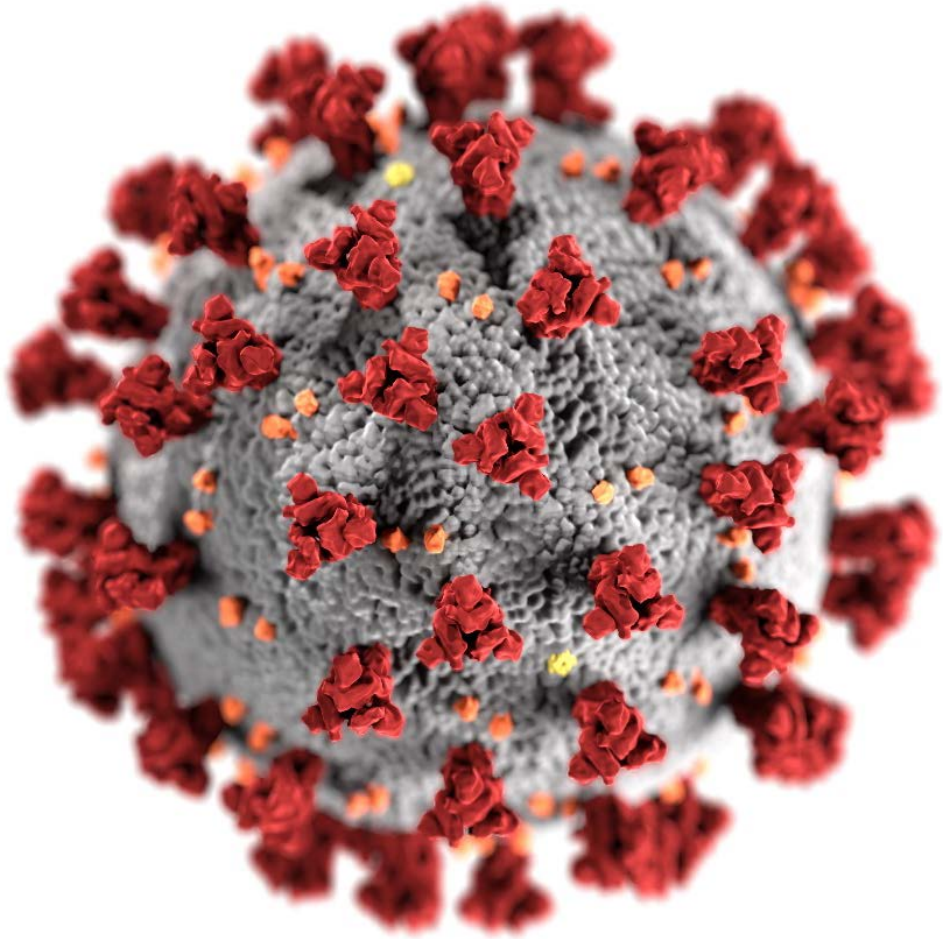
COVID-19 Vaccine Effectiveness for Moderna and Janssen Vaccines



Jefferson Jones, MD MPH FAAP
CDC COVID-19 Response
CDR, US Public Health Service

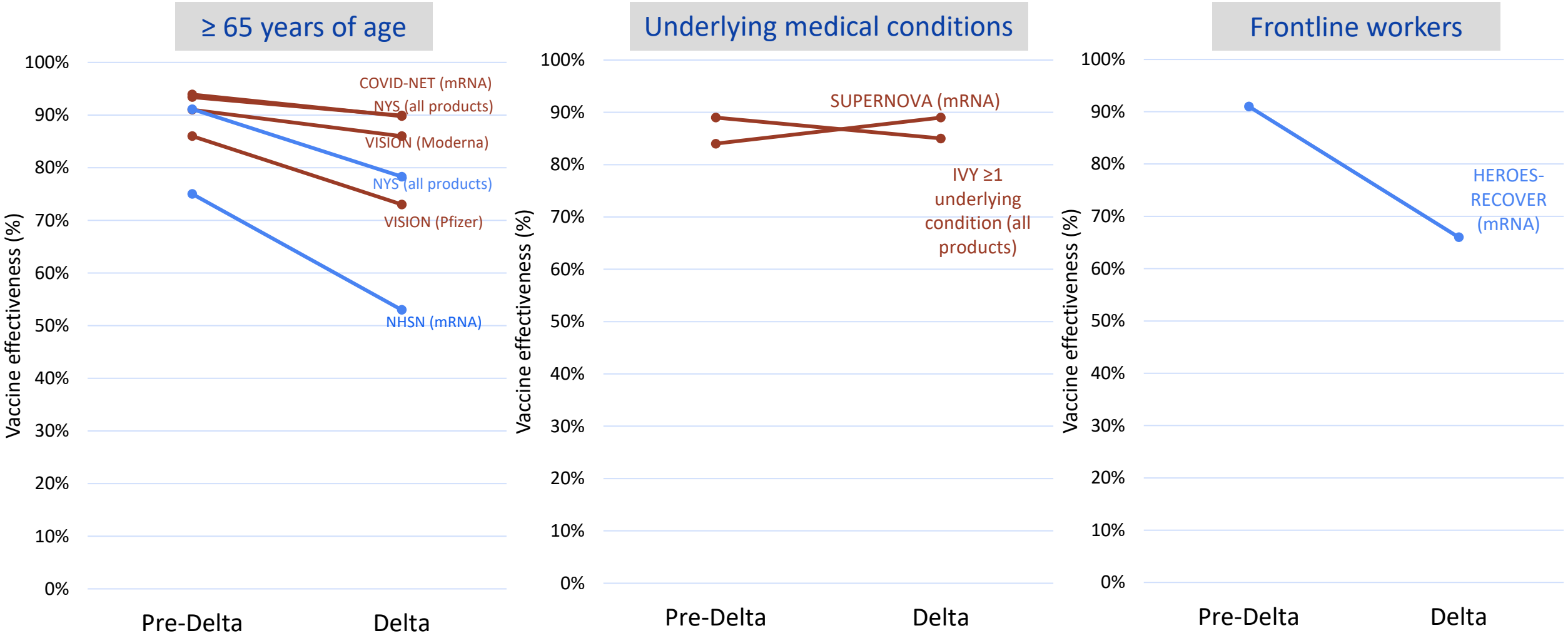
cdc.gov/coronavirus

Monitoring vaccine effectiveness (VE) evidence by risk group, outcome, and product over time

Risk group x Outcome x Product

x Pre-Delta vs. Post-Delta or Time Since Vaccination

VE against infection or hospitalization by Delta predominance*



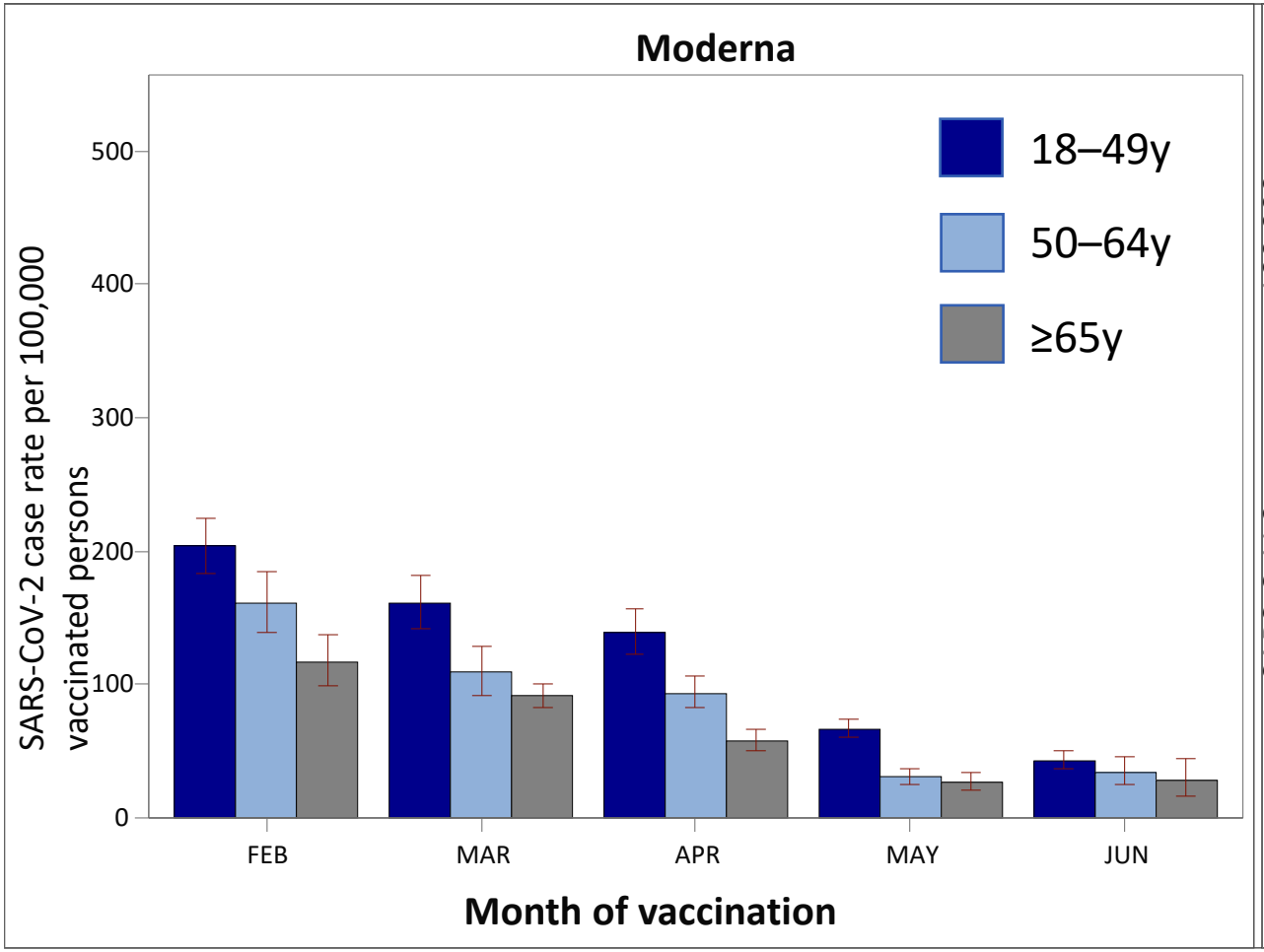
NHSN: https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e3.htm
COVID-NET: CDC unpublished
IVY: CDC unpublished data
NYS: https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e1.htm

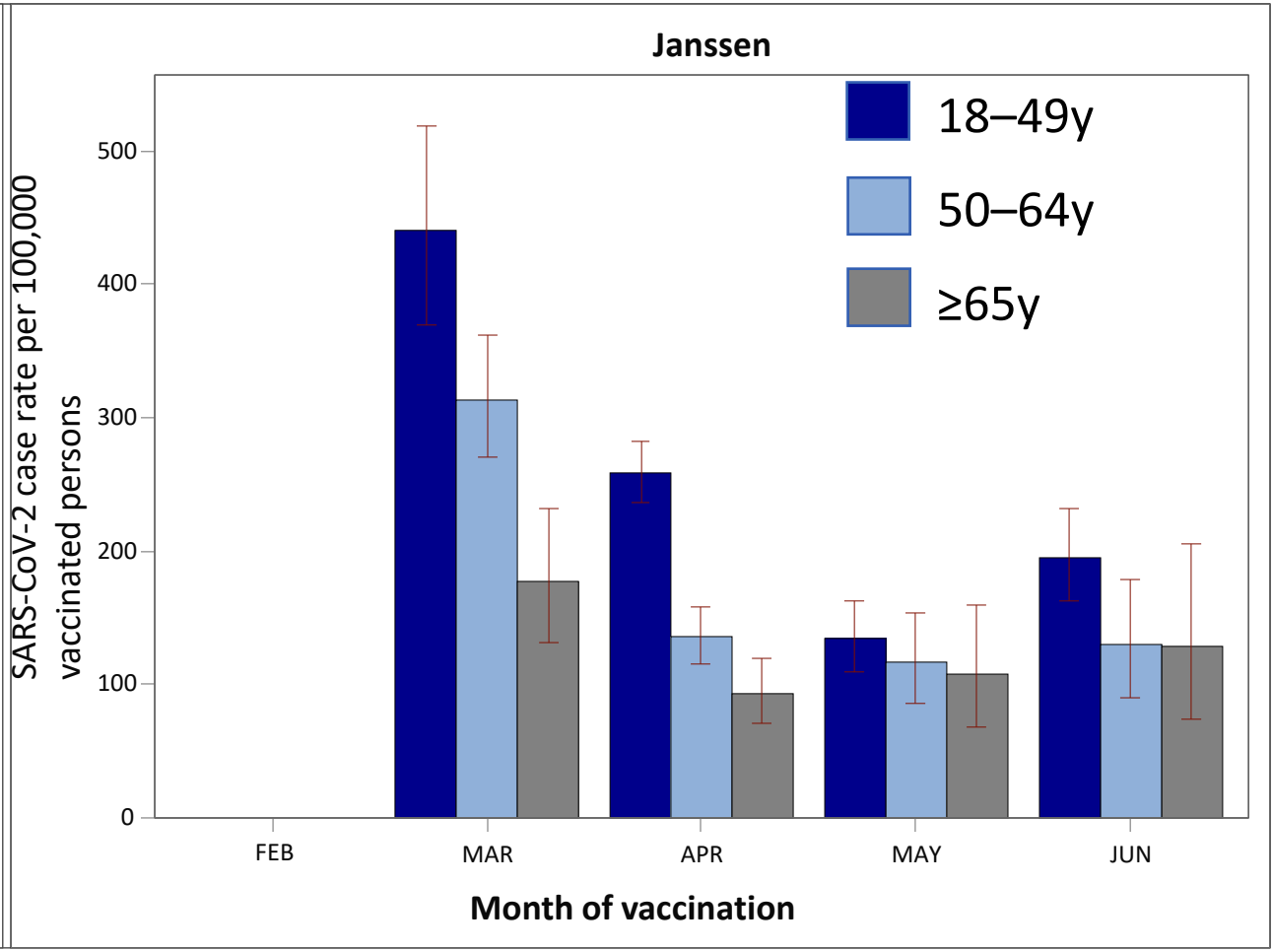
VISION: https://www.nejm.org/doi/10.1056/NEJMoa2110362/ https://www.cdc.gov/mmwr/volumes/70/wr/mm7037e2.htm
SUPERNOVA: https://www.cdc.gov/mmwr/volumes/70/wr/mm7037e3.htm
HEROES-RECOVER: https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e4.htm

*Pre-delta: May 2021 or earlier
Delta: June 2021 or later

Rates of COVID-19 cases and hospitalizations among vaccinated

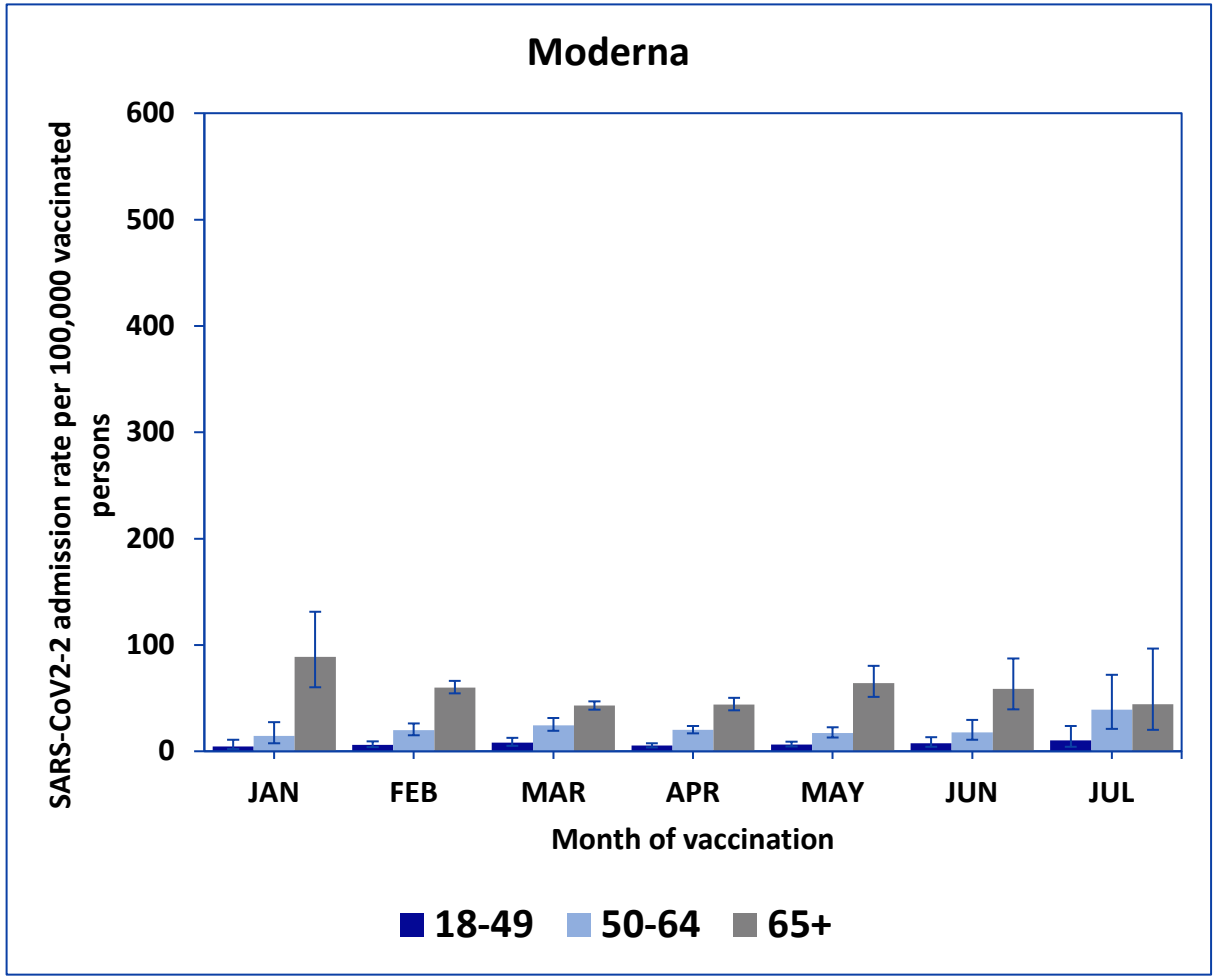
4 state public health departments: COVID-19 infection rates by month of vaccination, vaccine product, and age — July 2021*

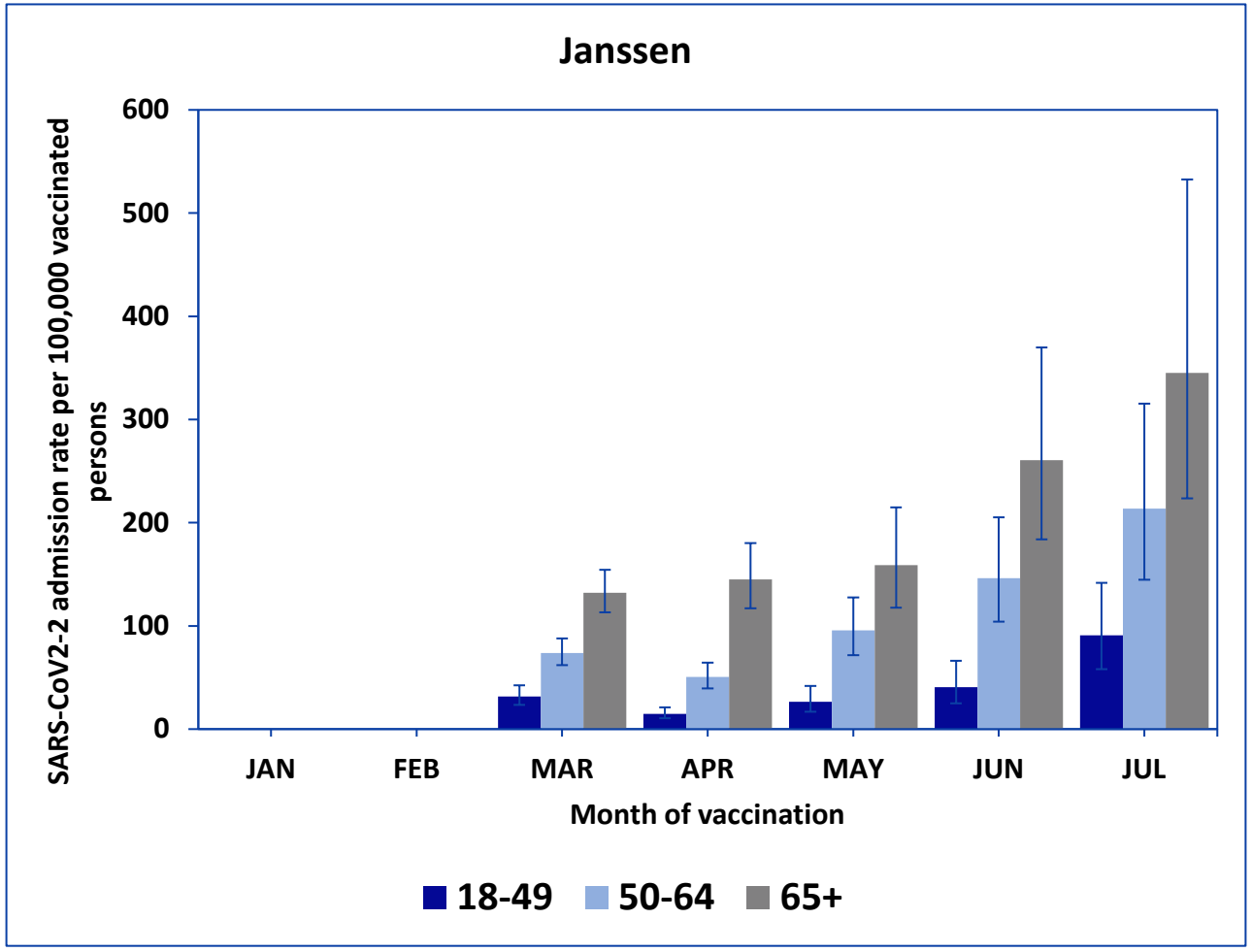




*Utah, Indiana, New Mexico and New Jersey. A fully vaccinated case had SARS-CoV-2 RNA or antigen detected on a respiratory specimen collected ≥14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine.

