The evolution and current status of vaccination programs for adults in Europe

Prof Helena Maltezou
National Public Health Organization
Athens, Greece

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Reduction of cases and deaths associated caused by vaccine-preventable diseases in the United States

Roush and Murphy. Historical comparisons of morbidity and mortality for vaccine-preventable diseases in the United States. JAMA 2007;298:2155-2163

Reduction of cases and deaths associated caused by vaccine-preventable diseases in the United States

Vaccinations save three million children every year.

World Health Organization

Roush and Murphy. Historical comparisons of morbidity and mortality for vaccine-preventable diseases in the United States. JAMA 2007;298:2155-2163

Young adults were disproportionately affected during epidemics of VPDs the last two decades

- gaps in immunity
- gaps in vaccination programs
- vaccine hesitancy
- barriers to attend vaccination services

Unsufficient protection through immune memory

against diphtheria, tetanus, pertussis, poliomyelitis

➡ **need for booster doses for**

children, adolescents and adults

Determinant factors of immune response after vaccination

age: immature immune response in young infants,

→ waning immunity in the elderly (immunosenescence)

previous exposure to vaccine antigens

maternal antibodies

underlying diseases and conditions

malnutrition

incubation period

vaccination schedule and vaccine dose

Poland GA. Influenza vaccine failure: failure to protect or failure to understand? Exp Rev Vaccines 2018;17:495-502

Rational for vaccinating adults

- provide protection because of waning immunity (e.g. pertussis)
- prevent serious morbidity and mortality (e.g. measles, varicella)
- address ageing-related decline of immune system (immunosenescence)
- comorbidities

Increase of life expectancy in Europe

vaccines

Article

Vaccination Programs for Adults in Europe, 2019

Dimitrios C. Cassimos [1], Evgnosia Effraimidou [1], Snezana Medic [2,3], Theoharis Konstantinidis [4], Maria Theodoridou [5] and Helena C. Maltezou [6,*]

Government and public health websites of 42 European countries

Adults ≥ 18 years old

General population or specific high-risk groups

23 pathogens (vaccines)

Catch-up vaccinations for childhood vaccinations

Vaccination programs for adults in Europe, 2019

- All countries had vaccination programs for adults.

- Differences in terms of number of vaccines, target populations, number of doses, and implementation frame (mandatory vs recommended)

Vaccination programs for adults in Europe, 2019

Country	D	T	P	Polio	Hib	HepB	HepA	Me	Mu	R	VZV	HZ	BCG	HPV	Flu	MenB	MenC	MCV4	PPV	PCV	TBE	TF	Rabies	YF
Albania	R	R	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Austria	R	R	R	R	nMnR	R	nMnR	R	R	R	nMnR	R	nMnR	R	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	R	nMnR	nMnR	nMnR
Belarus	M	M	nMnR	nMnR	nMnR	nMnR	nMnR	R	R	R	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Belgium	R/spR	R/spR	spR	spM	nMnR	spR	spR	R	R	R	R/SpR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Bosnia Herzegovina	M	M	nMnR	nMnR	nMnR	spM	spR	nMnR	nMnR	nMnR	spR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	spR	spR	nMnR	spR	spM	spM	nMnR
Bulgaria	M	M	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Croatia	R	M/R	R	R	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Cyprus	R	R	nMnR	nMnR	nMnR	R	spR	nMnR	nMnR	nMnR	nMnR	nMnR	spR	nMnR	R/spR	nMnR	nMnR	spR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR
Czech Republic	R/spR	M/R/spR	R/spR	nMnR	spR	spM/R	R/spM	nMnR	nMnR	nMnR	spR	R/spR	nMnR	R/spR	R/spR	spR	nMnR	spR	nMnR	spM/R	R	nMnR	spR	nMnR
