From Data to Decisions: The Evidence Base for 2025 Fall/Winter Immunizations

August 19, 2025

VACCINE INTEGRITY PROJECT

Introduction

Michael Osterholm, PhD, MPH
Director, Center for Infectious Disease Research and Policy, University of Minnesota

Kevin Griffis
Vaccine Integrity Project

Panelists

Oliver T. Brooks, MD

Clinical Professor of Pediatrics
Charles R. Drew School of Medicine and Science

Katelyn Jetelina, PhD, MPH

Founder, CEO
Your Local Epidemiologist

Eric Rubin, MD, PhD

Editor-in-Chief
New England Journal of Medicine

Marc Siegel, MD

Senior Medical Analyst
Fox News

Speakers

Michael Abers, MD

Physician, Scientist, Assistant Professor of Medicine
Albert Einstein College of Medicine

Caitlin Dugdale, MD, MSc

Physician
Department of Infectious Diseases,
Massachusetts General Hospital

Assistant Professor of Medicine
Harvard Medical School

Harleen Marwah, MD, MSc

Physician
Department of Pediatrics,
Massachusetts General Brigham for Children

Instructor of Pediatrics
Harvard Medical School

Jake Scott, MD

Physician, Clinical Associate Professor
Stanford University

Agenda

- Opening
  - Introductions
  - Purpose of Meeting
  - Review of Agenda
- Presentation of the Evidence Base
  - Systematic Review Methods
  - Topline Results on Pregnant Population
  - Topline Results on Pediatric Population
  - Topline Results on Immunocompromised Population
- Preview Data Visualization and Transparency App
- Conclusion

Evidence Base: Systematic Review Methods

Jake Scott, MD
Physician, Clinical Associate Professor, Stanford University

VACCINE INTEGRITY PROJECT

Systematic Review Methods

Pre-registered Protocol: PROSPERO CRD420251091346

Comprehensive Database Search

- 3 major databases: PubMed, Embase, Web of Science
- Timeframes anchored to last ACIP reviews:
  - **COVID: June 2024** – July 2025
  - **Respiratory syncytial virus (RSV): August 2024** – July 2025 (newer products)
  - **Influenza: August 2023** – July 2025 (two seasons)
- For safety studies, we included papers published in these windows regardless of when the underlying data were collected.

Use this QR code to read the publicly available protocol

Systematic Review Methods (Cont.)

- **Double Independent Review**
  - At each stage, every article screened twice (title, abstract and full-text)
  - Third senior reviewer resolved disagreements, as needed
  - Standardized screening guides ensured consistency
- **Rigorous Inclusion Criteria**
  - US-licensed products only
  - ≥10 study participants required
  - Randomized control trials and observational studies with lab confirmation of infection
  - Excluded: preprints, animal studies, modeling studies, phase 1 trials

Quality Assurance Measures

Pre-registered Protocol

- Methods specified before starting (PROSPERO registered July 10, 2025)

Double Data Screening & Extraction

- Double screening at EACH phase: title, abstract and full-text review
- Double extraction for all included studies
- Standardized REDCap forms

Overlap Detection

- Systematic checks for duplicate populations

Senior Verification

- 11 senior team members verified data
- Risk of bias will be assessed for every study

Systematic Review Methods: Outcomes and Populations

DISEASES
COVID
RSV
Influenza

SUBPOPULATIONS
Pregnancy
Pediatrics
Immunocompromised
Older adults
General adults

DOMAINS
Epidemiology
Vaccine Effectiveness (VE)
Vaccine Safety
Co-administration

Co-administration and Epidemiology Outcomes Analyzed

Co-administration Outcomes

Immunogenicity

- Serologic responses when vaccines given together

Safety

- Adverse events with concurrent vaccination
- Reactogenicity profiles

Epidemiologic Outcomes

Disease Burden

- Disease incidence
- Seroprevalence
- Hospitalization rates
- Critical care admission rates

Clinical Impact

- Medically-attended visit rates
- Infection-fatality rates

Vaccine Effectiveness Outcomes Analyzed

Severe Disease

- Hospitalization
- Critical care admission
- Death

Milder Illness

- Symptomatic laboratory-confirmed infection
- Medically-attended infection

Impact on Daily Activities

- School absenteeism
- Work absenteeism

Safety Events Analyzed

COVID Vaccines	RSV Vaccines & Antibodies	Influenza Vaccines
Myocarditis	Guillain-Barré syndrome	Guillain-Barré syndrome
Guillain-Barré syndrome	Stroke	Stroke
Immune thrombocytopenic purpura	Myocardial infarction	Myocardial infarction
Stroke	School absenteeism (children)	School absenteeism (children)
Cerebral venous sinus thrombosis		
School absenteeism (children)		

Safety Events Analyzed (Cont.)

Pregnancy-Specific Outcomes

- Gestational hypertension
- Preeclampsia/Eclampsia
- Preterm birth (<37 weeks)
- Placental abruption
- Small for gestational age
- Congenital anomalies
- Stillbirth
- Miscarriage

Comprehensive Safety Monitoring

- Other reported safety events were also collected for future analysis beyond our pre-specified events of special interest.

State of the Analysis

Analyses of additional studies are ongoing;

findings presented today have completed our full review process.

Study Selection Results

17,262

References Identified

↓

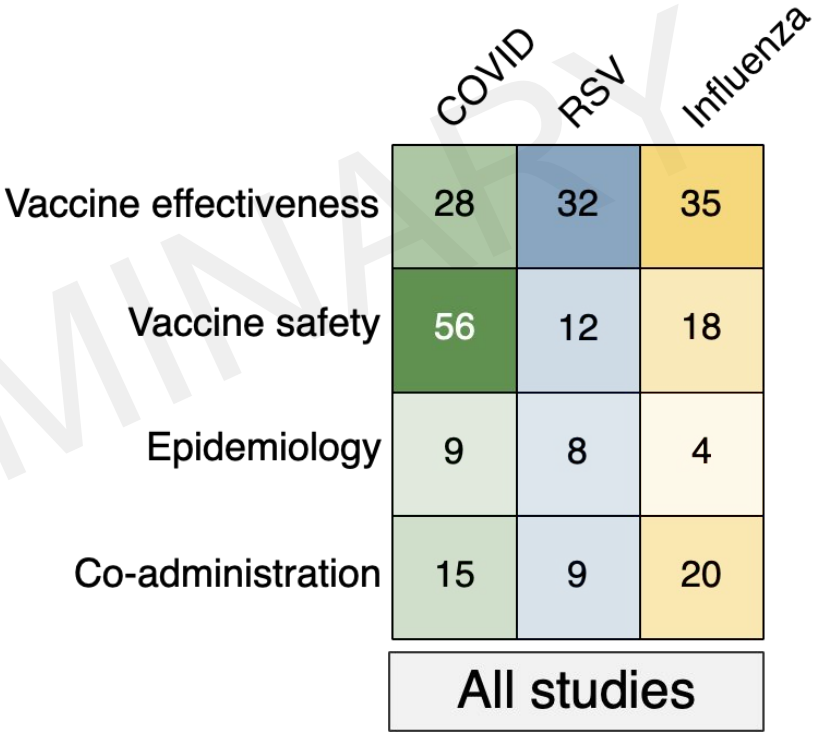
1,406

Full-Text Review

↓

590

Studies Included



Numbers represent studies with completed analysis for the three populations presented today. Analysis of remaining populations is ongoing.

Discussion

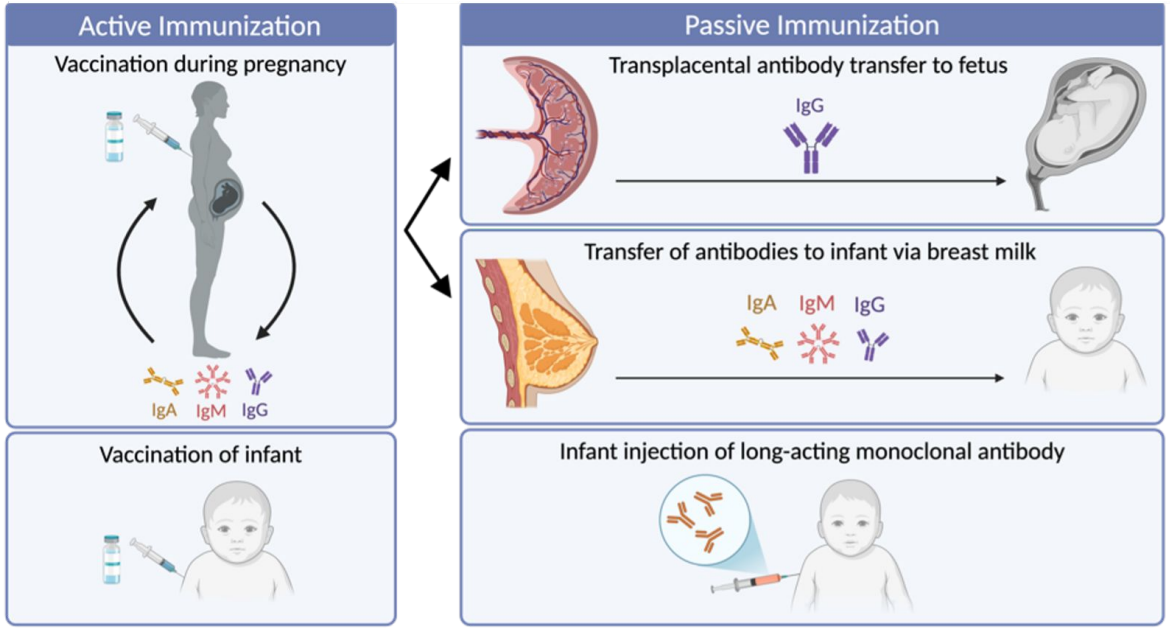
Evidence Base: Pregnancy

Caitlin Dugdale, MD, MSc
Physician, Division of Infectious Diseases, Massachusetts General Hospital
Assistant Professor of Medicine, Harvard Medical School