Cosmos: COVID-19 hospitalization rates by month of vaccination by month of vaccination, vaccine product, and age — United States, August 2021*

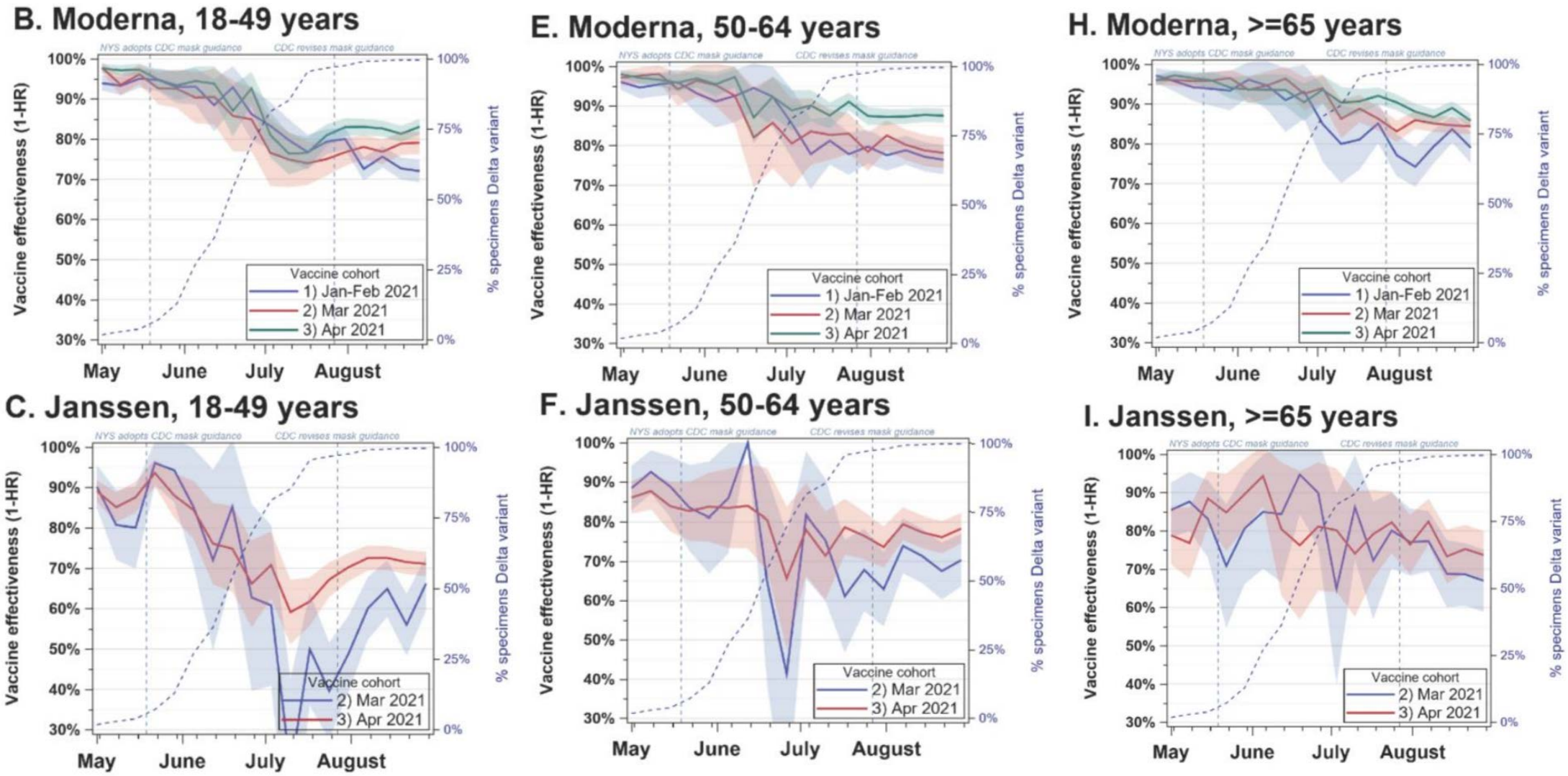




* Hospitals and clinics that use Epic health record system and participate in Cosmos data set. See supplemental slides. COVID-19 hospitalization = hospital admission during which patient had a COVID-19 diagnosis or hospital admission with any respiratory diagnosis within 14 days of a +PCR test or COVID-19 diagnosis

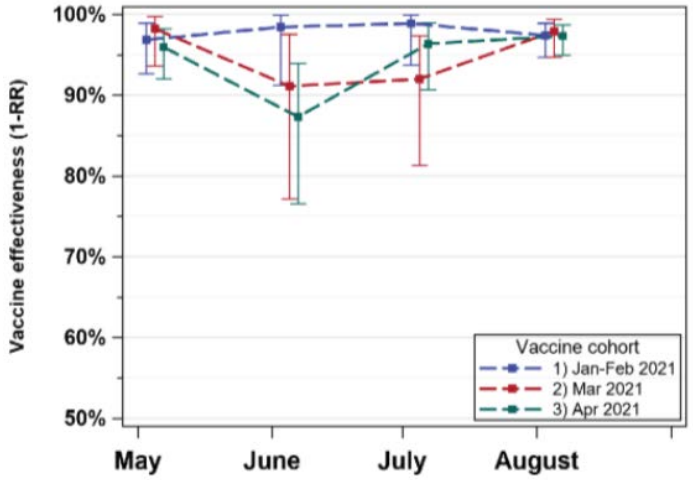
VE among people aged ≥65 years

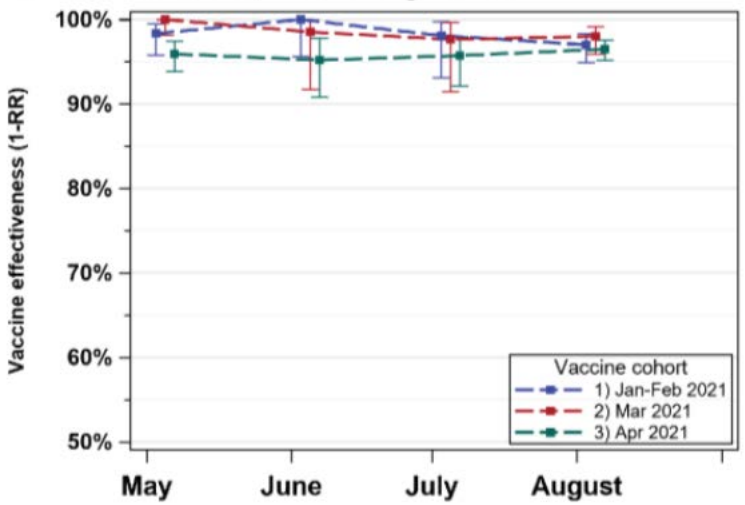
COVID-19 VE against infection by month of vaccination, vaccine product, and age — New York State, May–Aug 2021

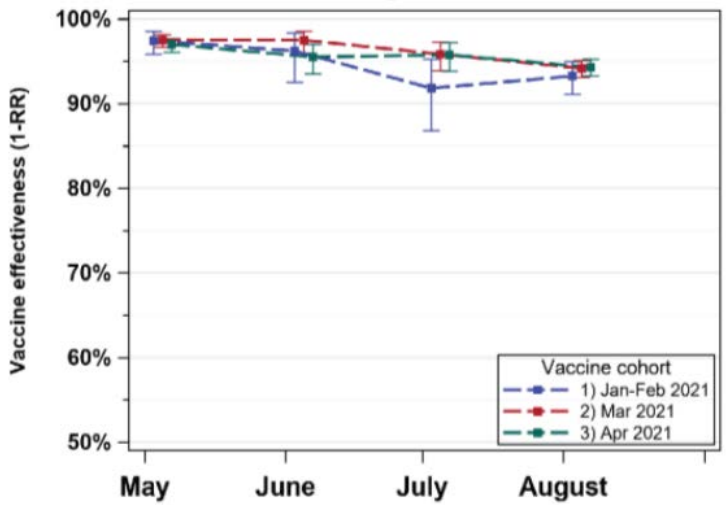


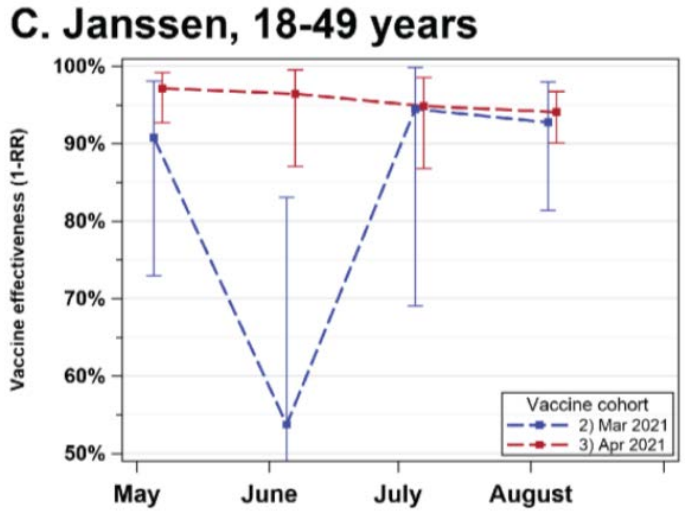
Rosenberg et al. MedRxIV. https://www.medrxiv.org/content/10.1101/2021.10.08.21264595v1.full.pdf

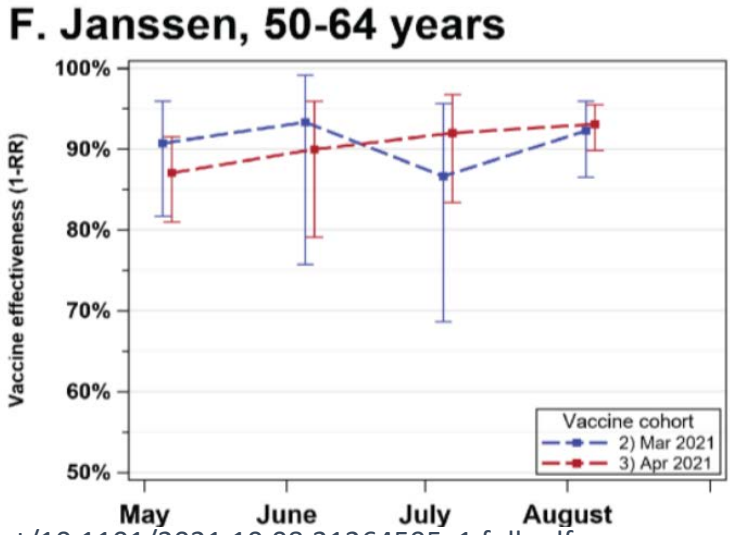
COVID-19 VE against hospitalization by month of vaccination, vaccine product, and age — New York State, May–Aug 2021

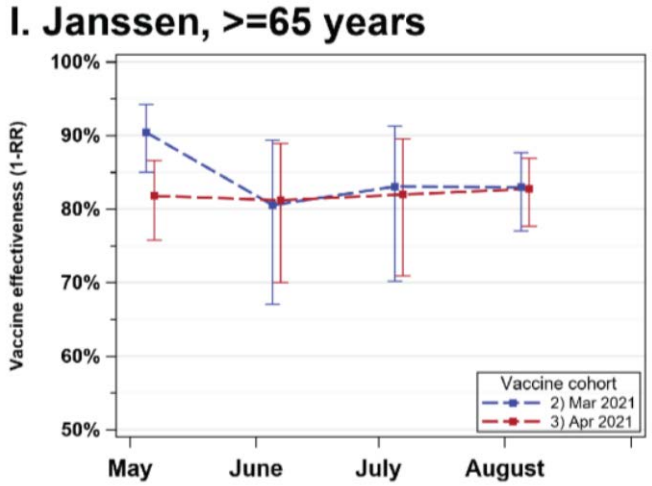








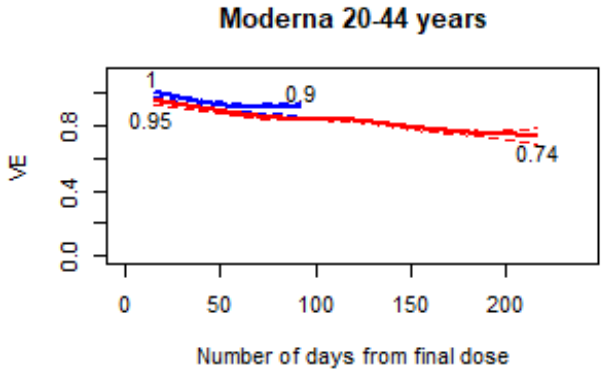


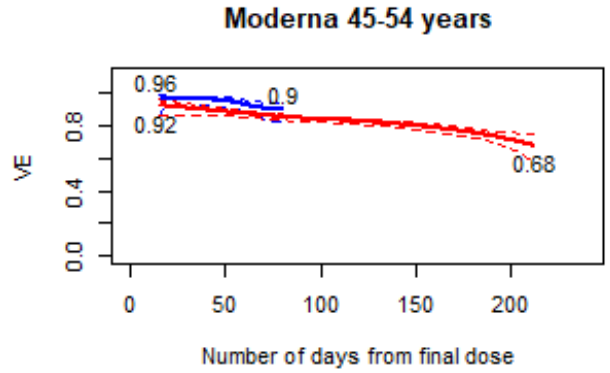


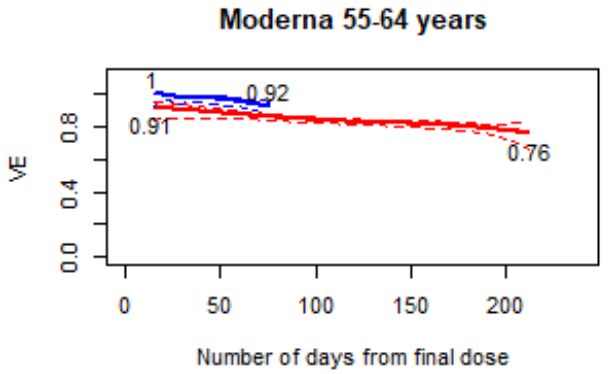
Rosenberg et al. MedRxIV. https://www.medrxiv.org/content/10.1101/2021.10.08.21264595v1.full.pdf

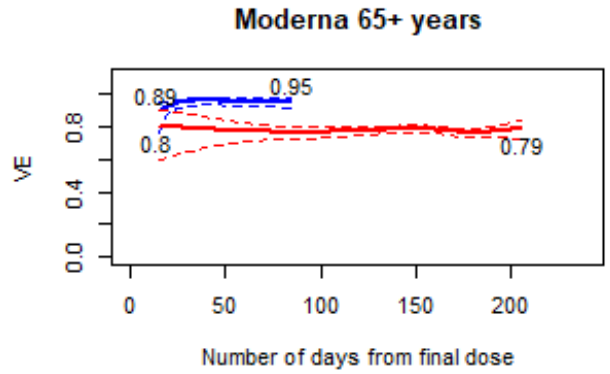
ICATT: Moderna VE against symptomatic infection by age group and time since vaccination in pre-Delta and Delta periods

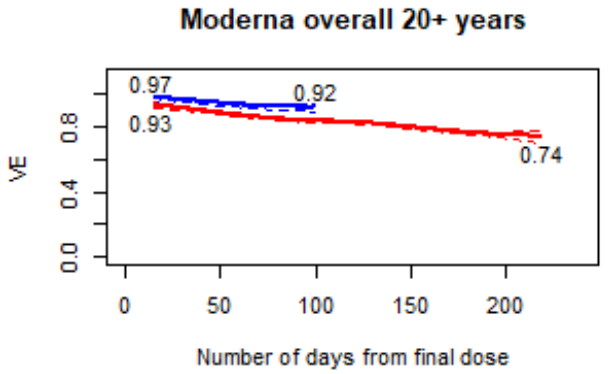
- VE is lower during Delta
- VE wanes during both periods
- Curves similar for 20-44, 45-54, and 55-64 age groups
- For ≥65, VE lower than for other age groups soon after vaccination, no clear trend over time since vaccination











Pre-Delta (March 13–May 29) with 95% CIs in dotted lines

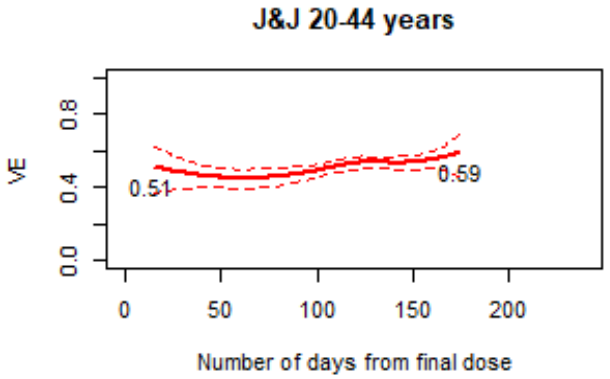
Delta (July 18–August 31) with 95% CIs in dotted lines

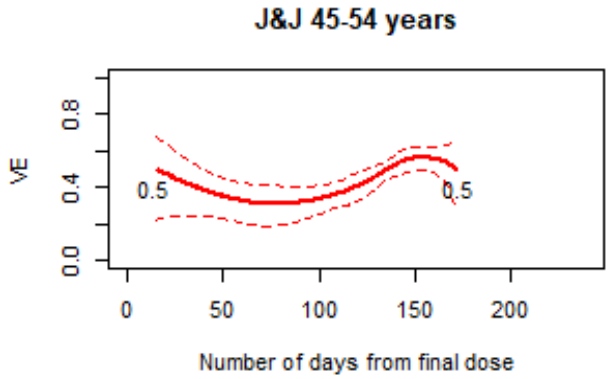
The presented (fitted) curves are truncated on the day with ≤10 cases observed beyond it to avoid presenting wide confidence bounds.

