; and Sweden. Participants were primary care patients aged 60 years or older with acute respiratory infection symptoms who were recruited at the 11 sites after the start of the COVID-19 vaccination campaign from September 2022 to August 2023. Cases and controls were defined as patients with positive and negative, respectively, reverse transcription-polymerase chain reaction (RT-PCR) test results. Exposures: The exposure was COVID-19 vaccination. The exposure group consisted of patients who received a COVID-19 vaccine during the autumn and winter 2022 to 2023 vaccination campaign and 14 days or more before symptom onset. Reference group included patients who were not vaccinated during or in the 6 months before the 2022 to 2023 campaign (seasonal CVE), those who were never vaccinated (absolute CVE), and those who

were vaccinated with at least the primary series 6 months or more before the campaign (relative CVE). For relative CVE of second boosters, patients receiving their second booster during the campaign were compared with those receiving 1 booster 6 months or more before the campaign. Main outcomes and measures: The outcome was RT-PCR-confirmed, medically attended, symptomatic SARS-CoV-2 infection. Four CVE estimates were generated: seasonal, absolute, relative, and relative of second boosters. CVE was estimated using logistic regression, adjusting for study site, symptom onset date, age, chronic condition, and sex. Results: A total of 9308 primary care patients were included, with 1687 cases (1035 females; median [IQR] age, 71 [65-79] years) and 7621 controls (4619 females [61%]; median [IQR] age, 71 [65-78] years). Within 14 to 89 days after vaccination, seasonal CVE was 29% (95% CI, 14%-42%), absolute CVE was 39% (95% CI, 6%-60%), relative CVE was 31% (95% CI, 15% to 44%), and relative CVE of second boosters was 34% (95% CI, 18%-47%) against all SARS-CoV-2 variants. In the same interval, seasonal CVE was 44% (95% CI, -10% to 75%), absolute CVE was 52% (95% CI, -23% to 82%), relative CVE was 47% (95% CI, -8% to 77%), and relative CVE of second boosters was 46% (95% CI, -13% to 77%) during a period of high XBB circulation. Estimates decreased with time since vaccination, with no protection from 180 days after vaccination. Conclusions and relevance: In this case-control study among older Europeans, all CVE approaches suggested that COVID-19 vaccines administered in autumn and winter 2022 to 2023 offered at least 3 months of protection against symptomatic, medically attended, laboratory-confirmed SARS-CoV-2 infection. The effectiveness of new COVID-19 vaccines against emerging SARS-CoV-2 variants should be continually monitored using CVE seasonal approaches.

4.8.3 Pardi N, Krammer F. mRNA vaccines for infectious diseases - advances, challenges and opportunities. Nat Rev Drug Discov. 2024 Nov;23(11):838-861.

The concept of mRNA-based vaccines emerged more than three decades ago. Groundbreaking discoveries and technological advancements over the past 20 years have resolved the major roadblocks that initially delayed application of this new vaccine modality. The rapid development of nucleoside-modified COVID-19 mRNA vaccines demonstrated that this immunization platform is easy to develop, has an acceptable safety profile and can be produced at a large scale. The flexibility and ease of antigen design have enabled mRNA vaccines to enter development for a wide range of viruses as well as for various bacteria and parasites. However, gaps in our knowledge limit the development of next-generation mRNA vaccines with increased potency and safety. A deeper understanding of the mechanisms of action of mRNA vaccines, application of novel technologies enabling rational antigen design, and innovative vaccine delivery strategies and vaccination regimens will likely yield potent novel vaccines against a wide range of pathogens.

4.8.4 Dallan, B., Proietto, D., De Laurentis, M. et al. Age differentially impacts adaptive immune responses induced by adenoviral versus mRNA vaccines against COVID-19. Nat Aging 4, 1121–1136 (2024).

Adenoviral and mRNA vaccines encoding the viral spike (S) protein have been deployed globally to contain severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Older individuals are particularly vulnerable to severe infection, probably reflecting age-related changes in the immune system, which can also compromise vaccine efficacy. It is nonetheless unclear to what extent different vaccine platforms are impacted by immunosenescence. Here, we evaluated S protein-specific immune responses elicited by vaccination with two doses of BNT162b2 or ChAdOx1-S and subsequently boosted with a single dose of BNT162b2 or mRNA-1273, comparing age-stratified participants with no evidence of previous infection with SARS-CoV-2. We found that aging profoundly compromised S protein-specific IgG titers and further

limited S protein-specific CD4+ and CD8+ T cell immunity as a probable function of progressive erosion of the naive lymphocyte pool in individuals vaccinated initially with BNT162b2. Our results demonstrate that primary vaccination with ChAdOx1-S and subsequent boosting with BNT162b2 or mRNA-1273 promotes sustained immunological memory in older adults and potentially confers optimal protection against coronavirus disease 2019.

4.8.5 COVID-19 mortality and progress towards vaccinating older adults – worldwide, 2020–2022 – WHO // https://www.who.int/publications/i/item/9789240066045

- ≥60 years accounted for >80% of the overall mortality across all income groups, with upper and lower middle income countries accounting for 80% of the overall estimated excess mortality.
- The July 2022 update to the WHO Global COVID-19 Vaccination Strategy prioritized vaccination of populations at increased risk, including older adults, with the goal of 100% coverage for at risk populations with a complete primary COVID-19 vaccination series
- The median overall completed primary series COVID-19 vaccination was 59%, ranging from a low of 21% (low-income countries) (50% [upper-middle–income] and 51% [lower-middle–income]) to a high of 74% (high-income countries). Only high-income countries surpassed the global target of 70% for the overall population. Among older adults, the median completed primary COVID-19 vaccination series coverage was 76%, ranging from 33% (low-income countries) to 90% (high-income countries), approaching the WHO-recommended goal of 100%. Median coverage among older adults in lower-middle– and upper middle–income countries was 73% and 70%, respectively. Reported coverage among both the overall population and among older adults varied among countries within and among different income groups (Figure 1). Coverage among older adults was the same or lower than that in the overall population in 36 (23%) countries, including 4 high-income, 8 upper-middle–income, 14 lower-middle–income, 8 low-income, and 2 no classified countries (see figure below).
- The collection of accurate disaggregated data by age, and by vaccination dose (i.e., primary series and booster doses) will be critical to monitoring progress in achieving coverage targets among older adults at highest risk for COVID-19–associated death. Because vaccination rates among older adult populations remain below the recommended global vaccination target of 100% in many parts of the world, efforts are needed to understand and address the reasons that target populations are not reached by current vaccination programmes, while integrating COVID-19 vaccination into primary care systems to facilitate completion of a primary COVID-19 vaccination series and receipt of booster doses recommended by WHO and national health authorities for all older adults.

