ESPID 2024: Očkování těhotných

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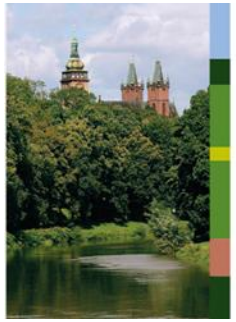


XIX. HRADECKÉ
VAKCINOLOGICKÉ DNY

3.–5. 10. 2024
Kongresové centrum Aldis
Hradec Králové

ČESKÁ VAKCINOLOGICKÁ SPOLEČNOST ČLS JEP

COPENHAGEN
& ONLINE
20-24 MAY
2024

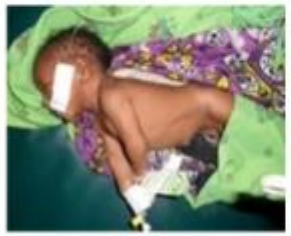
MATERNAL IMMUNIZATION SCHEDULES

Flor Munoz, MD
Baylor College of Medicine, USA

42ND ANNUAL MEETING OF THE
EUROPEAN SOCIETY FOR PAEDIATRIC INFECTIOUS DISEASES
Organised jointly by ESPID and the ESPID Foundation

#ESPID2024
espidmeeting.org

Maternal immunization began with the development of vaccines



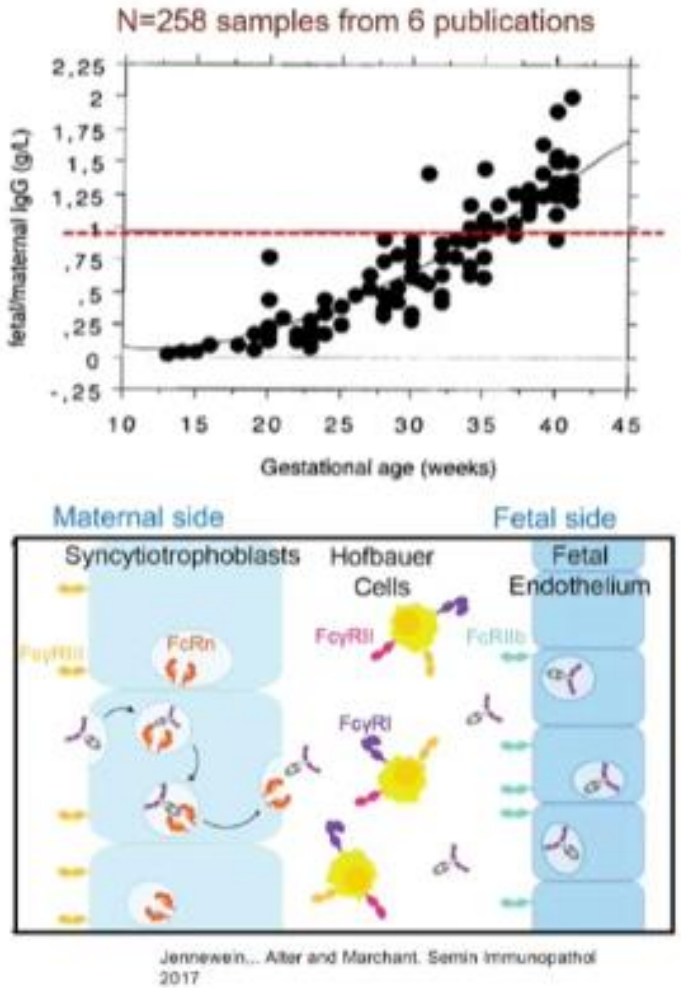
- **1879** - MI with **Vaccinia** protected **mothers and infants** against smallpox
- **1940's** - MI studies with **DTPw** vaccine in US to protect **infants** against pertussis
- **1960s – Influenza** vaccine recommended for **pregnant women** (at risk) since the 1957 pandemic
- **1961**- MI with **Tetanus Toxoid** to prevent **neonatal tetanus** added to WHO Expanded Program on Immunization (EPI) in 1970's; MNT elimination goal set in 1980's

Vaccine Research Pregnancy:

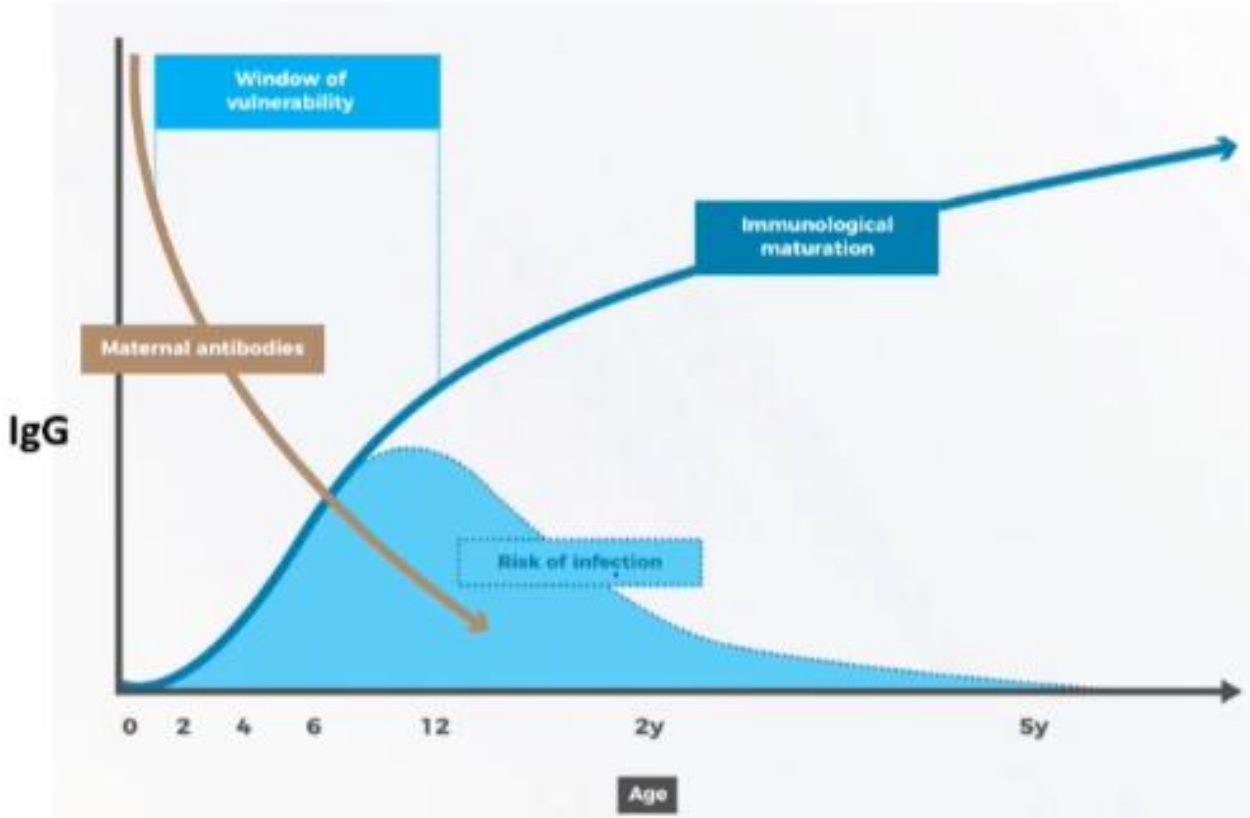
1970's Oral polio, Yellow Fever
1980's **Group B Strep** (ongoing)
1990's Pneumococcal, Hib, seasonal influenza vaccines
1990's **RSV**
2000's Tdap
2000's Mening A
2009 Pandemic Influenza
2018 Ebola vaccine
2020 Hepatitis E
2021 COVID-19

Source: google images

Antibodies and window of vulnerability
Maternal and Infant Immunization Strategies