VACCINE INTEGRITY PROJECT

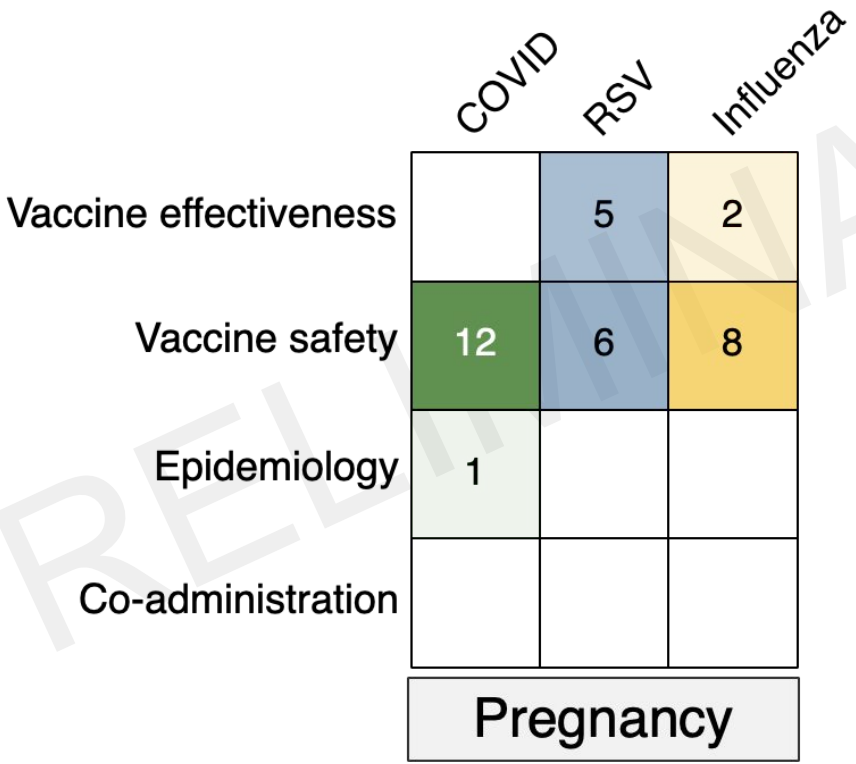
Background: Pregnancy-Specific Considerations

- Some infections (e.g., influenza) are more severe during pregnancy
- Infections in pregnancy may also increase the risk of preterm birth, stillbirth, and other adverse birth outcomes
- Immunizations during pregnancy can provide protection to the newborn during the first few months of life



Adapted from Cho 2024

Analysis: Pregnancy
Overall Distribution of Included Studies



Analysis: Pregnancy Epidemiology

- We identified one study (Metz 2024) in the publication window that provided data on epidemiologic trends related to the incidence of long COVID (PASC) and **COVID** vaccination in pregnancy
    - Among 1,502 pregnant patients in the US, incidence of long COVID was 7% among those vaccinated and 12% among those unvaccinated
- No studies were identified that provided new data on epidemiologic trends related to **RSV** or **influenza** infection and/or vaccination in pregnancy

Analysis: Pregnancy
Vaccine Effectiveness (VE) in Pregnancy

- There were no new data on **COVID** or **RSV** vaccine effectiveness in pregnant women in our publication window
- One study (Reeves 2025) found that **influenza** vaccines were 46% (95% CI: 36–55) effective at preventing against influenza-associated ED and urgent care visits in pregnancy during the 2023-2024 flu season

Analysis: Pregnancy
VE for Maternal Vaccines to Prevent Infant Infection - RSV

- 4 studies within the publication window examined the effectiveness of **RSV** vaccination in pregnancy to prevent infant hospitalization
  - 1 randomized controlled trial (MATISSE) found:
    - VE 70% (37%-87%) for hospitalization within 90 days of birth
    - VE 55% (24%-75%) for hospitalization within 180 days of birth
  - 3 test-negative design studies found that RSV vaccination was effective at preventing hospitalization (infants <6m) with a pooled VE of 72% (62%-79%)

Analysis: Pregnancy Safety Outcomes

	COVID	RSV	Influenza
Gestational hypertension		3	1
Pre-eclampsia/eclampsia		4	6
Placental abruption		4	4
Stillbirth	4	3	2
Miscarriage	2		2
Prematurity	6	6	5
Small for gestational age	5	4	5
Congenital defect	4	1	3
Guillain-Barré syndrome		1	1
Stroke		1	1
Myocardial infarction		3	

	BNT162b2	mRNA-1273	Abrysvo	IIV	Influenza - other
Gestational hypertension			3	1	
Pre-eclampsia/eclampsia			4	4	2
Placental abruption			4	3	1
Stillbirth	3	2	3	1	1
Miscarriage	2	2			2
Prematurity	5	3	6	4	1
Small for gestational age	4	2	4	4	1
Congenital defect	3	2	1	3	
Guillain-Barré syndrome			1	1	
Stroke			1	1	
Myocardial infarction			3		

NB: Some of these studies reported qualitative and/or descriptive data without directly comparing the incidence of events between unvaccinated and vaccinated populations.

Analysis: Pregnancy
Safety Outcomes of Special Interest - COVID-19

Safety Outcome	BNT162b2 (Pfizer)		mRNA-1273 (Moderna)	
	# Studies	Findings	# Studies	Findings
Miscarriage*	1	No safety concern	1	No safety concern
Stillbirth†	3	No safety concern	2	No safety concern
Congenital anomalies‡	1	No safety concern	1	No safety concern

*Sheth 2025. LaCroix 2025 also reported miscarriage incidence of 0.4% and 0.0% with BNT-162b2 and mRNA-1273, respectively.
†Denoble 2024, Mensah 2024, Suseeladevi 2024.
‡Jorgensen 2024. Tamir-Hostovsky 2024 also reported similar frequency of major congenital anomalies with and without vaccination: 3/78 (4%) unvaccinated controls, 4/78 (5%) vaccinated cases. Kim 2025 found similar similar rates of congenital malformations between BNT162b2 and mRNA-1273 vaccines (78/1000 births overall, 95%CI: 71-84).

Analysis: Pregnancy
Safety Outcomes of Special Interest - COVID-19 (cont.)

Safety Outcome	BNT162b2 (Pfizer)		mRNA-1273 (Moderna)	
	# Studies	Findings	# Studies	Findings
SGA*	3 studies	No safety concern	1 study	No safety concern
Preterm birth†	3 studies: Mensah 2024 Hall 2025 Suseeladevi 2024	**Mixed, possible protective effect** **OR: 0.86 (0.83, 0.90)** aHR: 1.12 (0.88, 1.42) **aHR: 0.93 (0.87, 0.99) for 32-36 weeks,** **aHR 0.79 (0.65, 0.97) for 24-<32 weeks**	2 studies: Mensah 2024 Hall 2025	**Possible protective effect** **OR: 0.86 (0.81, 0.93)** aHR: 0.84 (0.60, 1.16)

*Hall 2024, Suseeladevi 2024, Tamir-Hostovsky 2024. †Mensah 2024 and Suseeladevi 2024 both conducted in the UK with large sample sizes (514,013 and 284,275 pregnancies, respectively), whereas Hall 2025 was conducted in the US with a smaller sample size (7184 singleton live births). Mensah examined vaccination during pregnancy; Suseeladevi examined vaccination in the 12 months prior to pregnancy. Kim 2025 found similar similar rates of preterm birth between BNT162b2 and mRNA-1273 vaccines (50/1000 births overall, 95%CI: 45-55/1000 births).