Denmark	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R	R	R	nMnR	nMnR	nMnR	spR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Estonia	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Finland	R	R	R	nMnR	nMnR	spR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	spR	nMnR	nMnR	nMnR
France	R/spR	R/spR	spR	R	spR	nMnR	spR	R	R	R	spR	R	nMnR	spR	R/spR	spR	R	spR	spR	spR	nMnR	nMnR	nMnR	spM
Germany	R	R	R	R	nMnR	nMnR	nMnR	R	nMnR	nMnR	nMnR	R	nMnR	nMnR	R/spR	spR	nMnR	spR	R	nMnR	nMnR	nMnR	nMnR	nMnR
Greece	R/spR	R/spR	R/spR	R	spR	spR/R	spR	R/spR	R/spR	R/spR	R/spR	R	nMnR	spR	R/spR	spR	nMnR	spR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Hungary	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Iceland	spR	spR	spR	spR	nMnR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Ireland	spR	spR	spR	nMnR	nMnR	nMnR	nMnR	R/spR	R/spR	R/spR	nMnR	nMnR	spR	nMnR	R/spR	nMnR	nMnR	nMnR	R	nMnR	nMnR	nMnR	nMnR	nMnR
Italy	M/R/spR	M/R/spR	M/R/spR	M	nMnR	spR	spR	R/spR	R/spR	R/spR	nMnR	R/spR	nMnR	R	R/spR	nMnR	nMnR	R	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Latvia	R/spR	R/spR	R	nMnR	nMnR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	R	nMnR	nMnR	nMnR
Liechtenstein	R	R	R	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Lithuania	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	spR	nMnR	nMnR	nMnR	nMnR
Luxembourg	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R	R	R	nMnR	nMnR	nMnR	spR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Malta	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	R	nMnR	nMnR	nMnR	nMnR
Moldova	M	M	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	spR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Monaco	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	spR	nMnR	nMnR	nMnR	nMnR	nMnR
Montenegro	M	M	nMnR	nMnR	spM	spM	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	spR	spR	nMnR	nMnR	spM	spM	nMnR
Netherlands	nMnR	nMnR	nMnR	nMnR	nMnR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
NorthMacedonia	nMnR	M	nMnR	nMnR	nMnR	spM	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	spR	spR	nMnR	nMnR	spM	spM	nMnR
Norway	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R	nMnR	nMnR	nMnR	nMnR	nMnR
Poland	M	M	nMnR	nMnR	nMnR	spR	nMnR	R	R	R	nMnR	nMnR	nMnR	nMnR	R/spR	spR	R	R/spR	nMnR	R	nMnR	nMnR	nMnR	nMnR
Portugal	R/spR	R/spR	R/spR	nMnR	nMnR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	spR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Romania	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Russia	M	M	nMnR	nMnR	nMnR	M	nMnR	spM/spR	nMnR	spM	nMnR	nMnR	nMnR	R	R/spR	nMnR	nMnR	spM	R/spR	R/spR	spR	nMnR	nMnR	nMnR
Serbia	spR	spR	spR	nMnR	spM	spM/spR	spM/spR	nMnR	nMnR	spR	R/spM	spR	nMnR	spR	R/spM	nMnR	nMnR	spR/spM	spM/R	spM/R	spR	nMnR	spM	nMnR
Slovakia	R	R	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spM	nMnR	nMnR	nMnR	nMnR	R/spM	nMnR	nMnR	nMnR	nMnR
Slovenia	M	M	M	nMnR	nMnR	spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	spR	nMnR	spR	R/spR	R/spR	spR	nMnR	nMnR	nMnR
Spain	R	R	nMnR	nMnR	nMnR	spR	spR	nMnR	nMnR	nMnR	nMnR	R	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R/spR	R/spR	nMnR	nMnR	nMnR	nMnR
Sweden	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	R/spR	nMnR	nMnR	nMnR	R	nMnR	nMnR	nMnR	nMnR	nMnR
Switzerland	R	R	R	spR	nMnR	nMnR	nMnR	R	R	R	spR	nMnR	nMnR	spR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
Ukraine	M	M	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	spR	R/spR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR	nMnR
United Kingdom	spR	spR	spR	spR	nMnR	nMnR	nMnR	R	nMnR	nMnR	spR	R	nMnR	spR	R/spR	nMnR	nMnR	spR/R	R/spR	nMnR	nMnR	nMnR	spR	nMnR