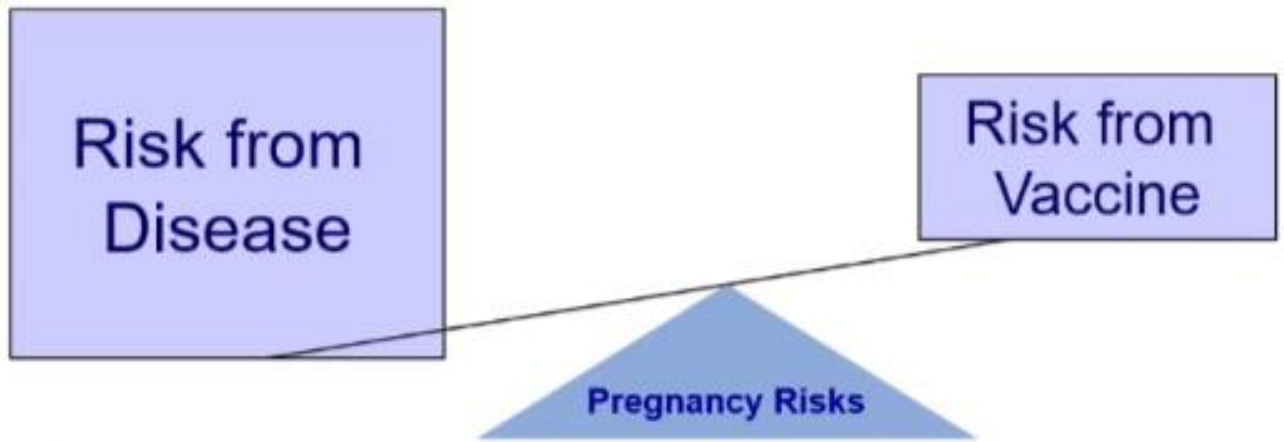
Jennewein... Alter and Marchant. Semin Immunopathol 2017



Source: Munoz F. Immunization during pregnancy to protect infants: the case of pertussis [Internet]; Texas Children's Hospital [cited 2019 Jun 1]. Available from: https://slideplayer.com/slide/12864482

When should pregnant mothers be vaccinated?

1. Mother has a high risk of exposure to the disease
2. Infection poses a special risk to the **mother**
3. Infection poses a special risk to the **fetus / infant**
4. A vaccine is available and is unlikely to cause harm



World Health Organization

ACOG The American College of Obstetricians and Gynecologists

CDC Centers for Disease Control and Prevention

Advisory Committee on Immunization Practices (ACIP)

Centers for Disease Control and Prevention. MMWR 1994;43,No RR-1-28; ACOG Committee on Obstetric Practice. Obstet Gynecol 2004;104:1125-6.

Vaccination Strategies During Pregnancy

WHO: Pregnancy should not deter a woman from receiving vaccines that are safe and will protect both her health and that of her unborn child.

Generally *recommended*	Recommended for disease prevention in specific situations	Contraindicated
Tetanus (Td, TT) **Acellular pertussis vaccine (Tdap) in areas of burden *** **Influenza inactivated (IIV)*** **SARS-CoV-2** **RSV****	Cholera Yellow Fever Meningitis A (meningococcal) Hepatitis A, B, E Japanese Encephalitis Polio (OPV, IPV) Rabies **Recommended vaccines are NOT contraindicated in pregnancy!**	BCG Measles Mumps Rubella Varicella Live Typhoid T21a Live influenza

Most vaccines are not approved/licensed specifically for pregnant women

- ****RSV vaccine: First vaccine licensed (2023) for use in pregnancy to protect infants, based on phase 3 global RCT**
- One Tdap vaccine licensed in US October 7, 2022 - Based on re-analysis of observational study and supportive data from 16 studies (one RCT and 15 observational studies) mostly conducted outside US with similar formulation vaccine.
- One influenza vaccine PI included indication for pregnancy in package insert in Europe and Australia (2019) based on 4 RCT in Africa and Asia

*2012 SAGE-WHO made Influenza vaccination of pregnant women a global priority for all countries were influenza vaccination is administered, incorporating it into ANC; *Tdap recommended since 2012

IIV, Tdap, SARS-CoV2 - Post-partum vaccination recommended if unable to vaccinate in pregnancy
MMR - Also given post-partum in non-immune mothers (rubella); most vaccines can be given w/lactation

WHO's specific vaccine position papers: http://www.who.int/immunization/documents/positionpapers_intro/en/.
https://www.cdc.gov/vaccines/pregnancy/hcp-toolkit/guidelines.html

SAFETY of MI

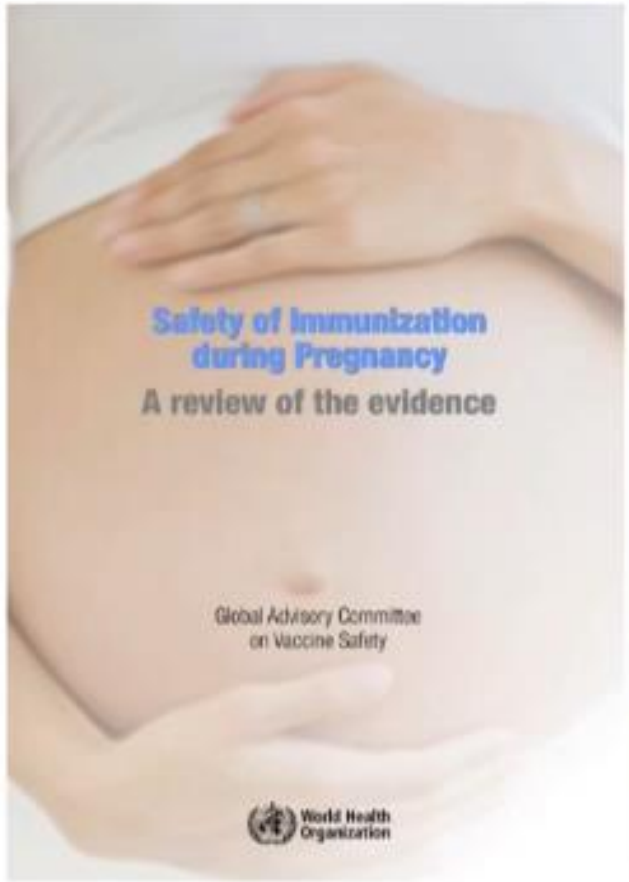


TABLE 1. SUMMARY OF VACCINES REVIEWED AND LEVEL OF EVIDENCE CONCERNING VACCINE SAFETY

Vaccine	Increased risk or severity of disease in pregnant women	Risk of disease to fetus or young infant	WHO recommendation on vaccination during pregnancy	Vaccine safety concerns	Level of evidence on vaccine safety
Inactivated vaccines					
Seasonal TIV or H1N1 2009–2010 monovalent, non-adjuvanted vaccines Oil-in-water adjuvanted, monovalent H1N1 vaccines	More severe disease especially in second and third trimester and increased risk of death in a pandemic	Possible increased spontaneous abortion rate and increased preterm delivery. No malformations confirmed.	Yes Yes	No safety concern identified No safety concern identified	++++ +++
Tetanus toxoid vaccines	Incidence depends on region; unaltered by pregnancy	Neonatal tetanus mortality 60%	Yes	No safety concern identified	++
Meningococcal polysaccharide vaccines Meningococcal conjugate vaccines	Incidence not altered by pregnancy	Unknown for fetus; infants may develop significant morbidity and mortality.	No As part of mass campaigns	No safety concern identified No safety concern identified	++ +
Live attenuated vaccines					
Rubella vaccine	Incidence not altered by pregnancy	Abortion and congenital rubella syndrome (CRS)	No	No CRS identified in children born to inadvertently vaccinated susceptible pregnant women	+++
Measles vaccines	More severe disease; low mortality	Possible higher abortion rate, infrequently congenital measles and if premature possible high case fatality rate	No	No safety concern identified	Indirect data from combined MR vaccines
Mumps vaccine	Incidence not altered by pregnancy	Probable increased rate of abortion in the first trimester	No	No safety concern identified	Indirect data from combined MMR vaccines
Oral poliovirus vaccine	Increased risk of paralytic disease	Anoxic fetal damage reported; 50% mortality in neonatal disease	No	No safety concern identified	+++
Yellow fever	Incidence not altered by pregnancy	Unknown	During epidemics and when travel to endemic areas cannot be avoided	No safety concern identified	+++