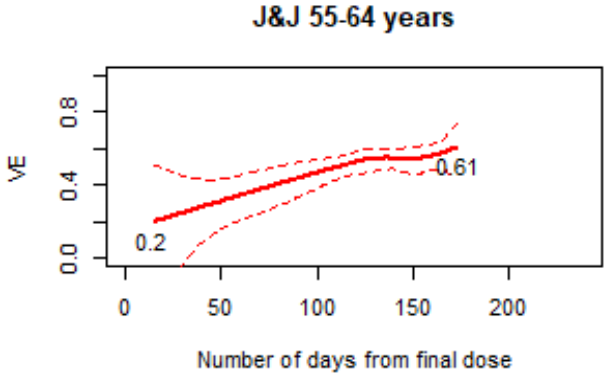
ICATT: Janssen (J&J) VE against symptomatic infection by age group and time since vaccination in Delta period

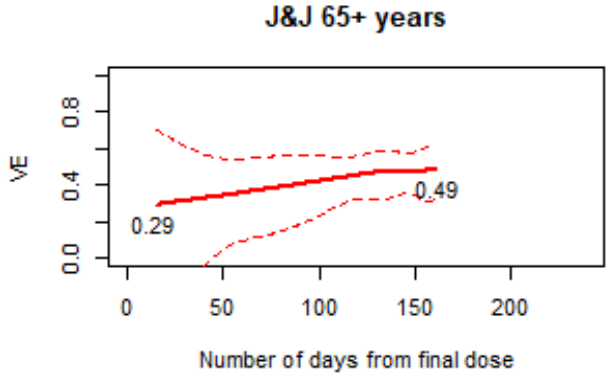
- VE appears stable over time since vaccination during Delta period
- Insufficient data to estimate VE over time during pre-Delta period

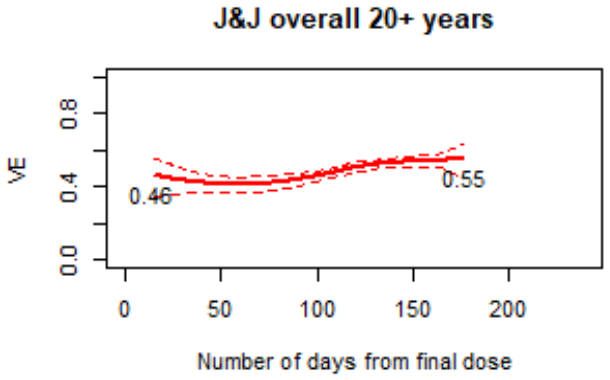
Delta (July 18–August 31) with 95% CIs in dotted lines





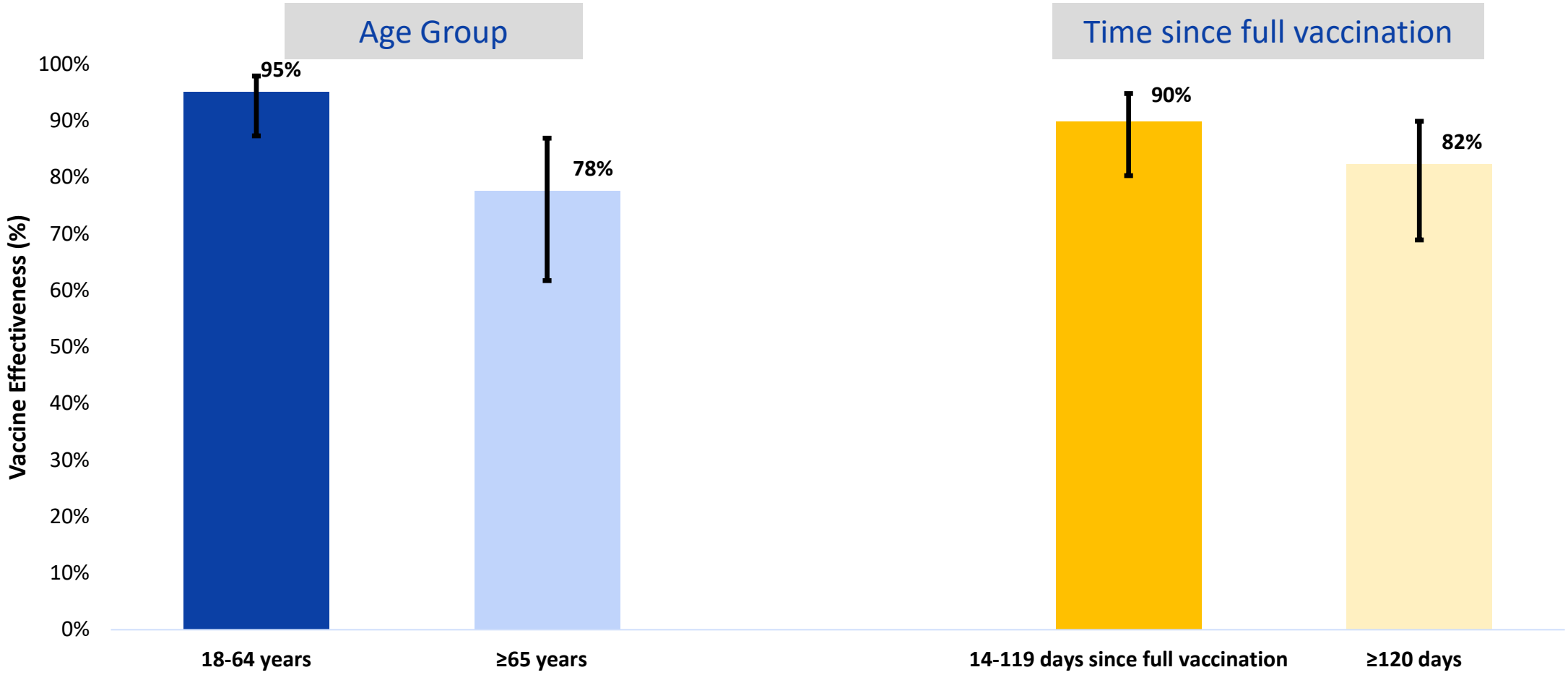






The presented (fitted) curves are truncated on the day with ≤10 cases observed beyond it to avoid presenting wide confidence bounds and y-axis is truncated at 0 (CIs <0 not shown).

SUPERNOVA: VE* of Moderna vaccine against COVID-19-associated Hospitalization— SUPERNOVA Network, February 1–September 17, 2021



**Adjusted for site, time (admission date), age, sex, race/ethnicity. Stratified models exclude adjustment for stratification variable. Among fully vaccinated*

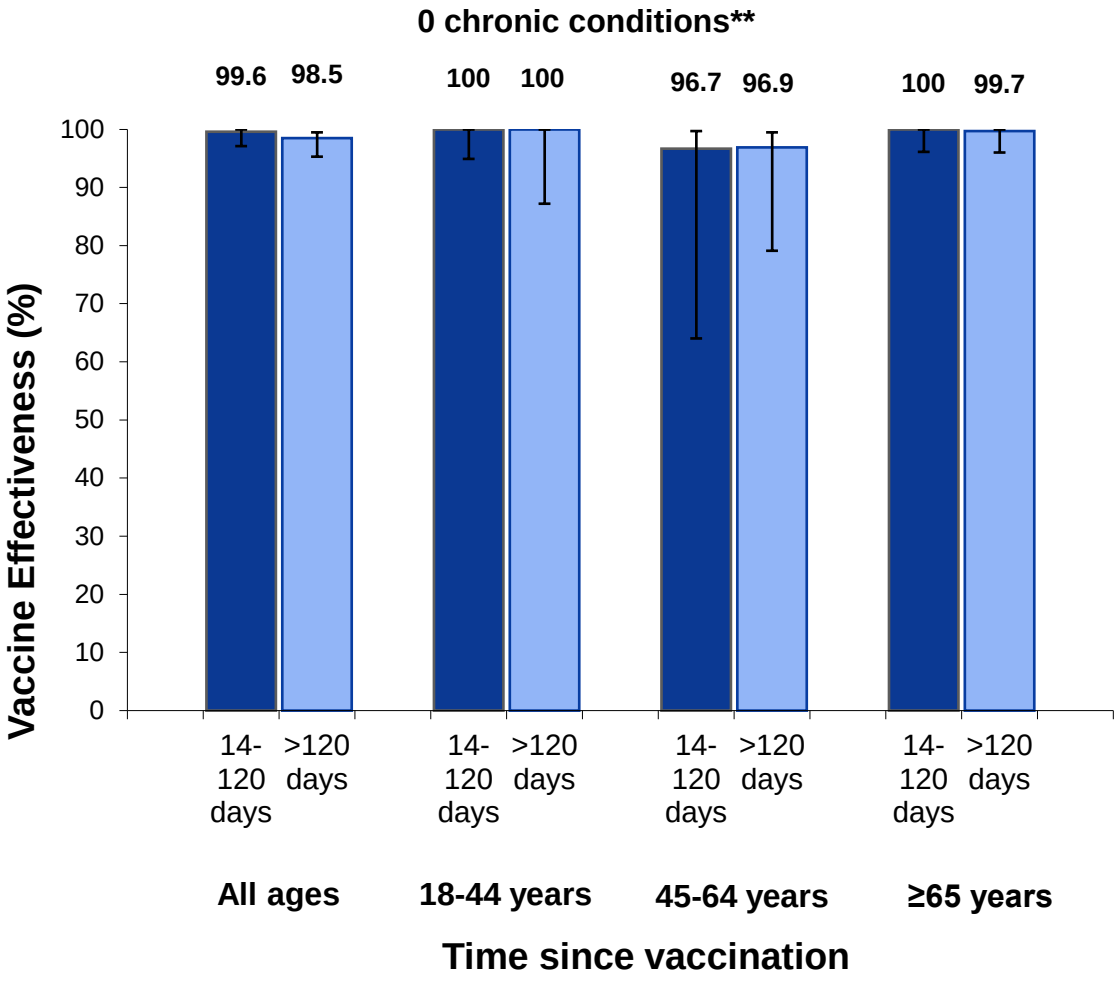
Summary: VE among people aged ≥65 years

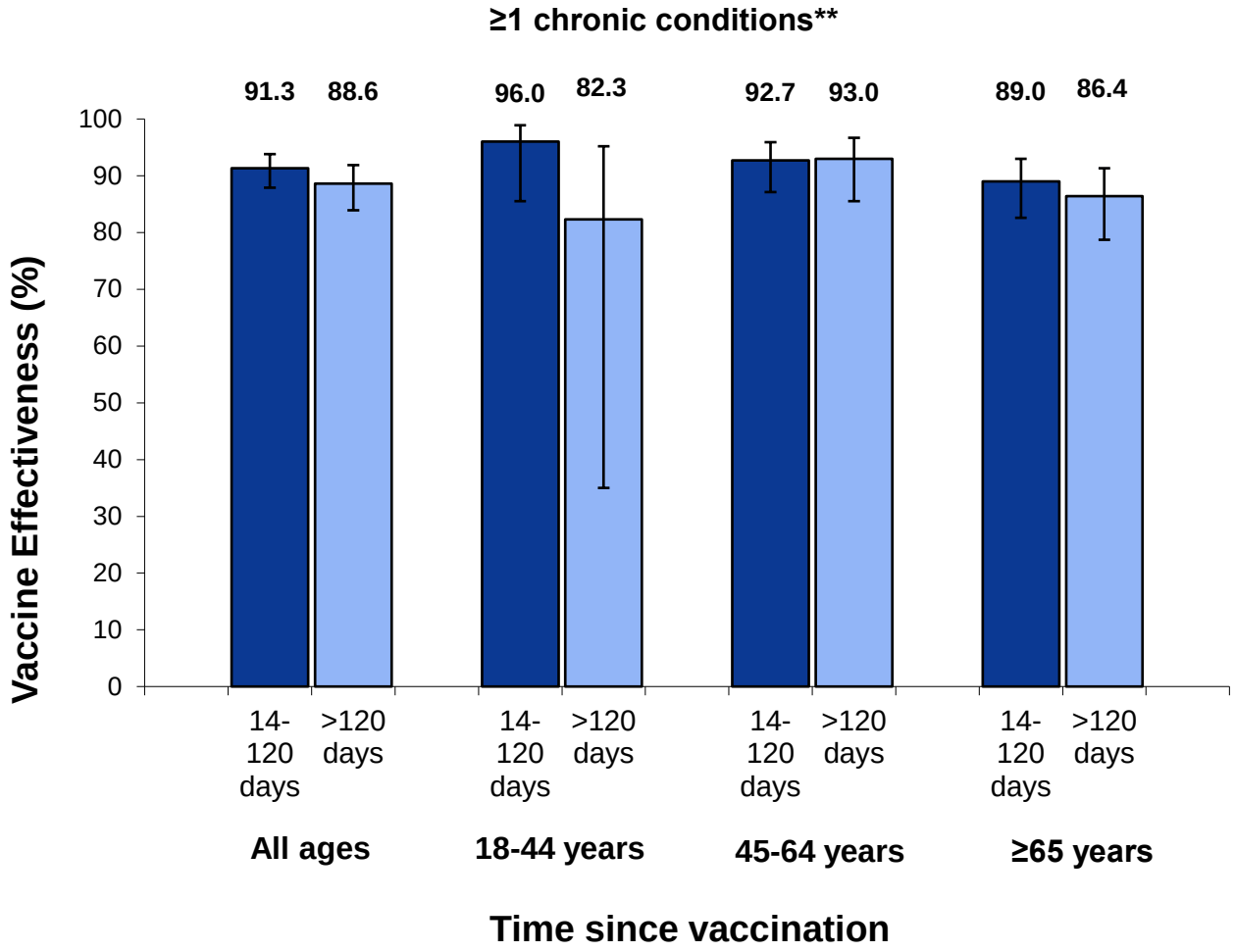
- Moderna
  - VE against hospitalization is lower in those aged ≥65 years compared to younger adults
  - Some studies show moderate declines in VE against infection and small declines in VE against hospitalization

- Janssen
  - Lower VE compared with mRNA vaccines for infection and hospitalization
  - Evidence of waning in VE over time is inconsistent
  - Fewer data available and VE estimates are less reliable

VE for adults aged <65 years with underlying medical conditions

IVY Network: COVID-19 VE against hospitalization among immunocompetent adults ≥18 years— March 11–September 15, 2021 for Moderna vaccine

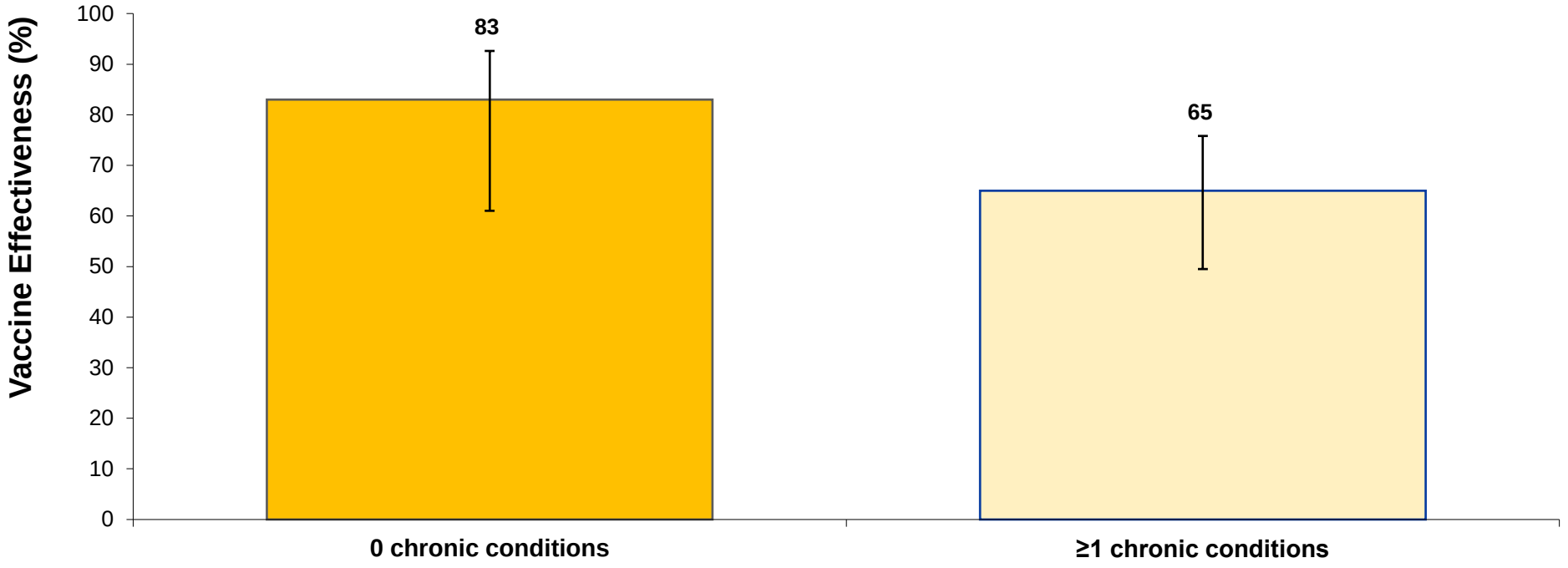




* Adjusted for admission date (biweekly), HHS region, age, sex, race/ethnicity. ****Chronic condition**: ≥1 cardiovascular, endocrine, gastrointestinal, hematological, neurological, pulmonary, or renal condition (*excluded patients with immunocompromising conditions*)

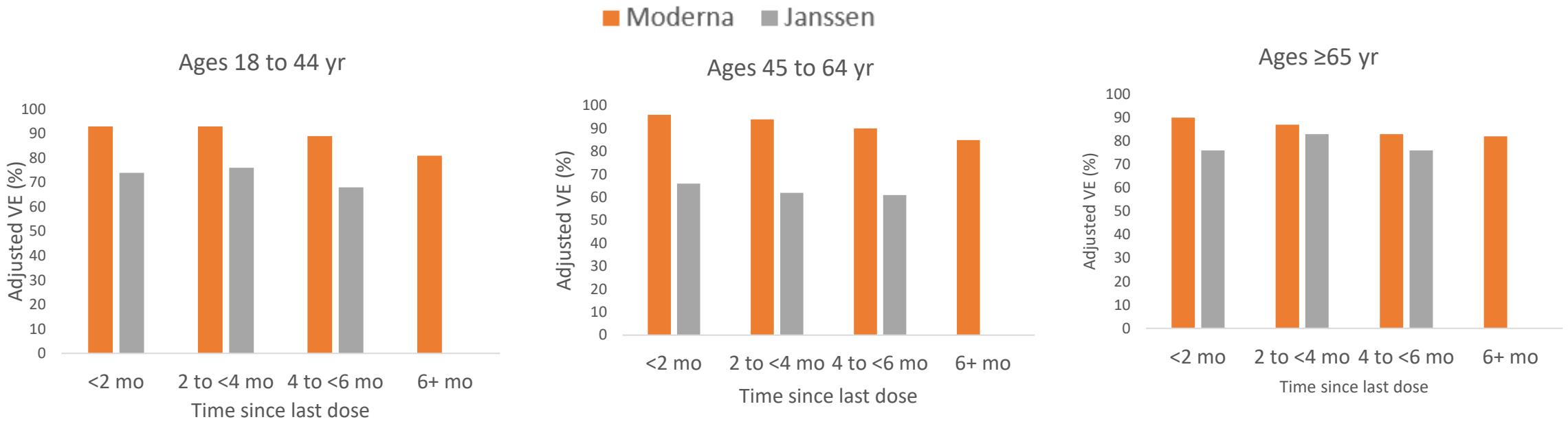
IVY Network: COVID-19 vaccine effectiveness against hospitalization among immunocompetent adults ≥18 years — March 11–September 15, 2021 for Janssen vaccine

- 75 hospitalizations and 108 controls in Janssen recipients (median 84 days from dose 1 to illness onset)



* Adjusted for admission date (biweekly), HHS region, age, sex, race/ethnicity.

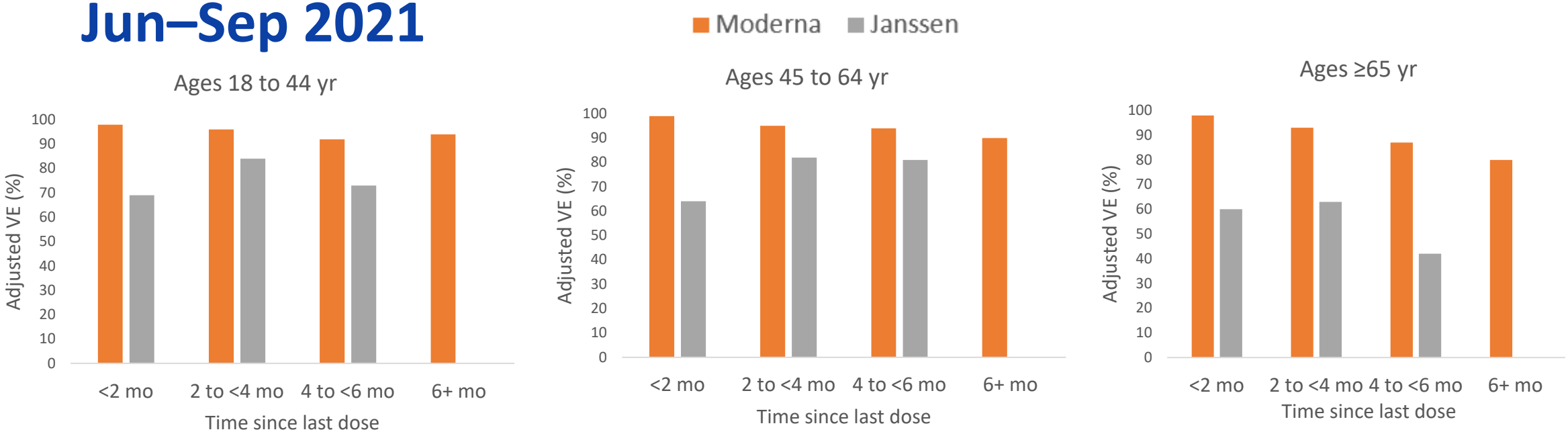
VISION: VE against COVID-19 ED/UC visits among immunocompetent adults without chronic conditions — Jun–Sep 2021



- In all age groups, Moderna VE is higher than Janssen VE.
- In all age groups, Moderna VE shows a modest waning trend.
- There is no consistent pattern of waning for Janssen VE.

All VE estimates are based on comparisons of fully vaccinated persons with unvaccinated persons.
Janssen VE estimates are based on preliminary analyses of relatively small samples. Sample size was insufficient to estimate Janssen VE for persons vaccinated ≥6 months.

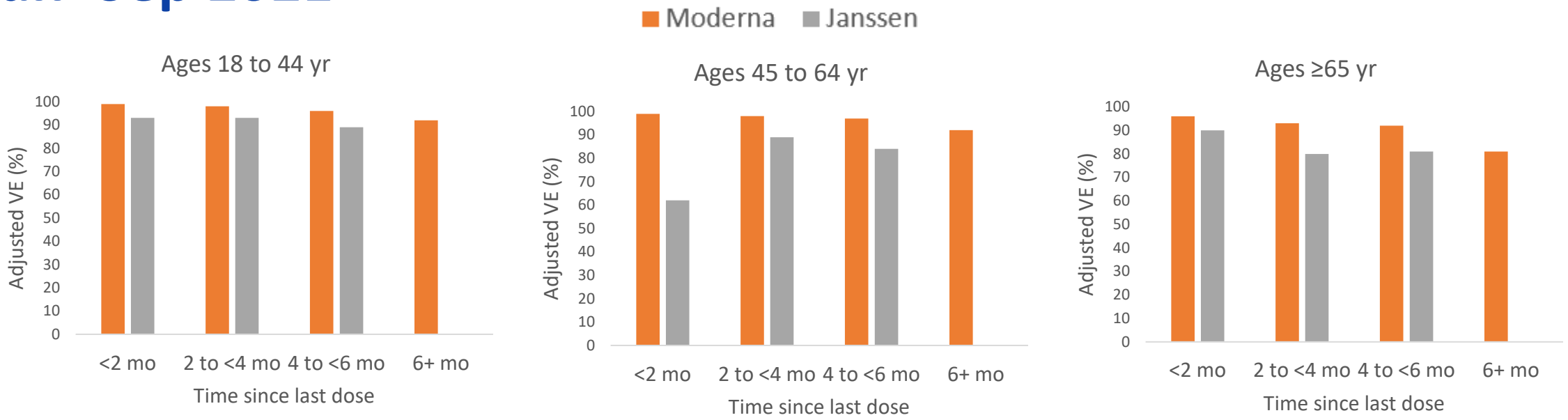
VISION: VE against COVID-19 ED/UC visits among immunocompetent adults with chronic conditions — Jun–Sep 2021



- In all age groups, Moderna VE is higher than Janssen VE.
- In 45 to 64 year and ≥65 year age groups, Moderna VE shows a modest waning trend.
- Janssen VE may be higher at 2 to 4 months post-vaccination than earlier or later.
- For both vaccines, waning of VE is more pronounced in the oldest age group.

