

Adult Vaccine Space: General Overview of the Current Vaccine Preventable Infections (VPIs) in the Adult Population

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Potential Conflicts of Interest

- ▶ VP & Global MDSCA Lead Viral Vaccines, **Pfizer** (to May 2021)
- ▶ Scientific and Strategic Advisor, **Vaccelerate**, Cologne University
- ▶ Editor-in-Chief, **Global Health Press**, Singapore
- ▶ Consultant to **Governments**
- ▶ Consultant to **Start-Ups**

Current Vaccines (Routine)

Maternal Immunization (5)

- Tdap
- Influenza
- COVID19
(Recommended, not licensed)
- **(RSV)** (if licensed)



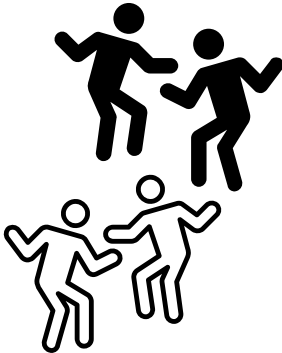
Infants, Toddlers (≥11+4)

- DTaP-Hib-IPV-HBV
- PCV
- Rotavirus
- Influenza
- MenACWY,
- Men B
- (TBE ≥1 yr)
- MMR-V



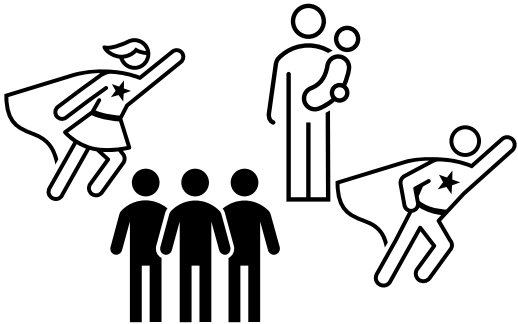
School Entry/ Adolescents (≥6)

- Missed Vx
- Boosters Tdap
- Influenza
- COVID19
- Men ACWY
- MenB
- HPV
- (TBE)



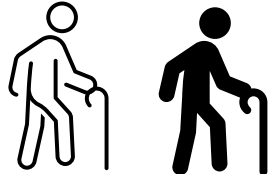
Adults (≥3)

- Missed Vx (MMR)
- Boosters Tdap(-IPV)
- COVID19
- Influenza
- HPV
- TBE
- HAV
- HBV
- Occupational Vx
- (RSV if licensed)



≥65 yrs (≥4)

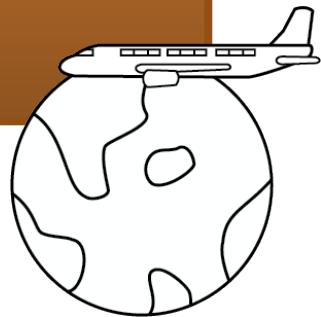
- Missed Vx (MMR)
- Boosters Tdap(-IPV)
- COVID19
- Influenza
- PCV/(PPV23)
- Zoster
- TBE
- MenACWY
- MenB



Medical need based on special host/exposure

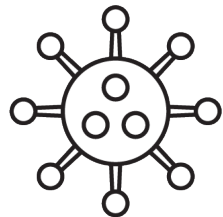
Traveller

- Boosters
- TBE (FSME)
- HAV
- HBV
- Influenza
- MenACWY
- MenB
- JE
- Typhoid
- Rabies
- Yellow fever
- Cholera
- Dengue



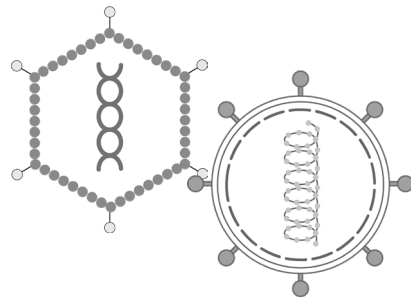
Underlying Diseases

- Boosters
- Influenza
- PCV
- MenB/ACWY
- (risk-based Vx)