Cassimos et al. Vaccines 2020;8:34

Pertussis

Reported NNDSS pertussis cases: 1922-2014

SOURCE: CDC, National Notifiable Diseases Surveillance System and Supplemental Pertussis Surveillance System and 1922-1949, passive reports to the Public Health Service

Prognosis of pertussis

infants: 2% fatality rate (96% of all deaths), permanent complications

older adults: increased morbidity and complications

Immunity against pertussis wanes significantly

- 7 years after vaccination
- 12 years after natural infection

booster doses at 11-18 years of age and in adulthood

Evolution of vaccination indications against pertussis

- adolescents
- family members of young infants (cocooning strategy)
- pregnancy
- adults

Pertussis vaccination for pregnancy women in Europe, 2021

- in 28 of 42 countries
- all but one regardless of past dose
- most countries in third trimester
  (+ second trimester)

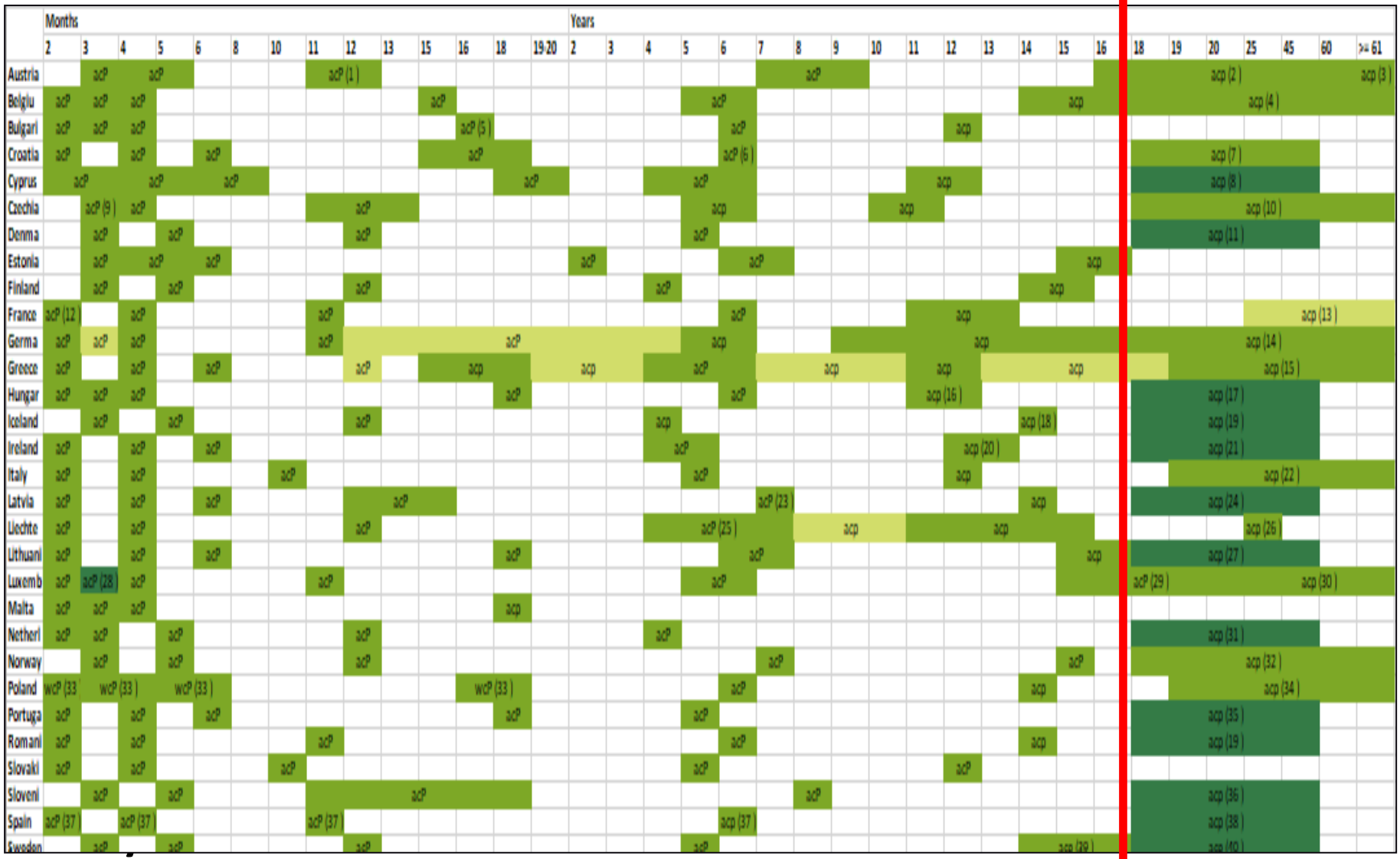
Country	1st trimester	2nd trimester	3rd trimester
Albania			
Austria			
Belarus			
Belgium[1]			
Bosnia and Herzegovina			
Bulgaria			
Croatia			
Cyprus			
Czech Republic			
Denmark[2]			
Estonia[3]			
Finland			
France			
Germany			
Greece			
Hungary			
Iceland			
Ireland			
Italy			
Latvia			
Liechtenstein			
Lithuania			
Luxembourg[4]			
Malta			
Moldova			
Monaco			
Montenegro			
Netherlands			
North Macedonia			
Norway			
Poland			
Portugal[5]			
Romania			
Russia			
Serbia			
Slovakia			
Slovenia			
Spain[6]			
Sweden			
Switzerland			
Ukraine			
United Kingdom[7]			

Green color: all women; dark green color: if more than 10 years have elapsed after the last dose; yellow color: premature labor expected; red color: during epidemics; orange: during epidemics or high-risk condition

[1]ideally in weeks 24–32
[2]around a full week 32
[3]from week 20
[4]ideally weeks 13–26
[5]ideally after week 32
[6]weeks 27–28
[7]ideally weeks 20–32