All VE estimates are based on comparisons of fully vaccinated persons with unvaccinated persons.
Janssen VE estimates are based on preliminary analyses of relatively small samples. Sample size was insufficient to estimate Janssen VE for persons vaccinated ≥6 months.

VISION: VE against COVID-19 hospitalization among immunocompetent adults with chronic conditions — Jun–Sep 2021



- In all age groups, Moderna VE is higher than Janssen VE.
- In all age groups, Moderna VE shows a modest waning trend, which is more pronounced among the oldest age group.
- There is no consistent pattern of waning for Janssen VE.

All VE estimates are based on comparisons of fully vaccinated persons with unvaccinated persons.
Janssen VE estimates are based on preliminary analyses of relatively small samples. Sample size was insufficient to estimate Janssen VE for persons vaccinated ≥6 months.

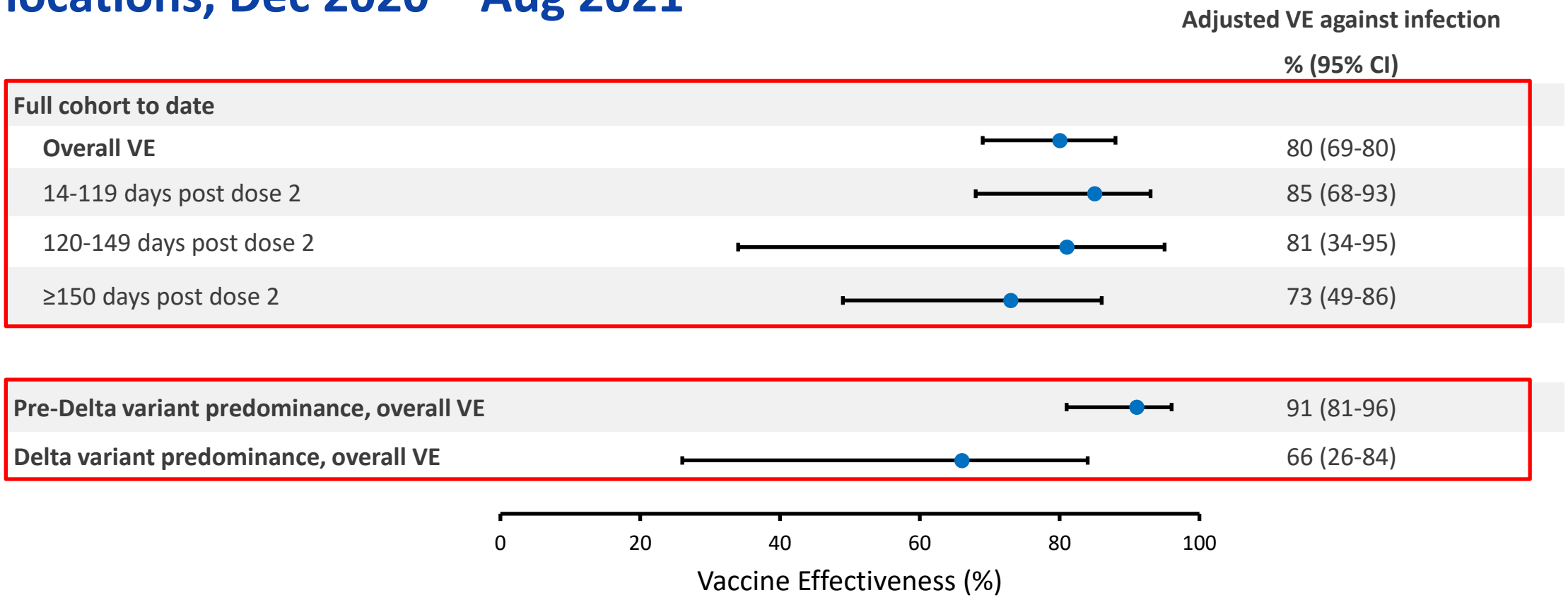
Summary: VE for adults age <65 years with underlying medical conditions

- Moderna
  - Mild decline in VE against hospitalization and against ED/UC visits, but VE remains high

- Janssen
  - Lower VE compared with mRNA vaccines for infection and hospitalization
  - No consistent evidence of waning

VE for workers employed in occupations with high risk of exposure to SARS-CoV-2

HEROES/RECOVER: mRNA VE against SARS-CoV-2 infection by Delta variant predominance* and time since full vaccination — Eight U.S. locations, Dec 2020 – Aug 2021



- VE against infection (80% symptomatic) declined from 91% pre-Delta to 66% during Delta
- Did not have enough power to look at time since vaccination pre-Delta and during Delta
- Do not see significant difference between mRNA products

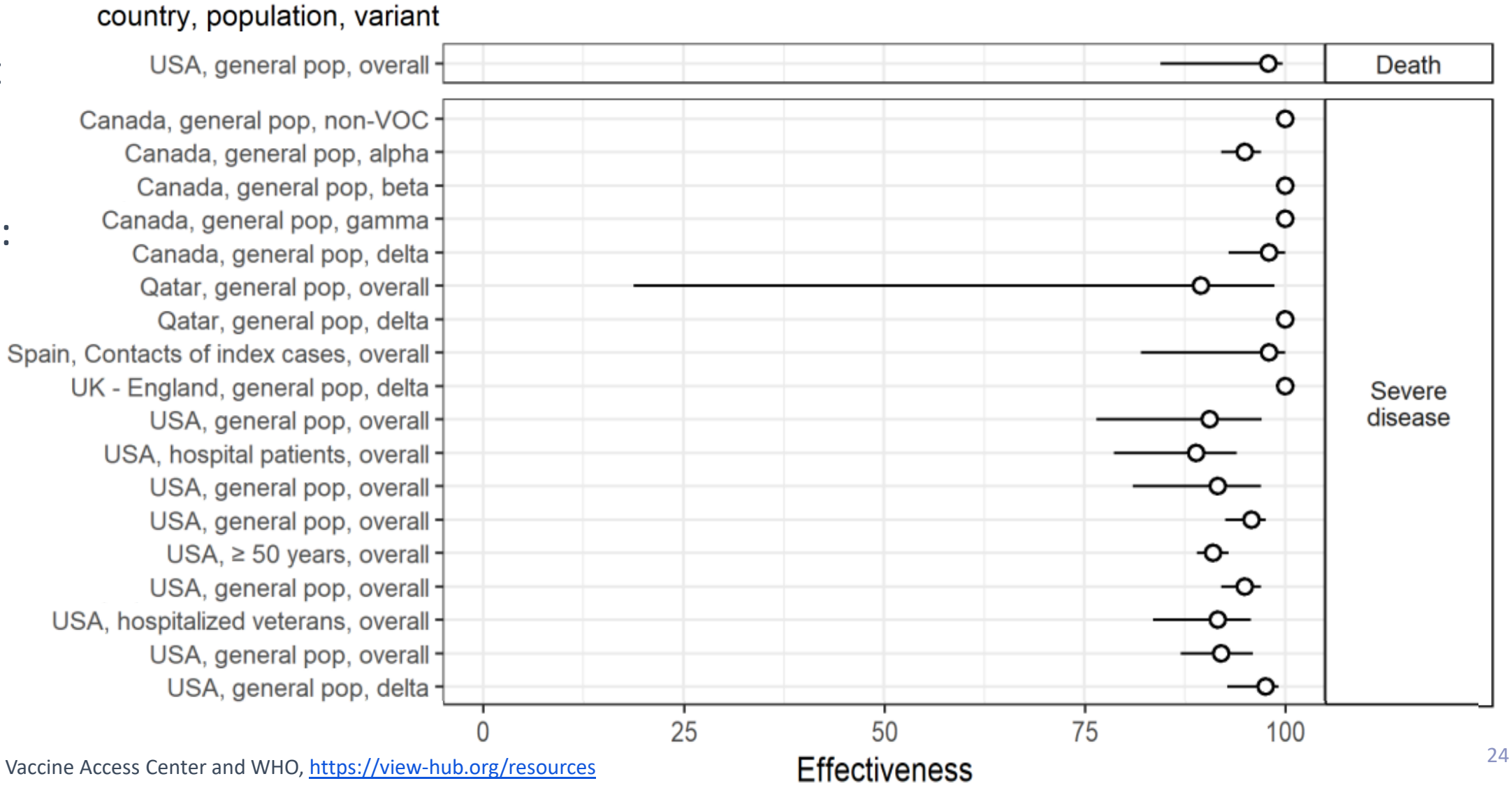
https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e4.htm

*Weeks when the Delta variant accounted for ≥50% of viruses sequenced, based on data from each respective location, were defined as weeks of Delta variant predominance

Global VE data

IVAC/WHO systematic review for Moderna VE against death or severe disease

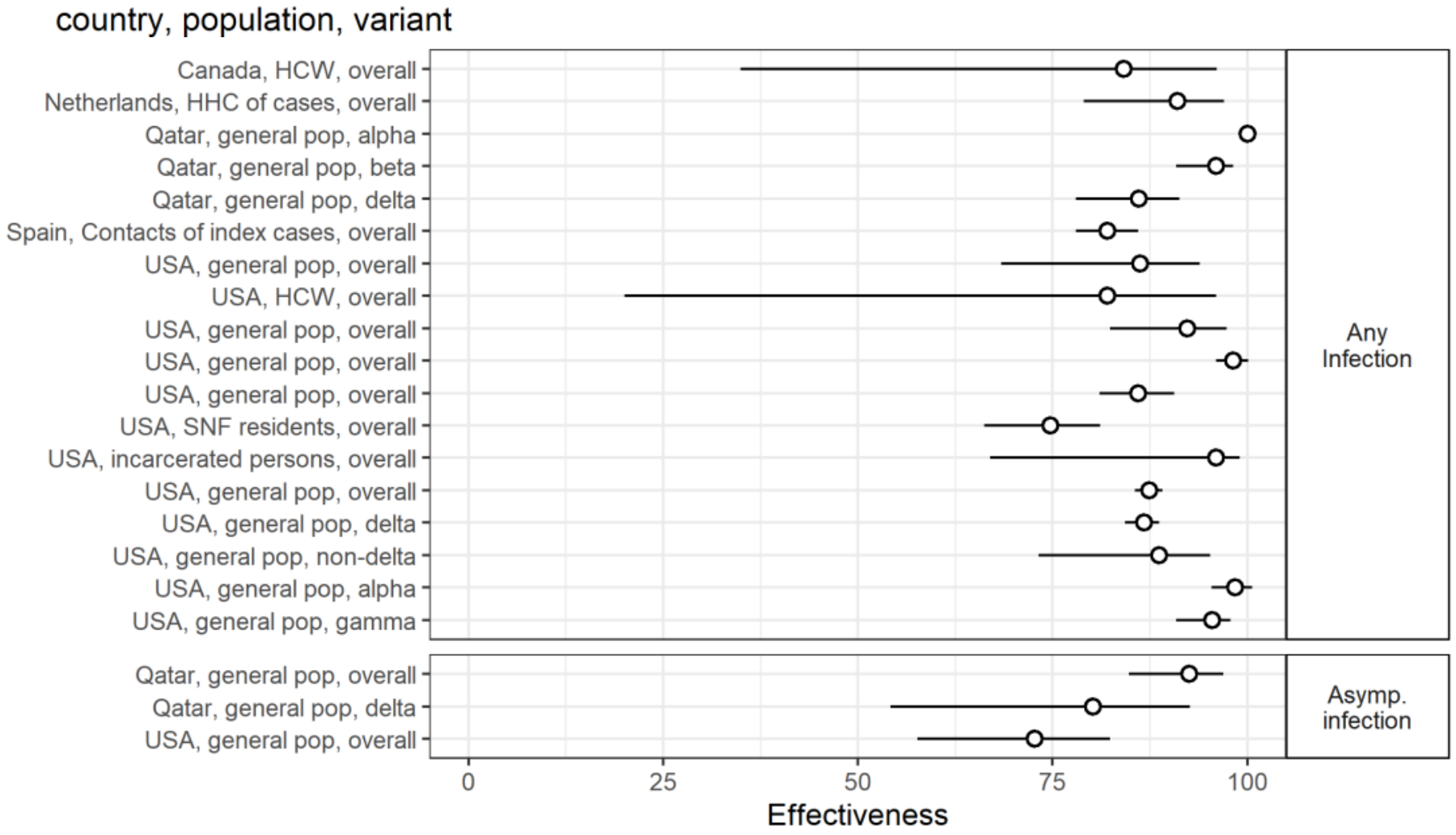
- VE against severe disease and death: 89–100%



International Vaccine Access Center and WHO, https://view-hub.org/resources

IVAC/WHO systematic review for Moderna VE against infection

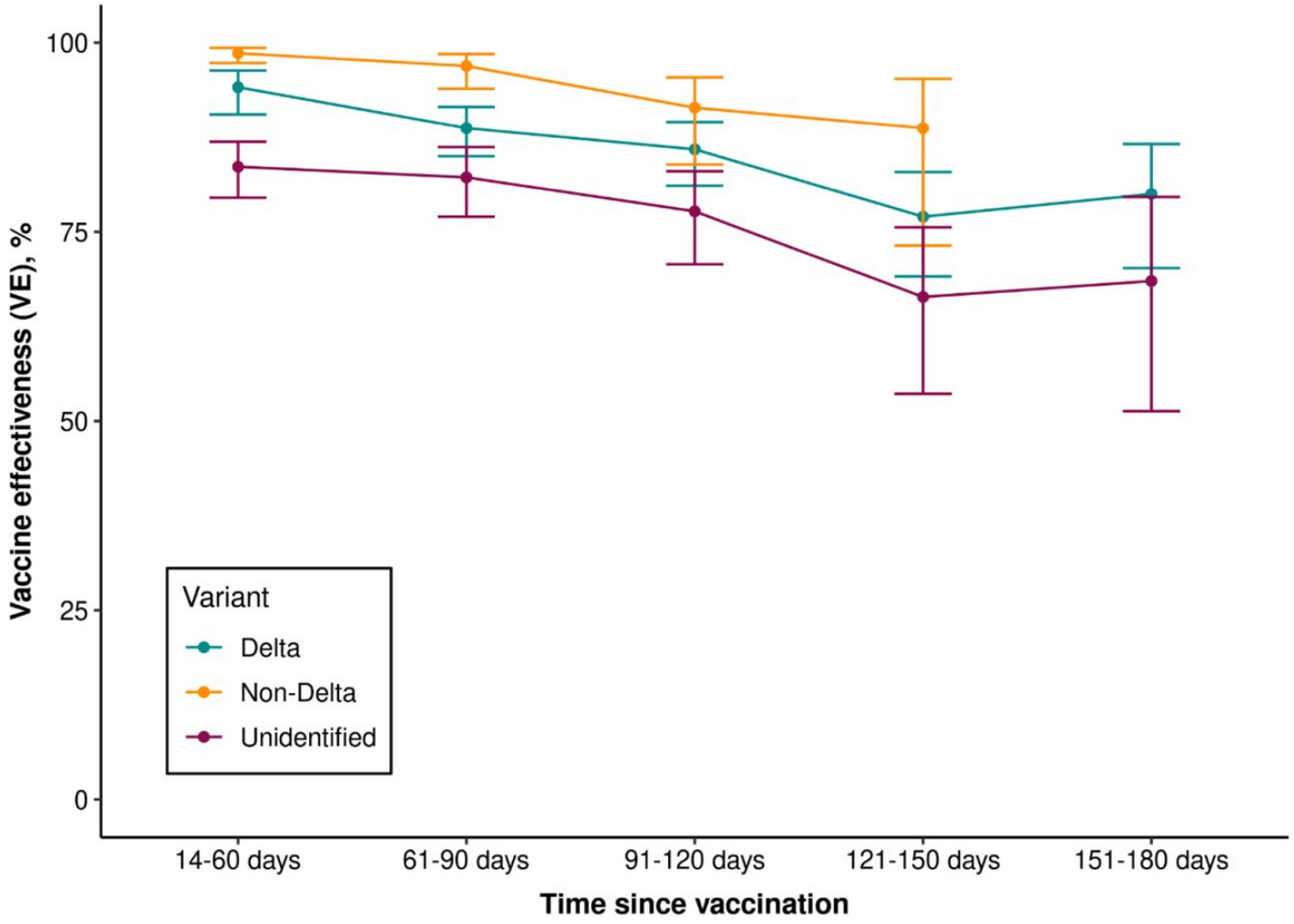
- VE against infection: 75–100%
- VE against asymptomatic infection: 70–90%



International Vaccine Access Center and WHO, https://view-hub.org/resources

Study: Moderna VE against infection

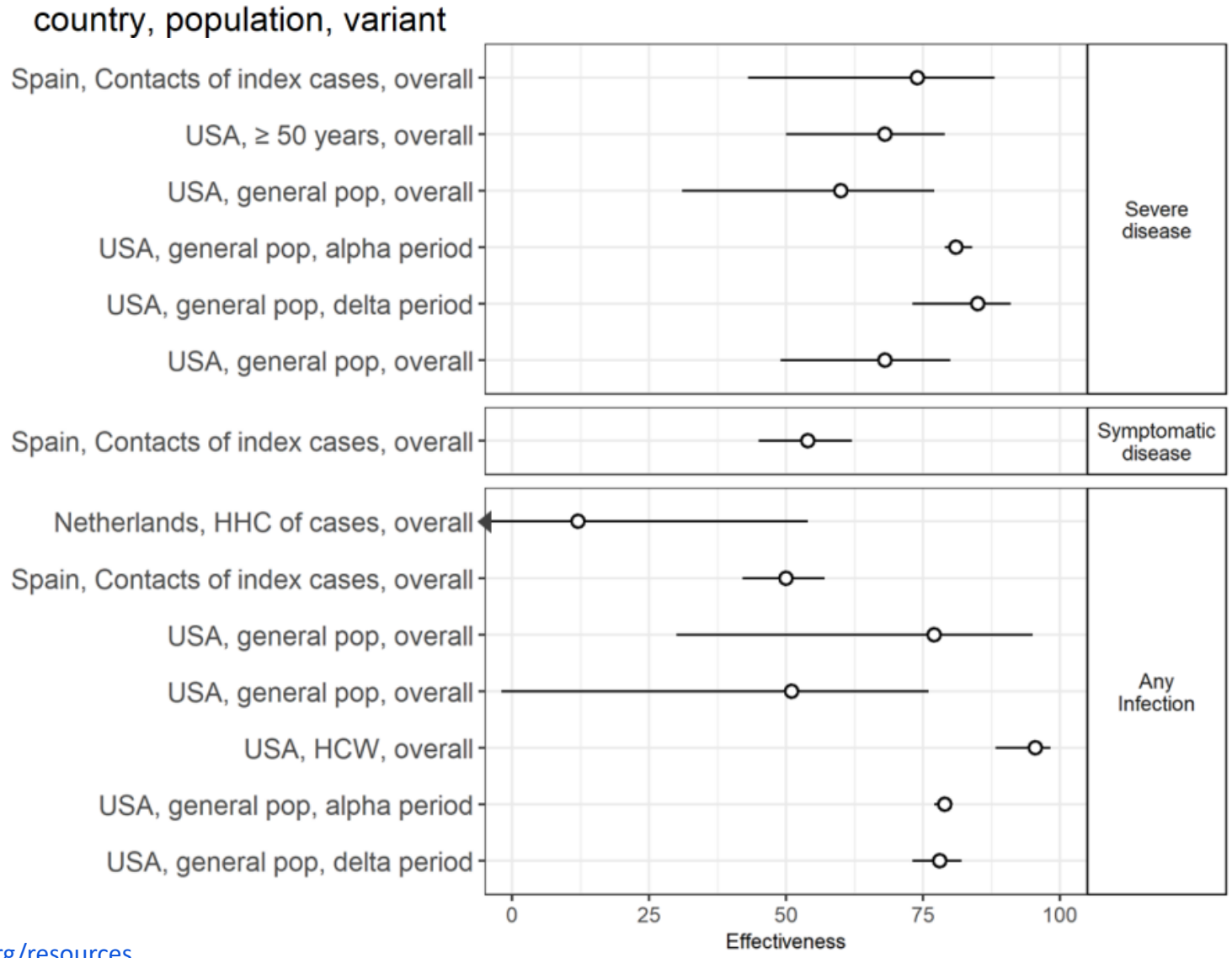
- Moderna-funded study
- Test-negative design using Kaiser Permanente Southern California patients
- 8,153 cases diagnosed between March and July 2021
  - 1 case with 5 matched controls
- VE against Delta infection
  - declined from 94% to 80%
  - lower among individuals aged ≥65 y (75%) compared with aged 18-64 y (88%)
- VE against hospitalization over time not included in manuscript, but was >96% for Delta and non-Delta



Bruxvoort, medRxiv, https://www.medrxiv.org/content/10.1101/2021.09.29.21264199v1

IVAC/WHO systematic review for Janssen vaccine

- VE against severe disease: 60–85%
- VE against symptomatic disease or any infection: 12–95%
- Wide confidence intervals because of few participants who received Janssen vaccine