Analysis: Pregnancy
Safety Studies of Special Interest - RSVPreF (Abrysvo)

Safety Outcomes	RSVPreF (Abrysvo)	
	# Studies	Findings
Stillbirth*	1	No safety concern
Congenital anomalies*	1	No safety concern
Gestational hypertension/ pre-eclampsia/eclampsia†	2	No safety concern
Placental abruption†	2	No safety concern
Small for gestational age‡	1	No safety concern

*Simões 2025. Alami 2025 - VAERS data: 1 stillbirth from 9/1/23 - 2/23/24. Li 2025 - VAERS data: 4 stillbirths from 5/2023 - 12/2024. †Simões 2025, JinHsieh 2025. Alami 2025 - VAERS data: 2 gestational hypertension and 2 pre-eclampsia from 9/1/23 - 2/23/24. Li 2025 - VAERS data: 7 pre-eclampsia/2 eclampsia from 5/2023 - 12/2024. Alami 2025 - VAERs data: 2 reports 9/1/23 - 2/23/24. Li 2025 - VAERS data: 3 reports from 5/2023 - 12/2024. ‡JinHsieh 2025, Otsuki 2024.

Analysis: Pregnancy
Safety Outcomes of Special Interest - RSVPreF (Abrysvo)

Safety Outcome	RSVPreF (Abrysvo)	
	# Studies	Findings
Preterm birth*	2 studies: Madhi 2025 Jin Hsieh 2025	**Possible association** **RR: 1.20 (0.98, 1.46)** aRR: 1.01 (0.89, 1.15)

*Alami 2025 - VAERS data: 27 from 9/1/23 - 2/23/24. Li 2025 - VAERS data: 88 from 5/2023 - 12/2024.

- MATISSE (Madhi2025) was a randomized controlled trial that enrolled pregnant women 6/2020-10/2023 to either RSVPreF vaccine (Abrysvo) or placebo between 24-36 weeks
  - Women enrolled from low- and middle-income countries had an increased risk of preterm birth
  - Based on data from this trial and a GSK RSV vaccine trial (no longer in development), CDC guidelines recommend RSV vaccine between 32-36 wks to reduce potential risk of preterm birth
- Jin Hsieh (9/23-4/24) used real world data, implementing CDC guidelines to give Abryvso 32-36 wks, 6387 vaccinated vs 6387 unvaccinated individuals

Analysis: Pregnancy
Safety Outcomes of Special Interest - Influenza

Safety Outcomes	# Studies	Findings
Miscarriage*	2 studies: Regan 2023 (2013-2022) Regan 2024 (2009-2018)	**Possible protective effect** aHR: 0.83 (0.47, 1.47) **aHR: 0.61 (0.50, 0.74)**
Stillbirth†	1	No safety concern
Placental abruption‡	2	No safety concern
Congenital anomalies§	2	No safety concern

*Regan 2023: Data from PRESTO prospective cohort study. Regan 2024: Claims data from Optum Labs Data Warehouse.†Regan 2024. Hsiao 2024 found that the risk of adverse birth outcomes were similar with age-appropriate inactivated influenza vaccine (SD-IIV) or recombinant influenza vaccine (RIV).‡Hsiao 2024, Getahun 2024. Fell 2024 and Choi 2025 also report on incidence. §Malange 2025, Lee 2025. Melange 2025 found possible protective effect of vaccination against cleft lip ± cleft palate and gastroschisis. Hsiao 2024 found no difference between SD-IIV and RIV as above.

Analysis: Pregnancy
Safety Outcomes of Special Interest - Influenza

Safety Outcome	# Studies	Findings
Gestational hypertension/ pre-eclampsia/eclampsia	3 studies: Getahun 2024 (2004-2018) Lee 2025 (2019-2022) Regan 2024 (2009-2018)	**Mixed findings*** aRR: 1.10 (0.99, 1.21) **aRR: 0.76 (0.72, 0.80)** **RR: 1.07 (1.03, 1.12)**

*Lee 2025: Linked mother-child database in Korea with 174,008 pregnancies examined. Used propensity score matching. Beneficial association remained when immunization examined separately for 1st, 2nd, and 3rd trimester administration. Regan 2024 used claims data from 117,626 pregnancies in the Optum Labs Data Warehouse in the US. Choi 2025, Hsaio 2024, and Fell 2024 also provide additional incidence data. Hsiao 2024 found that the risk of adverse birth outcomes were similar with age-appropriate inactivated influenza vaccine (SD-IIV) or recombinant influenza vaccine (RIV).

Analysis: Pregnancy
Safety Outcomes of Special Interest - Influenza

Safety Outcomes	# Studies	Findings
Preterm birth*	1 study: Getahun 2024 (2004-2018)	**Possible protective effect** **aRR: 0.83 (0.78, 0.89)**
Small for Gestational Age*	1 study	No safety concern

*Lee 2025 also provides data on incidence, but had single outcome for “preterm birth or low birth weight.” Linked mother-child database in Korea with 174,008 pregnancies examined. Used propensity score matching. Getashun 2024 used Vaccine Safety Datalink data from 2004-2018 amongst a cohort that had two successive pregnancies. Hsiao 2024 found that the risk of these adverse birth outcomes were similar with age-appropriate inactivated influenza vaccine (SD-IIV) or recombinant influenza vaccine (RIV). Fell 2024 and Choi 2025 also provide incidence data not amenable to comparative analysis.

Analysis: Pregnancy
Other Safety Studies

- Other safety studies of special interest:
  - Simões 2025 (MATISSE) - No reported episodes of Guillain-Barré syndrome, stroke, or myocardial infarction with RSVpreF (Abrysvo)
  - Jin Hsieh 2025 - Similar risks of major adverse cardiovascular events with RSVPreF (Abrysvo)
  - Lee 2025 - Risks of Guillain-Barré syndrome and stroke with (vs without) influenza immunization in pregnancy were no higher
  - Several studies provided data on safety outcomes not previously identified as of special interest (e.g., postpartum hemorrhage, gestational diabetes)
  - During our initial review, no major concerning safety signals were identified; these data will be further analyzed at a later date

Analysis: Pregnancy Co-administration

- There were no studies from our publication window that provided new data on the safety or effectiveness of **COVID**, **RSV**, or **influenza** immunizations for pregnant women when used in combination with other vaccines

Analysis: Pregnancy Conclusions

- There were no new epidemiologic data for **influenza** and **RSV** in pregnancy
- New studies supported the effectiveness of **influenza** vaccination to reduce medically-attended infection in pregnant women and of **RSV** vaccination in pregnancy to reduce hospitalization among newborns
- We reidentified the known potential increased risk of preterm birth with **RSVPreF** (Abrysvo), particularly if given early in pregnancy (MATISSE)
- For all other pregnancy outcomes examined, the risk of adverse outcomes with **COVID**, **RSV**, or **influenza** immunization in pregnancy was similar to or less than not receiving immunization during pregnancy

Discussion

Evidence Base: Pediatrics

Harleen Marwah, MD, MSc
Physician, Department of Pediatrics, Massachusetts General Brigham for Children
Instructor of Pediatrics, Harvard Medical School

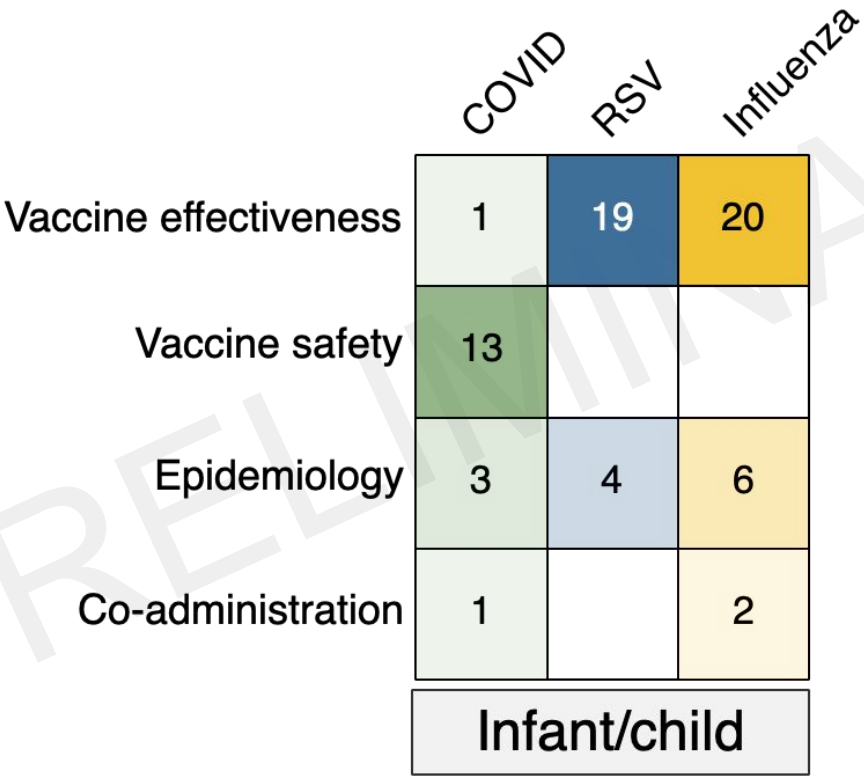
VACCINE INTEGRITY PROJECT

Background: Pediatric-Specific Considerations

Image Source: Harvard Center on the Developing Child

- Infants <6 months are at high risk for severe disease from many infections because their immune systems are still maturing
- Immunizations given to a mother during pregnancy cross the placenta to protect infants during their first few months of life
- Children, generally, are at increased risk for serious illnesses from many infections as they are in critical stages of development
- Illness in children may lead to missed school/work days for them or their caregivers, having broader consequences on development and family stability