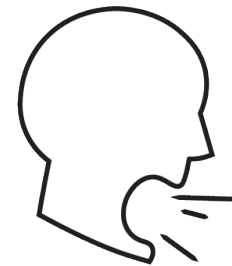
B-&T-cell Defect/ Cancer*

- Influenza
- PCV
- MenACWY
- MenB
- H. influenzae b
- HBV
- Boosters



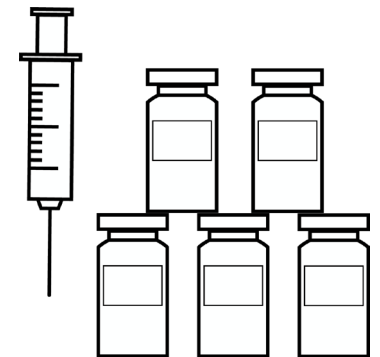
Emerging Infections

- COVID19 VOCs
- Avian influenza
- Monkeypox
- CEPI / WHO-list



Lack of Health Care Resources

- Monkeypox
- Ebola



* If sufficient immune responses can be reasonably expected

Adult immunization Schedule – CDC - COVID19

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
COVID-19 ⓘ	2- or 3- dose primary series and booster (see notes)			

Age based recommendation	+ risk factor or other indication	Shared decision	No recommendation, Not applicable

Opinion: COVID19 vaccination 2023 and beyond

- ▶ One (or several ?) annual boosters, including variants of concern for risk subjects and for those with occupational indication.
- ▶ Combination with influenza vaccines would be beneficial
- ▶ Research should focus on how carriage and acquisition can be reduced for any respiratory pathogen

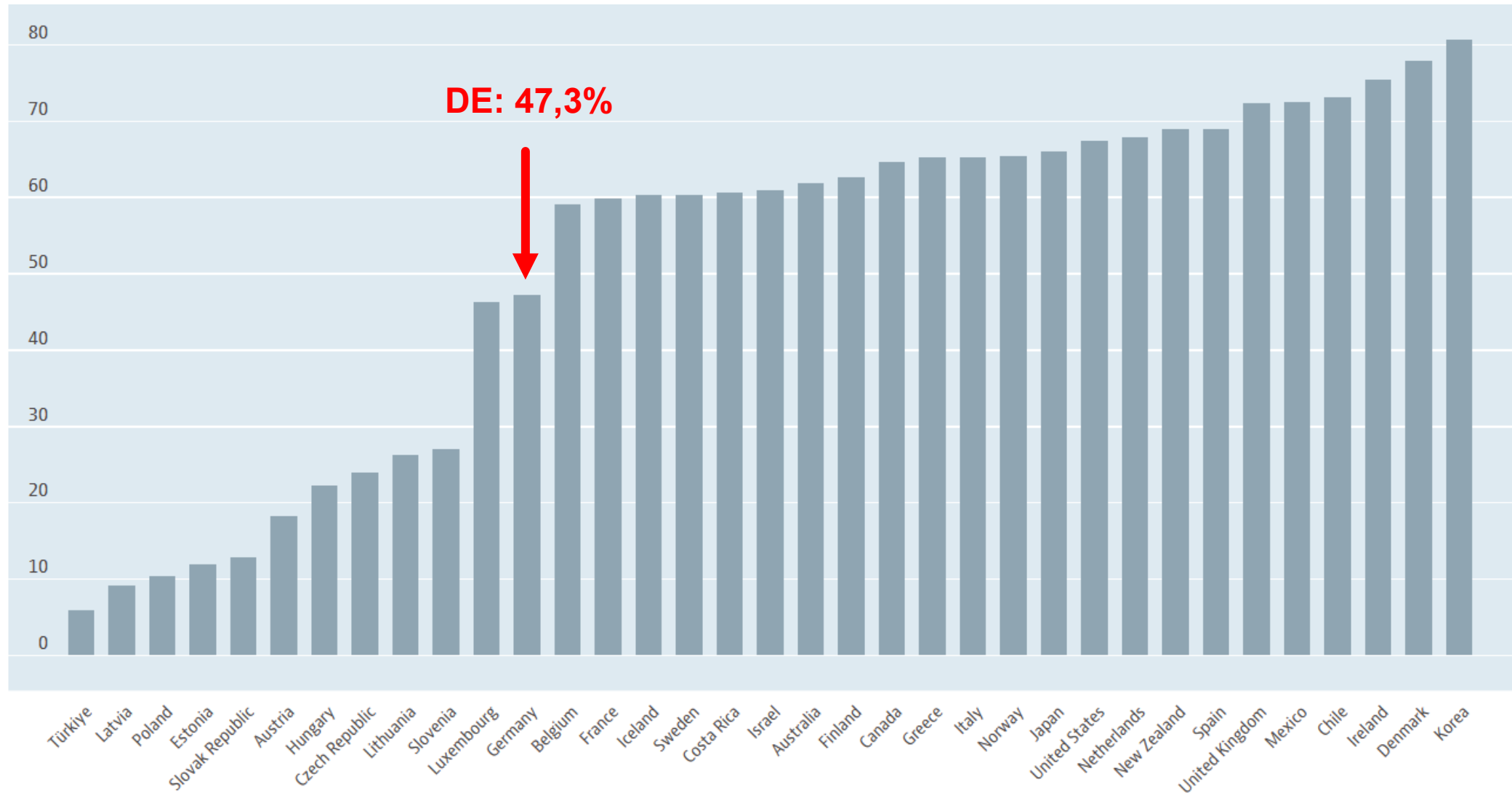
Adult immunization Schedule – CDC – Influenza