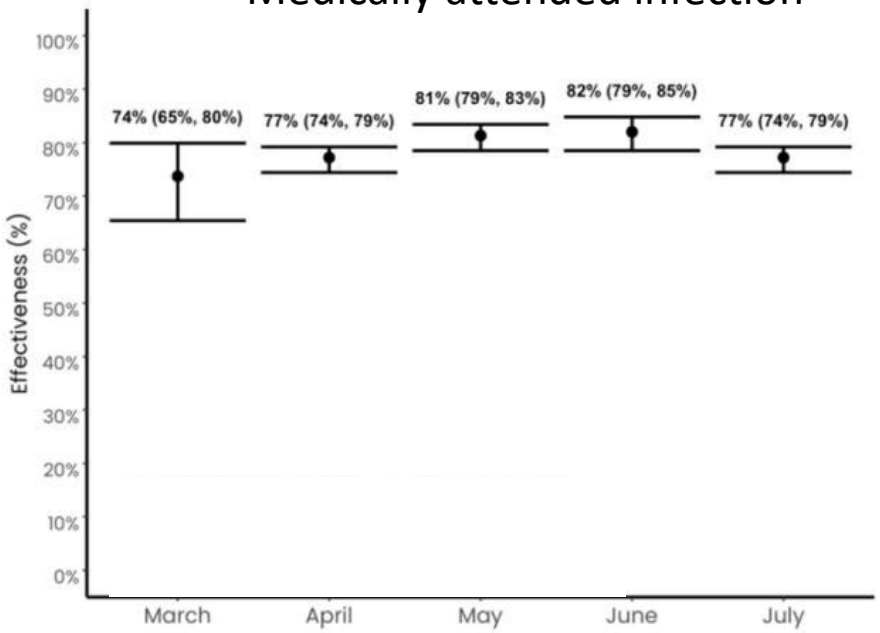


International Vaccine Access Center and WHO, https://view-hub.org/resources

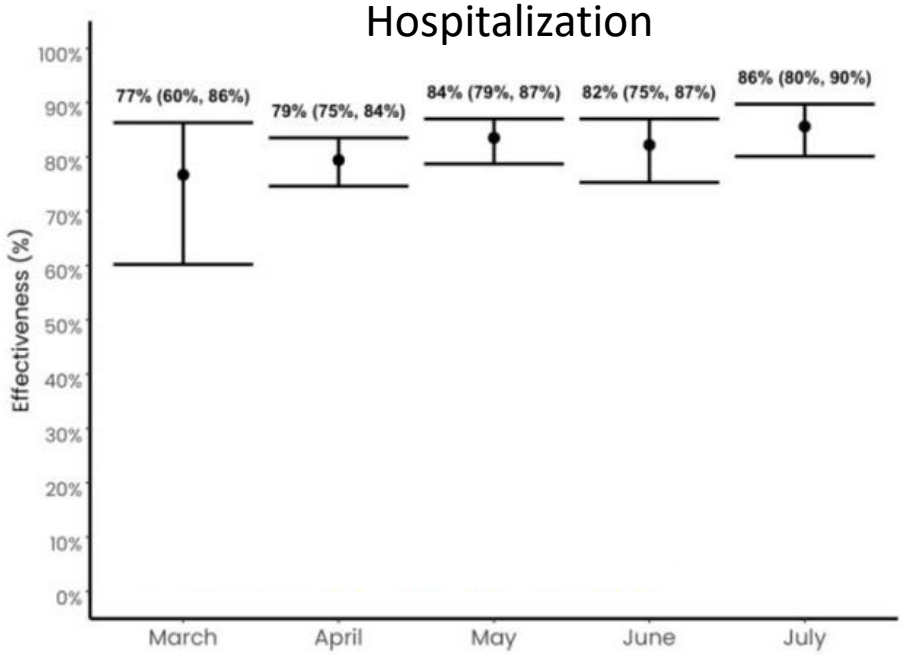
Study: Janssen VE against medically attended infection and hospitalization

- Janssen-funded study using U.S. insurance claims data
- Cohort design, matched 390,517 vaccinated between March and July 2021 with 1,524,153 unvaccinated individuals
- VE calculated from proportional hazards
- VE against
  - Medically attended COVID-19: ICD-10 code or PCR+
  - Hospitalization: discharge diagnosis of COVID or positive test within 21 days of hospitalization
- Assumed 40% unreported vaccination in control group, resulting in higher VE by 8-10%
- No decline of VE against medically attended COVID-19 or hospitalization
  - Similar results when restricted to states with high Delta incidence
- Uncorrected VE by age
  - VE against medically attended infection: Age ≥50y: 65%, Age 18y–49y: 75%
  - VE against hospitalization: Age ≥50y: 71%, Age 18y–49y: 79%

Medically attended infection



Hospitalization



Polinski et al., medRxiv, https://www.medrxiv.org/content/10.1101/2021.09.10.21263385v1.full.pdf

Limitations of VE studies

- Groups prioritized for vaccination early were often those at higher risk for SARS-CoV-2 infection or severe COVID-19
  - High risk groups may practice preventive measures more frequently
- After vaccination, people may change their behavior, engaging in riskier activities because of confidence in protection or seek testing for COVID-19 less frequently
  - Some studies report vaccinated practice preventive measures more frequently
- With time, risk of misclassification of vaccine status may increase
- SARS-CoV-2 infection and subsequent population infection-derived immunity will increase over time in the unvaccinated group, leading to apparent waning VE

WHO 20210928 Weekly COVID-19 Epi Update, https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---28-september-2021

Summary and conclusions

Summary & conclusions

- Moderna
  - Moderna VE against infection declines over time; both circulation of Delta variant and increasing time from vaccination appear to contribute
  - ≥65 years of age
    - VE against hospitalization is lower in those aged ≥65 years compared with VE in younger adults
    - Some studies show moderate declines in VE against infection and small declines in VE against hospitalization
  - <65 years of age with underlying medical conditions
    - Mild decline in VE against hospitalization and against ED/UC visits, but VE remains high
  - Occupations with high risk of exposure to SARS-CoV-2
    - No Moderna-specific data
    - For combined mRNA vaccines, VE against hospitalization declining

- Janssen
  - Lower VE compared with mRNA for infection and hospitalization
  - Evidence of waning in VE over time is inconsistent across studies
  - Fewer data available and VE estimates are less reliable

Acknowledgements

- Site PIs and teams for IVY, VISION, Signature, NHSN, HEROES-RECOVER, SUPERNOVA, COVID-NET, Cosmos
- CDC
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  - Gordana Derado
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  - Ruth Link-Gelles
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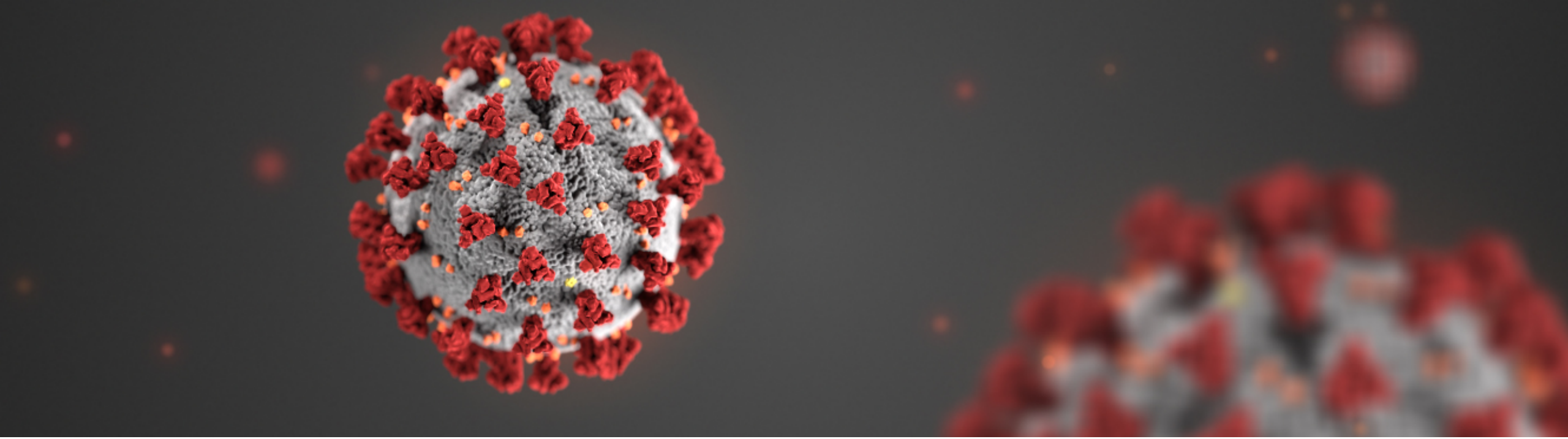
  - Srinivas Nanduri
  - Tamara Pilishvili
  - Diya Surie
  - Mila Prill
  - Kristina Bajema
  - Mark Thompson
  - Jill Ferdinands
  - Ian Plumb
  - Fiona Havers
  - Heidi Moline
  - Jessica Smith
  - Manish Patel
  - Minal Patel

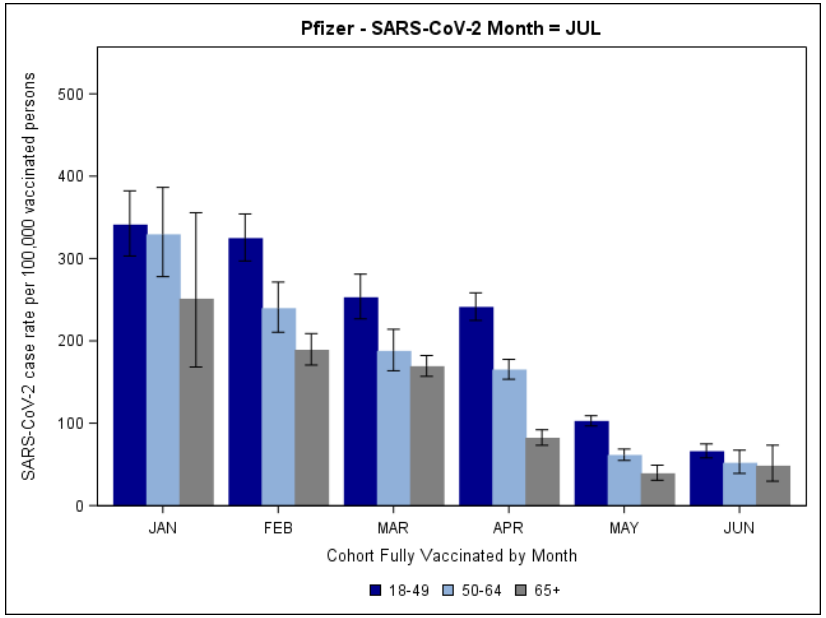


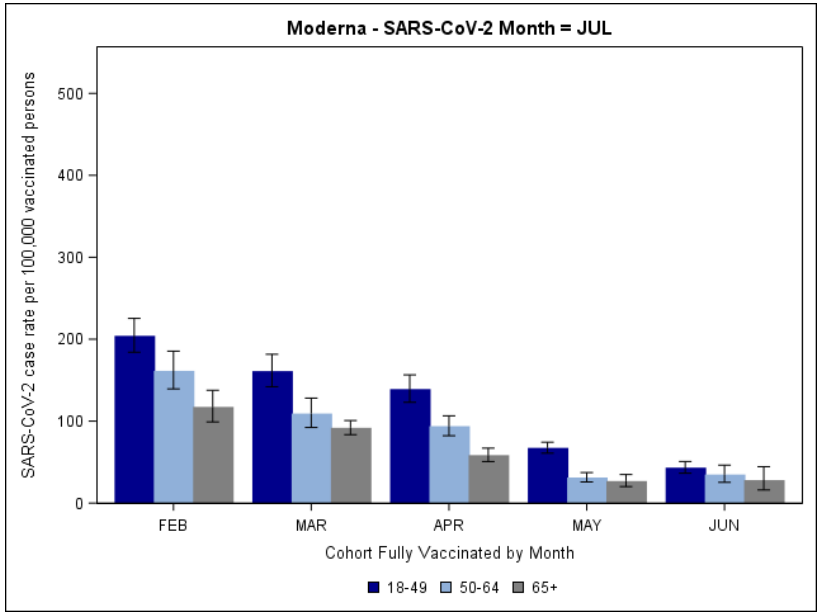
For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

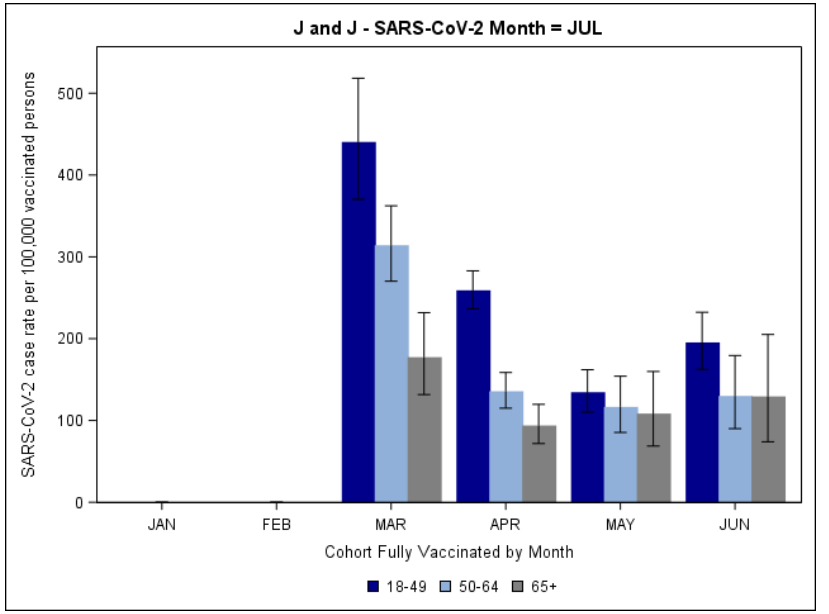
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Extra slides for reference

COVID-19 case rates by vaccination cohort, vaccine product and age, 4 states*, July 2021







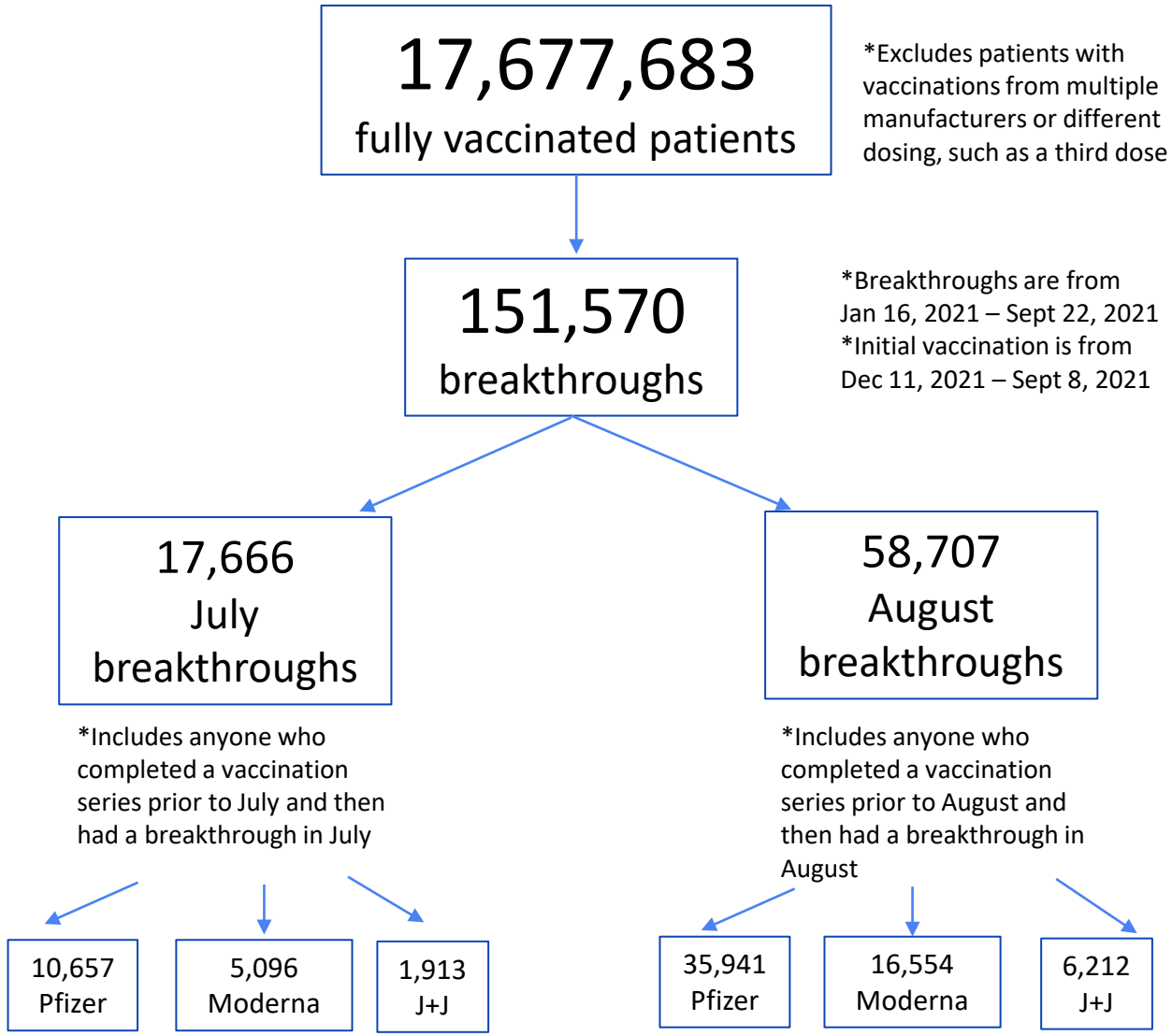
COVID-19 Surveillance data from 4 States. A fully vaccinated case had SARS-CoV-2 RNA or antigen detected on a respiratory specimen collected ≥14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine.

*Public health department data from Utah, Indiana, New Mexico and New Jersey

Cosmos Data Set

- Largest single-source EHR data set in US
  - 120+ million patients, 700+ hospitals, 10k clinics, all 50 states
  - All participating sites use Epic EHR
- Data Representativeness
  - All patient ages, all insurance types (including self-pay)
  - Data submission is automated, no site drop-outs in data overtime
- Data Items
  - Longitudinal charts - immunizations, problems, medications, lab results, office visits, social determinants, hospitalization records, etc.
  - Charts are de-duplicated when added to Cosmos

Cosmos Methods



Data Definitions

Term	Definition
Study period	12/11/2020 through 9/9/2021
Fully vaccinated patient	A patient who received manufacturer-recommend dosing for COVID-19 vaccination is considered fully vaccinated after 14 days have passed since the patient's last dose in the series. We have vaccination data for a patient if the vaccine was given at an organization that contributes to Cosmos or if the patient had an encounter with a healthcare system that prompted the automatic reconciliation of vaccination from outside sources, such as the state vaccination registry, into the EHR of an organization that contributes to Cosmos. We also capture data that a patient reports to their health system directly.
Manufacturer recommendations for timing	Moderna: Two doses, at least 28 days apart. Pfizer: Two doses, at least 21 days apart. Johnson & Johnson: 1 dose
COVID-19 Breakthrough Case	A PCR-based SARS-COV2 test result of positive and/or a COVID-19 diagnosis after being fully vaccinated.
PCR-based SARS-CoV2 test	A final result for one of the lab tests for SARS-CoV-2, with a lab value that could be interpreted definitively as Positive or Negative. LOINC codes include: 943068, 943076, 943084, 943092, 943100, 943118, 943126, 943134, 943142, 943159, 943167, 945006, 945022, 945097, 945105, 945113, 945311, 945329, 945337, 945345, 945584, 945592, 945659, 946392, 946400, 946418, 946426, 946434, 946442, 946459, 946467, 946475, 946608, 947457, 947465, 947564, 947572, 947580, 947598, 947606, 947630, 947648, 947655, 947663, 947671, 948190, 948224, 948455, 952093, 954065, 954099, 954248, 954255, 955211, 955229, 956086, 956094, 958231, 958249, 958264, 959700, 959718, 959726, 959734, 959742, 960914, 960948, 961193, 961201, 961219, 961227, 961235, 964486, 967414, 967513, 967521. Test Date: Date when the sample was collected; the date the test was resulted is used when the collection date is not available.
COVID-19 diagnosis	ICD-10-CM: U07.1
Hospital admission	A hospital admission during which the patient had a COVID-19 diagnosis OR a hospital admission with any respiratory diagnosis that happened within 14 days following the patient's COVID-19 start date. Respiratory Diagnosis Codes: J00-J99 (ICD-10-CM)
Emergency Use Authorization dates	Moderna: December 18, 2020 Pfizer: December 11, 2020 Johnson & Johnson: February 27, 2021

Cosmos Limitations

Limitations of Epic vaccination data

- We do not include unvaccinated patients for comparison since it is difficult to know if a patient is truly unvaccinated, or whether they received the vaccine, and it was not added to the state registry. Additionally, patients need to have an "encounter" with an Epic health system (a phone call, an office visit, etc.) in order to reconcile vaccinations received outside of an Epic facility.
- We are very confident that the 17,677,683 patients in our cohort are fully vaccinated and know the date when they had their final dose. We define "fully vaccinated" as a patient who is ≥ 14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine.

Limitations of surveillance data in general

- We don't know if a patient had a breakthrough case if they didn't get tested or weren't seen at a medical facility with a diagnosis or billing code of COVID-19.