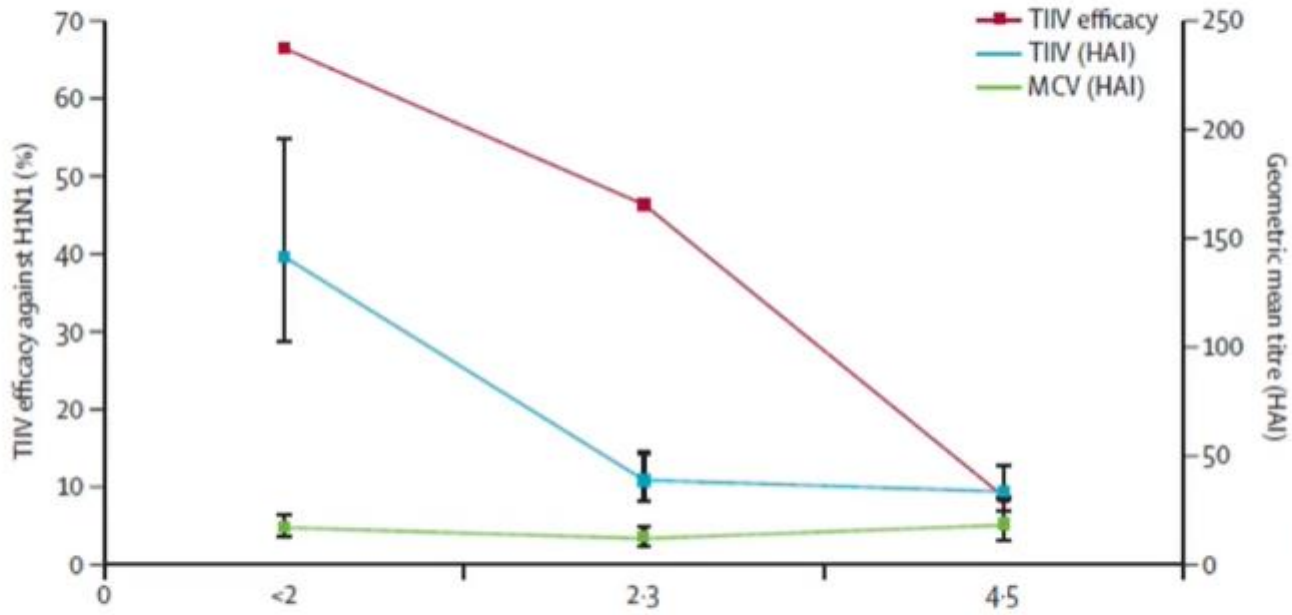
++++ Substantial evidence from RCTs, large observational studies or registries with pregnancy follow-up and passive surveillance
+++ Evidence from observational studies or registries with pregnancy follow-up and passive surveillance
++ Some evidence from studies with lower power, lack of information on some relevant pregnancy outcomes, short follow-up of offspring or other limitations of study design and passive surveillance
+ Passive surveillance data
- No data

- Chorioamnionitis – Tdap
- SAB - H1N1pdm 2009
- Preterm birth? - RSV

Efficacy and duration of protection from MI in infants correlates with maternally-derived antibody titer - Influenza

Mali
IIV3 RCT

Half life IgG
~ 6 weeks



	<2	2-3	4-5
TIIV efficacy	66·5% (−317·6 to 99·4)	46·4% (−44·7 to 81·9)	8·8% (−69·8 to 51·2)
TIIV (HAI)	141·6 (102·6 to 195·4)	39·0 (29·5 to 51·5)	33·7 (18·3 to 45·7)
MCV (HAI)	17·2 (12·8 to 23·1)	12·1 (8·3 to 17·6)	18·3 (10·9 to 30·7)

Tapia MD, *et al. Lancet ID* 2016.

Impact of Maternal Immunization Timing on Efficacy
RSV Nanoparticle Vaccine RCT

	Gestational Age at Immunization		Interval from Immunization to Delivery	
	<33 weeks	≥33 weeks	14 to <30 days	**≥30 days**
Transfer of anti-F IgG	**138%** (135, 141)	91% (88, 94)	66% (63, 70)	**127%** (125, 130)
Transfer of PCA	**122%** (119, 124)	83% (81, 86)	63% (60, 66)	**113%** (111, 115)
Transfer of RSV/A MN	**118%** (112, 125)	98% (93, 104)	85% (77, 94)	**114%** (104, 119)
Transfer of RSV/B MN	**117%** (111, 124)	97% (91, 103)	87% (80, 96)	**112%** (107, 117)
Efficacy vs. MS RSV LRTI*	**41.4%** (4.1, 64.2)	40.3% (0.9, 64.0)	11.1% (-118.9, 63.9)	**45.5%** (19.9, 63.0)
Efficacy vs. RSV LRTI w/severe hypoxemia*	**70.2%** (37.6, 85.7)	44.0 (-18.4, 73.5)	-19.7% (-510.8, 76.6)	**65.1%** (38.8, 80.1)
Efficacy vs. RSV LRTI w/hospitalization*	**53.5%** (23.0, 71.9)	26.3% 9-23.1, 55.9)	-43.6% (-339.0, 53.0)	**48.7%** (24.7, 65.1)

*expanded dataset, 90 day data

Earlier gestational age at immunization (< 33 weeks) and longer interval between immunization and delivery (≥30 days) enhance transplacental antibody transfer and efficacy

Timing of administration in pregnancy
Optimal timing for infant protection

Optimal timing of influenza vaccine during pregnancy: A systematic review and meta-analysis

Influenza Other Respi Viruses. 2019;13:438–452.

INFLUENZA

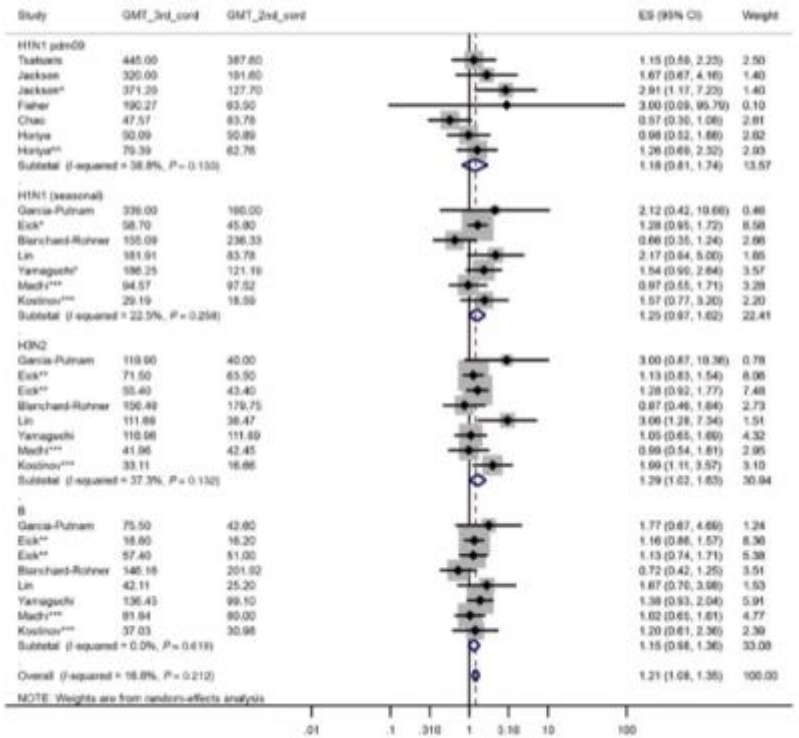
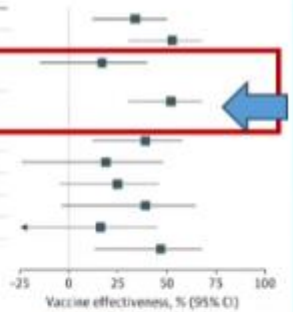