Analysis: Pediatrics
Overall Distribution of Included Outcomes



Analysis: Pediatrics Epidemiology

Virus	# Studies	Dates	Ages	Setting	# individuals	Outcomes reported
COVID	3	9/2022 - 8/2024	0-18 years, *2/3 in early childhood**	National and Regional	18,553	• Maternal vaccination status • Hospitalization rates and outcomes • Prevalence and incidence of co-detection
RSV	4	10/2018-2 /2025	0-18 years, *2/4 in early childhood**	National, Regional, and Single-site	69,266	• Viral gene sequencing patterns • Hospitalization rates and outcomes • Prevalence and incidence of co-detection
Influenza	6	2010 - 2/2025	0-18 years, *2/6 in early childhood**	National and Regional	36,553	• Prevalence and incidence of co-detection • Outpatient visits and hospitalizations • Hospitalization outcomes • Trends in influenza-associated encephalopathy

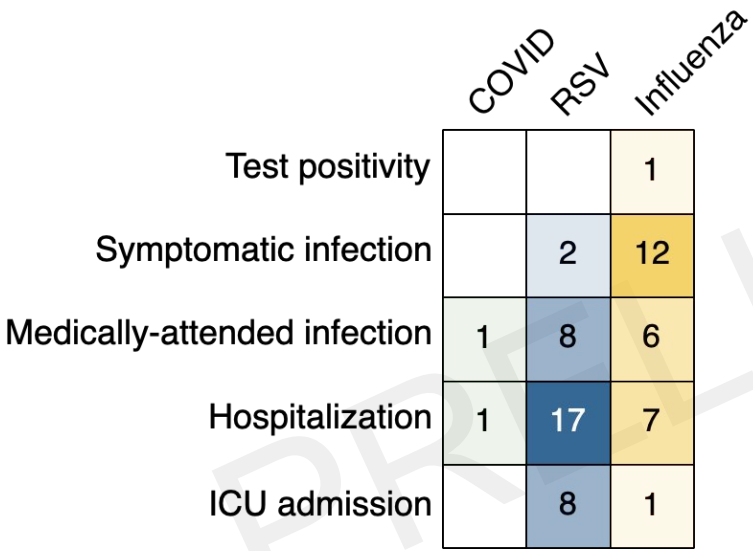
*Early childhood defined here as < 5 years

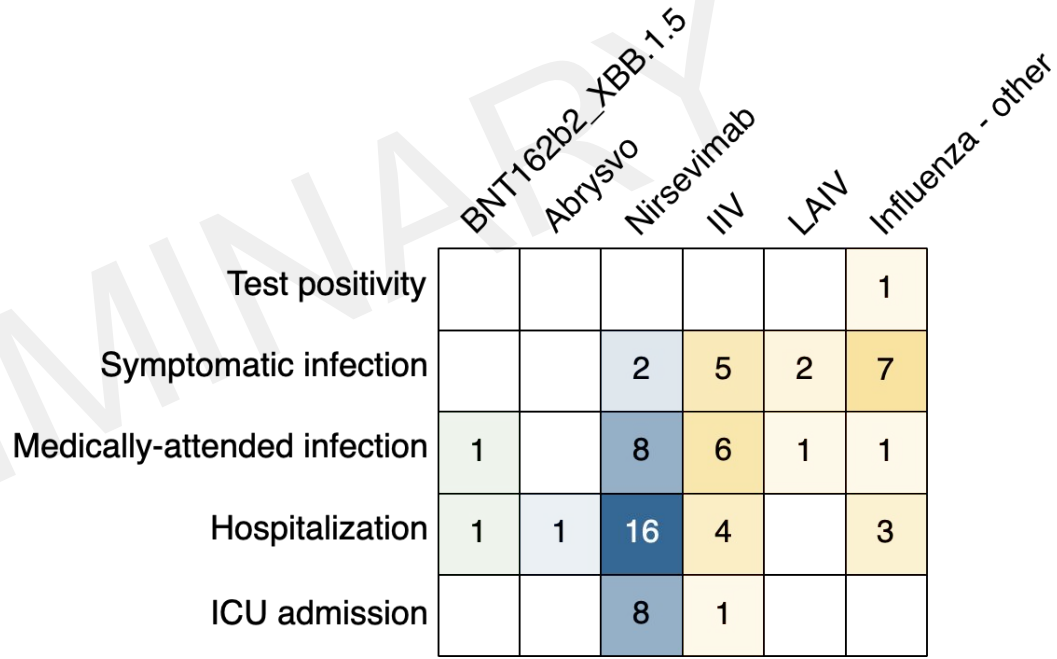
Analysis: Pediatrics
Epidemiology - Influenza Associated Encephalopathy (IAE)

- Our search identified 2 new studies that reported on influenza-associated encephalopathy
  - Fazal 2025 observed that the proportion of cases of IAE among influenza-associated pediatric death varies by year:
    - 2011-12 14%
    - 2020-21 0%
    - 2024-25 13%*
  - Silverman 2025: 32 of 38 cases of IAE with available history had not received age-appropriate seasonal influenza vaccination
  - Silverman 2025: 11 of 41 patients with IAE died from complications related to the illness; 10 of these 11 patients had not received age-appropriate seasonal influenza vaccination

*Through 2/8/25

Analysis: Pediatrics
Vaccine Effectiveness (VE)





Analysis: Pediatrics (5-17 Years)
BNT162b2 COVID Effectiveness vs ED or Hospitalizations

Studies (1 study)	VE (95% CI) vaccination vs. no vaccination	Interpretation
Tartof 2024	65% (36-81%)	**Protective***

*Among those ages 5 to 11 and 12 to 17 years, respectively, estimated adjusted BNT162b2 XBB vaccine effectiveness was 68% (95% CI, 11%-88%) and 63% (95% CI, 20%-83%) against COVID-19–associated hospital admission or ED or urgent care visits.
Study was carried out from 10/2023-4/2024.

Analysis: Pediatrics (Children <24 Months)
Nirsevimab Effectiveness vs RSV Hospitalization

Studies (13 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Ares-Gómez 2024	82 (66 to 90)	**Protective***
Barbas Del Buey 2024	88 (68 to 95)	
Carbajal 2024 (0-3m)	78 (62 to 88)	
Carbajal 2024 (4-6m)	88 (71 to 97)	
Carbajal 2024 (7-12m)	89 (72 to 97)	
Coma 2024†	88 (82 to 91)	
Guerrero-del-Cueto 2025	92 (72 to 97)	
Lefferts 2024	93 (64 to 99)	
Moline 2025	93 (82 to 97)	

*Exact age inclusion criteria vary by study (e.g., <6 months, <12 months). Future analyses may present results by finer age categories.
† Coma 2024 and Perramon-Malavez 2025 may have included overlapping populations

Analysis: Pediatrics (Children <24 Months) Nirsevimab Effectiveness vs RSV Hospitalization (Cont.)

Studies (13 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Munro 2025†	83 (68 to 92)	Protective*
Núñez 2025	88 (83 to 91)	
Perramon-Malavez 2025‡	74 (61 to 82)	
Rius-Peris 2025	68 (44 to 81)	
Silva-Afonso 2025	64 (10 to 86)	
Torres 2025	76 (73 to 79)	

*Exact age inclusion criteria varied by study (e.g., <6 months, <12 months). Future analyses may present results by finer age categories.
† Randomized controlled trial
‡ Coma 2024 and Perramon-Malavez 2025 may have included overlapping populations

Of these 13 studies reporting on vaccine effectiveness, VE ranged from 64% - 93% indicating overall protective effect of Nirsevimab on RSV-Hospitalization for patients < 24 months.

Analysis: Pediatrics (Children <24 Months) Nirsevimab Effectiveness vs RSV ICU Admission

Studies (6 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Ares-Gómez 2024	10/9408 recipients vs 0/851 non-recipients*	Protective†
Barbas Del Buey 2024	91 (-4 to 99)	
Coma 2024‡	90 (76 to 96)	
Marouk 2025	51 (11 to 74)	
Perramon-Malavez 2025‡	85 (72 to 93)	
Torres 2025	84 (79 to 88)	

*Too few events in the study to calculate incident rate ratios. †Exact age inclusion criteria varied by study (e.g., <6 months, <12 months). Future analyses may present results by finer age categories.

‡Coma 2024 and Perramon-Malavez 2025 may have included overlapping populations

Of these 6 studies reporting on vaccine effectiveness, VE ranged from 51% - 91% indicating overall protective effect of Nirsevimab on RSV-ICU Admission for patients < 24 months.