Maltezou et al. Vaccine 2021;39:6137-6143

Pertussis vaccination in Europe, 2024

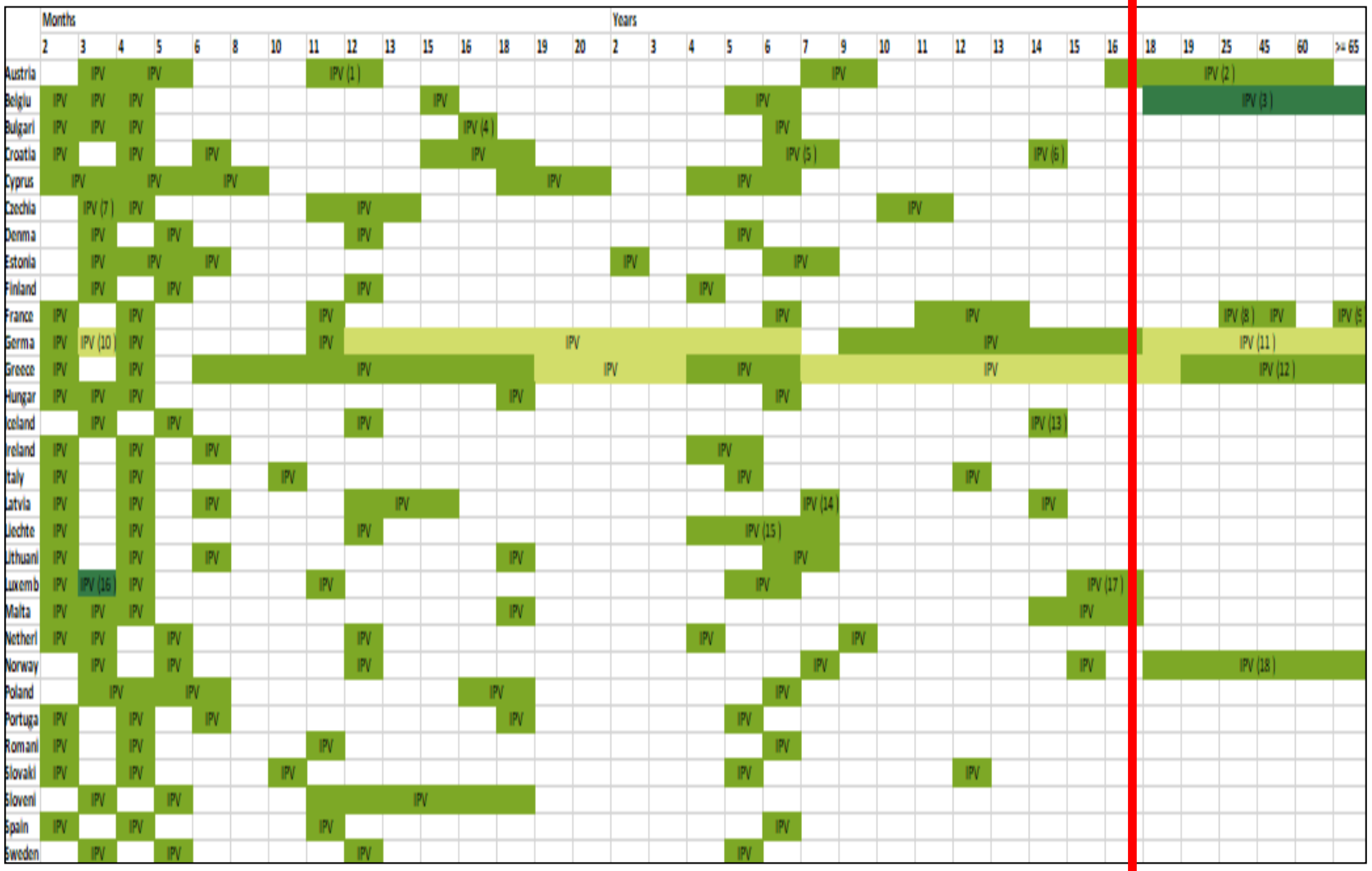


ECDC (last accessed: 16/4/2024)

Measles vaccination in Europe, 2024

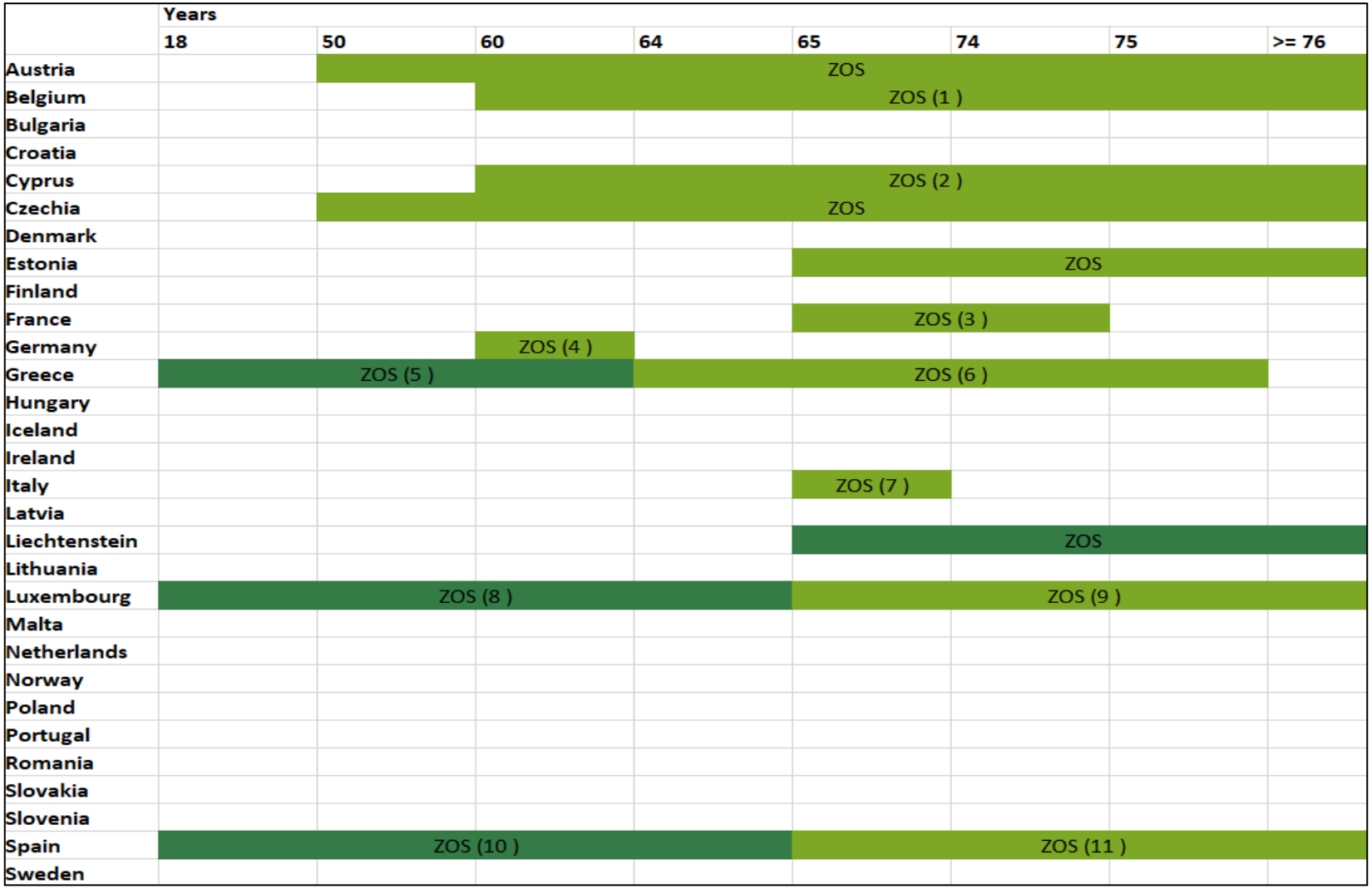
ECDC (last accessed: 16/4/2024)