Figure 2. Effectiveness of Maternal Influenza Vaccination During Pregnancy Against Influenza Hospitalizations and Emergency Department (ED) Visits in Infants

Infants <6 mo of age	Vaccinated mothers, No./total No. (%)		Effectiveness of maternal vaccination against influenza illness in infants, % (95% CI)
	Infants with influenza illness	Control infants	
Overall effectiveness of maternal vaccination	94/223 (42)	1913/3541 (54)	34 (12 to 50)
Infants <3 mo of age	49/106 (46)	1293/2147 (60)	53 (30 to 68)
Mother vaccinated during first or second trimester of pregnancy	59/188 (31)	1009/2637 (38)	17 (-15 to 40)
Mother vaccinated during third trimester of pregnancy	35/164 (21)	904/2532 (36)	52 (30 to 68)
Hospital admission	55/125 (44)	1416/2541 (56)	39 (12 to 58)
ED visit	39/98 (40)	497/1000 (50)	19 (-24 to 48)
Influenza A	70/157 (45)	1913/3541 (54)	25 (-5 to 46)
H1N1	21/53 (40)	1913/3541 (54)	39 (-4 to 65)
H3N2	42/87 (48)	1913/3541 (54)	16 (-29 to 45)
Influenza B	25/67 (37)	1913/3541 (54)	47 (13 to 68)



Prospective, Case-negative control design
2016-2010, NVSN – 7 US sites
3,754 infants (223 w/influenza, 3541 controls)
2,007 (53%) born to mothers vaccinated for influenza

JAMA Pediatr. 2024;178(2):176-184. doi:10.1001/jamapediatrics.2023.5639
Published online December 18, 2023.

Timing of administration in pregnancy
Optimal timing for infant protection

COVID-19

Subgroup	Case Infants	Control Infants	Effectiveness of Maternal Vaccination
	no. of vaccinated mothers/total no. (%)		*% (95% CI)*
Overall effectiveness of maternal vaccination	87/537 (16)	147/512 (29)	52 (33 to 65)
Timing of vaccination			
During first 20 wk of pregnancy	46/496 (9)	62/427 (15)	38 (3 to 60)
After 20 wk of pregnancy	31/481 (6)	79/444 (18)	69 (50 to 80)
Delta-predominant period	14/181 (8)	61/216 (28)	80 (60 to 90)
Vaccinated during first 20 wk of pregnancy	8/175 (5)	22/177 (12)	68 (19 to 87)
Vaccinated after 20 wk of pregnancy	5/172 (3)	37/192 (19)	88 (68 to 96)
Omicron-predominant period	73/356 (21)	86/296 (29)	38 (8 to 58)
Vaccinated during first 20 wk of pregnancy	38/321 (12)	40/250 (16)	25 (−26 to 56)
Vaccinated after 20 wk of pregnancy	26/309 (8)	42/252 (17)	57 (25 to 75)
Type of hospital admission			
ICU	11/113 (10)	147/512 (29)	70 (42 to 85)
Non-ICU	76/424 (18)	147/512 (29)	47 (25 to 62)

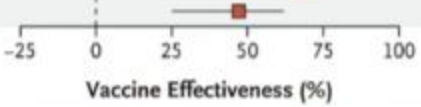


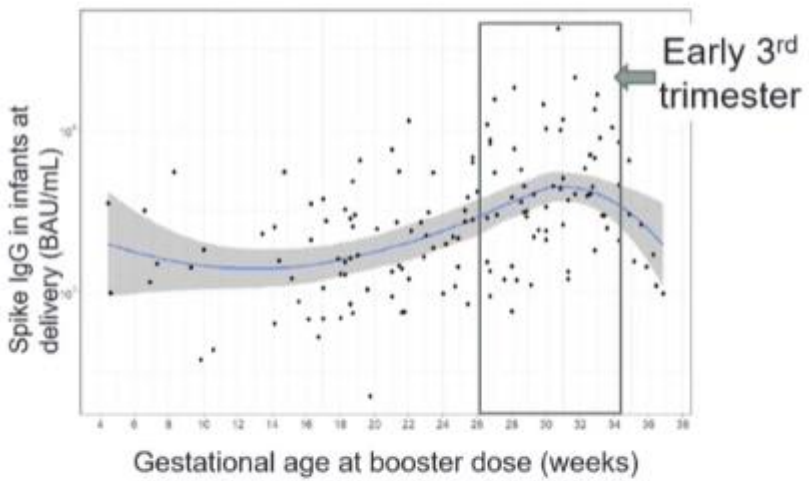
Figure 3. Effectiveness of Maternal Two-Dose mRNA Vaccination against Hospitalization for Covid-19 among Infants, Stratified According to Vaccination Timing, Variant, and Type of Admission.

*mostly nRNA vaccines

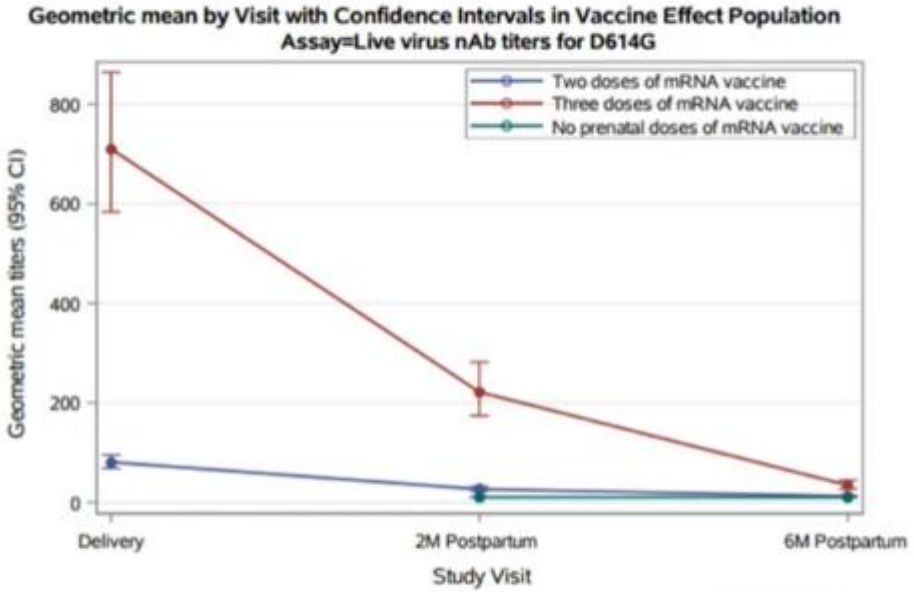
Halasa NB, et al. N Engl J Med. 2022;387:109-119.