Analysis: Pediatrics (Children <24 Months)
Nirsevimab Effectiveness vs Medically-Attended RSV

Studies (5 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Arbeter 2024† Barbas Del Buey 2024 Lefferts 2024 Moline 2025 Perramon-Malavez 2025	78 (64 to 86) 17 (-6 to 35) 82 (62 to 91) 89 (79 to 94) 53 (10 to 77)	**Protective***

*Exact age inclusion criteria vary by study (e.g., <6 months, <12 months). Future analyses may present results by finer age categories.
†Randomized controlled trial

Of these 5 studies reporting on vaccine effectiveness, VE ranged from 17% - 89% indicating overall protective effect of Nirsevimab on Medically-Attended RSV for patients < 24 months.

Analysis: Pediatrics (All Children <18 Years)
Vaccine Effectiveness - Influenza Hospitalization and ICU Admission

Studies (7 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Shinjoh 2024	Flu A: 51 (23 to 69); Flu B: 60 (22 to 79)	**Protective**
Tenforde 2024	58 (44 to 69)	
Shinjoh 2025	75 (62 to 85)	
Pérez-Gimeno 2024	77 (21 to 93)	
Frutos 2024	NVSN: 56 (30 to 73); VISION: 46 (7 to 69)	
Frutos 2025	NVSN: 63 (41 to 76); VISION: 78 (60 to 89)	
Lee 2024	Flu A(H1N1): 55 (30 to 72); Flu A(H3N2): 54 (33 to 69) Flu B: 66 (42-80)	

Some studies presented age-specific results for younger (e.g., 6 months to 5 years of age, 6 months to 8 years of age) and older (e.g., 5-17 years, 9-17 years) or more broadly (e.g., 2-14 years, or all children <18 years). Future analyses may present results by finer age categories.
Some studies presented influenza type- and subtype-specific results (e.g., influenza A (all subtypes), A(H1N1), A(H3N2), and B). Where possible, we present type/subtype-specific results.

In these 7 studies, VE ranged from 46% - 78% indicating overall protective effect of influenza vaccination on influenza-hospitalization or ICU admission (< 18y).

Analysis: Pediatrics (All Children <18 Years)
Vaccine Effectiveness - Medically-Attended Influenza†‡

Studies (15 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Shinjoh 2024†	Flu A: 54 (27 to 71); Flu B: 56 (26 to 74)	**Protective**
Tenforde 2024†	58 (44 to 69)	
Chung 2025‡	59-68 (35 to 79) (range by age)	
Shinjoh 2025†	64 (42 to 78)	
Pérez-Gimeno 2024†	70 (51 to 81)	
Frutos 2024‡	NVSN: 55 (41 to 66); VISION: 59 (55 to 62); US Flu VE: 46 (15 to 67)	
Frutos 2025‡	NVSN: 59 (47 to 68); VISION: 60 (56 to 63); US Flu VE: 32 (1 to 54)	
Kissling 2025‡	70 (61 to 78)	

Some studies presented age-specific results for younger (e.g., 6 months to 5 years of age, 6 months to 8 years of age) and older (e.g., 5-17 years, 9-17 years) or more broadly (e.g., 2-14 years, or all children <18 years). Future analyses may present results by finer age categories.
Some studies presented influenza type- and subtype-specific results (e.g., influenza A (all subtypes), A(H1N1), A(H3N2), and B). Where possible, we present type/subtype-specific results.
† Studies present VE for IIV (inactivated influenza vaccine) only.
‡Studies present VE for IIV and LAIV (live attenuated influenza vaccine), non-differentiated.

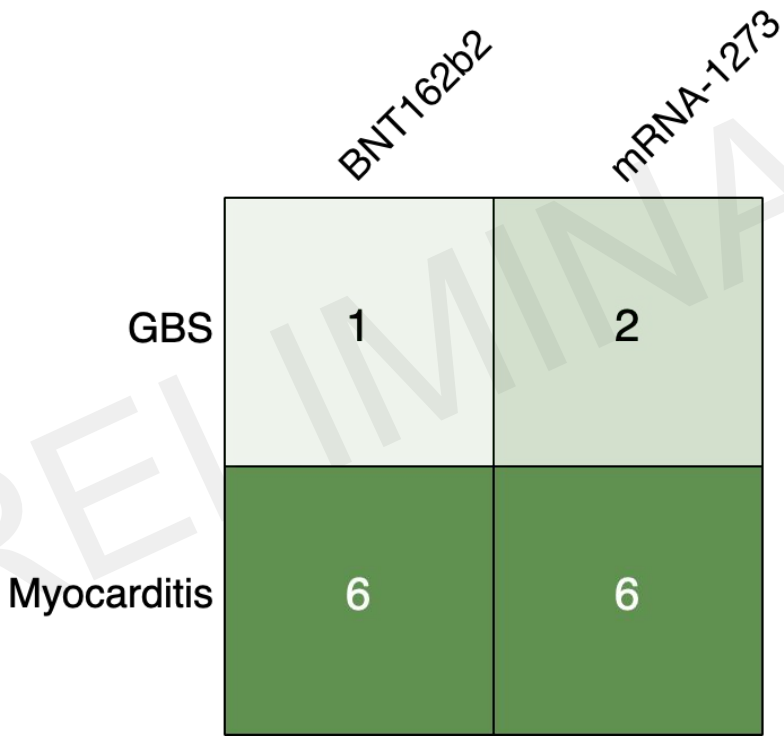
Analysis: Pediatrics (All Children <18 Years)
Vaccine Effectiveness - Medically-Attended Influenza (cont.)

Studies (15 studies)	VE, % (95% CI) vaccination vs. no vaccination	Interpretation
Rigamonti 2025§	IIV: 58 (44 to 68); LAIV: 40 (25 to 52)	**Protective**
Costantino 2024‡	38 (-1 to 62)	
Jiang 2025‡	57 (49 to 64)	
Abou Chakra 2025†	55-92 (32 to 93) (range by age)	
Marron 2024‡	68 (30 to 87)	
Gào 2024‡	39-46 (35 to 49) (range by age)	
Lei 2025‡	42-64 (36 to 72) (range by age)	

Some studies presented age-specific results for younger (e.g., 6 months to 5 years of age, 6 months to 8 years of age) and older (e.g., 5-17 years, 9-17 years) or more broadly (e.g., 2-14 years, or all children <18 years). Future analyses may present results by finer age categories.
Some studies presented influenza type- and subtype-specific results (e.g., influenza A (all subtypes), A(H1N1), A(H3N2), and B). Where possible, we present type/subtype-specific results.
† Studies present VE for IIV (inactivated influenza vaccine) only. ‡ Studies present VE for IIV and LAIV (live attenuated influenza vaccine), non-differentiated. § Study presents VE for LAIV only.

In these 15 studies, VE ranged from 32% - 92% indicating overall protective effect of influenza vaccination on medically-attended influenza in patients < 18 years of age.

Analysis: Pediatrics
Safety Outcomes of Special Interest - COVID



Analysis: Pediatrics
Safety Outcomes of Special Interest - COVID

Safety Outcome	BNT162b2 (Pfizer)		mRNA-1273 (Moderna)	
	Studies‡	Findings	Studies‡	Findings
Myocarditis	Ahn 2024	The overall incidence was 2.25 per 100,000 doses (95% CI, 1.94–2.60), similar to background levels.† The highest incidence rate was observed in males after dose 2 of the primary series.	Figueroa 2024	In 2,490 adolescents ages 12-17 yrs, 1 case (0.04%) of myocarditis detected.
	Copland 2024	In the 42 days after dose 1 and 2, an increased risk of myocarditis was observed in adolescents ages 12-17y (IRR 1.92 and IRR 2.96, dose 1 and 2, respectively).	Berthaud 2024	No new safety concerns were identified with booster.
	Pham-Huy 2024	Majority of cases occurred after the 2nd (12/17) or 3rd vaccine dose (4/17).	Dixit 2024	No new safety concerns were identified with booster.
	Soe 2024	Participant-reported myocarditis cases within 28 days peaked among male adolescents following dose 2 (0.04%, 3/8088).	Soe 2024	Participant-reported myocarditis cases within 28 days peaked among male adolescents following dose 2 (0.53%, 2/378).

†Nasreen 2022 found a 2.9 cases/100,000 population incidence for myocarditis and estimated rates for myo/pericarditis to be <5 per 100,000 for each of 0-4, 5-11, and 12-15 year age groups.

‡Two studies, Ko 2024 and Nv 2024, examined post-hoc reporting of myocarditis cases; rates could not be calculated

Data are consistent with prior literature and emerging adult literature, demonstrating a baseline incidence of myocarditis following COVID-19 vaccination, with higher incidence occurring after dose 2 of primary series, and lower incidence with subsequent booster doses.