Poliomyelitis vaccination in Europe, 2024



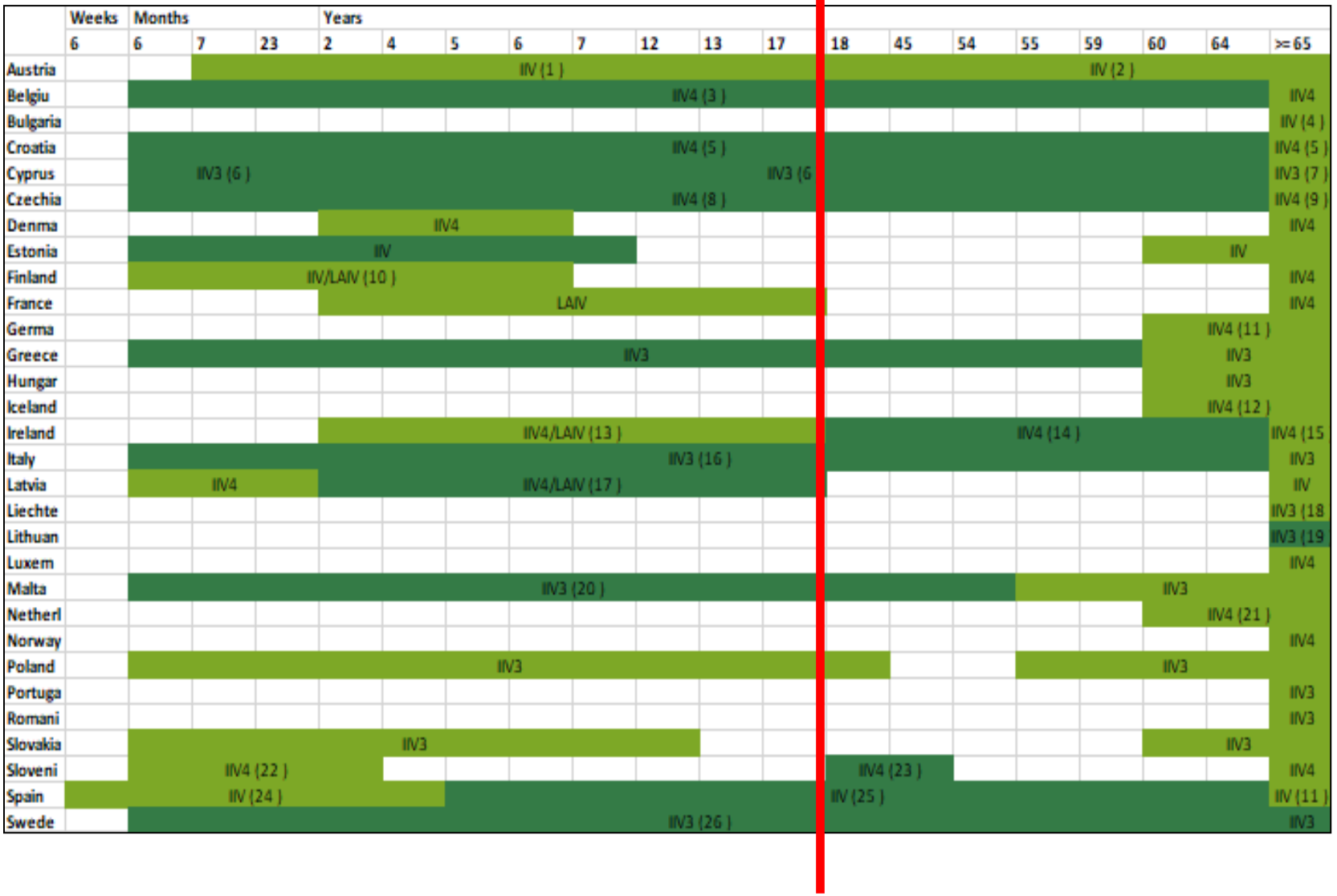
ECDC (last accessed: 16/4/2024)

Herpes zoster vaccination in Europe, 2024



ECDC (last accessed: 16/4/2024)

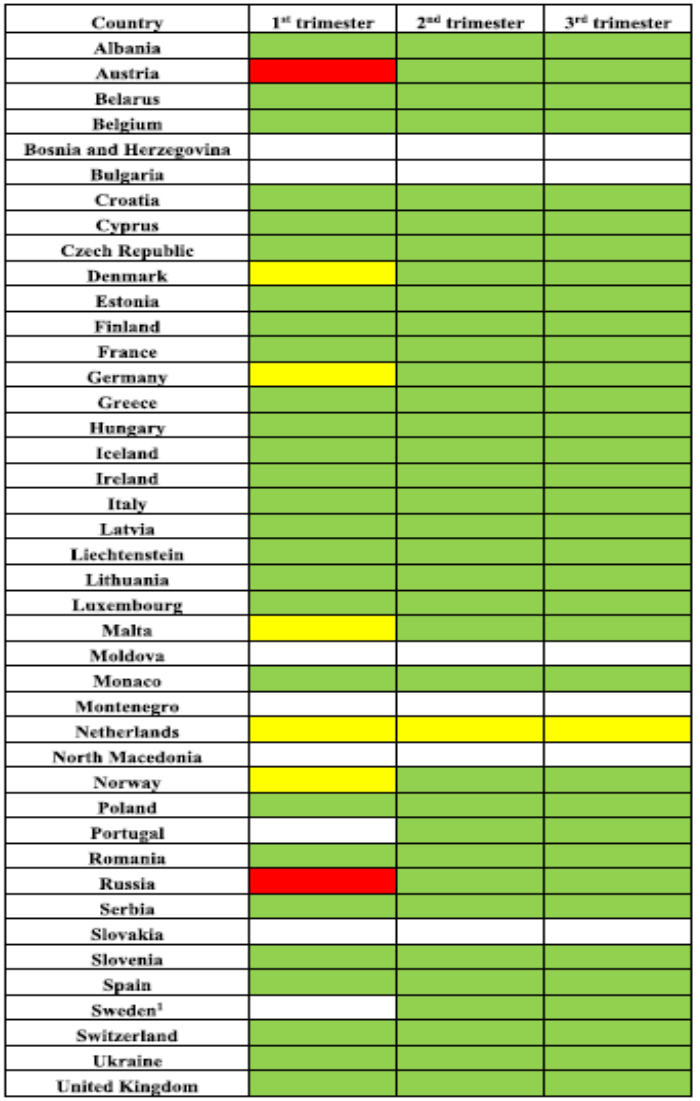
Influenza vaccination in Europe, 2024



ECDC (last accessed: 16/4/2024)