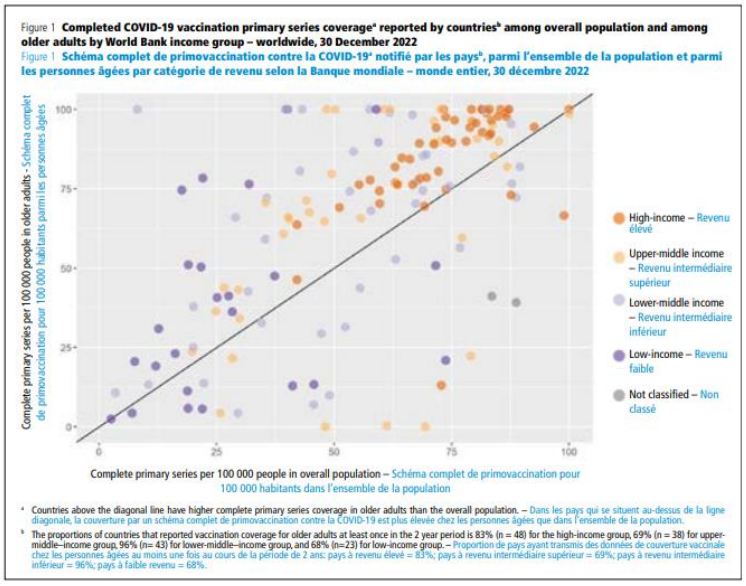


Figure 1 **Completed COVID-19 vaccination primary series coverage[a] reported by countries[b] among overall population and among older adults by World Bank income group – worldwide, 30 December 2022**

Figure 1 **Schéma complet de primovaccination contre la COVID-19[a] notifié par les pays[b], parmi l'ensemble de la population et parmi les personnes âgées par catégorie de revenu selon la Banque mondiale – monde entier, 30 décembre 2022**

[a] Countries above the diagonal line have higher complete primary series coverage in older adults than the overall population. – Dans les pays qui se situent au-dessus de la ligne diagonale, la couverture par un schéma complet de primovaccination contre la COVID-19 est plus élevée chez les personnes âgées que dans l'ensemble de la population.

[b] The proportions of countries that reported vaccination coverage for older adults at least once in the 2 year period is 83% (n = 48) for the high-income group, 69% (n = 38) for upper-middle–income group, 96% (n= 43) for lower-middle–income group, and 68% (n=23) for low-income group. – Proportion de pays ayant transmis des données de couverture vaccinale chez les personnes âgées au moins une fois au cours de la période de 2 ans: pays à revenu élevé = 83%; pays à revenu intermédiaire supérieur = 69%; pays à revenu intermédiaire inférieur = 96%; pays à faible revenu = 68%.

Session 5: Implementing vaccination in the older adults on multiple levels

Session 5: Implementing vaccination in the older adults on multiple levels	5.1 The policymakers level: Vaccine impact assessment and economic value of vaccination in aging adults	Simon Brassel
	5.2 The organizational level: what are challenges in reaching older adults and opportunities (e.g. co-administration)	Sofia Duque
	5.3 The population level: communicating the importance of vaccination for healthy aging	Litjen Tan

5.1 The policymakers level: Vaccine impact assessment and economic value of vaccination in aging adults

Potential questions/outcomes: Expected outcome: How can we effectively communicate the importance of vaccination to older adults and their caregivers? What approaches work best to address vaccine hesitancy in this group? How can healthcare providers be trained and supported to build trust and encourage vaccine uptake?

5.1.1 Ecarnot F, Amuthavalli Thiyagarajan J, Barbagallo M, Barratt J, Biering-Sørensen T, Botelho-Nevers E, Del Riccio M, Goeijenbier M, Gravenstein S, Lourenço L, Michel JP, Pedicino D, Sieber C, Torres A, Veronese N, Volpe M, Weinke T, Maggi S. Infectious diseases,

cardio-cerebrovascular health and vaccines: pathways to prevention. Aging Clin Exp Res. 2025 Mar 13;37(1):80.

Cardiovascular and infectious diseases both feature among the leading causes of death among men and women in the world. The pathophysiological pathways of infection and cardiovascular disease intersect, and there is a bidirectional relationship between the two. Vaccines are available for the most common infectious diseases affecting older adults, such as influenza, pertussis, pneumococcal disease, herpes zoster, COVID and respiratory syncytial virus (RSV). In many countries, these vaccines are recommended systematically for older adults and any adults with comorbidities, who are also those most likely to suffer from cardiovascular disease. There is a large body of evidence attesting to the benefits of vaccination on cardio- and cerebrovascular health. The European Interdisciplinary Council for Aging (EICA) and the Italian Society for Cardiovascular Prevention (Società Italiana per la Prevenzione Cardiovascolare, SIPREC) convened a 2-day meeting in June 2024 to review the state of the evidence on the relationship between cardio- and cerebrovascular health and the most common infectious diseases, and the role of vaccines in preventing both infection and its adverse consequences in terms of cardiovascular and cerebrovascular outcomes. We present here the Executive Summary of the proceedings of this meeting.