Cosmos Data Set

July 2021 Breakthrough Infections

Vaccine	Total Fully Vaccinated	Infections	Hospitalizations	Deaths	Infections/100k	Hospitalizations/100k	Deaths/100k	% Hospitalized*
Pfizer	9,713,025	10,657	1,106	137	109.7	11.4	1.4	10.4%
Moderna	6,003,385	5,096	564	77	84.9	9.4	1.3	11.1%
JJ	1,036,174	1,913	221	28	184.6	21.3	2.7	11.6%
Total	16,752,584	17,666	1,891	242	105.5	11.3	1.4	10.7%

August -2021 Breakthrough Infections

Vaccine	Total Fully Vaccinated	Infections	Hospitalizations	Deaths	Infections/100k	Hospitalizations/100k	Deaths/100k	% Hospitalized*
Pfizer	10,009,351	35,941	3,237	444	359.1	32.3	4.4	9.0%
Moderna	6,102,663	16,554	1,678	233	271.3	27.5	3.8	10.1%
JJ	1,078,579	6,212	754	94	575.9	69.9	8.7	12.1%
Total	17,190,593	58,707	5,669	771	341.5	33.0	4.5	9.7%

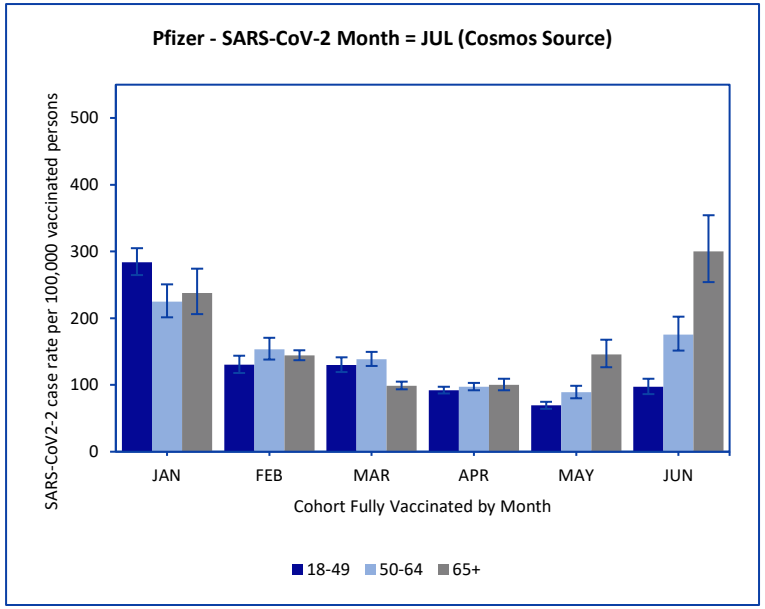
Overall Breakthrough** Infections

Vaccine	Total Fully Vaccinated	Infections	Hospitalizations	Deaths	Infections/100k	Hospitalizations/100k	Deaths/100k	% Hospitalized*
Pfizer	10,355,292	90,611	8,575	927	875.0	82.8	9.0	9.5%
Moderna	6,198,326	44,433	4,507	510	716.9	72.7	8.2	10.1%
JJ	1,124,065	16,526	2,155	203	1,470.2	191.7	18.1	13.0%
Total	17,677,683	151,570	15,237	1,640	857.4	86.2	9.3	10.1%

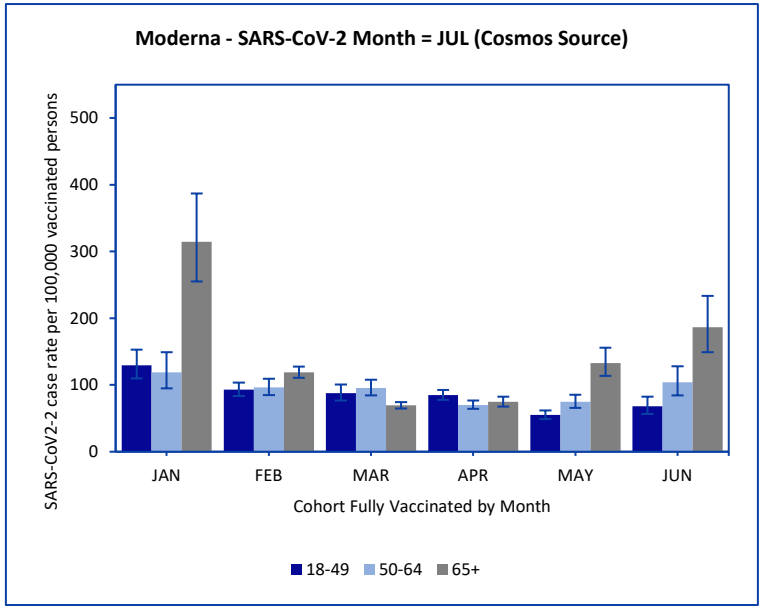
* “% Hospitalized” is the percent of breakthrough cases that were admitted (hospitalized).
**Overall breakthrough cases and admissions are from January 16, 2021 – September 22, 2021.
The infection, hospitalization, and in-hospital death rates are per 100,000 fully vaccinated patients.

Cosmos Data Set

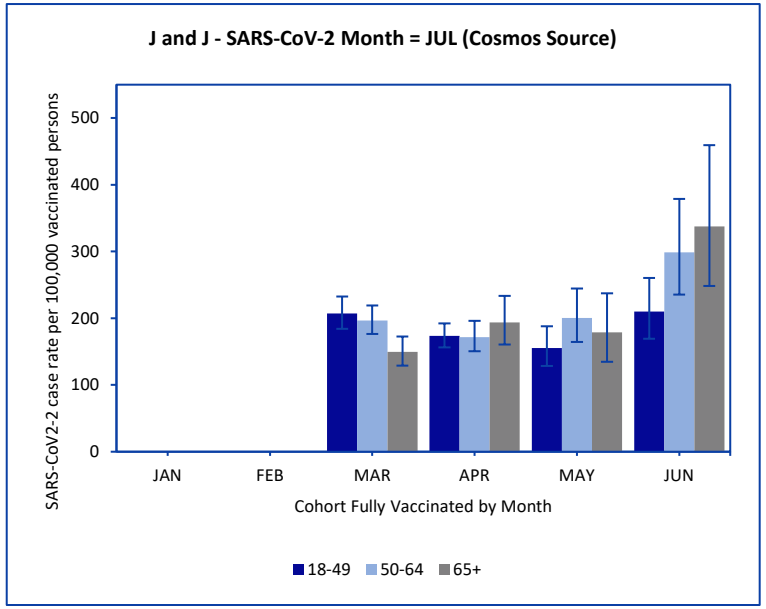
July 2021 Cases



Pfizer Infection Rate (July): 109.7 / 100k vaccinated
N = 10,657 / 9,713,025



Moderna Infection Rate (July): 84.9 / 100k vaccinated
N = 5,096 / 6,003,385

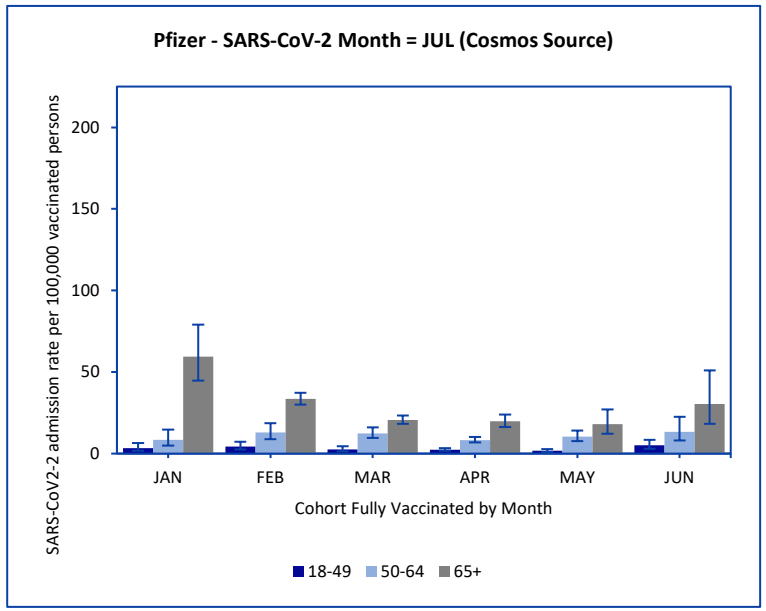


J and J Infection Rate (July): 184.6 / 100k vaccinated
N = 1,913 / 1,036,174

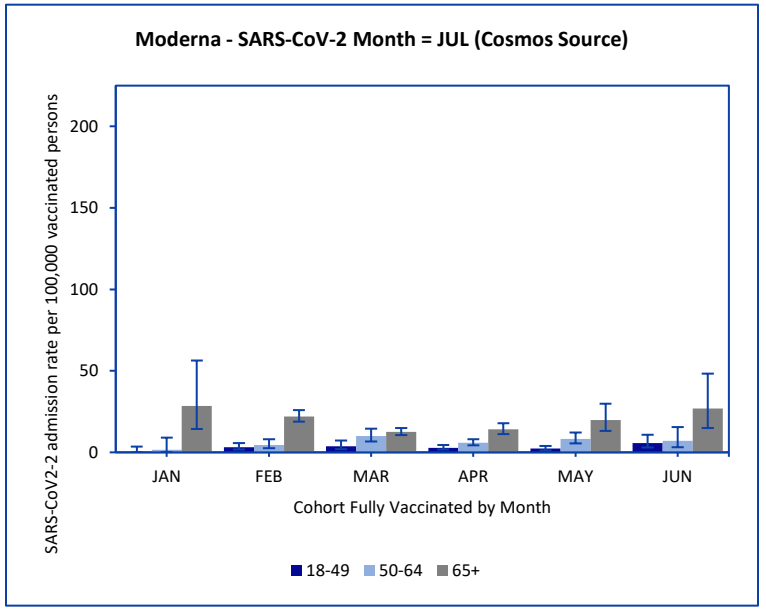
COVID-19 case rates by vaccination cohort, vaccine product, and age, July 2021. A patient is considered fully vaccinated ≥ 14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine. A breakthrough case defined as a patient with PCR SARS-CoV-2 positive test result or a COVID-19 medical diagnosis.
Data is from Cosmos, a HIPAA-defined Limited Data Set. As of September 23, 2021, there were 17,677,683 fully vaccinated patients in the Cosmos data set. Cosmos data are from 700+ hospitals, 10,000 clinics, and all 50 states.

Cosmos Data Set

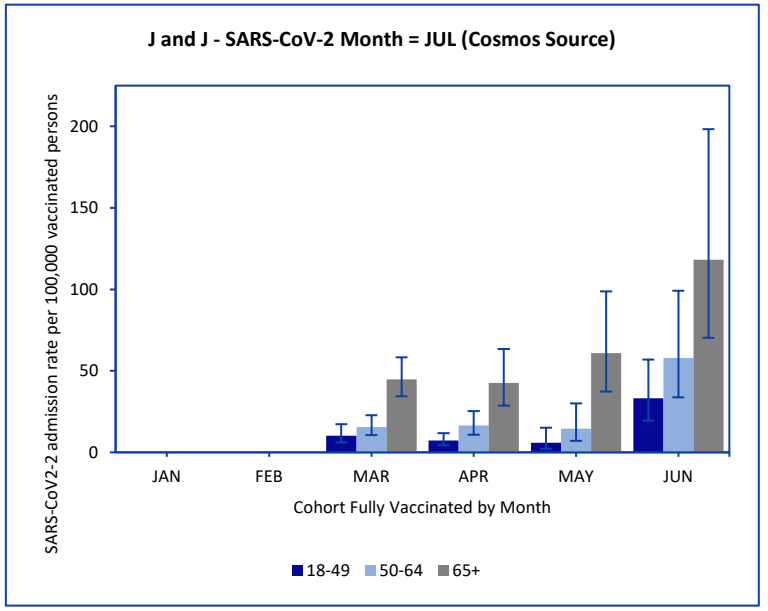
July 2021 Hospitalizations



Pfizer Hospitalization Rate (July): 11.4 / 100k vaccinated
N = 1,106 / 9,713,025



Moderna Hospitalization Rate (July): 9.4 / 100k vaccinated
N = 564 / 6,003,385

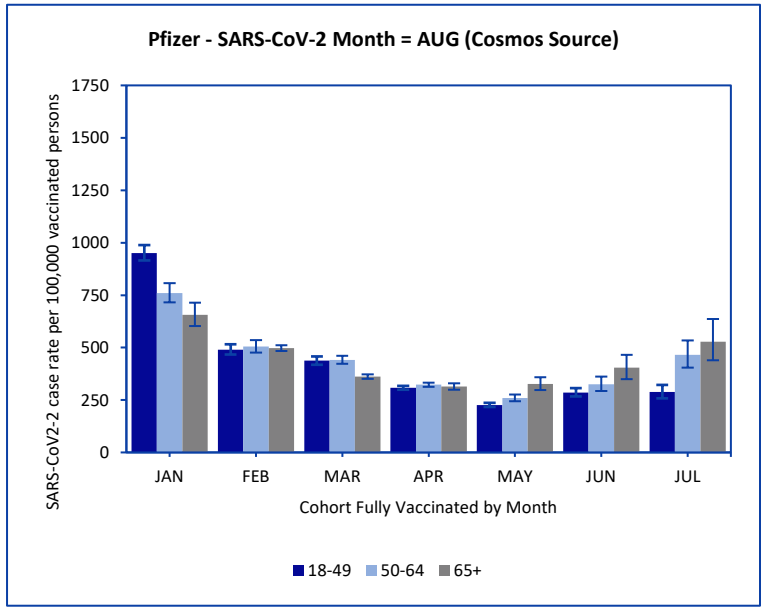


J and J Hospitalization Rate (July): 21.3 / 100k vaccinated
N = 221 / 1,036,174

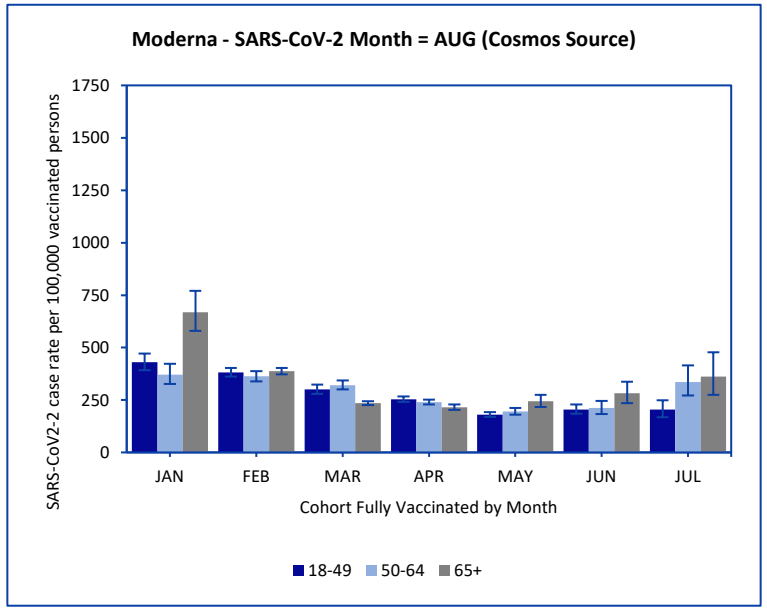
COVID-19 hospitalization rates by vaccination cohort, vaccine product, and age, July 2021. A patient is considered fully vaccinated ≥ 14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine. A breakthrough case defined as a patient with PCR SARS-CoV-2 positive test result or a COVID-19 medical diagnosis.
Data is from Cosmos, a HIPAA-defined Limited Data Set. As of September 23, 2021, there were 17,677,683 fully vaccinated patients in the Cosmos data set. Cosmos data are from 700+ hospitals, 10,000 clinics, and all 50 states.

Cosmos Data Set

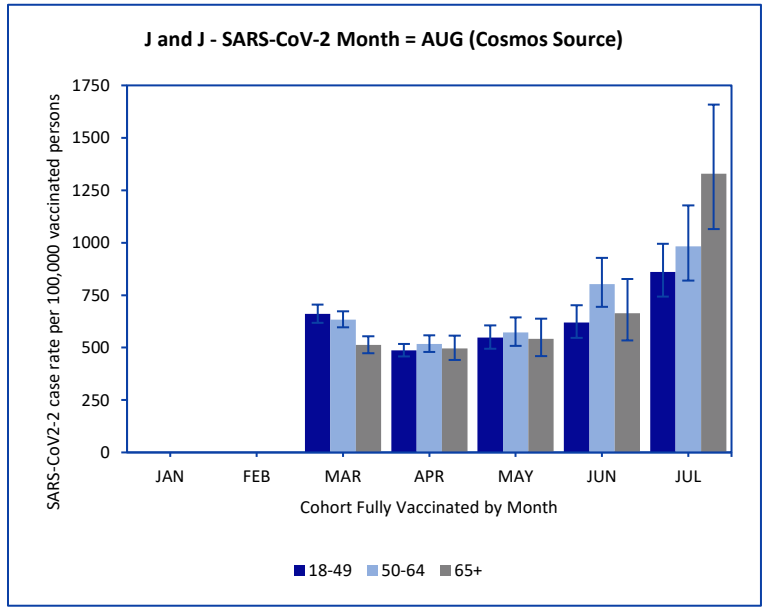
August 2021 Cases



Pfizer Infection Rate (Aug): 359.1 / 100k vaccinated
N= 35,941 / 10,009,351



Moderna Infection Rate (Aug): 271.3 / 100k vaccinated
N = 16,554 / 6,102,663

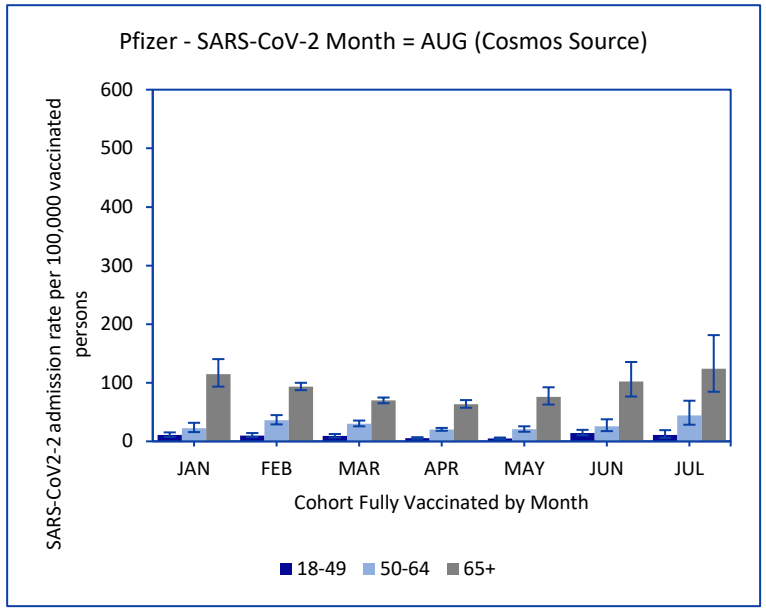


J and J Infection Rate (Aug): 575.9 / 100k vaccinated
N= 6,212 / 1,078,579

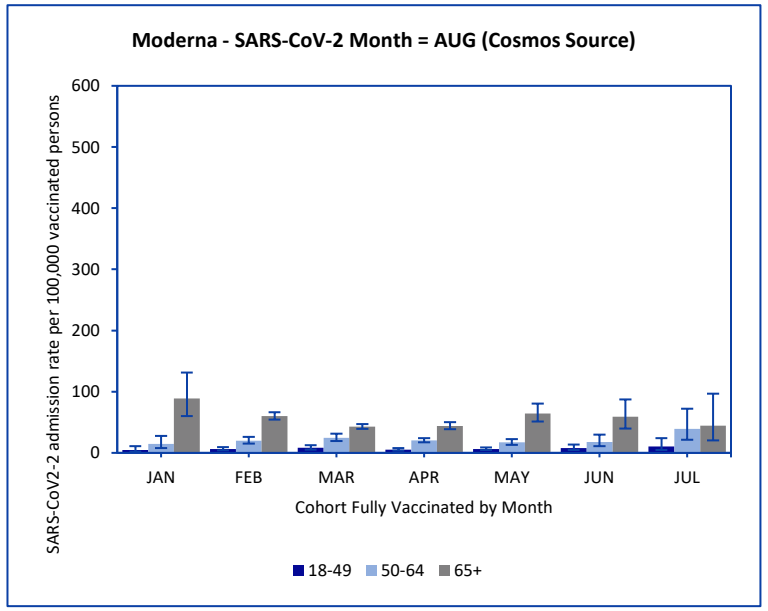
COVID-19 case rates by vaccination cohort, vaccine product, and age, August 2021. A patient is considered fully vaccinated ≥ 14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine. A breakthrough case defined as a patient with PCR SARS-CoV-2 positive test result or a COVID-19 medical diagnosis.
Data is from Cosmos, a HIPAA-defined Limited Data Set. As of September 23, 2021, there were 17,677,683 fully vaccinated patients in the Cosmos data set. Cosmos data are from 700+ hospitals, 10,000 clinics, and all 50 states.