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
COVID-19 ⓘ	2- or 3- dose primary series and booster (see notes)			
Influenza inactivated (IIV4) or Influenza recombinant (RIV4) ⓘ	1 dose annually			
or Influenza live attenuated (LAIV4) ⓘ				

LAIV
Fluenz® no longer authorized by EMA as MAH withdrew for commercial reasons

Age based recommendation	+ risk factor or other indication	Shared decision	No recommendation, n.a.

OECD: Influenza-Vaccine Uptake 2021 Adults ≥ 65 years



OECD -Organisation für wirtschaftliche Zusammenarbeit und Entwicklung

Opinion: Influenza vaccination

Influenza vaccines ...

- ▶ are far away from being ideal vaccines (modest efficacy)
- ▶ uptake is way too low
- ▶ **Cell culture based platform** needed for pandemic preparedness
- ▶ Both, **HD and MF59-based / enhanced vaccines** should be recommended (pandemic preparedness) for specific groups

Adult immunization Schedule – CDC – Tdap-IPV

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Tetanus, diphtheria, pertussis (Tdap or Td) ⓘ	1 dose Tdap each pregnancy; 1 dose Td/Tdap for wound management (see notes)			
	1 dose Tdap, then Td or Tdap booster every 10 years			

Age based recommendation	+ risk factor or other indication	Shared decision	No recommendation, n.a.

Opinion: TdaP (-IPV)

▶ Tetanus: Italy has highest EU-case numbers (?)

- ▶ The incidence of reported tetanus in Italy decreased from 0.5/100 000 in the 1970s to 0.2/100 000 in the 1990's. ... the case-fatality ratio decreased from 68% to 39%. Italy has the highest reported number of tetanus cases in European countries. **Elderly women are the most affected:** ... 60% in the 1970s to 76% in the 1990s. Vaccination campaigns need to be conducted to target this group, and the surveillance of tetanus has to be improved to identify additional groups of population at risk. [Eurosurveillance | Epidemiology of tetanus in Italy in years 1971-2000](#)

▶ Diphtheria: Outbreak among immigrants in Germany

([Eurosurveillance | Outbreak of imported diphtheria with *Corynebacterium diphtheriae* among migrants arriving in Germany, 2022](#))

▶ Pertussis: TdaP every 10 years – or 5 doses sufficient for life? **Monovalent aP available elsewhere**

▶ IPV: The art of ending ... (4 doses of trivalent vaccine sufficient (?));

- ▶ **Search for unvaccinated pockets** (e.g. religious beliefs, „alternative thinking“, ...)
- ▶ In 2022, cases of poliomyelitis (PM) related to circulating vaccine derived polioviruses (**cVDPV**) occurred in unvaccinated persons in non-endemic countries. cVDPV2 in London (UK) sewage water raised public health concerns even more. Consequently, poliovirus vaccination coverage in non-endemic countries needs to be elucidated.

Adult immunization Schedule – CDC – MMR

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Measles, mumps, rubella (MMR) ⓘ	1 or 2 doses depending on indication (if born in 1957 or later)			For healthcare personnel, (see notes)

Age based recommendation	+ risk factor or other indication	Shared decision	No recommendation, n.a.

Adult immunization Schedule – CDC – VZV/Zoster

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Varicella (VAR) ⓘ	2 doses (if born in 1980 or later)		2 doses	
Zoster recombinant (RZV) ⓘ	2 doses for immunocompromising conditions (see notes)			2 doses

Age based recommendation	+ risk factor or other indication	Shared decision	No recommendation, n.a.
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Herpes Zoster Vaccines

	Recombinant Zoster Vaccine	Live Zoster Vaccine
Brand name	Shingrix®	Zostavax®
Vaccine Type	Subunit vaccine	Live vaccine
Antigen	VZV glycoprotein E (50µg) and the AS01B adjuvant system	Oka/Merck varicella 19,400 PFU
Use in highly immunocompromised patients*	Under investigation, currently no data	Contraindicated
Efficacy against Zoster	91.3% (95% CI = 86.8–94.5)	38% (95% CI = 25–48)
Efficacy against PHN	88.8% (95% CI = 68.7–97.1)	66.8% (95% CI = 43.3–81.3)
Duration of protection	Modest waning of protection over 4 years following vaccination	Substantial decrease over time Maximal protection 9 – 11 years
Safety profile	Favorable Injection site reactions 45 – 78%	Favorable Injection site reactions 48%