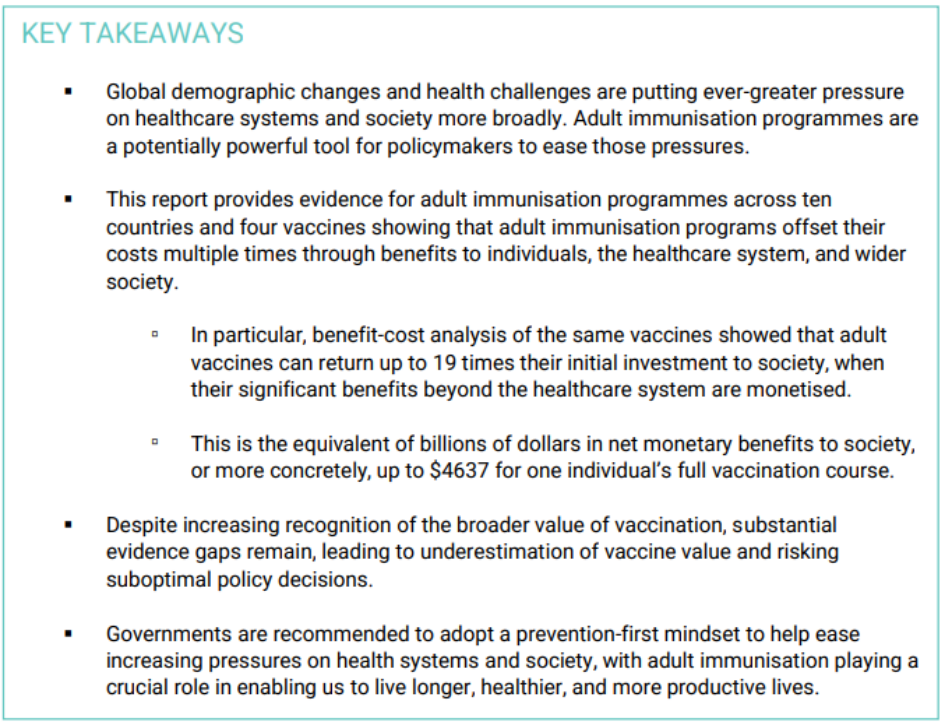
5.1.2 Ecarnot F, Thiyagarajan JA, Barbagallo M, Barratt J, Constantinescu S, Elkayam O, Ferrucci L, Hiligsmann M, Kapetanovic M, Macchia F, Michel JP, Migliore A, Pilotto A, Sieber C, Strangfeld A, Veronese N, Vetrano DL, Maggi S, Rizzoli R. Musculoskeletal diseases, infections and vaccines: state of the art, research perspectives and educational needs. Aging Clin Exp Res. 2025 Feb 22;37(1):46.

Vaccine responsiveness is often reduced in older adults. Yet, our lack of understanding of low vaccine responsiveness hampers the development of effective vaccination strategies to reduce the impact of infectious diseases in the ageing population. Young-adult (25-49 y), middle-aged (50-64 y) and older-adult (≥ 65 y) participants of the VITAL clinical trials (n = 315, age-range: 28-98 y), were vaccinated with an annual (2019-2020) quadrivalent influenza (QIV) booster vaccine, followed by a primary 13-valent pneumococcal-conjugate (PCV13) vaccine (summer/autumn 2020) and a primary series of two SARS-CoV-2 mRNA-1273 vaccines (spring 2021). This unique setup allowed investigation of humoral responsiveness towards multiple vaccines within the same individuals over the adult age-range. Booster QIV vaccination induced comparable H3N2 hemagglutination inhibition (HI) titers in all age groups, whereas primary PCV13 and mRNA-1273 vaccination induced lower antibody concentrations in older as compared to younger adults (primary endpoint). The persistence of humoral responses, towards the 6 months timepoint, was shorter in older adults for all vaccines (secondary endpoint). Interestingly, highly variable vaccine responder profiles overarching multiple vaccines were observed. Yet, approximately 10% of participants, mainly comprising of older male adults, were classified as low responders to multiple vaccines. This study aids the identification of risk groups for low vaccine responsiveness and hence supports targeted vaccination strategies. Trial number: NL69701.041.19, EudraCT: 2019-000836-24.

5.1.3 Ecarnot F, Boccardi V, Calcagno A, Franceschi C, Fülop T, Itzhaki RF, Michel JP, Panza F, Rainero I, Solfrizzi V, Ticinesi A, Veronese N, Maggi S. Dementia, infections and vaccines: 30 years of controversy. Aging Clin Exp Res. 2023 Jun;35(6):1145-1160.

This paper reports the proceedings of a virtual meeting convened by the European Interdisciplinary Council on Ageing (EICA), to discuss the involvement of infectious disorders in the pathogenesis of dementia and neurological disorders leading to dementia. We recap how our view of the infectious etiology of dementia has changed over the last 30 years in light of emerging evidence, and we present evidence in support of the implication of infection in dementia, notably Alzheimer's disease (AD). The bacteria and viruses thought to be responsible for neuroinflammation and neurological damage are reviewed. We then review the genetic basis for neuroinflammation and dementia, highlighting the genes that are currently the focus of investigation as potential targets for therapy. Next, we describe the antimicrobial hypothesis of dementia, notably the intriguing possibility that amyloid beta may itself possess antimicrobial properties. We further describe the clinical relevance of the gut-brain axis in dementia, the mechanisms by which infection can move from the intestine to the brain, and recent findings regarding dysbiosis patterns in patients with AD. We review the involvement of specific pathogens in neurological disorders, i.e. SARS-CoV-2, human immunodeficiency virus (HIV), herpes simplex virus type 1 (HSV1), and influenza. Finally, we look at the role of vaccination to prevent dementia. In conclusion, there is a large body of evidence supporting the involvement of various infectious pathogens in the pathogenesis of dementia, but large-scale studies with long-term follow-up are needed to elucidate the role that infection may play, especially before subclinical or clinical disease is present.

5.1.4 El Banhawi H., Chowdhury S., Neri M., Radu P., Besley S., Bell E., Brassel S., Steuten L., 2024. The Socioeconomic Value of Adult Immunisation Programmes. OHE Contract Research Report: Office of Health Economics. Available at: https://www.ohe.org/publications/the-socio-economic-value-ofadult-immunisation-programmes/



KEY TAKEAWAYS

- Global demographic changes and health challenges are putting ever-greater pressure on healthcare systems and society more broadly. Adult immunisation programmes are a potentially powerful tool for policymakers to ease those pressures.
- This report provides evidence for adult immunisation programmes across ten countries and four vaccines showing that adult immunisation programs offset their costs multiple times through benefits to individuals, the healthcare system, and wider society.
    - In particular, benefit-cost analysis of the same vaccines showed that adult vaccines can return up to 19 times their initial investment to society, when their significant benefits beyond the healthcare system are monetised.
    - This is the equivalent of billions of dollars in net monetary benefits to society, or more concretely, up to $4637 for one individual's full vaccination course.
- Despite increasing recognition of the broader value of vaccination, substantial evidence gaps remain, leading to underestimation of vaccine value and risking suboptimal policy decisions.
- Governments are recommended to adopt a prevention-first mindset to help ease increasing pressures on health systems and society, with adult immunisation playing a crucial role in enabling us to live longer, healthier, and more productive lives.

5.2 The organizational level: what are challenges in reaching older adults and opportunities (e.g. co-administration)

Potential questions/outcomes: Expected outcome: How can we effectively communicate the importance of vaccination to older adults and their caregivers? What approaches work best to address vaccine hesitancy in this group? How can healthcare providers be trained and supported to build trust and encourage vaccine uptake?

5.2.1 Rice D, Callies D. Enhancing Preventive Care for Adults 50+ Through Pre-Visit Planning in Primary Care. J Nurs Care Qual. 2025 Apr 1.