Timing of administration in pregnancy
Optimal timing for infant protection

COVID-19



https://publications.aap.org/pediatrics/article/doi/10.1542/peds.2023-064252/196616/Maternal-COVID-19-Vaccination-and-Prevention-of?autologincheck=redirected
MOMI-VAX Study – IDCRC_DMID_Presented IDWeek 2023



A maternal booster during pregnancy was associated with a **56% (95% CI: 8-79%) reduction in risk of infant symptomatic infection in the first 6 months of life** vs. infants of non-boosted mothers, during a period of Omicron dominance

Munoz, FM, et al. Presented at PAS Meeting, May 5, 2023, Toronto, CA

COVID-19 Impact on Pregancy, Fetus and Newborn

- Not a cause of congenital infection or birth defects
- Preterm delivery and stillbirths reported in women w/acute, severe COVID-19
- Postnatal transmission – increased NICU admission

COLLEGE of AMERICAN PATHOLOGISTS

ARCHIVES of Pathology & Laboratory Medicine

Placental Tissue Destruction and Insufficiency from COVID-19 Causes Stillbirth and Neonatal Death from Hypoxic-Ischemic Injury: A Study of 68 Cases with SARS-CoV-2 Placentitis from 12 Countries

David A. Schwartz, MD, MS Hyg; Elyzabeth Avvad-Portari, MD PhD; Pavel Babál, MD, PhD; Marcella Baldewijns, MD, PhD; Marie Blomberg, MD, PhD; Amine Bouachiba, MD; Jessica Camacho, MD; Sophie Collardeau-Frachon, MD, PhD; Arthur Colson, MD; Isabelle Dehaene MD; Joan Carles Ferreres MD, PhD;

SARS-CoV-2 placentitis, is defined by the coexistent occurrence of 3 microscopic findings – chronic histiocytic intervillositis (CHI), increased fibrin deposition (IF), and trophoblast necrosis (TN)

doi: 10.5858/arpa.2022-0029-SA

- Case-based retrospective clinico-pathological analysis
- Placental and autopsy pathology findings from **64 stillborns and 4 neonatal deaths** having placentas testing positive for SARS-CoV-2 following delivery to mothers with COVID-19.
- Fetal death occurred at a mean gestational age of 30 weeks.

The pathology abnormalities composing **SARS-CoV-2 placentitis** cause **widespread and severe placental destruction** resulting in **placental malperfusion and insufficiency**.

Intrauterine and perinatal death likely results directly from placental insufficiency and fetal hypoxic-ischemic injury.

There was no evidence that SARS-CoV-2 involvement of the fetus had a role in causing these deaths.

Timing of administration in pregnancy
Optimal timing for infant protection Pertussis

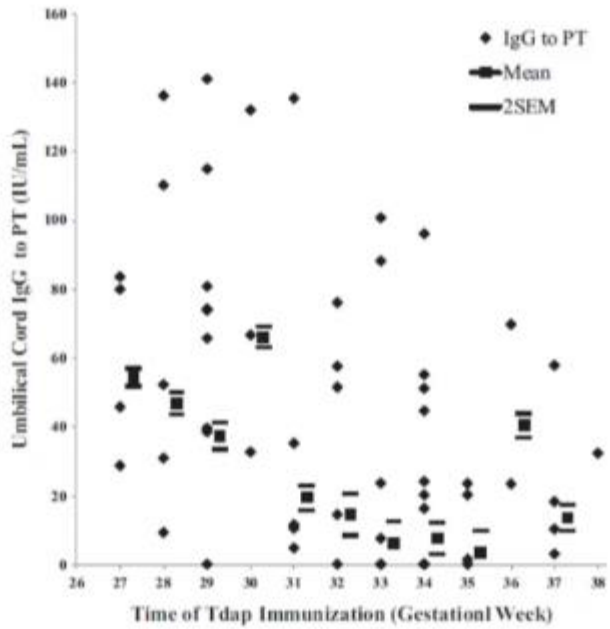


Fig. 2. Scatter graph of the mean (±2 standard error of the mean) of umbilical cord immunoglobulin G to pertussis toxin concentrations as a function of timing of gestational tetanus, diphtheria and acellular pertussis immunization (weeks). *Abbreviations*: IgG, immunoglobulin G; PT, pertussis toxin; SEM, standard error of the mean; Tdap, tetanus, diphtheria and acellular pertussis; IU/mL, international unit/milliliter.

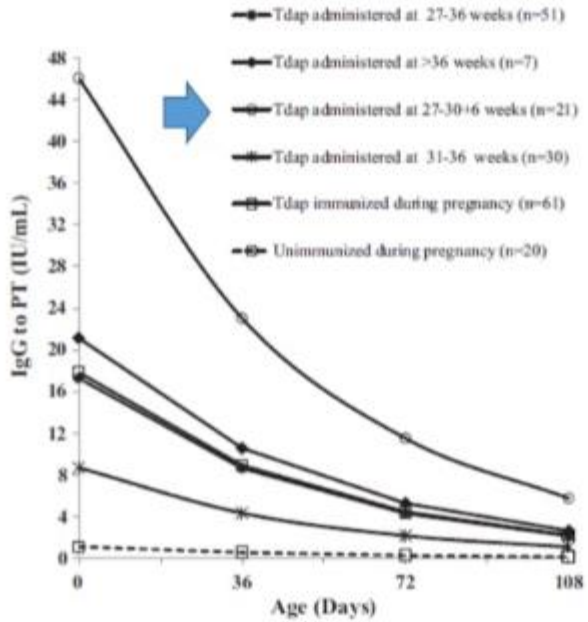
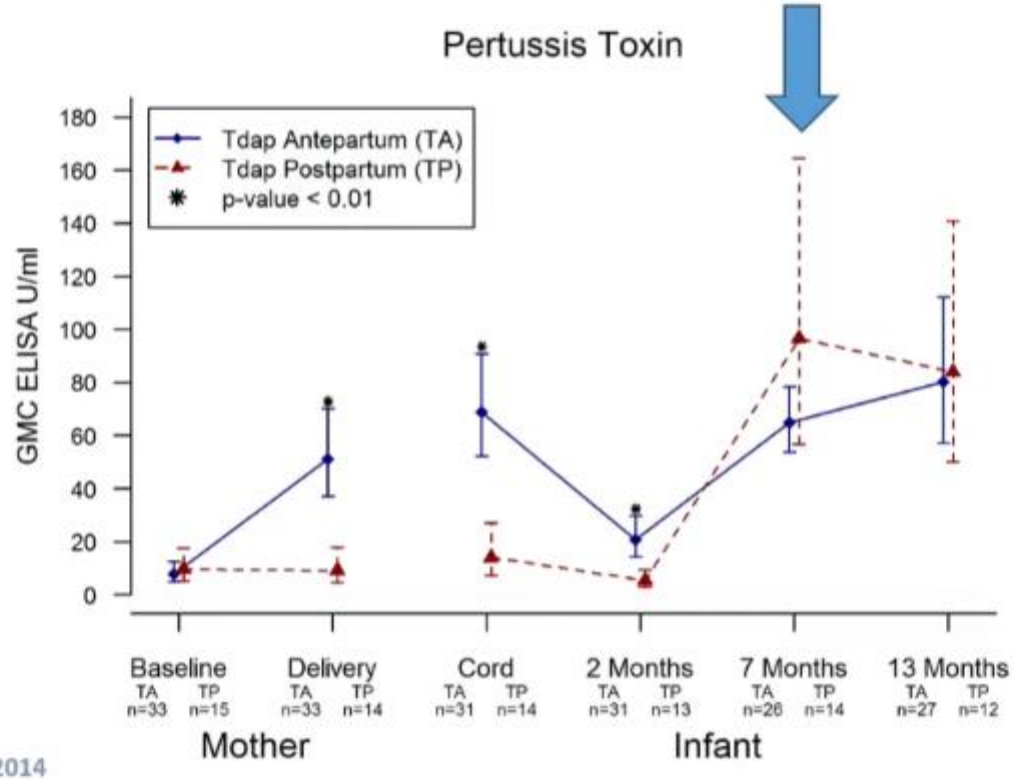


Fig. 3. Geometric mean concentrations (GMCs) of pertussis toxin immunoglobulin G in newborn cord sera interpolated up to 108 days post-partum stratified by sequential time frames of tetanus, diphtheria and acellular pertussis administration in late pregnancy. Confidence intervals for newborns' umbilical cord GMCs are presented in Table 3. *Abbreviations*: Tdap, tetanus, diphtheria and acellular pertussis; PT, pertussis toxin; IgG, immunoglobulin G; IU/mL, international unit/milliliter.