Influenza vaccination for pregnancy women in Europe, 2021

- in 36 of 42 countries
- 27 countries for all women regardless of trimester

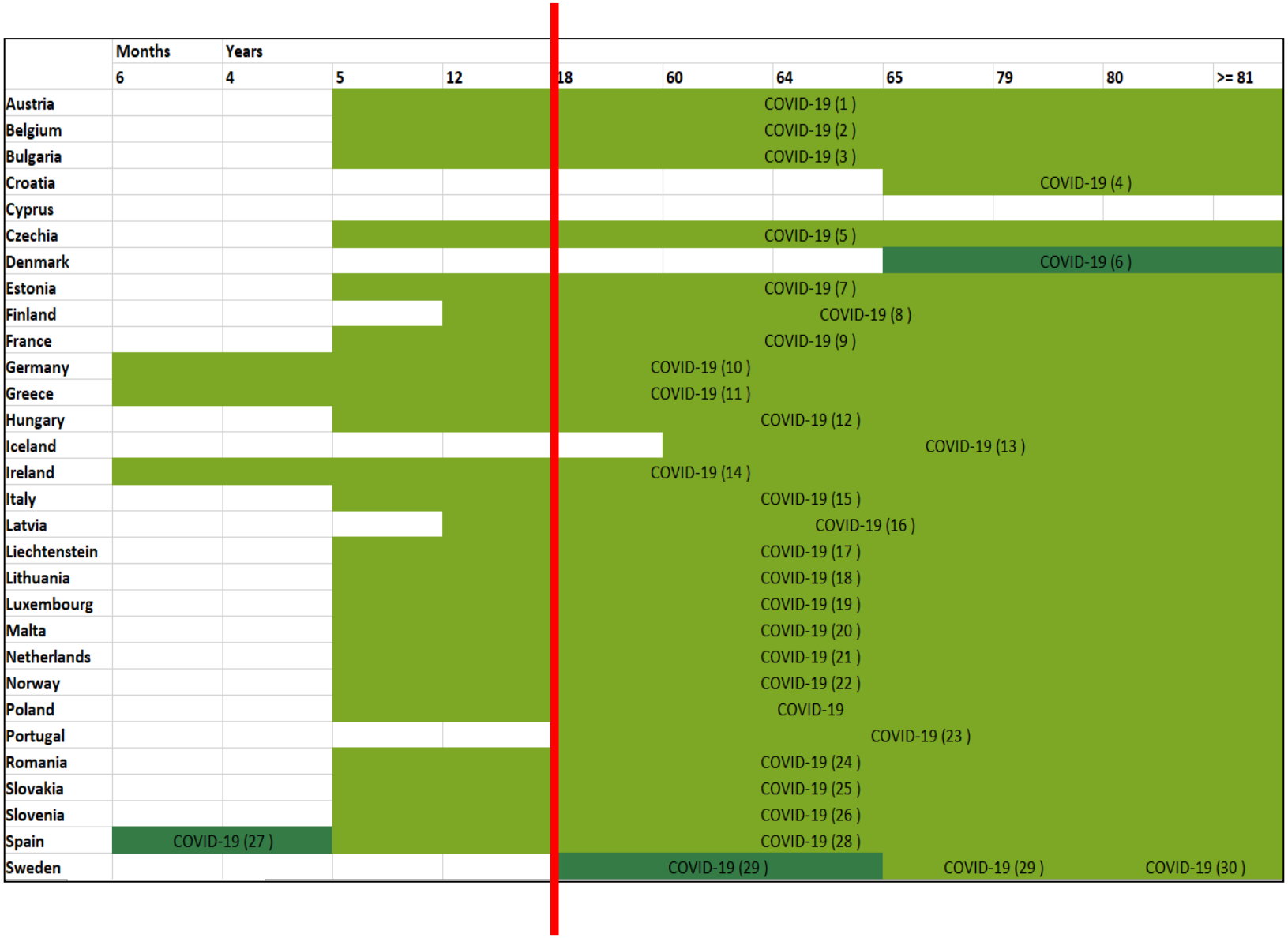


Country	1st trimester	2nd trimester	3rd trimester
Albania			
Austria			
Belarus			
Belgium			
Bosnia and Herzegovina			
Bulgaria			
Croatia			
Cyprus			
Czech Republic			
Denmark			
Estonia			
Finland			
France			
Germany			
Greece			
Hungary			
Iceland			
Ireland			
Italy			
Latvia			
Liechtenstein			
Lithuania			
Luxembourg			
Malta			
Moldova			
Monaco			
Montenegro			
Netherlands			
North Macedonia			
Norway			
Poland			
Portugal			
Romania			
Russia			
Serbia			
Slovakia			
Slovenia			
Spain			
Sweden[1]			
Switzerland			
Ukraine			
United Kingdom			

Green color: all women; yellow color: only women with high-risk conditions; red color: during epidemics [1]from week 16