Background: Preventive care is often overlooked in older adults due to the complexity of care. A pre-visit planning checklist may be effective in enhancing prevention. Local problem: A Midwest internal medicine department identified the need to increase age-appropriate vaccinations and screenings in adults 50 and older. Methods: A pre-visit planning checklist for cancer screenings, bone density scans, and immunizations, guided by the American Medical Association, was implemented. The number of ordered preventive measures was compared 3 months pre and post-implementation. Interventions: Staff members reviewed patient charts prior to appointments using the pre-visit checklist, which guided staff to look at appropriate preventive tasks and notify the provider of needed items. Results: There was a significant increase in the percentage of patients who received orders for colonoscopies (10.6% vs 16.6%) and bone density scans (2.9% vs 5.7%). Conclusion: Pre-visit planning may be an effective way to increase preventive measures in primary care.

5.2.2 Tan L, Trevas D, Falsey AR. Adult Vaccine Coadministration Is Safe, Effective, and Acceptable: Results of a Survey of the Literature. Influenza Other Respir Viruses. 2025 Mar;19(3):e70090.

Background: Coadministration of vaccines in children is a long-standing practice that has proven to be safe and effective in improving the efficiency of vaccine administration, thereby increasing immunization coverage rates. As the number of vaccines routinely recommended for adults increases, and with limited opportunities for adults to have preventive health touchpoints with providers, adult vaccine coadministration should be considered as a routine practice to improve vaccination coverage rates and public health. A review of existing literature was conducted to examine the potential reactogenicity and impact on effectiveness when co-administering vaccines to adults. Methods: Medline was searched for research articles with the search term "influenza vaccine" or "vaccination," combined with the search terms "simultaneous," "concomitant," "concurrent," and "combination." Another search of Medline was conducted on the search term "influenza vaccine" or "vaccination" combined with the following individual search terms: "RSV," "COVID," and "Tdap." The references of extracted articles were also examined for potential other relevant articles. Results and conclusions: Adult vaccine coadministration is safe for all the combinations we assessed. Most adverse events (AEs) were generally mild to moderate and of short duration. Some studies showed slightly more reactogenicity with coadministration but few or no serious AEs or safety signals. Nearly every study confirmed that coadministration had no significant effect on immune response for either vaccine. The benefits of vaccine coadministration outweigh the risks. It increases convenience for vaccinees, reduces the number of missed opportunities to vaccinate, and contributes to efficient use of healthcare resources.

5.2.3 Vaccinating older adults against COVID-19 9789240066045-eng.pdf - 20 June 2023

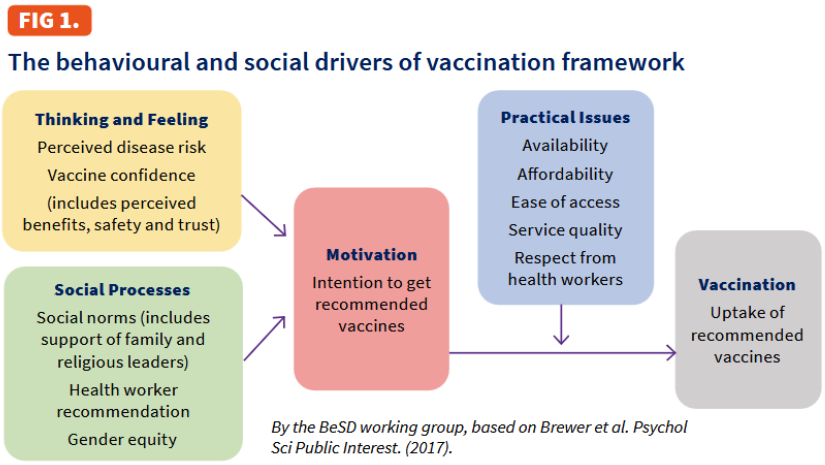
The objective of this document is to identify successful strategies, enablers and examples of successful strategies to identify and offer vaccine doses against coronavirus disease (COVID-19) to older adults, especially in low- and middle-income settings. The primary target audience for this document includes national and subnational managers of immunization and other programmes who deliver health and social services to older adults. Global, regional and country level stakeholders and partners (i.e. nongovernmental organizations (NGOs), community service organizations) who support the design, planning, implementation, monitoring and evaluation of COVID-19 vaccinations and care for older adults may find this guidance useful as well.