Abu Raya, Vaccine 2014 (Boostrix) – 63 vaccinated PW vs. 20 unvaccinated controls

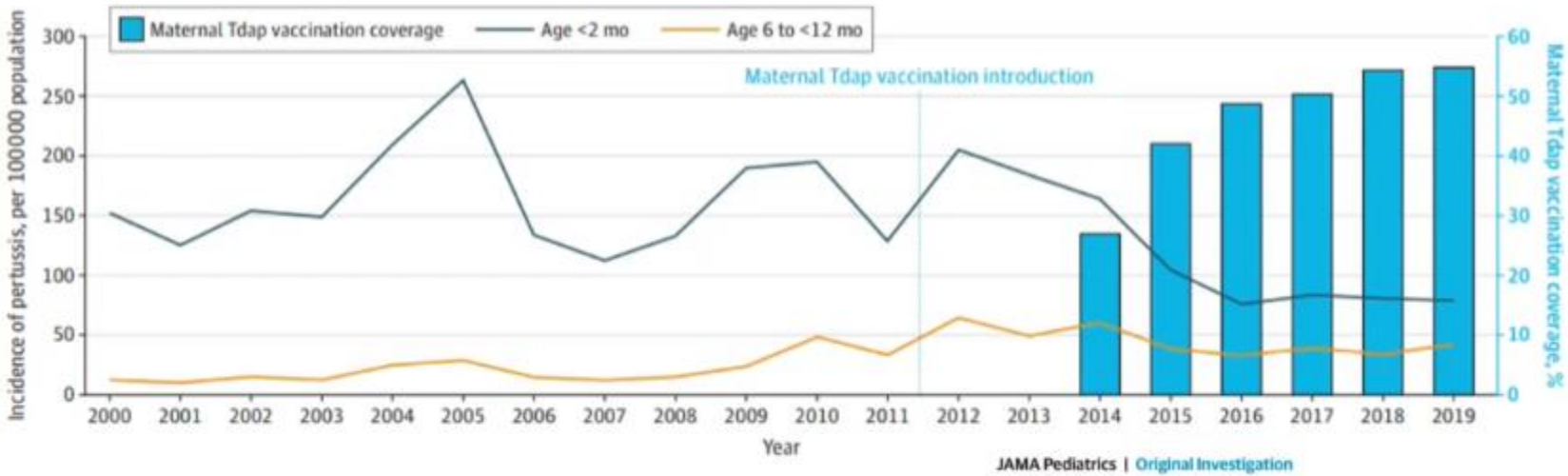
Antibodies and “blunting”effect on infant responses to active immunization



Munoz FM et al. JAMA 2014

Maternal Tdap Vaccination
Incidence of Infant Pertussis - US

Figure 1. Annual Incidence of Reported Pertussis Among Infants Younger Than 2 Months and Infants Aged 6 Months to Less Than 12 Months, 2000-2019



JAMA Pediatr. 2023;177(4):395-400. doi:10.1001/jamapediatrics.2022.5689
Published online February 6, 2023.

JAMA Pediatrics | Original Investigation

US Infant Pertussis Incidence Trends Before and After Implementation of the Maternal Tetanus, Diphtheria, and Pertussis Vaccine

Tami H. Skoff, MS; Li Deng, PhD; Catherine H. Bozio, PhD; Susan Hariri, PhD

Maternal Immunization Policies Vary Worldwide

Pertussis – Different GA of administration

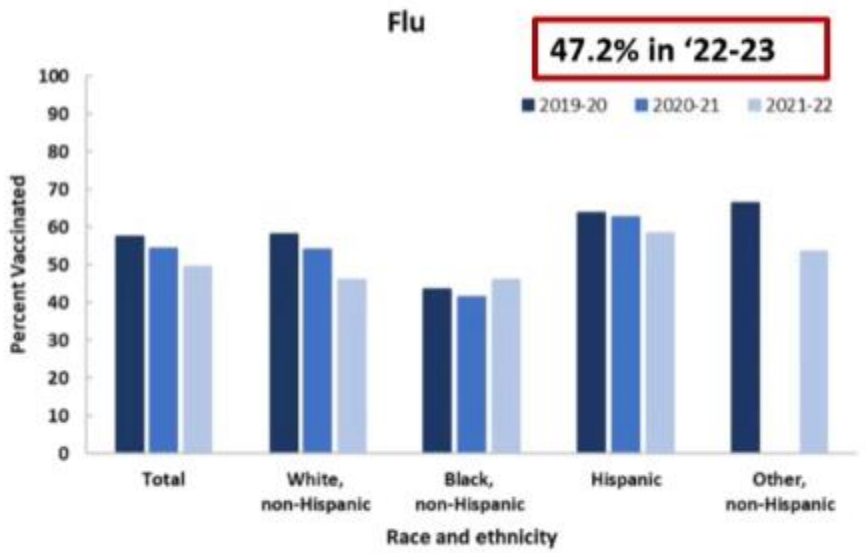
FIGURE 1 | Countries with recommendations for immunization against pertussis in pregnancy by official authorities (for South America, pertussis immunization during pregnancy is recommended by The Pan American Health Organization). This figure was inspired by G. Amirthalingham and K. Maertens and created by K. Maertens.

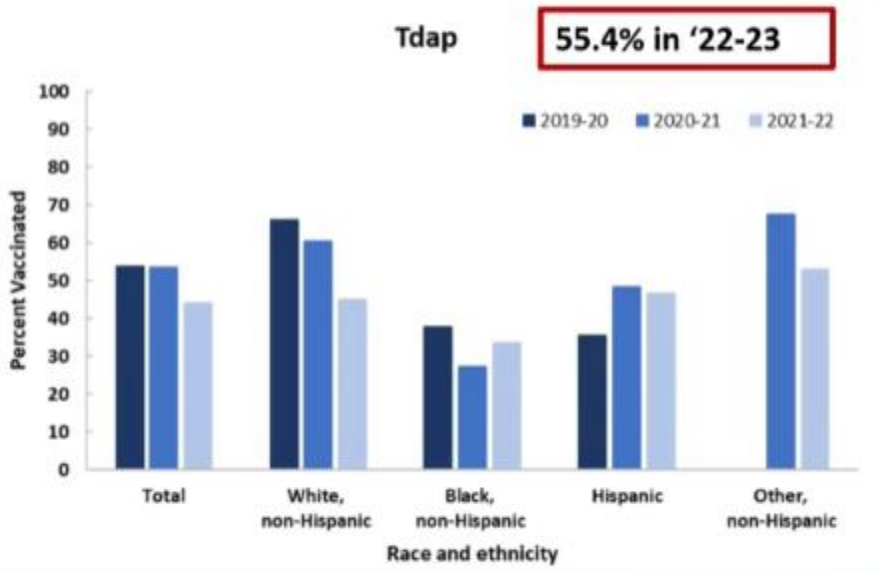
Front. Immunol., 24 June 2020
Sec. Vaccines and Molecular Therapeutics
Volume 11 - 2020 | https://doi.org/10.3389/fimmu.2020.01282

Covid-19 vaccine policies on pregnancy

https://www.comitglobal.org/explore/public-health-authorities/pregnancy
Tracking ended January 2023

Pregnancy vaccination coverage – suboptimal
US April 2020-April 2022 ; 2023 (Internet panel survey)