Maltezou et al. Vaccine 2021;39:6137-6143

COVID-19 vaccination in Europe, 2024



ECDC (last accessed: 16/4/2024)

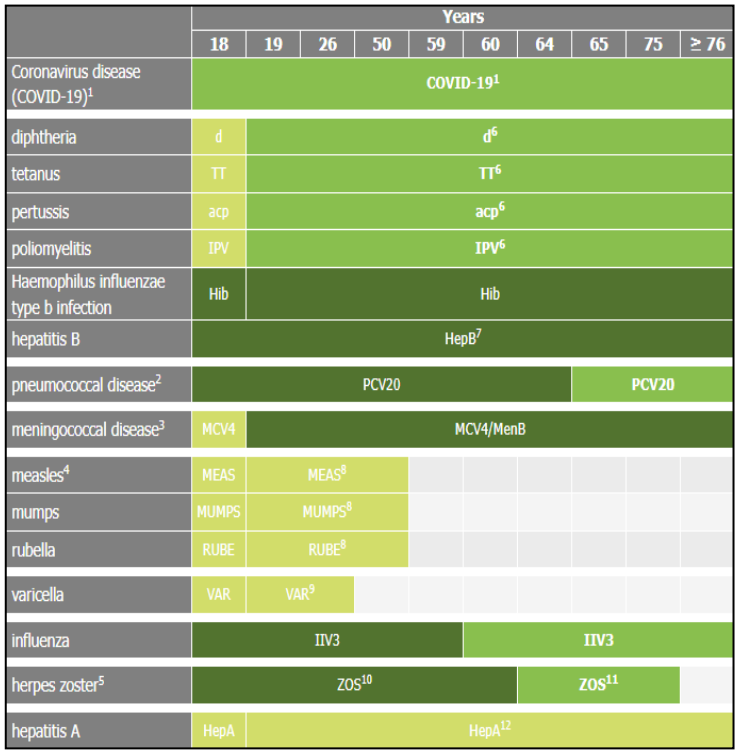
RSV vaccination in Europe, 2024

	Years		
	60	74	>= 75
Austria	RSV		
Belgium	RSV (1)		
Bulgaria			
Croatia			
Cyprus			
Czechia			
Denmark			
Estonia			
Finland			
France			
Germany			
Greece			
Hungary			
Iceland			
Ireland			
Italy			
Latvia			
Liechtenstein			
Lithuania			
Luxembourg			
Malta			
Netherlands			
Norway			
Poland			
Portugal			
Romania			
Slovakia			
Slovenia			
Spain			
Sweden	RSV (2)		RSV (2)

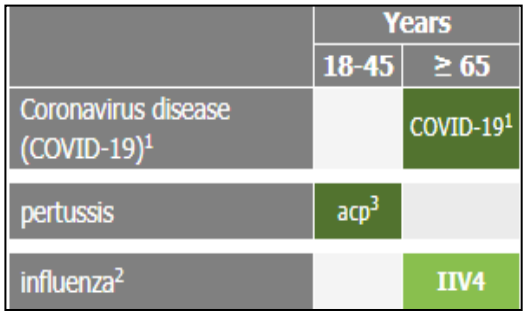
ECDC (last accessed: 16/4/2024)

Still significant differences* in vaccination programs for adults across Europe in 2024