Analysis: Pediatrics
Safety Outcomes of Special Interest - COVID

Safety Outcome	BNT162b2 (Pfizer)		mRNA-1273 (Moderna)	
	Studies	Findings	Studies	Findings
Guillain-Barré syndrome (GBS)	Copland 2024†	Ages 5-11yrs, no observed increased risk of GBS in 42 days following vaccination.	Copland 2024† Dixit 2024	Ages 5-11 yrs, no observed increased risk of GBS in 42 days following vaccination; <0.1% of the population received the mRNA-1273 vaccine. Ages 6m-5yrs, the safety profile within 28 days after either dose of the primary series and the booster dose was consistent with that of the primary series; no new safety concerns or vaccine-related serious adverse events (including GBS) observed.

† This analysis lacked power to detect statistically significant associations, except for very large effect sizes.

These data demonstrate no new safety signals with regards to COVID-19 vaccination and Guillain-Barré Syndrome in children 6 months - 11 years of age.

Analysis: Pediatrics
Co-administration

Study	Study design	Vaccines co-administered	Outcomes studied	Findings and interpretation
Walter 2024	Randomized controlled trial	**COVID mRNA vaccine** + **inactivated influenza vaccine (IIV4)**	Reactogenicity, serious adverse events	30 children ages 5-17y enrolled (15 per arm); **no serious adverse events reported in this age group in either arm**
Xu 2025	Self-controlled case series	**COVID mRNA XBB1.5 vaccine** + **seasonal influenza vaccine**	Tinnitus	**No increased risk of tinnitus with influenza vaccine coadministration** in any age group (includes 12-39yr)

Analysis: Pediatrics
Conclusions

- Moderate volume of new data regarding the epidemiology of **COVID**, **RSV**, and **influenza** among children of all ages with new data suggesting pediatric influenza-associated encephalopathy cases have varied by year and rates are higher among unvaccinated groups
- New data on **RSV** immunization showed protective effective of nirsevimab on hospitalization, ICU admission, and medically-attended RSV for patients <24m
- No new safety signals were identified for **COVID booster doses** and myocarditis
- New data on **COVID** and **influenza** co-administration showed no serious adverse events

Discussion

Evidence Base: Immunocompromised

Michael Abers, MD
Physician, Scientist, Assistant Professor of Medicine
Albert Einstein College of Medicine

VACCINE INTEGRITY PROJECT

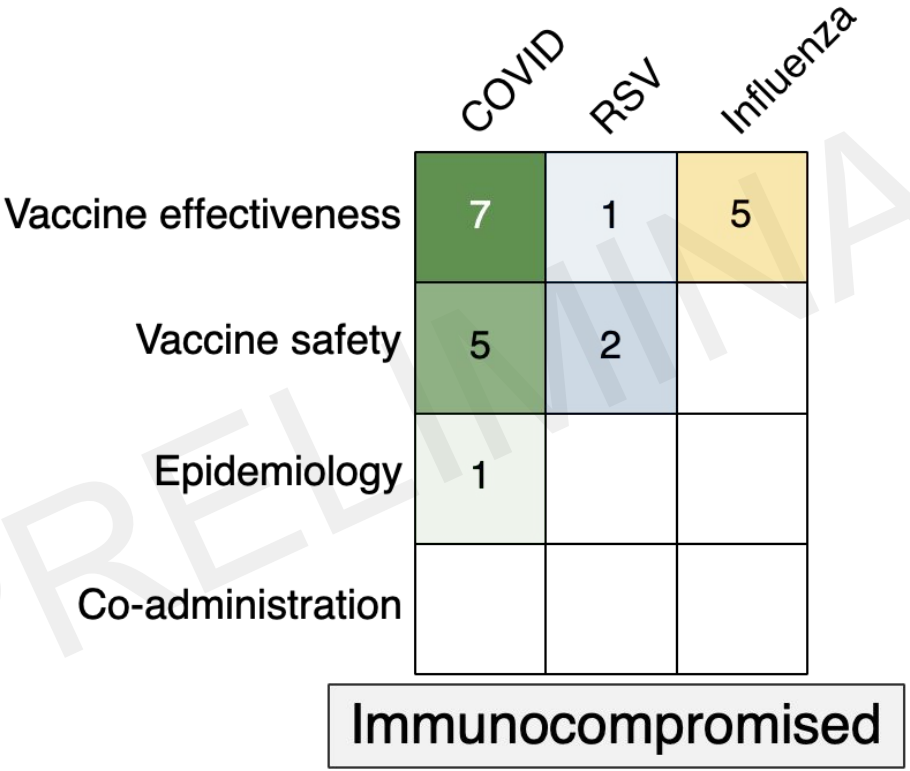
Background: Immunocompromised Specific Considerations

- Immune system is responsible for host-protection against infection
- Vaccines train immune system to rapidly recognize/eliminate pathogens
- Impaired (compromised) immunity leads to:
    - ↑ risk of infection
    - ↑ risk of infectious complications
    - ↓ response to vaccination (↓ vaccine effectiveness)

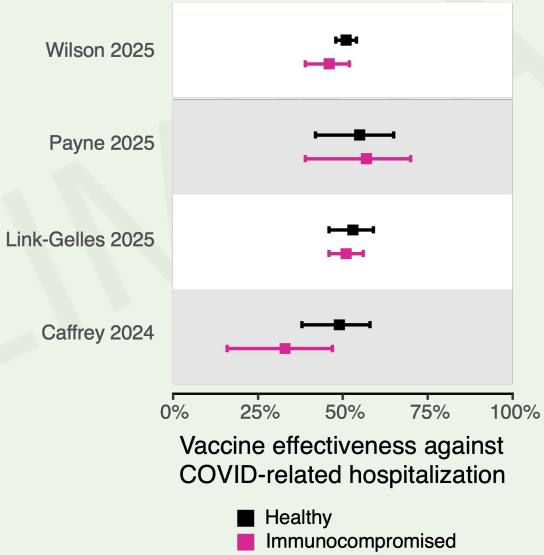
Background: Immunocompromised
Examples of Immunocompromised States

- Following organ transplantation
    - Solid organ transplantation (SOT) - kidney, liver, lung, heart, etc.
    - Bone marrow transplantation (BMT)
- Cancer and cancer treatment
    - Leukemia/lymphoma
    - Chemotherapy for other cancers
- Autoimmunity and other immune system disorders
    - Mostly related to immunosuppressive treatment
- Advanced HIV infection
- Inherited immunodeficiencies

Analysis: Immunocompromised
Overall Distribution of Included Studies



Analysis: Immunocompromised
Effectiveness of COVID- Vaccines - COVID-hospitalization

Virus	# Studies	Patient population	Results*	Interpretation
COVID	4	Adults age ≥ 18 years		• Vaccination is protective against COVID-related hospitalization

* Outcome was COVID-related hospitalization

Analysis: Immunocompromised Effectiveness of RSV Vaccines

Virus	# Studies	Patient population	Results*	Interpretation
RSV	1 (Fry 2025)	Adults age ≥ 60 years	Immunocompetent: VE: 76% (73-78) Immunocompromised: VE: 70% (65-73) SOT: VE: 73% (62-81) BMT: VE: 33% (12-49)	• Vaccination is protective against RSV infection • Lower vaccine effectiveness in BMT recipients, but vaccination still reduces the risk of RSV in this group of patients

* Outcome was acute respiratory infection

BMT = bone marrow transplant. SOT = solid organ transplant

Analysis: Immunocompromised
Safety of RSV Vaccines

Virus	# Studies	Patient population	Results*	Interpretation
RSV	2	Adults ≥ 60y	<u>Guillain-Barré syndrome</u> Abrysvo: IRR 2.4 (1.5-4.0) Arexvy: IRR 1.5 (0.9-2.2)	• Abrysvo: ↑ increased risk of Guillain-Barré syndrome • Magnitude of overall risk is very low (<1 case per 30,000)

* Data are from Fry 2025. Other study (Almeida 2025) reported 0 cases of Guillain-Barré syndrome among 203 patients who received Abrysvo

Analysis: Immunocompromised
Effectiveness of Influenza Vaccines

Virus	# Studies	Patient population	Results	Interpretation
Influenza	4	Adults ≥ 18y	<u>Overall immunocompromised (1 study)</u>: • Lewis 2025: VE for immunocompromised 32% (7-50) vs. 40% (30-49) for immunocompetent <u>SOT (2 studies):</u> • Prins 2025: VE for standard dose vaccine against symptomatic influenza: 7% (-41-38) • Mombelli 2024: MF59-adjuvant or high dose vaccine vs. standard dose vaccine. Insufficient data to draw conclusions about effectiveness	• Vaccination is protective against influenza-related hospitalization • Possible ↓ effectiveness of standard dose vaccine in certain populations (SOT) but wide confidence interval

SOT = solid organ transplantation

Analysis: Immunocompromised Conclusions

- **COVID**
  - Vaccination is protective against COVID-related hospitalization
- **RSV**
  - Vaccination is protective against RSV infection
  - Risk of Guillain-Barré syndrome after Abrysvo is < 1 per 30,000
- **Influenza**
  - Seasonal influenza vaccine is effective at preventing influenza infection
  - Insufficient data to draw conclusions about vaccine effectiveness for standard dose vs. high dose vs. adjuvanted influenza vaccines