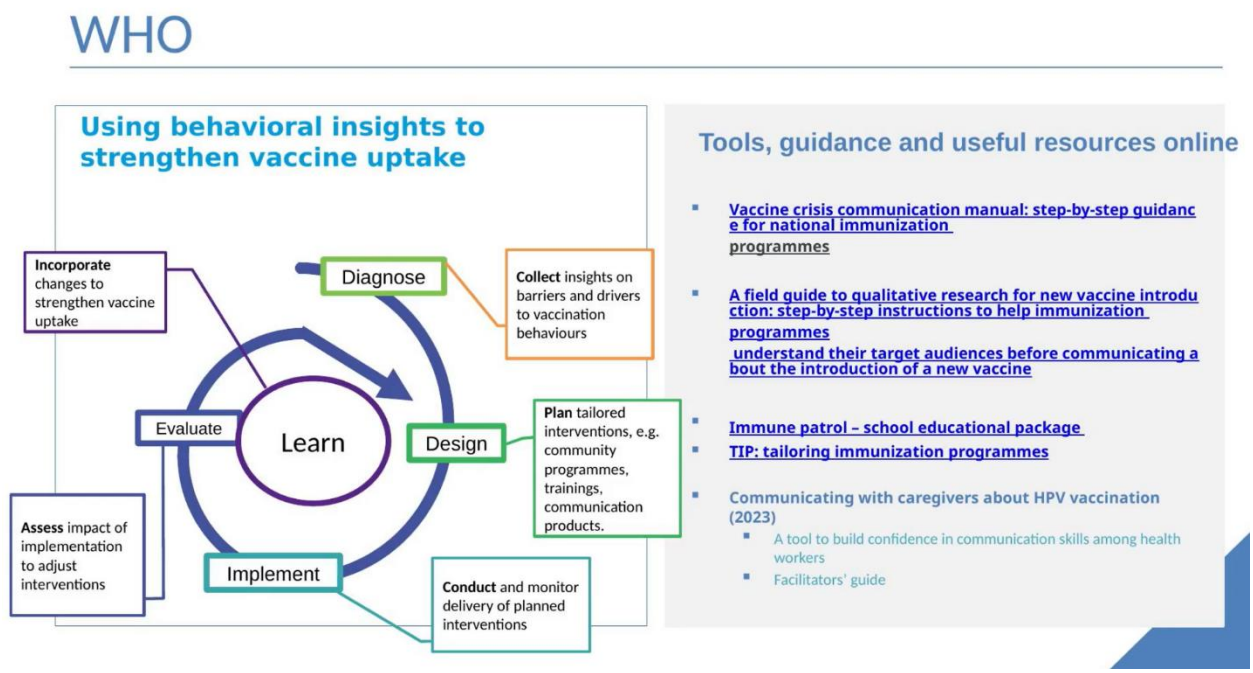
- The COVID-19 pandemic has had a significant impact on older adults (1) (ages 50 or 60 years are commonly used cut-offs for identifying older adults but the appropriate age cut off should be made at the country-level), with the highest proportion of severe disease and death concentrated in this age group. Besides these direct outcomes, the sequelae of COVID-19 often result in significant loss of physical and mental capacities and functional ability, requiring additional care.
- Reaching this group is difficult in many settings, as national immunization programmes traditionally target infants, children, adolescents and women of reproductive age. In addition, fully reaching the older adult population requires different responses owing to its diversity. For example, access to health care, functional ability levels and health literacy need to be considered.
- The COVID-19 pandemic has highlighted issues of ageism evident in the large disparities in access, uptake barriers and existing gaps in health and social services and systems for older adults
- The COVID-19 pandemic has provided an opportunity to build and strengthen health and social services under universal health coverage and within communities that could better serve older adults, and to adopt a life course approach to immunization.
- It is anticipated that COVID-19 vaccines may continue to be delivered as periodic boosters for older adults. Moreover, as is done in childhood programmes, any contact with the health system (at primary care and/or hospital level) should be used as an opportunity to vaccinate older adults.
- Older adults are a heterogenous group with various levels of physical and mental capacity and health and care needs. While some may have multiple comorbidities and require daily assistance, many live independently and are able to navigate their needs easily. Drawing broad generalizations is challenging. Nonetheless, in order to reach the most at risk, governments must consider the barriers and enablers that could improve access to health interventions, such as immunization, to effectively reach older people
- Older adults are often harder to reach by traditional immunization programmes, as few vaccines are routinely offered to this group beyond seasonal influenza and pneumococcus. In some locations, no immunization programmes are offered to older adults at all, or services may be poorly designed to meet their needs. Additionally, health systems often focus on curative rather than preventive measures such as vaccines. In addition to these system level issues, older adults may have physical and/or cognitive impairments which make them more reliant on caregivers to attend clinics.

- Because older adults are not routinely engaged or empowered through communication and demand-generation activities, they may not have adequate awareness of the vaccines available to them.
- The products used to disseminate information may not meet the challenges of older adults, which may range from visual impairment, hearing loss or cognitive decline to accessibility to social media or digital tools. In settings where social media and digital tools are used extensively, older adults may not be able to learn more about the benefits of vaccines, access or how to register for vaccination services. In light of these considerations, several overarching principles can guide programmes to reach this vulnerable population.
- Regardless of the strategies used, microplanning to reach older adults should consider the following:
  - **Identification of the target population:**
    - using processes such as census data, voter registration, government pension plans as well as formal or informal processes such as knowledge from community health workers. Knowing where to find older adults will help delineate the best strategies to reach them.
  - **Acceptability**:
    - social customs, religious and cultural norms, trust in public services, high-quality services, health workers and communications, timing, location (safety and reliability), preferences and integration with other services (such as other primary health services).
  - **Accessibility (includes availability):**
    - terrain, hours of services, location (such as remotely located and hard-to-reach older age groups), minimizing cost (direct and indirect), marginalized populations (including migrants and tribal groups), rural and remote populations, highly mobile or nomadic populations, conflict-affected areas and fragile contexts (such as natural disasters).
  - **Approachability**:
    - behaviour of vaccinators and frontline workers and perceived quality and trust in services and past experiences with health workers.
- Using data to design and evaluate interventions: measures alone do not lead to action, and therefore it is necessary to use findings to design and implement interventions, and to include indicators for monitoring and evaluation. In planning interventions, four broad areas may be considered: community engagement; communication and education; service quality; and supportive policies.
- Leverage existing programmes: The applicability of other preventive health interventions, such as NCD screening and influenza vaccination in older adults, can be explored by countries for potential learning. Countries may use community sites close to older adults to reduce travel time, minimize costs and decrease the logistical barriers to attending a clinic. Developing a plan to reach older adults may require conducting surveys (in writing or through interviews) or holding community meetings, focus groups for older persons and so forth to gather preferences on vaccine strategy and sites to maximize uptake.
- Caregivers (formal and informal) provide necessary support to help older adults or assist people with disabilities with daily activities. Opportunities should be provided for caregivers (i.e. family members, personal care aides, home health care providers and other caregivers) to be vaccinated at the same time as those for whom they provide

care. This may facilitate on-site vaccination options for adults who are homebound and reduce the likelihood of wasting vaccine.

- A reminder and recall system should be set up to assist with completion of a second dose and further booster doses. The record (electronic or paper based) should include at least the following information: date of vaccination, type/brand of vaccine used, number of dose (first, second, booster) and the lot number.
- Periodic reviews of the data and analysis should be used to create a feedback loop to improve processes, delivery and services offered to older adults.





Slide from Siff Malue Nielsen (WHO-Europe) during European Immunization Week 2025

Table A1.1. Considerations for different vaccination strategies in older adults

Settings> / Delivery strategies[1] v	 **Fixed health care facilities** (e.g. public or private – hospitals, primary care clinics NCD Clinics, physiotherapy clinics)	 **LTC facilities** (e.g. residential facilities, old-age homes, nursing homes, assisted-living facilities, mental health facilities)
Geographical access	• Known location • Different care pathway might be required • Can integrate into disease and function management care pathway	• Older adults may already be on-site • Does not reach older adults within the community
Physical access	• May already be accessible by public transit, suitable for wheelchairs or equipped with ramps • Signage to vaccination site may need to be in large print	• May be wheelchair accessible • May already have signs in large print • Residents are likely already familiar with the site
Community mobilization	• May need more intensive and targeted mobilization for older adults to attend • Engage reception, pharmacy staff and physicians at the health facility to identify vaccination needs and refer older adults to the vaccination site • Display of IEC materials related to COVID-19 vaccine at prominent places, and availability of vaccination at the facility	• Client base is well defined to allow focused mobilization • Facility staff can assist with communication and demand generation • Ministry of health can engage facility staff in vaccination activities on vaccine clinic days
Vaccine supply	• Vaccine storage may be available at some facilities; for others a vaccine distribution plan needs to be prepared	• Preparation of vaccine logistics distribution plan from nearest vaccine store will need to be detailed
Cold chain	• Cold chain is usually available	• Vaccine carriers and ice packs most likely need to be prepared to maintain the cold chain
Integration opportunities	• Help to strengthen older adult health services (e.g. screening for NCDs, coadministration with influenza vaccine)	• Help to strengthen older adult health services (e.g. screening for NCDs, coadministration with influenza vaccine)
Cost	• Low if supported by health care budget • Additional training for health facility staff might be required	• Medium-high (depends whether using existing LTC staff is possible or whether COVID-19 vaccination services can be integrated into existing services) • Additional training for facility staff may be required