Country A



Country B

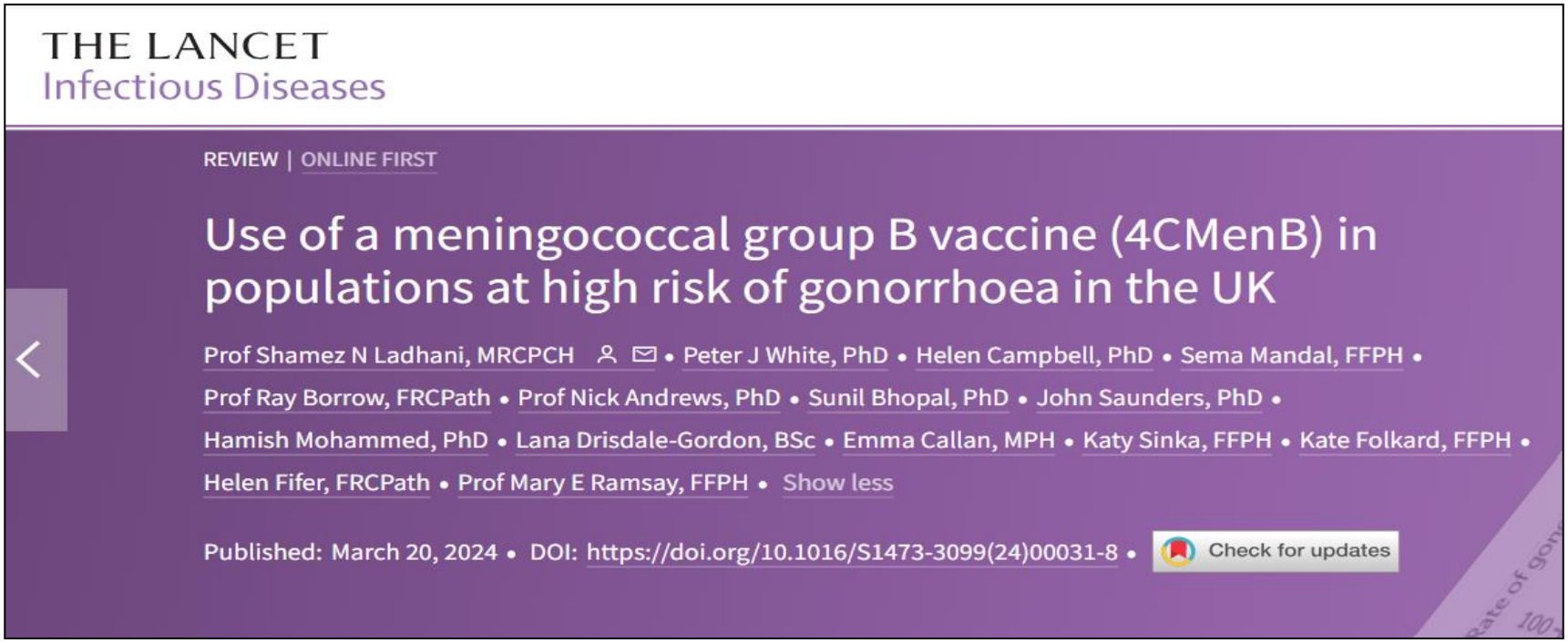


- in terms of number of vaccines, target populations, number of doses, and time intervals

ECDC (last accessed: 16/4/2024)

Challenges for new vaccines: common pathogens & threats for public health globally

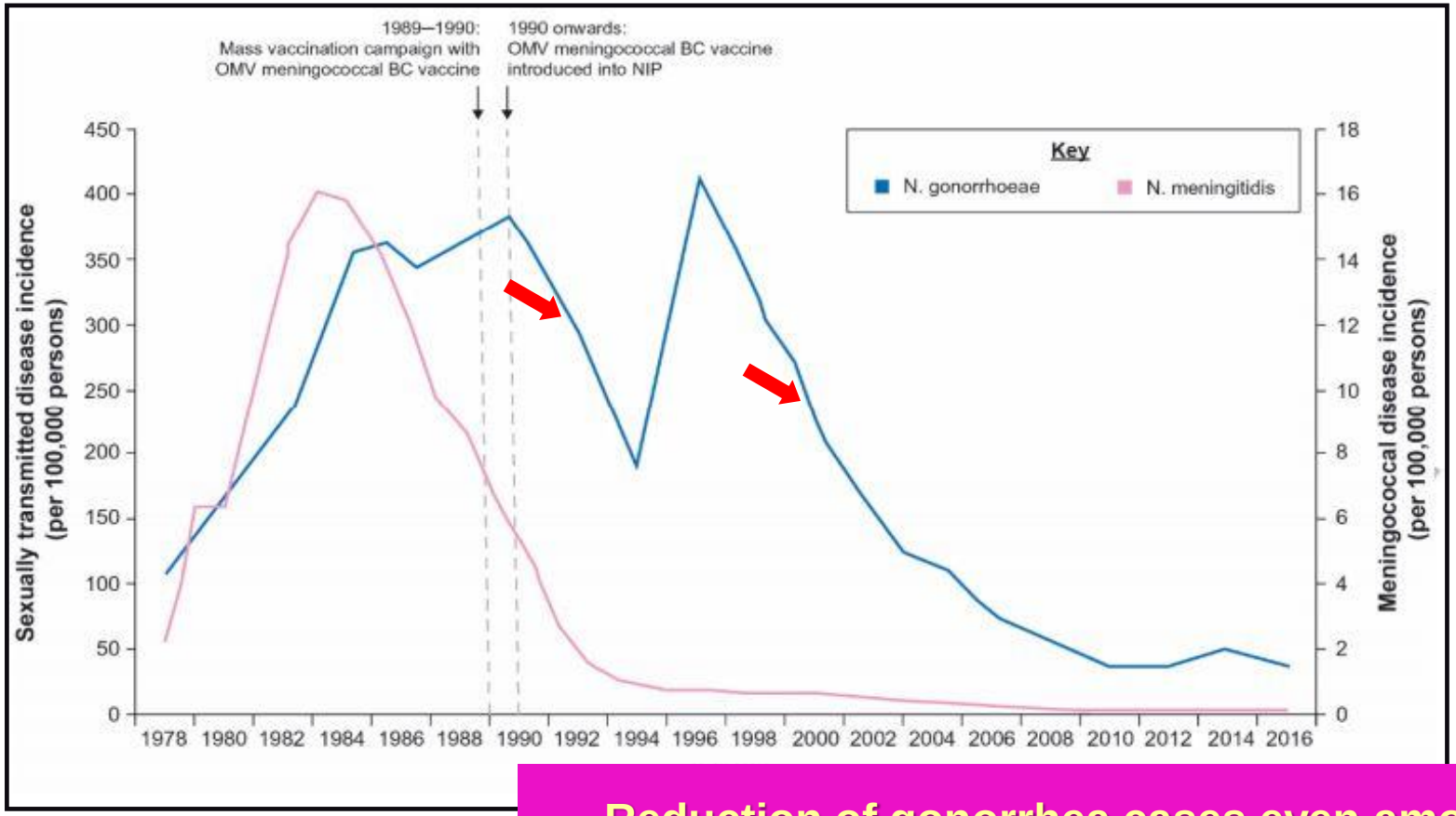
- Tuberculosis (XDR)
- Respiratory syncytial virus
- Malaria
- Dengue fever
- Ebola
- Multidrug-resistant pathogens
- Disease X



- **Vaccination program targeting individuals at higher risk of gonorrhea infection**

- **Expected protection: 33% - 47%**

Incidence of *N. gonorrhoeae** and *N. meningitidis*, Cuba 1978-2016



Reduction of gonorrhea cases even among unvaccinated people (herd immunity)

***80-90% genetic similarity (sequencing)**

Ochoa Azze RF. Expert Review on Vaccines 2019;8:110-115

Thank you for your attention!