≥1350 PFU Oka strain in the pediatric VZV formulation

PHN – Post-herpetic neuralgia

Adult immunization Schedule – HPV

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Human papillomavirus (HPV) ⓘ	2 or 3 doses depending on age at initial vaccination or condition	27 through 45 years		

Opinion: HPV

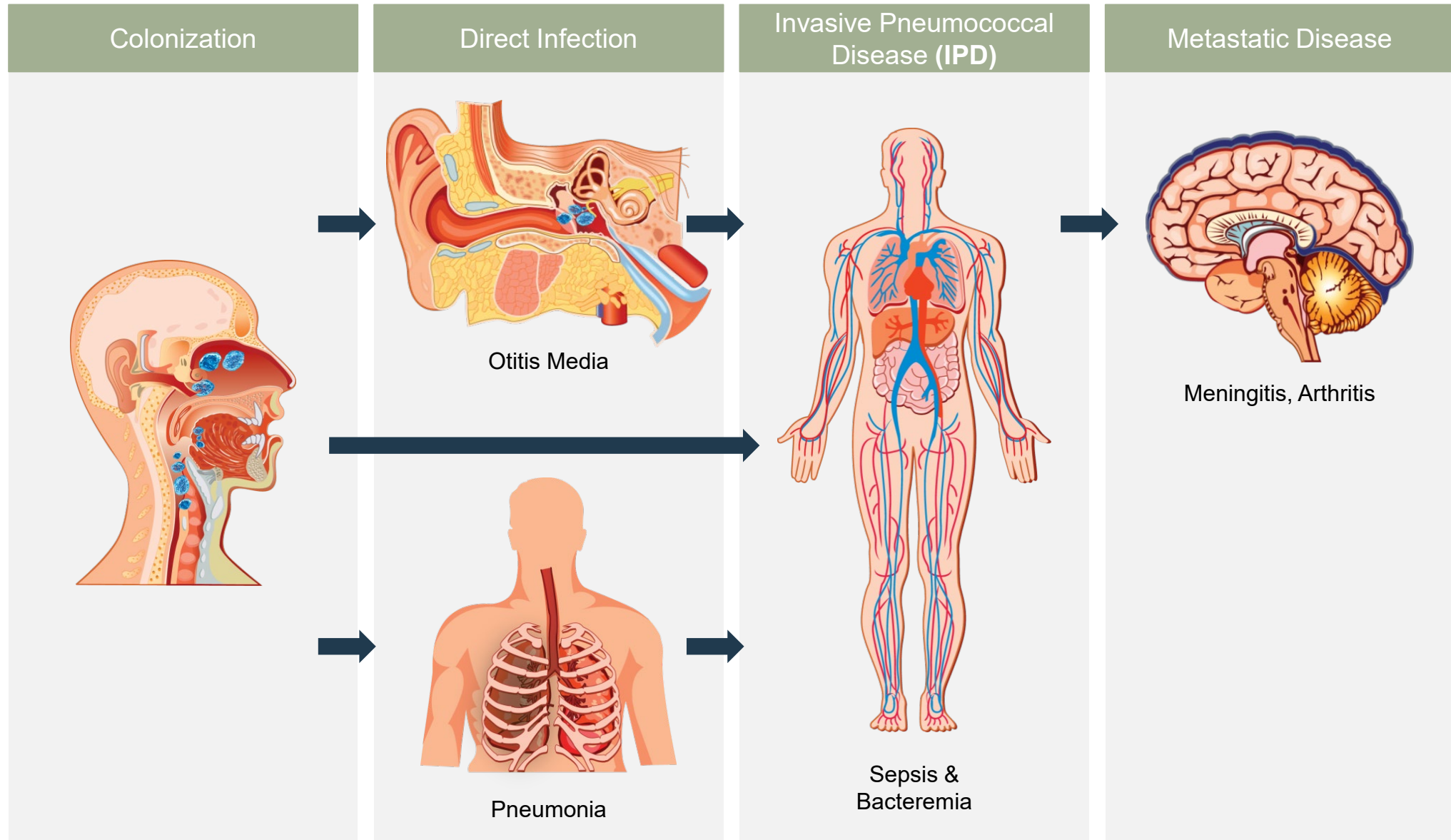
- ▶ **Comprehensive HPV/genital cancer program needed, male and female vx.**
 - ▶ Stop routine PCR-testing for HPV-serotypes
 - ▶ Value of annual screening vs value of >95% participation every 5 years