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1 Many countries report using multiple delivery methods to reach older adults; these strategies may therefore be complementary. COVID-19: coronavirus disease; IEC: information, education and communication; LTC: long-term care; NCD: noncommunicable disease; NGOs: nongovernmental organizations.

 **Community outreach** (e.g. markets, places of worship, pharmacies, community centres, social clubs, workplaces, weekly markets and routine vaccination sites)	 **Outreach** (e.g. house to house and teams for hard-to-reach sparse populations, detention centres, prisons)	 **Mass campaigns** (i.e. mass vaccination centres set up in stadiums, shopping malls, social or religious gathering places and school gymnasiums or large spaces)
• Shorter travel to the site within the community	• Mobile vehicles or posts can be positioned closer to where older adults live • Easier access points when using house-to-house visits	• Require travel to site • Information on the location needs to be shared with older adults and caregivers
• Arrangements may need to be made to ensure accessibility for those with mobility assistive products (e.g. cane, wheelchair) • Signage needed to direct to vaccination site • Site may need to be modified to allow for noise dampening and good lighting	• More accessible for those with loss of mobility or disability and who are homebound or bedridden	• Arrangements may need to be made to ensure accessibility for those with mobility assistive products and signage to direct to vaccination site • Site may need to be modified to allow for noise dampening and good lighting
• Requires engaging health workers, community mobilizers, NGOs, religious leaders and community representatives to inform and mobilize older adults • Displaying IEC materials such as banners and posters helps to generate demand • Having the same outreach locations as for other vaccinations may make mobilization easier than a new site would	• Requires engaging health workers, community mobilizers, NGOs, religious leaders and community representatives to provide information on the importance of vaccination and the date of visit to the area/house • Displaying IEC materials such as banners, posters and leaflets in a community setting could help to generate demand	• Needs strong mobilization • Engage local newspaper, radio, FM and TV channels for awareness • Displaying IEC materials such as banners, posters and leaflets may help to generate demand
• Challenging to know the exact number of older adults who will attend outreach sessions • Preparation of vaccine logistics distribution plan from nearest vaccine store will need to be detailed	• Challenging to know the exact number of older adults who will attend a mobile clinic or who will accept vaccine (house to house) • Preparation of vaccine logistics distribution plan from nearest vaccine store will need to be detailed	• Large volume of vaccine needed over short duration • Distribution challenges (must be able to redistribute/ resupply quickly during campaign) may exist and require plans • Plan to replenish vaccine in case of shortage
• Vaccine carriers and ice packs must be prepared to maintain the cold chain	• Vaccine carriers, cold boxes and ice packs must be prepared to maintain the cold chain	• Vaccine carriers, cold boxes, and ice packs are needed • Temporary vaccine storage at a large site may be needed
• Co-delivery with short-duration interventions possible (i.e. NCD screening) • Co-delivery with routine vaccination	• Co-delivery with other home interventions such as NCD screenings and home-based long-term care that include other family members (neonatal, pregnancy care) – i.e. whole family care	• Integrate with other health services (e.g. health check-ups, NCD screening) and campaigns (e.g. influenza vaccine), whole family care (see box 1)
• Medium-high (depends whether using existing outreach sessions that are already planned and funded)	• Generally high (but for small and hard-to-reach populations may be more cost-effective) • Additional budget for per diems, transport, demand generation, etc.	• Generally high (but may be more cost-effective for small and hard-to-reach populations) • Additional budget for set up of new vaccination site, per diems, transport, demand generation, etc.

5.3 The population level: communicating the importance of vaccination for healthy aging

Potential questions/outcomes: Expected outcome: How can we effectively communicate the importance of vaccination to older adults and their caregivers? What approaches work best to address vaccine hesitancy in this group? How can healthcare providers be trained and supported to build trust and encourage vaccine uptake?

5.3.1 Holford D, Schmid P, Fasce A, Garrison A, Karlsson L, Taubert F, Verger P, Lewandowsky S, Fisher H, Betsch C, Rodrigues F, Soveri A. Difficulties faced by physicians from four European countries in rebutting antivaccination arguments: a cross-sectional study. BMJ Public Health. 2024 Mar 12;2(1):e000195.

Introduction: Physicians play a critical role in encouraging their patients to get vaccinated, in part by responding to patients' concerns about vaccines. It is, therefore, important to understand what difficulties physicians have in dealing with different concerns they may encounter. The aim of this article was to determine physicians' perceptions of difficulties in rebutting different antivaccination arguments from patients using data collected as part of a cross-sectional, cross-national questionnaire on physicians' vaccine attitudes and behaviours. **Methods:** Physicians in 4 European countries (Finland, Germany, France and Portugal, total n=2718) rated 33 different arguments, chosen to represent 11 different psychological motivations underlying vaccine hesitancy, in terms of their perceptions of how difficult each argument would be to rebut. **Results:** Across all countries, physicians perceived arguments based on religious concerns and 'reactance' (ie, resistance to perceived curbs of freedom) to be the most difficult to rebut, whereas arguments based on patients' distorted perception of the risks of disease and vaccines were perceived to be the easiest. There were also between-country differences in the level of perceived difficulty of argument rebuttal. Physicians' perceived difficulty with rebutting arguments was significantly negatively correlated with their vaccine recommendation behaviours and their preparedness for vaccination discussions. **Conclusions:** Physicians may feel better equipped to counter arguments that can be rebutted with facts and evidence but may struggle to respond when arguments are motivated by psychological dispositions or values.

5.3.1 Immunize.org Communication Material

Some examples:

Vaccine information statements (VIS)

https://www.immunize.org/wp-content/uploads/vis/flu_inactive.pdf

Ask the Experts is one of our most popular features. For more than 25 years, our experts have provided practical answers to more than 1,300 clinical questions about vaccines and their administration.