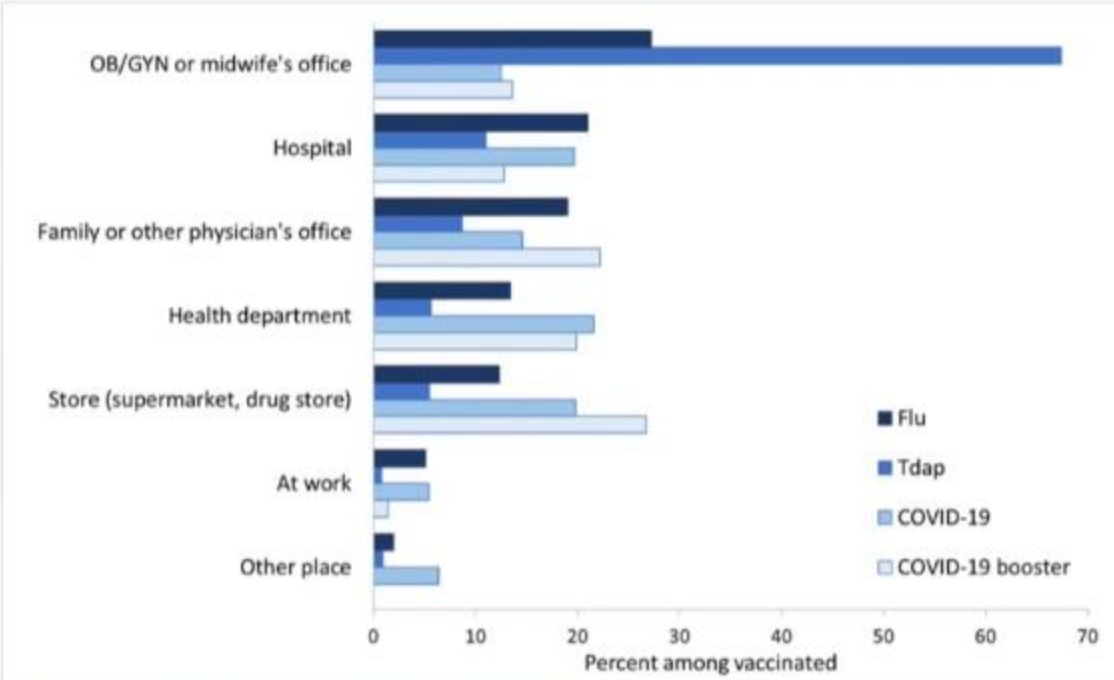


https://www.cdc.gov/flu/fluvaxview/pregnant-women-apr2022.htm
https://www.cdc.gov/mmwr/volumes/72/wr/pdfs/mm7239a4-H.pdf

25.6 % received both influenza and Tdap

Only 32.7 % of pregnant women were vaccinated with COVID-19 vaccines by end of 2021, 27.3% received Bivalent booster 2022-23

Factors contributing to vaccine acceptance among pregnant women



Place of Vaccination Among Pregnant Women, US Internet Panel Survey, April 2022

Patient Perspective:
Most important maternal **concern**: **SAFETY** of the Baby

Most important factor for **acceptance**: **Provider Recommendation**

Other contributing factors: **Access, Perception of risk**

Provider Perspective:
Time, Infrastructure, Reimbursement, Liability

https://www.cdc.gov/flu/fluvaxview/pregnant-women-apr2022.htm
https://www.cdc.gov/mmwr/volumes/72/wr/pdfs/mm7239a4-H.pdf

Adult Immunization Schedule US 2024

Table 1 Recommended Adult Immunization Schedule by Age Group, United States, 2024

Vaccine	19–26 years	27–49 years	50–64 years	≥65 years
COVID-19	1 or more doses of updated (2023–2024 Formula) vaccine (See Notes)			
Influenza inactivated (IIV4) or Influenza recombinant (RIV4)	1 dose annually			
Influenza live, attenuated (LAIV4)	1 dose annually			
Respiratory Syncytial Virus (RSV)	Seasonal administration during pregnancy. See Notes.			≥60 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			
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)			For healthcare personnel, see notes
Varicella (VAR)	2 doses (if born in 1980 or later)		2 doses	
Zoster recombinant (RZV)	2 doses for immunocompromising conditions (see notes)		2 doses	
Human papillomavirus (HPV)	2 or 3 doses depending on age at initial vaccination or condition	27 through 45 years		
Pneumococcal (PCV15, PCV20, PPSV23)				See Notes
				See Notes
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)	19 through 23 years	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations		
Haemophilus influenzae type b (Hib)	1 or 3 doses depending on indication			
Mpox				

Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of immunity

Recommended vaccination for adults with an additional risk factor or another indication

Recommended vaccination based on shared clinical decision-making

No recommendation/ Not applicable

Adult Immunization Schedule US 2024

Table 2 Recommended Adult Immunization Schedule by Medical Condition or Other Indication, United States, 2024

Always use this table in conjunction with Table 1 and the Notes that follow. Medical conditions or indications are often not mutually exclusive. If multiple medical conditions or indications are present, refer to guidance in all relevant columns. See Notes for medical conditions or indications not listed.

VACCINE	Pregnancy	Immunocompromised (excluding HIV infection)	HIV infection CD4 percentage and count: <15% or <200mm³	HIV infection CD4 percentage and count: ≥15% and ≥200mm³	Men who have sex with men	Asplenia, complement deficiency	Heart or lung disease	Kidney failure, End-stage renal disease or on dialysis	Chronic liver disease; alcoholism[a]	Diabetes	Healthcare Personnel[b]
COVID-19		See Notes									
IIV4 or RIV4	1 dose annually										
LAIV4					1 dose annually if age 19–49 years						
RSV	Seasonal administration. See Notes	See Notes									
Tdap or Td	Tdap: 1 dose each pregnancy	1 dose Tdap, then Td or Tdap booster every 10									
MMR	•										
VAR	•			See Notes							
RZV		See Notes									
HPV	•	3 dose series if indicated									
Pneumococcal											
HepA											
Hep B	See Notes									Age ≥ 60 years	
MenACWY											
MenB											
Hib											
Mpox	See Notes										See Notes

Routine vaccination

- **Pregnant at 32 weeks 0 days through 36 weeks and 6 days gestation from September through January in most of the continental United States*:** 1 dose RSV vaccine (Abrysvo™). Administer RSV vaccine regardless of previous RSV infection.
  - Either maternal RSV vaccination or infant immunization with nirsevimab (RSV monoclonal antibody) is recommended to prevent respiratory syncytial virus lower respiratory tract infection in infants.
- **All other pregnant persons:** RSV vaccine not recommended

There is currently no ACIP recommendation for RSV vaccination in subsequent pregnancies. No data are available to inform whether additional doses are needed in later pregnancies.

*Note: Heplisav-B and PreHevbrio are not recommended in pregnancy due to lack of safety data in pregnant persons.

- **Pregnancy:** There is currently no ACIP recommendation for Jynneos use in pregnancy due to lack of safety data in pregnant persons. Pregnant persons with any risk factor described above may receive Jynneos.

Recommended for all adults who lack documentation of vaccination, **OR** lack evidence of immunity

Not recommended for all adults, but recommended for some adults based on either age **OR** increased risk for or severe outcomes from disease

Recommended based on shared clinical decision-making

Recommended for all adults, and additional doses may be necessary based on medical condition or other indications. See Notes.

Precaution: Might be indicated if benefit of protection outweighs risk of adverse reaction

Contraindicated or not recommended. *Vaccinate after pregnancy, if indicated

No Guidance/ Not Applicable

a. Precaution for LAIV4 does not apply to alcoholism.