- ▶ **Booster with 9-valent product: 3 doses**
 - ▶ Implementation is lacking

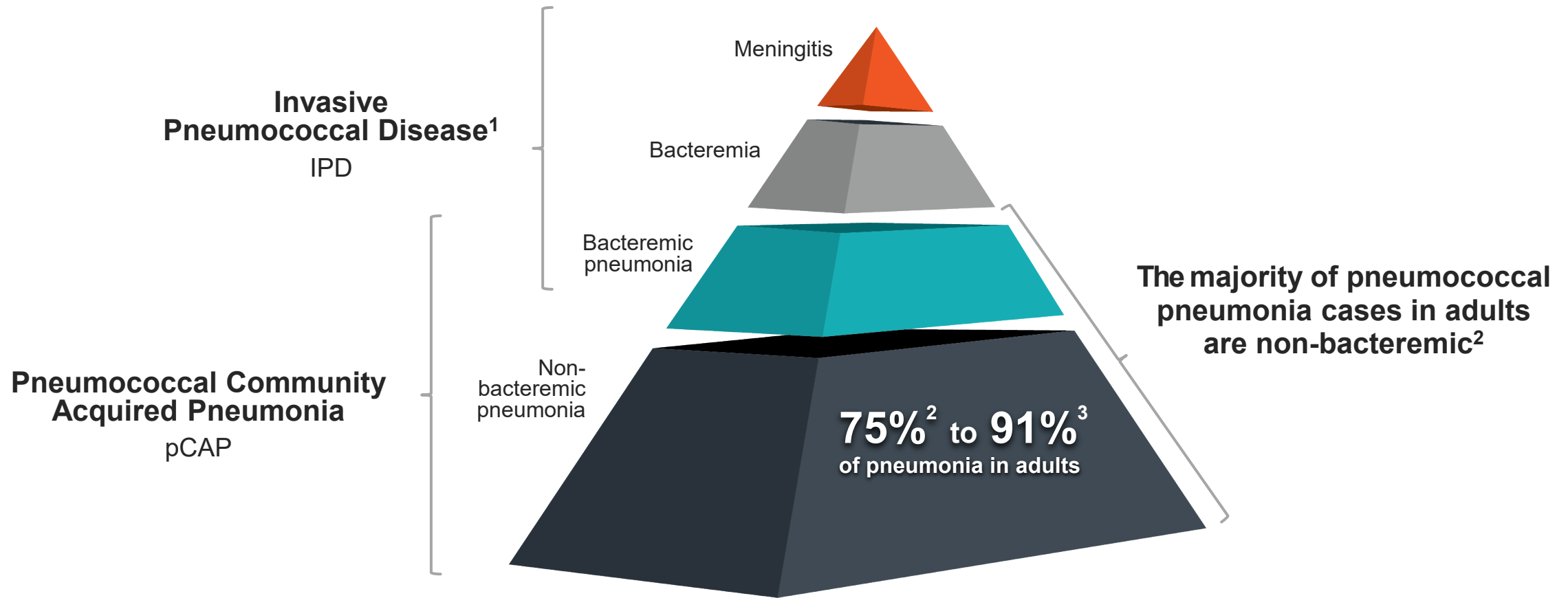
Adult immunization Schedule – *Pneumococcus*

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Pneumococcal (PCV15, PCV20, PPSV23) ⓘ	1 dose PCV15 followed by PPSV23 OR 1 dose PCV20 (see notes)			See Notes
				See Notes