Communicating the Benefits of Influenza Vaccination

Halo check list

Before You Vaccinate Adults, Consider Their "H-A-L-O"!

What is H-A-L-O? It's an easy-to-use chart to help you make an *initial* decision about vaccinating a patient based on four factors — the patient's **Health, Age, Lifestyle, and Occupation**. Not all patients who mention one or more **H-A-L-O** factors will need to be vaccinated. Before you make a *definitive* decision about vaccinating your patient, you should refer to the more detailed information found in the complete vaccine recommendations of the CDC's Advisory Committee on Immunization Practices (ACIP) at www.cdc.gov/acip-recs/hcp/vaccine-specific/index.html.

H-A-L-O checklist of factors that indicate a possible need for adult vaccination

	H Health Factors									A Age Factors	L Lifestyle Factors							O Occupational or Other Factors				
Vaccine	During pregnancy	Certain chronic diseases	Immunosuppressed (including HIV infection)	History of sexually transmitted diseases	Asplenia	Cochlear implant candidate/recipient	Organ transplant (for stem cell transplant, see ACIP's Best Practices Guidelines for Immunization)	Cerebrospinal fluid (CSF) leak	Alcoholism		Men who have sex with men	Not in a long-term, mutually monogamous relationship	User of injecting or non-injecting drugs	Homelessness	International traveler	Close contact of international adoptee	Tobacco smoking	College students	Healthcare worker	Certain lab workers	People who live or work in an area of an outbreak	Adults in institutional settings (e.g., long-term care, correctional)
COVID-19	Routine for all adults, including during pregnancy. Recommendations may vary by age, and immunocompromised status →																					
HepA		✔	✔							Anyone of any age who wants to be protected	✔		✔	✔	✔	✔				✔	✔	
HepB		✔	✔	✔						Routine through 59 yrs and based on risk factors for 60 yrs and older; may give to anyone 60+	✔	✔	✔		✔				✔			✔
Hib		✔			✔																	
HPV										Routine through 26 yrs; based on SCDM* for 27–45 yrs												
IPV										Recommended for any adult known or suspected of being unvaccinated					✔					✔		
Influenza	Annual vaccination is recommended for all adults →																					
Meningococcal ACWY		✔	✔		✔										✔			✔		✔	✔	
Meningococcal B		✔			✔					Based on SCDM* for 16–23 yrs										✔	✔	
MMR			†							Routine 1 dose if born after 1956; 2nd dose for some					✔			✔	✔		✔	
Mpox‡				✔							✔	✔								✔		
PCV15/PCV20/PCV21		✔	✔		✔	✔	✔	✔	✔	Routine for age 50 yrs and older; based on risk factors for 19–49 yrs							✔					
PPSV23	PPSV23 only recommended after an adult with an indication for PCV (see row above) has received PCV15; PPSV23 not needed after PCV20 or PCV21.																					
RSV	✔§	✔	✔							Routine 1 dose for age 75 yrs and older; based on risk factors for 60–74 yrs												✔
Tdap/Td	Tdap/Td boosters every 10 years for all adults; pregnant women should receive Tdap during each pregnancy (gestational weeks 27–36) →																					
Varicella‖	Completion of a 2-dose series for non-pregnant adults without evidence of immunity to varicella (see immunization schedule for details of acceptable evidence of immunity) →																					
Zoster		✔	✔				✔			Routine for 50+ yrs; for 19–49 yrs who are immunocompromised												

NOTES
* = SCDM (Shared Clinical Decision-Making): See ACIP recommendations on considerations for SCDM for HPV for adults 27–45 yrs and for MenB for 16–23 yrs.
† = Vaccination may be indicated depending on degree of immunosuppression.
‡ = Post-exposure vaccination also recommended. Further evaluation for specific risks is required.
§ = Seasonal, one-time option for RSV vaccine at 32 through 36 wks 6 days gestation.
‖ = Varicella is contraindicated in people with severe immunocompromise.

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www.immunize.org/catg.d/p3070.pdf
Item #P3070 (2/3/2025)
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Quick Tips

How to discuss flu vaccination

- **Recommend flu and other needed vaccines at every clinical encounter:** "I strongly recommend you get your flu vaccine today. It can be given at the same time as other vaccines."
- **Keep it simple:** "Flu vaccine helps reduce your risk of hospitalization and death."
- **Use a presumptive approach:** "Today we are giving you your annual flu vaccine."
- **Communicate why we vaccinate:** "Vaccination prevents flu and its severe complications." "Preventing the flu means preventing missed workdays and doctor appointments."
- **Communicate the variability and unpredictability of flu:** "Flu seasons are unpredictable. The best way to prepare for any season is to get a flu vaccine."
- **Acknowledge that flu vaccines are not always a perfect match with the circulating virus strains:** "While the flu vaccine won't prevent all illnesses, it is the best way to reduce severe flu illness and its complications."

Use the SHARE method[4]

- **Share** why a flu vaccine is right for a patient
- **Highlight** positive experiences with flu vaccines
- **Address** patient questions
- **Remind** patients a flu vaccine can protect them and their loved ones from serious complications
- **Explain** the potential costs of getting sick with flu

Vaccinations for Adults

You're never too old to get vaccinated!

Getting vaccinated is a lifelong, life-protecting job. Don't leave your healthcare provider's office without making sure you've had all the vaccinations you need.