Discussion

Data Visualization Tool

Michael Abers, MD
Physician, Scientist, Assistant Professor of Medicine
Albert Einstein College of Medicine

VACCINE INTEGRITY PROJECT

Data visualization tool

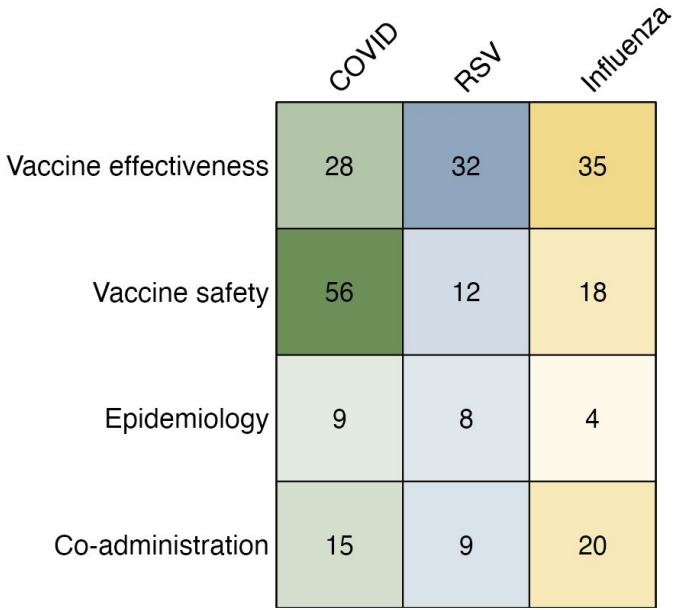
- Complex data set
  - 3 viruses
  - 17 vaccine products
  - 5 patient populations
  - 4 study domains
    - Each with many outcomes
- Goals of data visualization tool:
  - Transparency
  - Reproducibility
  - Allow for customized and interactive analysis
  - Publicly available

Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Patient population

- [x] Infants
- [x] Children
- [x] Adults
- [x] Elderly
- [x] Pregnancy
- [x] Immunocompromised



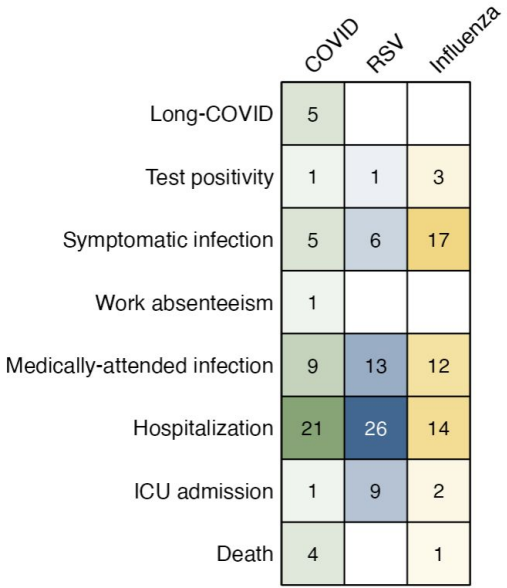
Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Select data

Select plot variables

Plot style



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

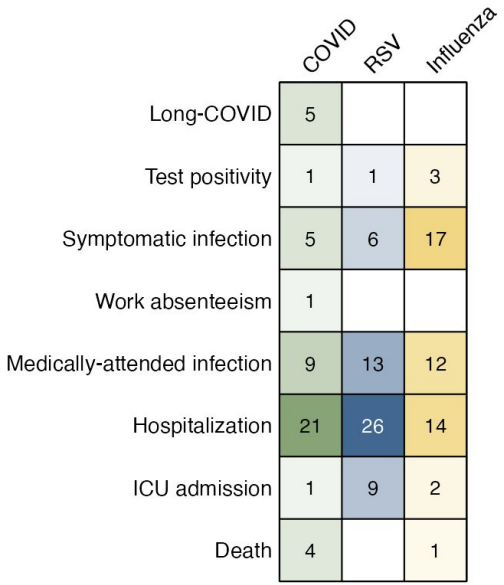
Select data

Patient population

- [x] Infants
- [x] Children
- [x] Adults
- [x] Elderly
- [x] Pregnancy
- [x] Immunocompromised

Virus

- [x] COVID
- [x] RSV
- [x] Influenza



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

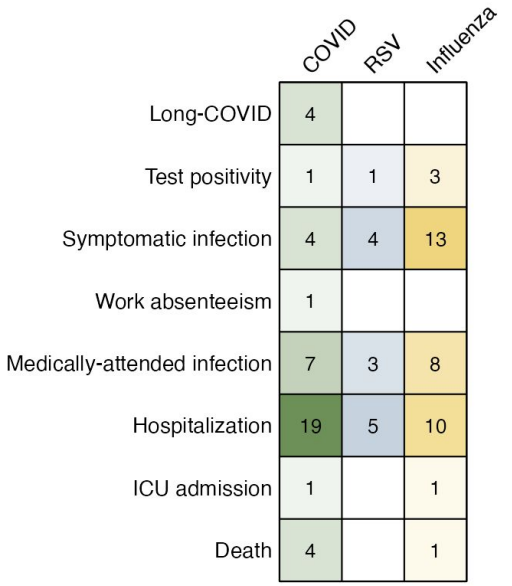
Select data

Patient population

- [ ] Infants
- [ ] Children
- [x] Adults
- [x] Elderly
- [ ] Pregnancy
- [ ] Immunocompromised

Virus

- [x] COVID
- [x] RSV
- [x] Influenza



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Select data

Select plot variables

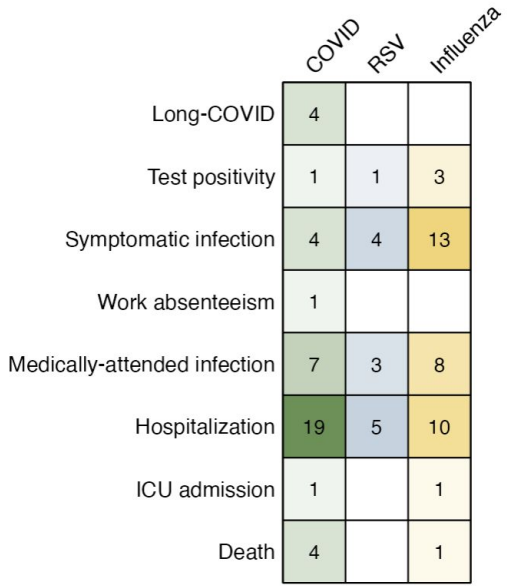
x axis variable

Virus

y axis variable

Study outcome

Plot style



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

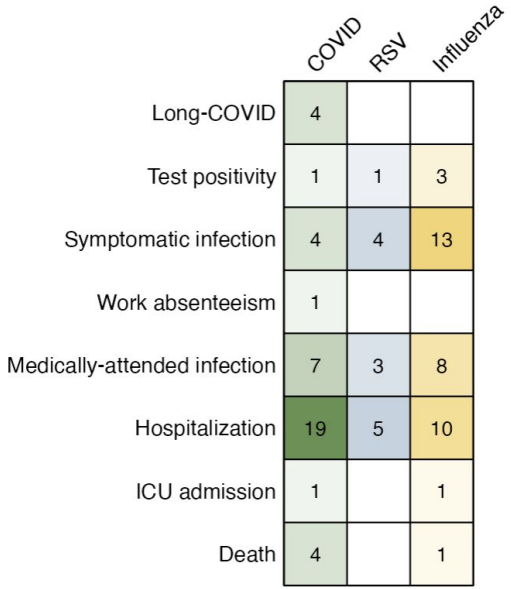
Select data

Select plot variables

x axis variable

Virus

- Virus
- Vaccine
- Patient population
- Study type
- Study outcome
- Study design