Pathogenesis of *S. pneumoniae* Diseases

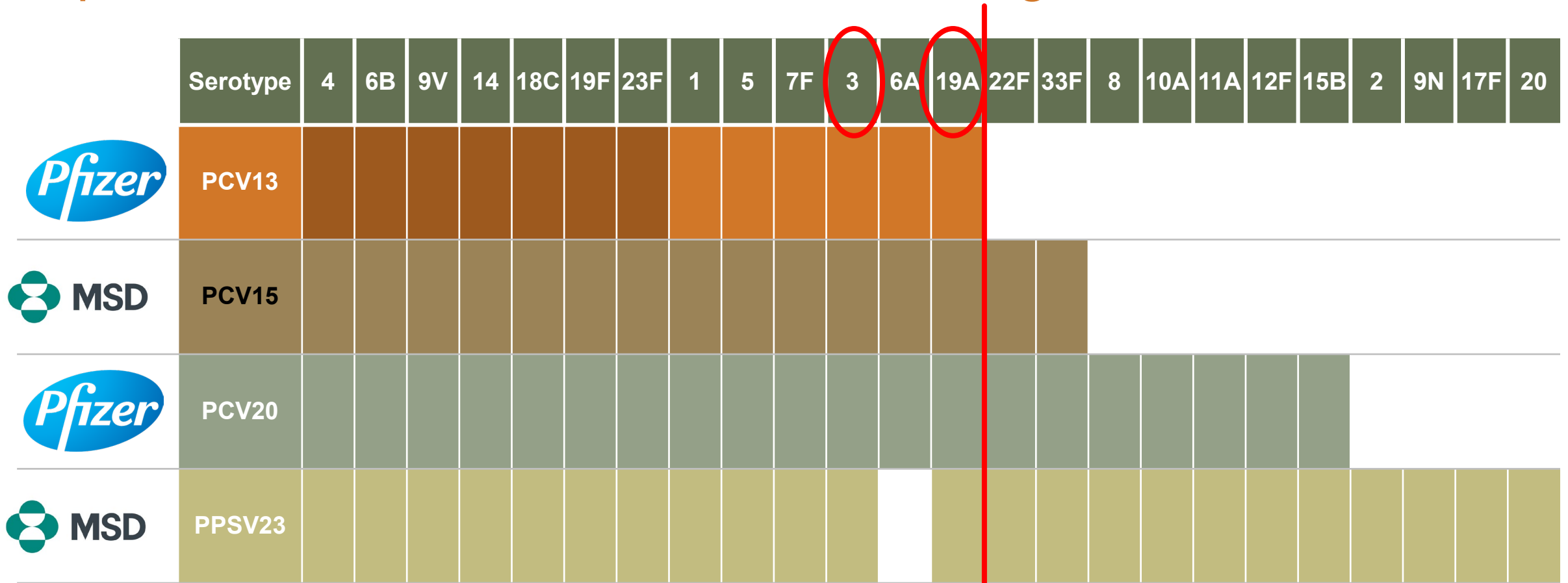


Pneumococcal CAP Represents the Majority of Pneumococcal Disease^{1,2}



1. Huang SS, et al. *Vaccine*. 2011;29:3398-3412. 2. Said MA, et al. *PLoS One*. 2013;8:e60273.

Pipelines of Vaccine Producers for Next-generation PCVs



PPV23: **25µg**/polysaccharide

PCV15: 2.0 µg/polysaccharide (except serotype 4: 4.0 µg) individually conjugated to CRM₁₉₇

PCV13, PCV20: 2.2µg/polysaccharide (except serotype 4: 4.4 µg) individually conjugated to CRM₁₉₇

Opinion: Pneumococcal Vaccines for Adults

▶ PPV23 has a modest effect on IPD, none on non-bacteremic pneumonia

- ▶ CDC (2015): Japanese study (Maruyama et al.) owns misclassification of cases
Gessner 2019: lack of internal and external validity
- ▶ Effectiveness is short-lived, no immunological memory (Andrews, PHE 2012)
- ▶ PPV23 doubled the risk for IPD in AIDS patients (d-b-r study in Uganda (French 2000))

▶ PCV 15 / PCV 20 and beyond: Decision criteria – for discussion

(roughly same price, 10 doses: € 767,35)

- ▶ Both products licensed based on safety/serological /non-inferiority to PCV13
- ▶ Do lower titers make a difference? - Herd protection more relevant?
- ▶ Impact/effectiveness against **serotypes 3 and 19A**
- ▶ Size of local **strain coverage AND case number reduction** regarding
 - ▶ 22F, 33F (PCV15) PLUS 8, 10A, 11A, 12F, 15B (PCV20)
- ▶ With excellent surveillance in place, we will only know 1-5 years after licensure (or never) if one vaccine is superior to the other
- ▶ **IMPLEMENTATION IS WHAT MATTERS**

Adult immunization Schedule – CDC – other Vx

Vaccine	19-26 years	27-49 years	50-64 years	≥65 years
Hepatitis A (HepA) ⓘ	2, 3, or 4 doses depending on vaccine			
Hepatitis B (HepB) ⓘ	2, 3, or 4 doses depending on vaccine or condition			
Meningococcal A, C, W, Y (MenACWY) ⓘ	1 or 2 doses depending on indication, see notes for booster recommendations			
Meningococcal B (MenB) ⓘ	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations			
	19 through 23 years			
Haemophilus influenzae type b (Hib) ⓘ	1 or 3 doses depending on indication			