Cosmos Data Set

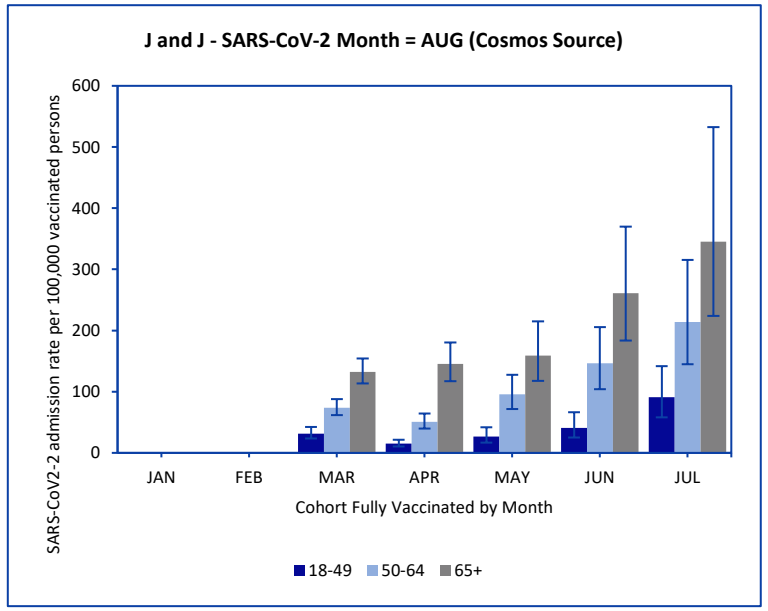
August 2021 Hospitalizations



Pfizer Hospitalization Rate (Aug): 32.3/ 100k vaccinated
N = 3,237 / 10,009,351



Moderna Hospitalization Rate (Aug): 27.5 / 100k vaccinated
N = 1,678 / 6,102,663



J and J Hospitalization Rate (Aug): 69.9 / 100k vaccinated
N = 754 / 1,078,579

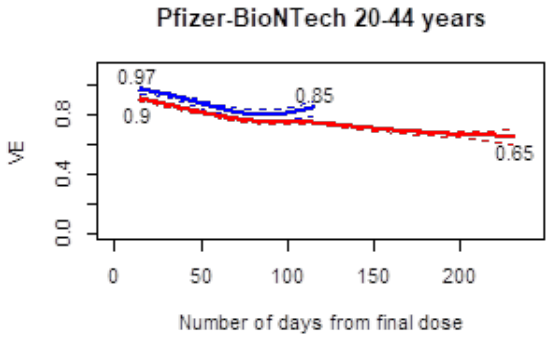
COVID-19 hospitalization rates by vaccination cohort, vaccine product, and age, August 2021. A patient is considered fully vaccinated ≥ 14 days after completing the primary series of an FDA-authorized or approved COVID-19 vaccine. A breakthrough case defined as a patient with PCR SARS-CoV-2 positive test result or a COVID-19 medical diagnosis. Data is from Cosmos, a HIPAA-defined Limited Data Set. As of September 23, 2021, there were 17,677,683 fully vaccinated patients in the Cosmos data set. Cosmos data are from 700+ hospitals, 10,000 clinics, and all 50 states.

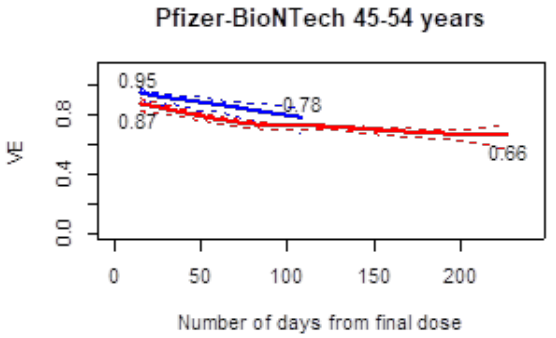
Increasing Community Access to Testing (ICATT) Partnership: VE analysis for symptomatic infection, March 13–August 31, 2021

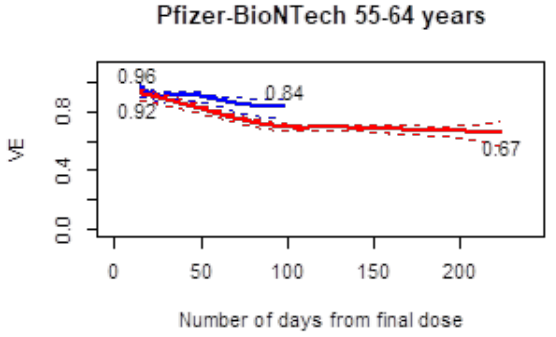
- Nationwide community-based COVID-19 testing via pharmacies and partners
- Self-reported vaccine history at time of registration for COVID-19 testing; excluded those who did not report vaccination status (18%)
- **Design**: Test-negative, case-control assessment
- **Period**: Pre-Delta: March 13–May 29 (N=255,519); Delta: July 18–August 31 (N=519,699)
- **Population**: Persons aged 20–64 years of age with COVID-like illness (CLI) and laboratory-based nucleic acid amplification testing (NAAT)
- **Adjusted for**:
  - Calendar day, race, ethnicity, gender, site's HHS region and state, site census tract's social vulnerability index (SVI)
  - **Not** adjusted for underlying conditions or prior infection

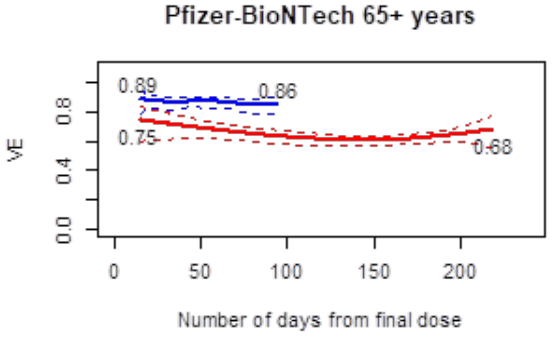
ICATT: Pfizer VE against symptomatic infection by age group and time since vaccination in pre-Delta and Delta periods

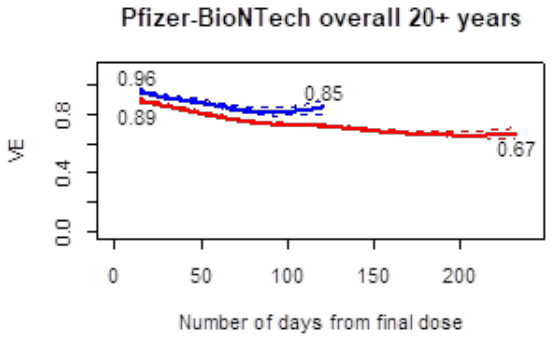
- VE is lower during Delta
- VE wanes during both periods
- Curves similar for 20-44, 45-54, and 55-64 age groups
- For ≥65, VE lower than for other age groups soon after vaccination, no clear trend over time since vaccination











Pre-Delta (March 13–May 29) with 95% CIs in dotted lines

Delta (July 18–August 31) with 95% CIs in dotted lines

The presented (fitted) curves are truncated on the day with ≤10 cases observed beyond it to avoid presenting wide confidence bounds.

ICATT limitations for VE against symptomatic infection

- Self-reported vaccination data, no clinical assessment
  - By limiting to persons with known vaccination status, a substantial proportion of records were lost
- No information on co-morbidities, prior infection, risk behaviors
- Analysis based on tests, no unique identifiers to track individuals in data
- No genetic sequencing results
  - Pre-Delta: March 13–May 29 2021
  - Delta: July 18–August 31 2021

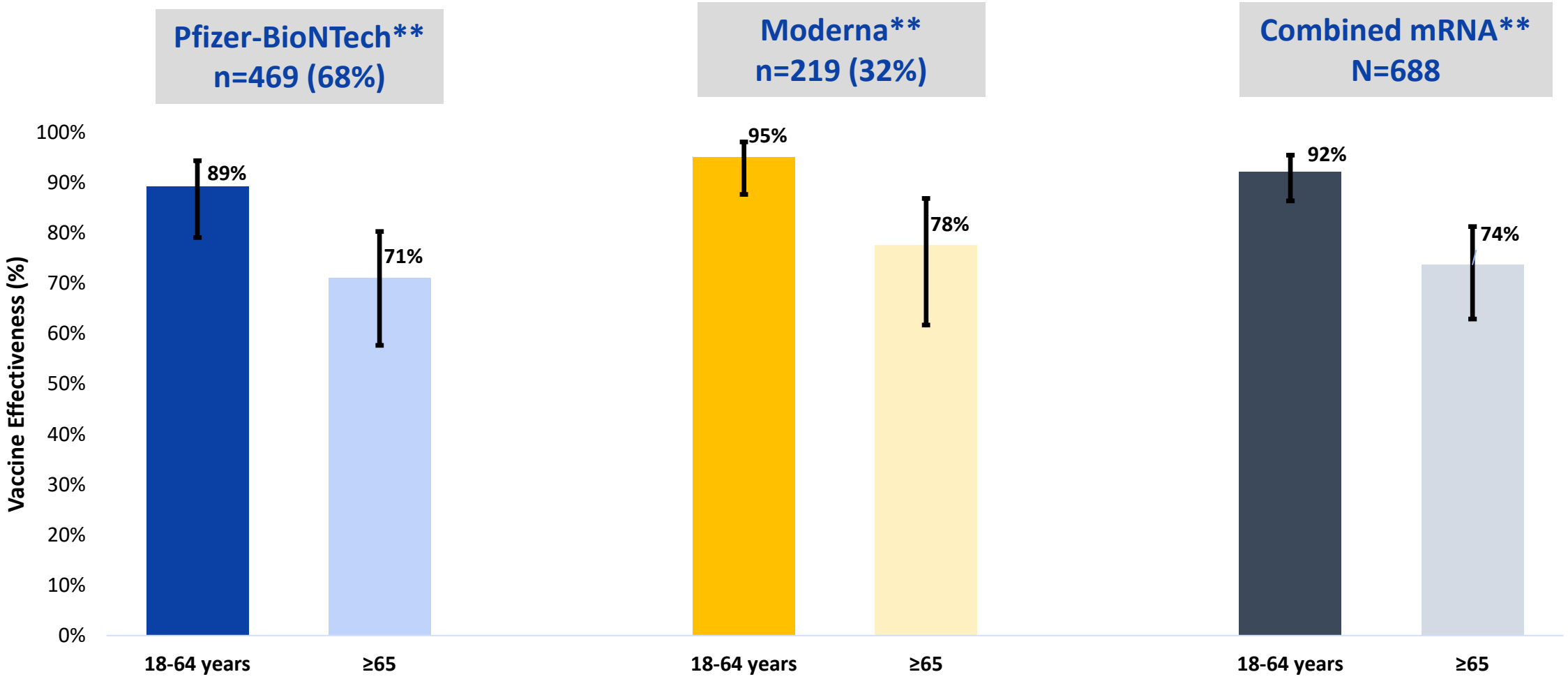
Vaccine effectiveness of mRNA vaccines against COVID-19-associated Hospitalization: SUPERNOVA Network

- **Design**: Test-negative, case-control assessment
- **Period**: February 1–September 17, 2021
- **Population**: U.S. Veterans (aged ≥18 years) hospitalized at 5 Veterans Affairs Medical Centers
- **Participants**
  - Cases: COVID-like illness (CLI) and SARS-CoV-2-positive test results by RT-PCR
  - Controls: CLI and SARS-CoV-2-negative test results by RT-PCR
- **Demographics:**
  - Median age: 68 years
  - 48% Black, non-Hispanic
  - 44% with Charlson Comorbidity Index score ≥3
    - 69% hypertension; 47% obesity; 43% diabetes

SUrveillance **P**latform for **E**nteric and **R**espiratory i**N**fectious **O**rganisms at the **VA**

https://www.cdc.gov/mmwr/volumes/70/wr/mm7037e3.htm

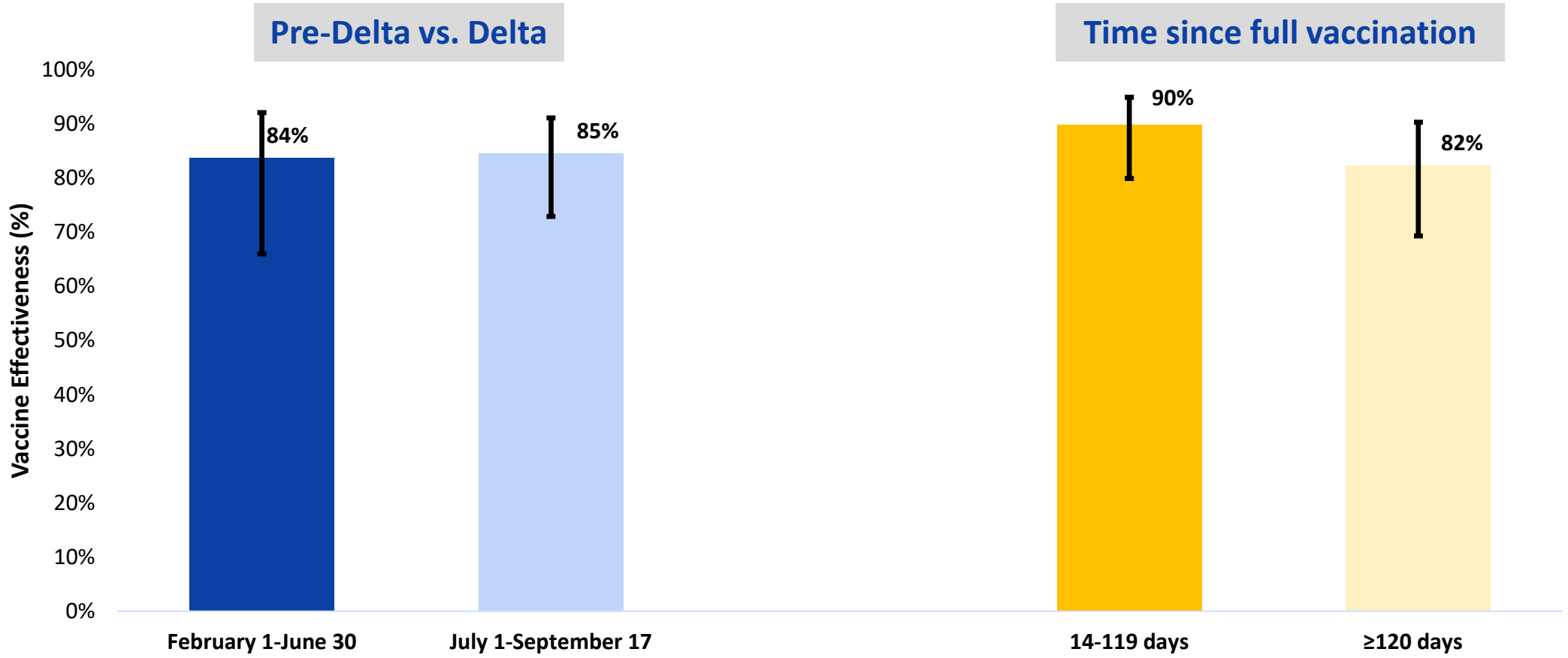
VE* against COVID-19-associated Hospitalization, by mRNA vaccine — SUPERNOVA Network, February 1–September 17, 2021



*Adjusted for site, time (admission date), age, sex, race/ethnicity. Stratified models exclude adjustment for stratification variable

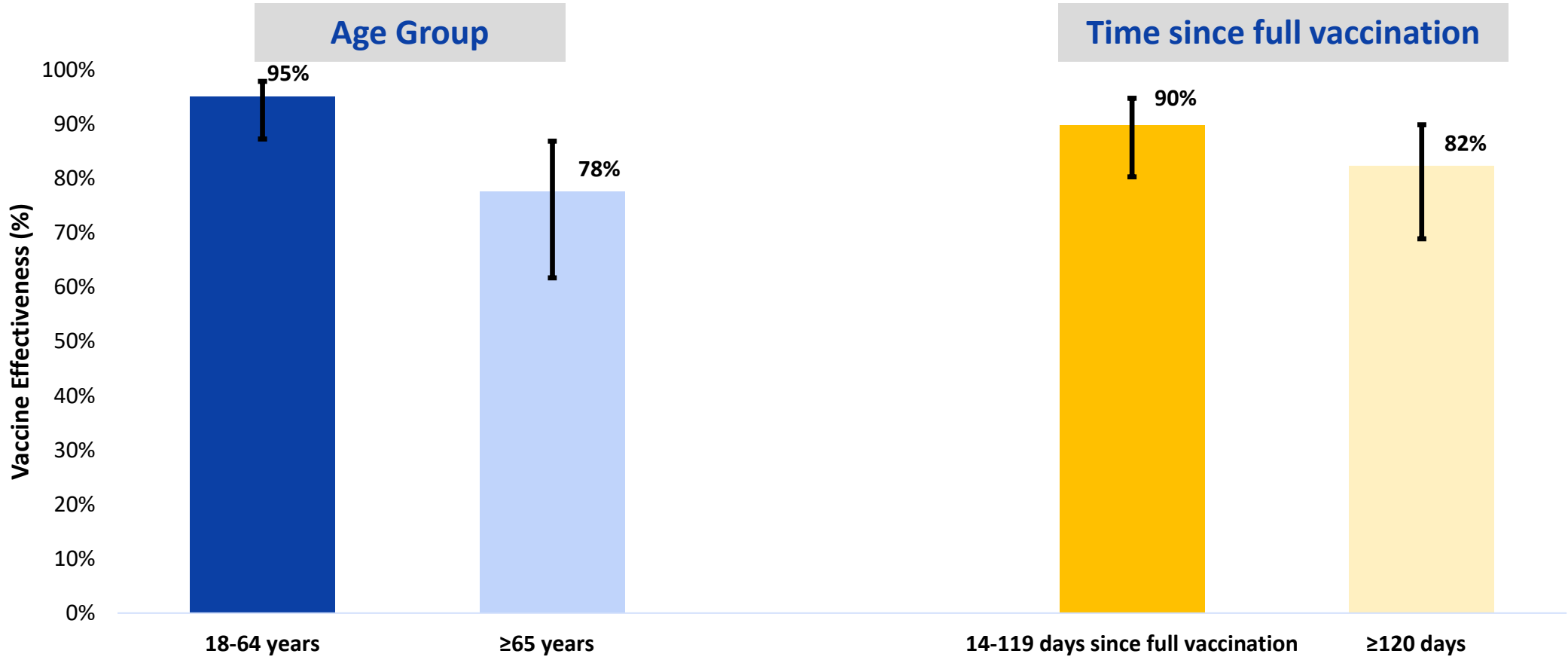
**Among fully vaccinated participants

VE* of Moderna vaccine against COVID-19-associated Hospitalization, by Delta variant predominance and time since vaccination — SUPERNOVA Network, February 1–September 17, 2021



**Adjusted for site, time (admission date), age, sex, race/ethnicity. Stratified models exclude adjustment for stratification variable.*

VE* of Moderna vaccine against COVID-19-associated Hospitalization — SUPERNOVA Network, February 1–September 17, 2021



*Adjusted for site, time (admission date), age, sex, race/ethnicity. Stratified models exclude adjustment for stratification variable.

Effectiveness of mRNA Vaccines for Preventing COVID-19 Hospitalizations, IVY Network

IVY
INFLUENZA AND OTHER VIRUSES IN THE ACUTELY ILL

- **Population**: Adults (≥18 years) hospitalized at 21 medical centers in 18 states
- **Case status**:
  - Cases with COVID-19-like illness and SARS-CoV-2 antigen / RT-PCR positive
  - Controls: SARS-CoV-2 RT-PCR negative
- SARS-CoV-2 testing within 10 days of illness onset and admission within 14 days of illness onset
- **Analytic period**: Admitted March 11–September 15, 2021
- **Chronic condition**: ≥1 cardiovascular, endocrine, gastrointestinal, hematological, neurological, pulmonary, or renal condition (*excluded patients with immunocompromising conditions*)

Tenforde et al. *MMWR* https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e2.htm

VISION Waning VE Study

- VISION VE uses linked EMR, laboratory, and vaccination data from 187 hospitals and 265 EDs/urgent care clinics to estimate VE against COVID-19 hospitalizations and emergency department (ED)/urgent care (UC) visits
- Research question: Does vaccine effectiveness against laboratory-confirmed COVID-19-associated medical encounters vary with time since vaccination among adults ≥18 years old?
- This analysis includes medical encounters experienced from June to September 2021.
- This analysis is restricted to **immunocompetent** adults, and VE for prevention of ED/UC visits is stratified by **presence or absence of an underlying medical condition**.
- Results are presented by **age group** (18 to 44 years, 45 to 64 years, 65+ years) and **vaccine product.**

VISION VE methods

- **Data**: Hospitalizations and ED/UC visits among adults ≥18 yr with SARS-CoV-2 molecular testing and a COVID-19-like illness diagnosis
- **Design**: Test-negative design
- **Statistical model**: Logistic regression conditioned on calendar week and site-region, adjusted for covariates (age, sex, race ethnicity, underlying medical conditions, local percent SARS-CoV-2 positivity by date, propensity to be vaccinated score)
- **Outcome**: Laboratory-confirmed COVID-19-related hospitalization; ED/UC visit (separate analyses)
- **Excludes**: Vaccinees with more than 2 doses, individuals with prior positive SARS-CoV-2 test (historical infection)

VISION VE methods, continued

- **Comorbidities** included asthma, COPD, other lung disease, heart failure, ischemic heart disease, hypertension, other heart disease, stroke, other cerebrovascular disease, diabetes, other metabolic diseases, obesity, underweight, renal, liver, blood disorders, musculoskeletal/neurologic disorders, Down syndrome, dementia, and cancers without immunocompromise
- **Immunocompromising conditions** included HIV/AIDS other than asymptomatic HIV/AIDS, hematologic and solid malignancies, organ transplant, rheumatologic disorders, and chronic systemic steroid use

VE against COVID-19 ED/UC visits among immunocompetent persons **without comorbidity**

- Ages 18-44: Pfizer, Moderna, Janssen
- Ages 45-64: Pfizer, Moderna, Janssen
- Ages 65+: Pfizer, Moderna, Janssen

Pfizer-BioNTech VE against ED/UC visits for COVID-19 among immunocompetent adults **18-44** years without comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	5459/17,763 (30.7)		
Full <2 mo	22/923 (2.4)	**93** (89 – 95)	
Full 2 to <4 mo	108/2182 (4.9)	**88** (86 – 90)	
Full 4 to <6 mo	96/1249 (7.7)	**82** (77 – 85)	
Full ≥6 mo	50/497 (10.1)	**79** (71 – 84)	<0.001
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was high among recent vaccinees.
- Pfizer VE waned, declining to 79% among those vaccinated ≥6 months.