Vaccine	Do you need it?
COVID-19	*Yes!* All adults need to be up to date on COVID-19 vaccination. Talk to your healthcare provider.
Hepatitis A (HepA)	*Maybe.* You need this vaccine if you have a specific risk factor for hepatitis A* or simply want to be protected from this disease. The vaccine is usually given in 2 doses, 6–18 months apart.
Hepatitis B (HepB)	*Yes!* All unvaccinated adults younger than 60 are recommended to complete a 2- or 3-dose series of hepatitis B vaccine, depending on the brand. You also need this vaccine if you are 60 or older and have a specific risk factor,* or you simply want to be protected from infection. All adults should be screened for hepatitis B infection with a blood test at least one time; talk with your healthcare provider.
Hib (*Haemophilus influenzae* type b)	*Maybe.* Some adults with certain high-risk conditions need vaccination with Hib. Talk to your healthcare provider to find out if you need this vaccine.
Human papillomavirus (HPV)	*Yes!* You should get this vaccine if you are 26 years or younger. Adults age 27 through 45 may also choose to be vaccinated after a discussion with their healthcare provider.* The vaccine is usually given in 2 or 3 doses, depending on the age at which the first dose was given.
Influenza (Flu)	*Yes!* You need to be vaccinated against influenza every fall or winter.
Measles, mumps, rubella (MMR)	*Maybe.* You need at least 1 dose of MMR if you were born in 1957 or later. You may also need a second dose.* Pregnant people and people with a severely weakened immune system should not get MMR.*
Meningococcal ACWY (MenACWY, MenABCWY)	*Maybe.* You may need MenACWY vaccine if you have one of several health conditions* and also if your risk is ongoing. You also will need this vaccine if you are a first-year college student living in a residence hall and (1) you have not had a dose since turning 16, or (2) it has been more than 5 years since your last dose. Anyone age 19 through 21 can have a catch-up dose if they have not had one since turning 16. A combination MenABCWY is an option when both MenB and MenACWY vaccines are needed.
Meningococcal B (MenB, MenABCWY)	*Maybe.* You may need MenB if you have one of several health conditions* and boosters if your risk is ongoing. If you are age 16 through 23, you can discuss getting MenB vaccine with your healthcare provider, even if you don't have a high-risk condition. A combination MenABCWY is an option when both MenACWY and MenB vaccines are needed.
Mpox	*Maybe.* You need the 2-dose series of mpox vaccine (Jynneos) if you are at risk due to known or suspected exposure to someone with mpox or if you have certain sexual practices that increase your risk of exposure to mpox.* Talk with your healthcare provider.
Pneumococcal (PCV, PPSV23)	*Yes!* All adults age 50 and older need pneumococcal vaccination. Adults younger than 50 with certain underlying health conditions or other risk factors* also need pneumococcal vaccination. Newer vaccines may be recommended now for people vaccinated in the past. Your healthcare provider can determine what vaccine, if any, you need.
Respiratory Syncytial Virus (RSV)	*Yes!* You should get this one-time vaccine if you are 75 years or older, or if you are between the ages of 60 and 74 and are at increased risk of severe RSV. To protect infants from RSV, either the pregnant person should be vaccinated with Abrysvo (Pfizer) RSV vaccine, or the infant should be given RSV preventive antibody (nirsevimab).
Tetanus, diphtheria, pertussis (Tdap, Td)	*Yes!* If you have never received a dose of Tdap, you need to get a Tdap shot now. After that, you need a Tdap or Td booster dose every 10 years. Consult your healthcare provider if you haven't had at least 3 tetanus- and diphtheria-toxoid containing shots in your life or if you have a deep or dirty wound.
Varicella (Chickenpox)	*Maybe.* If you have never had chickenpox, never were vaccinated, or were vaccinated but only received 1 dose, talk to your healthcare provider to find out if you need this vaccine. Pregnant people and people with a severely weakened immune system should not get varicella vaccine.
Zoster (Shingles)	*Yes!* If you are 19 or older and have a weakened immune system or are 50 or older, you should get a 2-dose series of the Shingrix brand of shingles vaccine.

* Consult your healthcare provider to determine your level of risk for infection and your need for this vaccine.

Are you planning to travel outside the United States? Visit the Centers for Disease Control and Prevention's (CDC) website at wwwnc.cdc.gov/travel/destinations/list for travel information, or consult a travel clinic.

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www.immunize.org/catg.d/p4030.pdf

Item #P4030 (10/30/2024)

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5.3.2 ECDC report: Effective communication around the benefit and risk balance of vaccination in the EU/EEA 2024

Vaccination protects people against serious and potentially life-threatening infectious diseases: the World Health Organization (WHO) estimates that vaccination prevents 3.5 to 5 million deaths every year globally [1]. However, despite the importance of vaccines, numerous surveys done in European Union/European Economic Area (EU/EEA) countries show that the concerns of some people regarding the safety of vaccines as well as the perception that they are not effective pose a major challenge to the efforts of public health authorities to promote vaccine acceptance and uptake. This report presents the results of a study that dealt specifically with effective communication around the benefit and risk balance of vaccination, people's risk perceptions around vaccines and diseases, and approaches to enhancing communication about the safety and effectiveness of vaccines. The study was performed between June and November 2023, with an aim to increase knowledge about: **1/ How to communicate effectively about vaccination with a focus on its individual and community benefits outweighed against risks. The risks include the individual risk of contracting the disease and its outcomes, and potential risks associated with being vaccinated (i.e. side-effects). 2/ How people and communities perceive risks related to vaccines and infectious diseases. 3/ How the safety and effectiveness of vaccines can be better communicated to different audiences based on innovative and effective approaches.**

This study used a literature review, an online survey, interviews and an online workshop to contribute to the knowledge base on these topics. The literature review consisted of a structured review of both grey and published literature to get an overview of existing, peer-reviewed and other academic literature, and other documentary evidence, and covered the period 2018 to 2023 (2015 to 2023 for review articles). The work took into account lessons learned by public health organisations during the COVID-19 pandemic. In addition to COVID-19 vaccination, it also focused on recent influenza, MMR, and HPV vaccination campaigns conducted by public health organisations in the EU/EEA. The findings of this study can support public health professionals in the EU/EEA involved in vaccination programmes, in particular in communication on vaccines, and other organisations in their work to promote vaccine acceptance and uptake in the EU/EEA.

5.3.3 Michel JP, Goldberg J. Education, Healthy Ageing and Vaccine Literacy. J Nutr Health Aging. 2021;25(5):698-701.

Evidence: Health and vaccine literacy encompass people's knowledge, motivation, and competence to access, understand, appraise and apply health information in order to make judgements and take decisions in everyday life concerning health care, disease prevention and health promotion. Findings: Appropriate vaccine communication, which depends greatly on personal and contextual determinants, as well as on societal and environmental circumstances, is essential to reassure people about vaccine efficacy, safety, and possible side effects. However, vaccine confidence is not solely a question of trust in the vaccine's efficacy, safety. and individual protective benefit of vaccination. It also encompasses the mechanism(s) of vaccine activity, immunization schedules, organization and trust in the healthcare system that promotes and delivers the vaccines, and at what costs. When healthcare professionals as science brokers of vaccine knowledge attempt to increase vaccine knowledge and confidence, they must adjust their communication to the educational or health literacy level of their intended audience. Even if their messages are apparently clear and simple, they

absolutely need to verify that they are properly understood. Relevance: Specific vaccine communication training appears essential to increase vaccine communication skills among healthcare providers. Moreover, further randomized controlled studies are warranted to improve vaccine empowerment among different populations, from a variety of educational backgrounds.