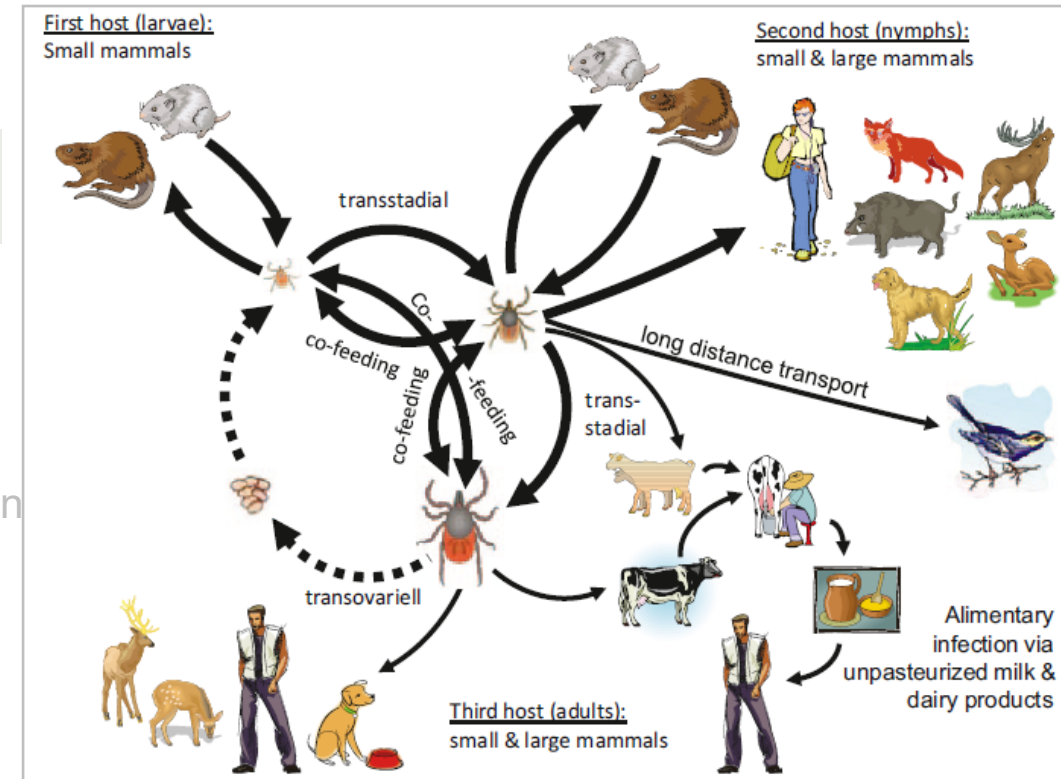
Reminder: Eculizumab (Soliris®) inhibits terminal complement activation

TBE – Basics

1. **TBE:** CNS infection caused by the TBE virus (TBEV)
2. **Transmission:** Ticks, unpasteurized milk/products, transplantation, aerosols

3. **Occurrence:** UK to Japan, polar circle to northern Tunisia (forest belt EurAsia)

1. **Seasonality:** 95% of cases occurring May to November
2. **Incidence:** $<1/10^5$ to $>30/10^5$, unpredictable variations
3. **3 “classic” TBEV subtypes:** European, Siberian, Far-Eastern
2 potential new subtypes (Baikalian; Himalayan)
4. **3 Manifestations:** no symptoms – non-CNS diseases – CNS infection
5. **Sequelae:** $<46\%$ of patients; in children mainly mental sequelae
6. **Case fatality:** 0.5–20%
7. **Specific therapy:** Not licensed / not available
8. **Local authorities, E-CDC, WHO recommend vaccination as best way for prevention**



TBE Risk definition based on ECDC criteria for arboviruses:

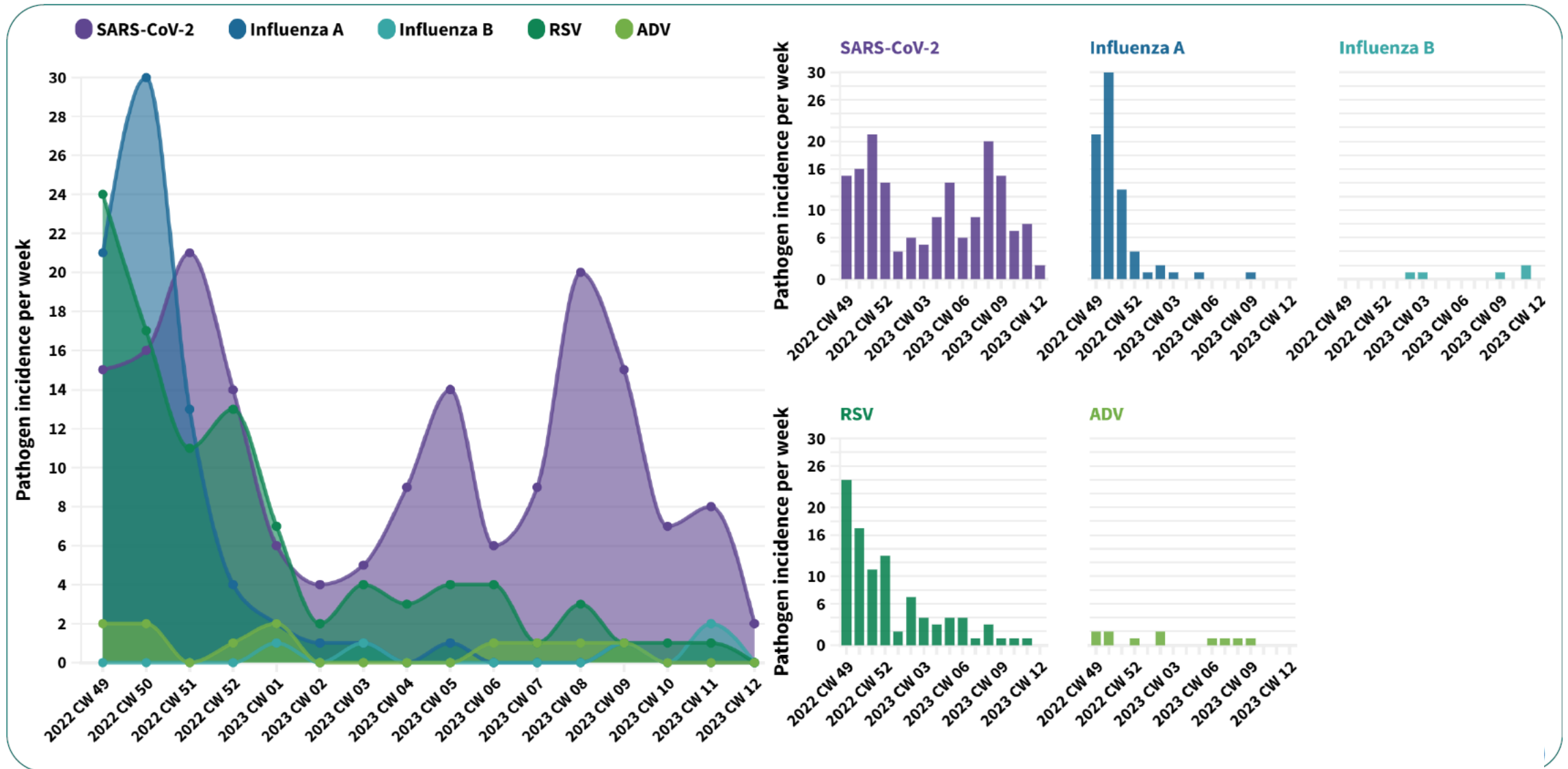
- **Predisposed:** Area and ticks suitable to sustain TBEV circulation
- **Imperiled:** TBEV identified in appropriate ticks
- **Affected:** TBE cases reported
- **Endemic:** Annual cases reported

Opinion - TBE

- ▶ Hugely underdiagnosed
- ▶ Low Vaccine uptake even in risk areas and among risk subjects
- ▶ Most ridiculous vaccination schedule for any vaccine
 - ▶ High effectiveness after 3 doses; 10-year boosters in Switzerland and Finland (but not in EMA lable)
- ▶ Recommended as a travel vaccine for Europe and Asia (e.g. China) in the USA

Soon to come?

Electronic ARI-Case Reports based on self-testing

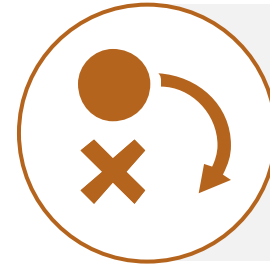


GAPS in Adult Vaccination in EU

Most EU-countries own Vaccine Recommendations, but no Vaccination Program with:



Goals



Plan



Implementation

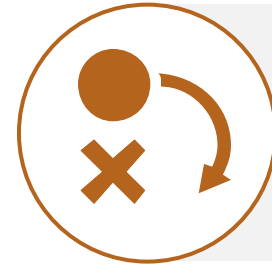


Evaluation

Vaccination Programmes consist of:



Goals:
A) Future needs
B) Current targets



Plan:
A) One, comprehensive
B) Current updates



Implementation:
A) Responsib/Account.
B) Government PR



Evaluation:
A) Uptake by population
B) Burden of Disease

Thank you !