Moderna VE against ED/UC visits for COVID-19 among immunocompetent adults **18-44** years without comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	P*
Unvaccinated	5459/17,763 (30.7)		
Full <2 mo	10/431 (2.3)	**93** (87 – 96)	
Full 2 to <4 mo	43/1228 (3.5)	**93** (90 – 95)	
Full 4 to <6 mo	45/918 (4.9)	**89** (85 – 92)	
Full ≥6 mo	37/397 (9.3)	**81** (74 – 87)	0.006
*Comparing most remote vaccination category to full vaccination <2 mo			

- Moderna VE against ED/UC visits was high among recent vaccinees.
- Moderna VE waned, declining to 81% among those vaccinated ≥6 months.

Janssen VE against ED/UC visits for COVID-19 among immunocompetent adults **18-44** years without comorbidity

Vaccination Status	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	5310/16,949 (31.3)		
Full <2 mo	16/150 (10.7)	**74** (55 – 85)	
Full 2 to <4 mo	38/398 (9.5)	**76** (67 – 83)	
Full ≥4 mo	55/363 (15.2)	**68** (57 – 76)	0.55
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits among recent vaccinees was lower for Janssen vaccinees compared to mRNA vaccinees.
- VE declined from 74% to 68% but this decline was not statistically significant.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Pfizer-BioNTech VE against ED/UC visits for COVID-19 among immunocompetent adults **45-64** years without comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	2310/5409 (42.7)		
Full <2 mo	15/341 (4.4)	**91** (84 - 95)	
Full 2 to <4 mo	131/1136 (11.5)	**80** (76 - 84)	
Full 4 to <6 mo	148/993 (14.9)	**79** (74 – 83)	
Full ≥6 mo	36/233 (15.5)	**78** (68 - 85)	0.008
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was high among recent vaccinees.
- Pfizer VE waned, declining to 78% among those vaccinated ≥6 months.

Moderna VE against ED/UC visits for COVID-19 among immunocompetent adults **45-64** years without comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	2310/5409 (42.7)		
Full <2 mo	4/198 (2.0)	**96** (88 - 98)	
Full 2 to <4 mo	36/744 (4.8)	**94** (91 - 95)	
Full 4 to <4 mo	55/676 (8.1)	**90** (87 – 93)	
Full ≥6 mo	26/231 (11.3)	**85** (78 - 90)	0.03
*Comparing most remote vaccination category to full vaccination <2 mo			

- Moderna VE against ED/UC visits was very high among recent vaccinees.
- Moderna VE waned, declining to 85% among those vaccinated ≥6 months.

Janssen VE against ED/UC visits for COVID-19 among immunocompetent adults **45-64** years without comorbidity

Vaccination Status	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	2267/3052 (43.1)		
Full <2 mo	12/63 (19.0)	**66** (34 – 83)	
Full 2 to <4 mo	43/222 (19.4)	**62** (46 – 74)	
Full ≥4 mo	80/301 (26.6)	**61** (48 – 70)	0.69
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits among recent vaccinees was lower for Janssen vaccinees compared to mRNA vaccinees.
- VE declined from 66% to 61% but this decline was not statistically significant.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Pfizer-BioNTech VE against ED/UC visits for COVID-19 among immunocompetent adults **65+** years without comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	769/2422 (42.2)		
Full <2 mo	6/63 (9.5)	**84** (60 – 94)	
Full 2 to <4 mo	43/544 (7.9)	**80** (72 – 86)	
Full 4 to <6 mo	237/1237 (19.2)	**69** (62 – 75)	
Full ≥6 mo	90/304 (29.6)	**62** (49 – 72)	0.08
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was moderate (84%) among recent vaccinees.
- VE declined from 84% to 62% but this decline was not statistically significant.

Moderna VE against ED/UC visits for COVID-19 among immunocompetent adults **65+** years without comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	769/1822 (42.2)		
Full <2 mo	3/48 (6.3)	**90** (66 – 97)	
Full 2 to <4 mo	23/399 (5.8)	**87** (79 – 92)	
Full 4 to <4 mo	113/787 (14.4)	**83** (78 – 87)	
Full ≥6 mo	33/182 (18.1)	**82** (73 – 89)	0.37
*Comparing most remote vaccination category to full vaccination <2 mo			

- Moderna VE against ED/UC visits was high among recent vaccinees.
- VE declined from 90% to 82% but this decline was not statistically significant.

Janssen VE against ED/UC visits for COVID-19 among immunocompetent adults **65+** years without comorbidity

Vaccination Status	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	761/1783 (42.7)		
Full <2 mo	2/14 (14.3)	**76** (-16 – 95)	
Full 2 to <4 mo	5/57 (8.8)	**83** (49 – 94)	
Full ≥4 mo	22/114 (19.3)	**76** (57 – 86)	0.98
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits among recent vaccinees was lower for Janssen vaccinees compared to mRNA vaccinees.
- Protection remained consistent, with no evidence of waning.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Summary among persons without comorbidity

Adjusted VE against laboratory-confirmed COVID-19 ED/UC visits and pattern of waning among immunocompetent adults without underlying comorbidity; VISION Network, June to September 2021

Age	Vaccine product	VE against ED/UC visits	
		VE for recent vaccinees	Waning pattern
18 to 44 yr	BNT162b2 Pfizer	high	declined to 79%
	mRNA-1273 Moderna	high	declined to 81%
	Janssen	moderate (74%)	none
45 to 64 yr	BNT162b2 Pfizer	high	declined to 78%
	mRNA-1273 Moderna	very high	declined to 85%
	Janssen	moderate (66%)	none
65+ yr	BNT162b2 Pfizer	moderate (84%)	mild; NS
	mRNA-1273 Moderna	high	mild; NS
	Janssen	moderate (76%)	none

Highlighted = statistically significant $p<0.05$; NS = not statistically significant

- mRNA vaccines have high initial VE.
- Pfizer VE exhibits mild to moderate waning.
- Moderna VE exhibits mild to moderate waning.
- Janssen vaccine has moderate initial VE and no statistically significant evidence of waning.

VE against COVID-19 ED/UC visits among immunocompetent persons **with comorbidity**

- Ages 18-44: Pfizer, Moderna, Janssen
- Ages 45-64: Pfizer, Moderna, Janssen
- Ages 65+: Pfizer, Moderna, Janssen

Pfizer-BioNTech VE against ED/UC visits for COVID-19 among immunocompetent adults **18-44** years with comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1013/3959 (25.6)		
Full <2 mo	3/201 (1.5)	**95** (84 - 99)	
Full 2 to <4 mo	12/379 (3.2)	**92** (85 - 95)	
Full 4 to <6 mo	14/206 (6.8)	**88** (77 – 93)	
Full ≥6 mo	3/73 (4.1)	**92** (73 - 97)	0.52
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was very high among recent vaccinees.
- VE estimates declined with increasing time since vaccination but this decline was not statistically significant.

Moderna VE against ED/UC visits for COVID-19 among immunocompetent adults **18-44** years with comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	P*
Unvaccinated	1013/3959 (25.6)		
Full <2 mo	1/120 (0.8)	**98** (84 - 100)	
Full 2 to <4 mo	5/232 (2.2)	**96** (90 - 98)	
Full 4 to <6 mo	8/184 (4.3)	**92** (83 – 96)	
Full ≥6 mo	2/47 (4.3)	**94** (75 - 99)	0.45
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was very high among recent vaccinees.
- VE estimates declined with increasing time since vaccination but this decline was not statistically significant. Protection remained high among those vaccinated ≥6 months.

Janssen VE against ED/UC visits for COVID-19 among immunocompetent adults **18-44** years with comorbidity

Vaccination Status	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	994/3828 (26.0)		
Full <2 mo	5/51 (9.8)	**69** (18 – 89)	
Full 2 to <4 mo	5/101 (5.0)	**84** (59 – 94)	
Full ≥4 mo	9/71 (12.7)	**73** (40 – 87)	0.86
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits among recent vaccinees was lower for Janssen vaccinees compared to mRNA vaccinees.
- Protection remained consistent, with no evidence of waning.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Pfizer-BioNTech VE against ED/UC visits for COVID-19 among immunocompetent adults **45-64** years with comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1035/3120 (33.2)		
Full <2 mo	3/239 (1.3)	**97** (89 - 99)	
Full 2 to <4 mo	26/552 (4.7)	**89** (83 - 93)	
Full 4 to <6 mo	41/381 (10.8)	**82** (74 – 87)	
Full ≥6 mo	9/81 (11.1)	**84** (67 - 92)	0.03
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was very high among recent vaccinees.
- Pfizer VE waned, with VE of 84% at 6 months or more after vaccination.

Moderna VE against ED/UC visits for COVID-19 among immunocompetent adults **45-64** years with comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1035/3120 (33.2)		
Full <2 mo	1/161 (0.6)	**99** (91 - 100)	
Full 2 to <4 mo	13/417 (3.1)	**95** (90 - 97)	
Full 4 to <4 mo	12/276 (4.3)	**94** (89 – 97)	
Full ≥6 mo	4/52 (7.7)	**90** (72 - 97)	0.08
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was very high among recent vaccinees.
- VE declined from 99% to 90% but this decline was not statistically significant.

Janssen VE against ED/UC visits for COVID-19 among immunocompetent adults **45-64** years with comorbidity

Vaccination Status	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1026/3052 (33.6)		
Full <2 mo	8/53 (15.1)	**64** (20 – 84)	
Full 2 to <4 mo	13/148 (8.8)	**82** (66 – 90)	
Full ≥4 mo	15/123 (12.2)	**81** (66 – 89)	0.21
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits among recent vaccinees was lower for Janssen vaccinees as compared to mRNA vaccines.
- Protection remained consistent, with no evidence of waning.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Pfizer-BioNTech VE against ED/UC visits for COVID-19 among immunocompetent adults **65+** years with comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	680/2422 (28.1)		
Full <2 mo	4/149 (2.7)	**88** (65 – 96)	
Full 2 to <4 mo	33/938 (3.5)	**82** (74 – 88)	
Full 4 to <6 mo	121/1220 (9.9)	**74** (67 – 80)	
Full ≥6 mo	55/310 (17.7)	**64** (48 – 75)	0.05
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was moderately high (88%) among recent vaccinees.
- VE declined from 88% to 64% but this decline was not statistically significant at the p<0.05 level.

Moderna VE against ED/UC visits for COVID-19 among immunocompetent adults **65+** years with comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	680/2422 (28.1)		
Full <2 mo	1/108 (0.9)	**98** (82 – 100)	
Full 2 to <4 mo	16/671 (2.4)	**93** (89 – 96)	
Full 4 to <4 mo	72/908 (7.9)	**87** (82 – 90)	
Full ≥6 mo	22/165 (13.3)	**80** (66 – 88)	0.05
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits was very high among recent vaccinees.
- VE declined from 98% to 80% but this decline was not statistically significant at the $p<0.05$ level.

Janssen VE against ED/UC visits for COVID-19 among immunocompetent adults **65+** years with comorbidity

Vaccination Status	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	673/2392 (28.1)		
Full <2 mo	4/46 (8.7)	**60** (-27 – 87)	
Full 2 to <4 mo	13/148 (8.8)	**63** (30 – 80)	
Full ≥4 mo	28/125 (22.4)	**42** (6 – 65)	0.57
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against ED/UC visits among recent vaccinees was lower for Janssen vaccinees as compared to mRNA vaccines.
- VE declined from 60% to 42% but this decline was not statistically significant.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

VE against COVID-19 hospitalizations among immunocompetent persons **with comorbidity**

- Ages 18-44: Pfizer, Moderna, Janssen
- Ages 45-64: Pfizer, Moderna, Janssen
- Ages 65+: Pfizer, Moderna, Janssen

Pfizer-BioNTech VE against COVID-19 hospitalizations among immunocompetent adults **18-44** years with comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1440/4983 (28.9)		
Full <2 mo	1/274 (0.4)	**99** (94 - 100)	
Full 2 to <4 mo	12/517 (2.3)	**97** (94 - 98)	
Full 4 to <6 mo	6/259 (2.3)	98 (94 – 99)	
Full ≥6 mo	6/62 (9.7)	**88** (70 - 95)	0.02
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalization was very high among recent vaccinees.
- Pfizer VE had mild waning, to VE of 88% at 6 months post vaccination.

Moderna VE against COVID-19 hospitalizations among immunocompetent adults **18-44** years with comorbidity

Vaccination Status	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1440/4983 (28.9)		
Full <2 mo	1/132 (0.8)	**99** (90 - 100)	
Full 2 to <4 mo	5/302 (1.7)	**98** (96 - 99)	
Full 4 to <6 mo	7/160 (4.4)	**96** (92 – 98)	
Full ≥6 mo	3/33 (9.1)	**92** (71 - 98)	0.14
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalization was very high among recent vaccinees.
- VE declined from 99% to 92% but this decline was not statistically significant.

Janssen VE against COVID-19 hospitalizations among immunocompetent adults **18-44** years with comorbidity

Vaccination	Ad26.COV2.S (Janssen)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1323/3869 (34.2)		
Full <2 mo	2/36 (5.6)	**93** (69- 99)	
Full 2 to <4 mo	5/75 (6.7)	**93** (82 – 98)	
Full ≥4 mo	7/42 (16.7)	**89** (72 – 96)	0.58
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations among recent vaccinees was high for Janssen vaccinees aged 18-44 yr.
- Protection remained consistent, with no evidence of waning.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Pfizer-BioNTech VE against COVID-19 hospitalizations among immunocompetent adults **45-64** years with comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1885/4760 (39.6)		
Full <2 mo	3/346 (0.9)	**98** (94 - 99)	
Full 2 to <4 mo	44/844 (5.2)	**94** (92 - 96)	
Full 4 to <6 mo	42/447 (9.4)	**94** (90 – 96)	
Full ≥6 mo	8/76 (10.5)	**96** (89 - 98)	0.25
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations was very high among recent vaccinees.
- Protection remained consistent, with no evidence of waning.

Moderna VE against COVID-19 hospitalizations among immunocompetent adults **45-64** years with comorbidity

Vaccination	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1885/4760 (39.6)		
Full <2 mo	2/265 (0.8)	**99** (96 - 100)	
Full 2 to <4 mo	15/675 (2.2)	**98** (96 - 99)	
Full 4 to <6 mo	18/321 (5.6)	**97** (94 – 98)	
Full ≥6 mo	7/48 (14.6)	**92** (81 - 97)	0.02
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations was very high among recent vaccinees.
- Moderna VE waned modestly, but protection remained high at 6 months post vaccination.

Janssen VE against COVID-19 hospitalizations among immunocompetent adults **45-64** years with comorbidity

Vaccination	Janssen		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1756/3809 (46.1)		
Full <2 mo	12/62 (19.4)	**62** (20 – 82)	
Full 2 to <4 mo	16/193 (8.3)	**89** (80 – 94)	
Full ≥4 mo	36/135 (26.7)	**84** (73 – 90)	0.06
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations among recent vaccinees was lower among Janssen vaccinees.
- Protection remained consistent, with no evidence of waning.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.
- Janssen VE estimates are based on preliminary analyses of relatively small samples.

Pfizer-BioNTech VE against COVID-19 hospitalizations among immunocompetent adults **65+** years with comorbidity

Vaccination Status	BNT162b2 (Pfizer-BioNTech)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1299/5137 (25.3)		
Full <2 mo	3/262 (1.1)	**95** (85 - 99)	
Full 2 to <4 mo	66/2128 (3.1)	**85** (80 - 88)	
Full 4 to <6 mo	252/2870 (8.8)	**81**(77 – 84)	
Full ≥6 mo	76/488 (15.6)	**74** (65 - 81)	0.004
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations was very high among recent vaccinees.
- Pfizer VE waned, declining to 74% among adults aged 65+ vaccinated 6 months or more.

Moderna VE against COVID-19 hospitalizations among immunocompetent adults **65+** years with comorbidity

Vaccination	mRNA-1273 (Moderna)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1299/5137 (25.3)		
Full <2 mo	2/195 (1.0)	**96** (83 - 99)	
Full 2 to <4 mo	36/1621 (2.2)	**93** (90 - 95)	
Full 4 to <6 mo	96/1939 (5.0)	**92** (90 – 94)	
Full ≥6 mo	30/247 (14.6)	**81** (71 - 88)	0.04
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations was very high among recent vaccinees.
- Moderna VE waned, declining to 81% among adults aged 65+ vaccinated 6 months or more

Janssen VE against COVID-19 hospitalizations among immunocompetent adults **65+** years with comorbidity

Vaccination	Ad26.COV2.S (Janssen)		
	Pos./Total (%)	**VE** % (95% CI)	p*
Unvaccinated	1183/3889 (30.4)		
Full <2 mo	7/80 (8.8)	**90** (71 - 97)	
Full 2 to <4 mo	18/237 (7.6)	**80** (65 - 88)	
Full ≥4 mo	21/123 (17.1)	**81** (67 – 89)	0.27
*Comparing most remote vaccination category to full vaccination <2 mo			

- VE against hospitalizations was high among recent vaccinees.
- VE declined from 90% to 81% but this decline was not statistically significant.
- Sample size was insufficient to estimate VE for persons vaccinated ≥6 months.

Summary among persons with comorbidity

Adjusted VE against laboratory-confirmed COVID-19 medical encounters and pattern of waning among immunocompetent adults with underlying comorbidity; VISION Network, June to September 2021

Age	Vaccine product	VE against ED/UC visits		VE against hospitalizations	
		VE for recent vaccinees	Waning pattern	VE for recent vaccinees	Waning pattern
18 to 44 yr	BNT162b2 Pfizer	very high	very mild; NS	very high	declined to 88%
	mRNA-1273 Moderna	very high	very mild; NS	very high	very mild; NS
	Janssen	moderate (~70%)	none	high (~93%)	none
45 to 64 yr	BNT162b2 Pfizer	very high	declined to 84%	very high	none
	mRNA-1273 Moderna	very high	very mild; NS	very high	declined to 92%
	Janssen	moderate (~65%)	none	moderate (~62%)	none
65+ yr	BNT162b2 Pfizer	high (88%)	potential waning; NS	very high	declined to 74%
	mRNA-1273 Moderna	very high	potential waning; NS	very high	declined to 81%
	Janssen	moderate (~60%)	potential waning; NS	high (~90%)	mild; NS

Highlighted = statistically significant p<0.05; NS = not statistically significant

- mRNA vaccines have high initial VE against both outcomes.
- Pfizer VE exhibits mild to moderate waning, with waning more pronounced for VE against ED/UC visits. Pfizer VE against hospitalization remains >85% at 6 months after second dose for 18-64 yo but declines to 74% among 65+ yo.
- Moderna VE wanes mildly for both outcomes and remains highly protective (≥90%) at 6 months after second dose for 18-64 yo, but declines to 81% among 65+ yo.
- Janssen vaccine has moderate initial VE against ED/UC visits and high to moderate VE against hospitalizations (depending on age group), with no significant evidence of waning. Sample sizes were smaller and duration of follow-up shorter for Janssen.

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Ongoing systematic review of vaccine effectiveness, WHO and International Vaccine Access Center

- Available at https://view-hub.org/resources
- Methods for VE and impact studies
  - Published or preprint studies (not press release, presentations, media)
  - Needs confidence intervals around VE
  - Needs to include persons with & without infection or disease and with and without vaccination (i.e., a proper comparison group)
  - No case only studies (e.g., impact studies, risk of progression to severe disease [i.e., PHE]).
  - No modeled comparison group
  - No comparison to historical cohort
  - VE should be adjusted or state adjustment made no difference
  - Outcomes must be lab confirmed, not syndromic
  - Documented vaccination status needed
  - VE for one vaccine or combined vaccines of same platform e.g., Pfizer + Moderna
  - No significant bias that likely affects results
  - Cannot include day 0-12 in unvaccinated definition
  - Cannot compare to early post vaccination to calculate VE (e.g., day 0-12 vs day 12-21)

Study: VE against transmission from close contacts (infection)

- Public health data in Navarre, Spain
- Included 30,240 close contacts of 12,263 laboratory-confirmed cases during April to August 2021
  - 7,177 infections
- Compared incidence in vaccinated and unvaccinated
- VE against infection decreased if last dose ≥90 days from time of close contact
- VE against Delta lower than against Alpha but overlapping 95% CI

	Adjust VE (95% CI)	
Vaccine	**<90 days since last dose**	**≥90 days since last dose**
Unvaccinated	REF	REF
Janssen	52 (44-59)	28 (-8-53)
Moderna	85 (80-88)	67 (50-78)

	Variant	
	Alpha	**Delta**
Unvaccinated	REF	REF
Janssen	77 (27-93)	42 (18-59)
Moderna	86 (56-95)	77 (64-85)

Martinez-Baz et al. *Eurosurveillance*. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.39.2100894