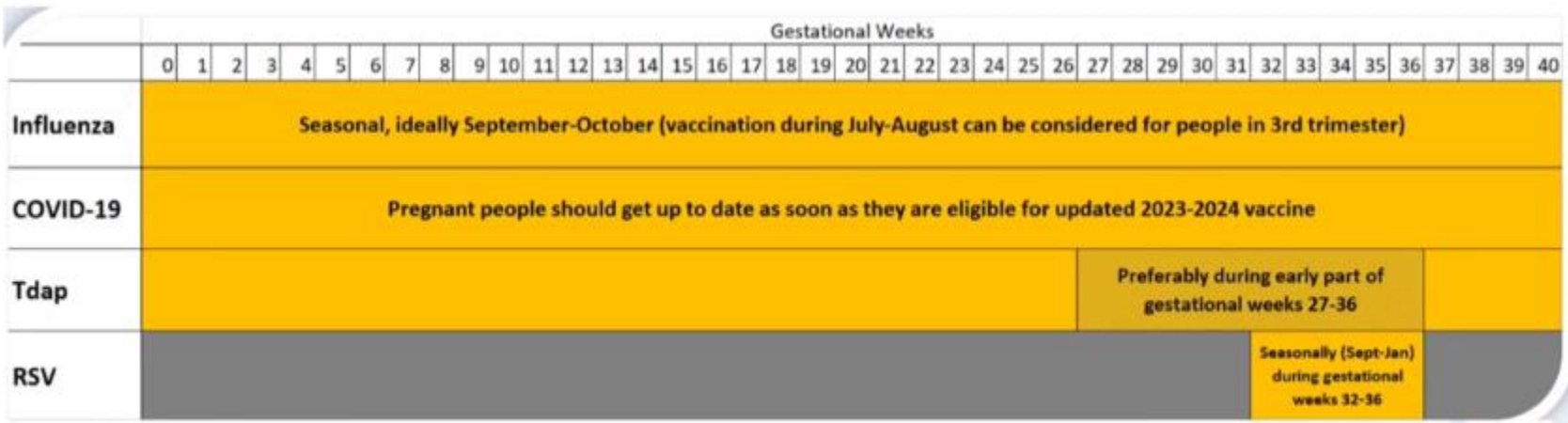
b. See notes for influenza, hepatitis B, measles, mumps, and rubella, and varicella vaccinations.

c. Hematopoietic stem cell transplant.

#ESPID2024

Maternal Immunization Implementation Challenges

- Increasingly complex maternal immunization schedule, with different timing of **vaccines based on seasonality and/or gestational age** (with seasonal timing varying by location)
- **Willingness to accept multiple vaccines** in pregnancy
- **Burden on OB providers, prescription, documentation of vaccination, linkage mom-baby**
- **Limited window for vaccine administration** increases risk of missing dose, especially in some vulnerable populations (equity), and of birth occurring soon after vaccination



Source: ACIP meeting 22 SEP 2023

Vaccines for pregnant women and their infants

Public health potential

Vaccines in Development for Pregnancy

Phase I → Phase II → Phase III

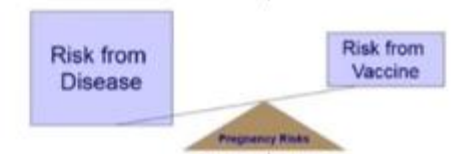
GBS

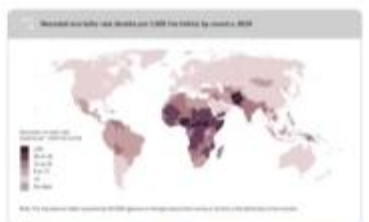
Existing Recommended Vaccines

Recommended in specific situations	Generally recommended
HAV, HBV	Tetanus (Td)
Meningococcal	Pertussis (Tdap)
Pneumococcal	Influenza
Polio	SARS-CoV-2
Typhoid	RSV
Rabies virus	
Cholera	
Yellow fever	
Japanese encephalitis	
Anthrax	

Opportunities for Maternal Immunization

- CMV
- HSV
- **Malaria**
- **Ebola** (rVSV-ZEBOV vaccine)
- **Hepatitis E** (Genotype 1 subunit vaccines)
- **Lassa fever**
- **Chikungunya**
- Zika
- Nipah virus
- Cholera, *E.coli,* Listeria
- TB





Adapted from : Philipp Lambach, World Health Organization. "Integration of infant and maternal immunization – A global challenge!" INMIS 2017, Brussels, Belgium.

Optimizing Maternal Vaccine Schedules

- Designed for
  - Mother, infant or both
  - Pathogen and risk period
- Evidence-based
  - Burden of disease
  - Safety
  - Immunogenicity and transplacental transfer
  - Optimal time of vaccination in pregnancy
  - Efficacy/Effectiveness
  - Integrated with infant immunization schedule
- Research – Inclusion of PW/Funding
- Implementable
- Surveillance systems in place to assess safety and impact on disease
- Communication strategies

FIGURE 2 | A summary of the major factors affecting vaccination in pregnancy. Created by Claudio Rosa.

Global Perspectives on Immunization During Pregnancy and Priorities for Future Research and Development: An International Consensus Statement

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frontiers in Immunology

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+ Create a Maternal Immunization Schedule!

- Téma očkování v těhotenství se rychle vyvíjí v posledních letech
- Tetanus na Papua Nová Guinea a pak celosvětově
- Koncept je jasný a záleží na protilátkách IgG procházejících přes placentu do krve plodu
- V prvních dnech a týdnech života právě mateřské protilátky pomáhají dítěti přežít a odolat infekcím
- Tři kategorie: doporučené, zvláštní situace, kontraindikované
- Vakcíny podávané těhotným nemají žádné bezpečnostní riziko (safety concerns)
- U RSV, covid-19 vakcín se neprokázaly předčasné porody,
- Jsou důležité vysoké titry protilátek při narození
- Důležité je, kdy se matka očkuje, v kterém gestačním týdnu a jak dlouhý je interval mezi očkováním a porodem
- 9 U chřipky se dříve předpokládal zejména benefit pro matku, ale ukazuje se že i pro dítě, očkování během 3.a 2. trimestru, vakcinace ve 3.trimestru je účinnější (52 %) než očkování v 1. nebo 2. trimestru (17%). To je optimální pro ochranu dítěte.
- 10 riziko chřipky pro těhotnou je zejména v pozdním třetím trimestru, a ochranné protilátky potřebuje zejména ve 3. trimestru, ale protože nejsou dosud studie, jak dlouho je samotná matka chráněna po očkování proti chřipce, existuje možnost vyvanutí protilátek… a pak zde hraje roli ještě chřipková sezóna
- 11 Covid je na tom podobně, vyšší hladiny protilátek byly pozorovány, pokud byly matky očkovány mezi 25. a 34. gestačním týdnem, vysoké hladiny protilátek u matky jsou důležité, protože chrání následně dítě do věku 6 měsíců než může být očkování proti covid i chřipce.
- 12 covid u matky (a nemusela mít závažný průběh ani být hospitalizována na JIPu) znamenal přítomnost virus SARS-Cov-2 v placentě, a následně byly popisovány abnormality, způsobující placentární destrukci, nedostatečné prokrvení a hypoxii plodu, předčasné porody, případně úmrtí. Možná si řeknete, že Covid není zase tak závažné onemocnění, proč očkovat těhotnou, ale je tady riziko poškození placenty v případě infekce těhotné
- 13 timing očkování proti pertusi u těhotné, aby bylo dosaženo co nejvyšších titrů protilátek u novorozence, je okolo 27 až 30 gestačního týdne.
- 14
- 15 naštěstí blunting nemá klinický efekt, což dokazuje následující slide
- 16 kde vidíme nemocnost na pertusi, která po zavedení očkování těhotných, významně klesla u dětí do dvou měsíců života a ani u dětí ve věku 6-12 měsíců nestoupala (žlutá čára)
- 18 země se liší v doporučení, ale i v gestačním věku pro očkování
- 19 covid měl negativní vliv na očkování v USA
- 20 faktory spojené s pozitivním vnímáním očkování, hlavně bezpečnost, pro dítě… ochrana dítěte
- 21 22 pro těhotné je třeba vlastní očkovací kalendář zacílené pouze na ně, aby se očkování těhotných neztrácelo v očkování pro dospělé, aby bylo snadno vyhledatelné a srozumitelné
- 23 příklad ACIP