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Select data

Select plot variables

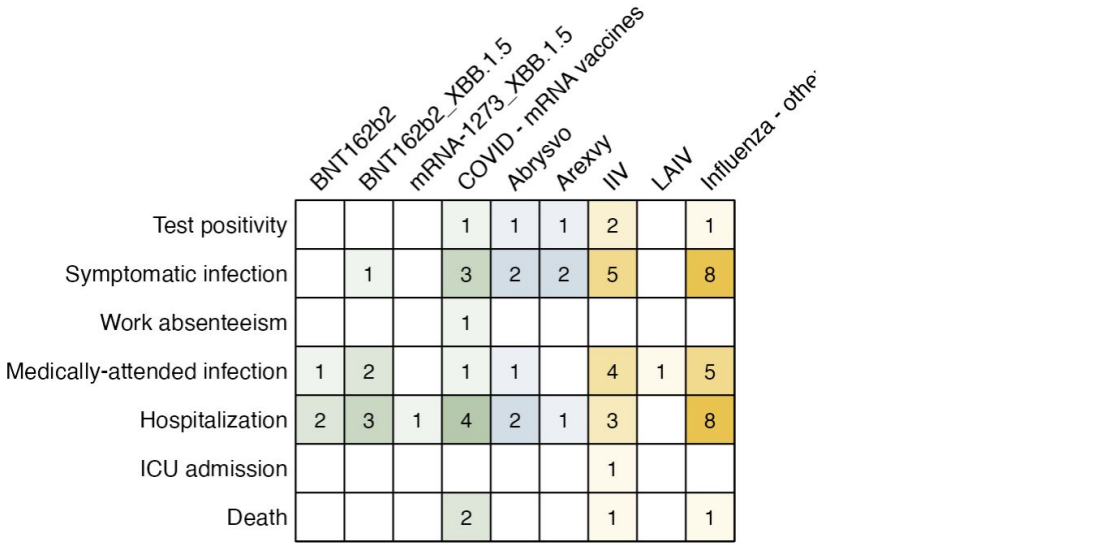
x axis variable

Vaccine

y axis variable

Study outcome

Plot style



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Select data

Select plot variables

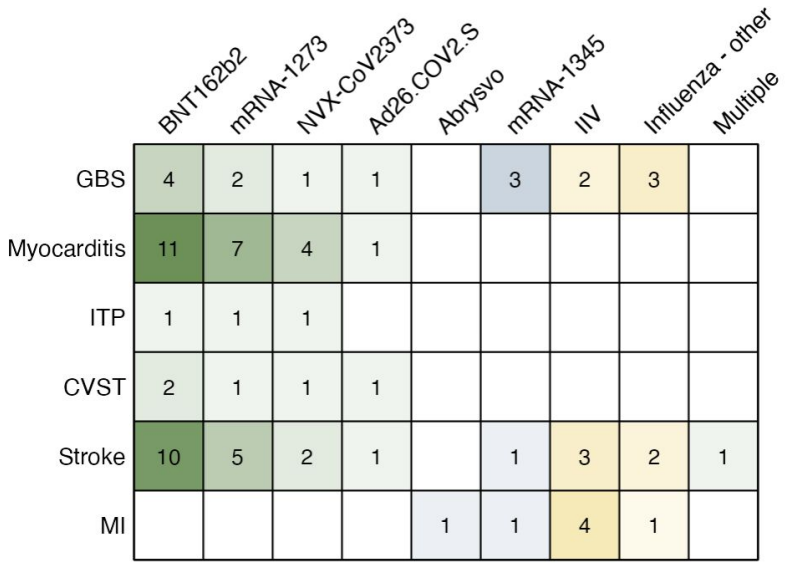
x axis variable

Vaccine

y axis variable

Study outcome

Plot style



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Select data

Select plot variables

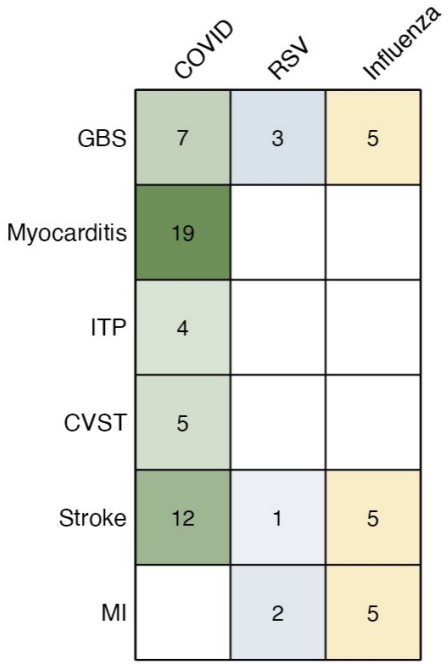
x axis variable

Virus

y axis variable

Study outcome

Plot style



VIP

Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

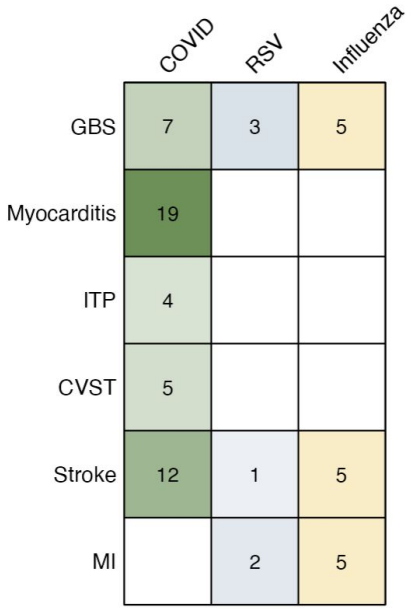
Select data

Patient population

- [ ] Infants
- [ ] Children
- [x] Adults
- [x] Elderly
- [ ] Pregnancy
- [ ] Immunocompromised

Virus

- [x] COVID
- [x] RSV
- [x] Influenza



Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

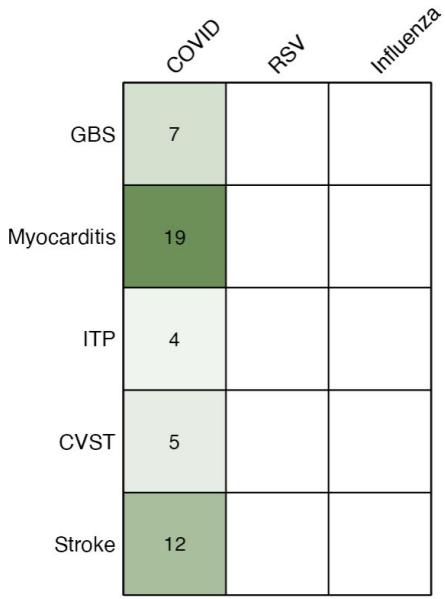
Select data

Patient population

- [ ] Infants
- [ ] Children
- [x] Adults
- [x] Elderly
- [ ] Pregnancy
- [ ] Immunocompromised

Virus

- [x] COVID
- [ ] RSV
- [ ] Influenza



VIP

Vaccine Integrity Project

Study domain | Vaccine effectiveness | Vaccine safety | Meta-analysis | Custom plots

Select data

Select plot variables

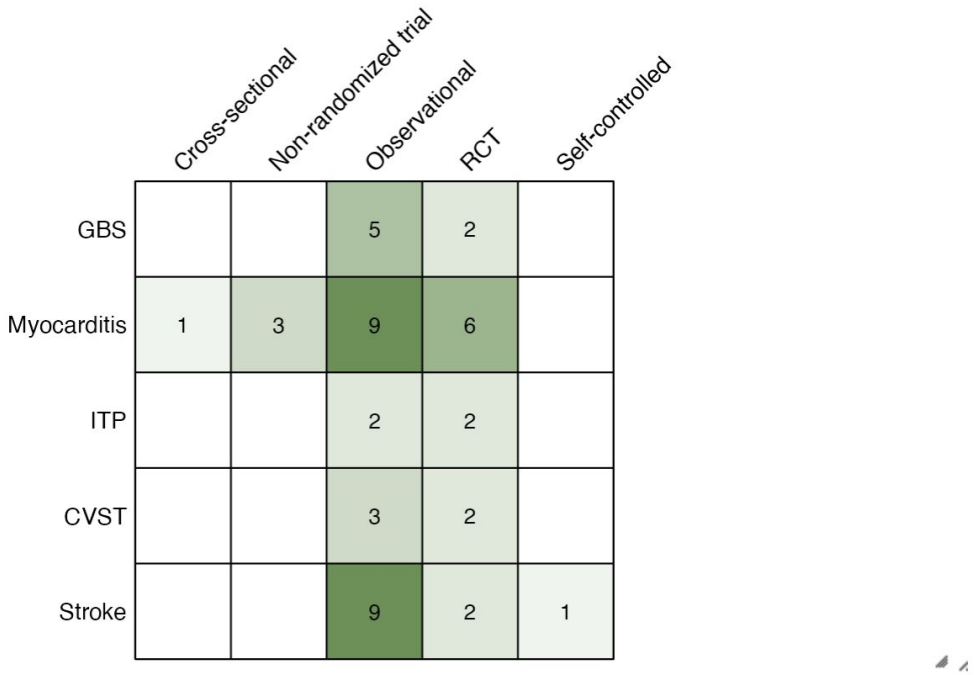
x axis variable

Study design

y axis variable

Study outcome

Plot style



Discussion

Conclusion

Michael Osterholm, PhD, MPH
Director, Center for Infectious Disease Research and Policy, University of Minnesota

Conclusion

- Thank you for attending today's presentation of the Vaccine Integrity Project's Evidence Base for 2025 Fall/Winter Immunizations
- Analysis is ongoing and additional information is coming soon
- Continue to visit our webpage for updates
  - https://www.cidrap.umn.edu/vaccine-integrity-project

Use this QR code to visit the Vaccine Integrity Project webpage

Thank You

VACCINE INTEGRITY PROJECT