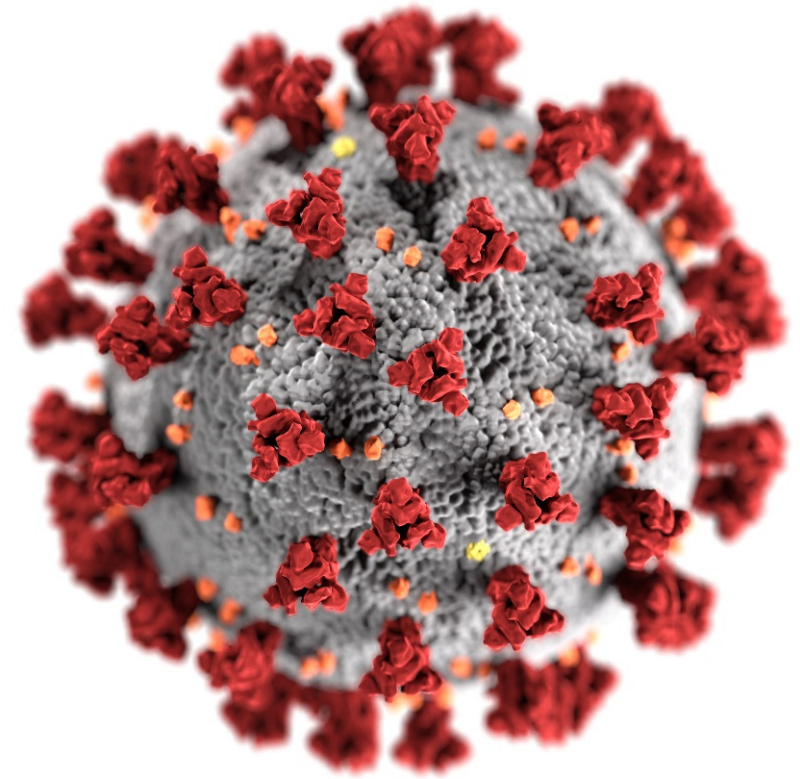


# Framework for booster doses of COVID-19 vaccines

Sara Oliver MD, MSPH  
ACIP Meeting  
August 30, 2021



[cdc.gov/coronavirus](https://cdc.gov/coronavirus)

# Roles of an Additional Dose

There are two distinct potential uses for an additional dose:

- **Additional dose after an initial primary vaccine series**: administration of an additional vaccine dose when the initial immune response following a primary vaccine series is likely to be insufficient
- **Booster dose**: a dose of vaccine administered when the initial sufficient immune response to a primary vaccine series is likely to have waned over time

## Booster doses of COVID-19 vaccines

- Are booster doses of COVID-19 vaccines needed for those previously vaccinated with a primary series?
- Policy on booster doses will be coordinated with **FDA** for regulatory allowance, and **ACIP** for recommendations for use

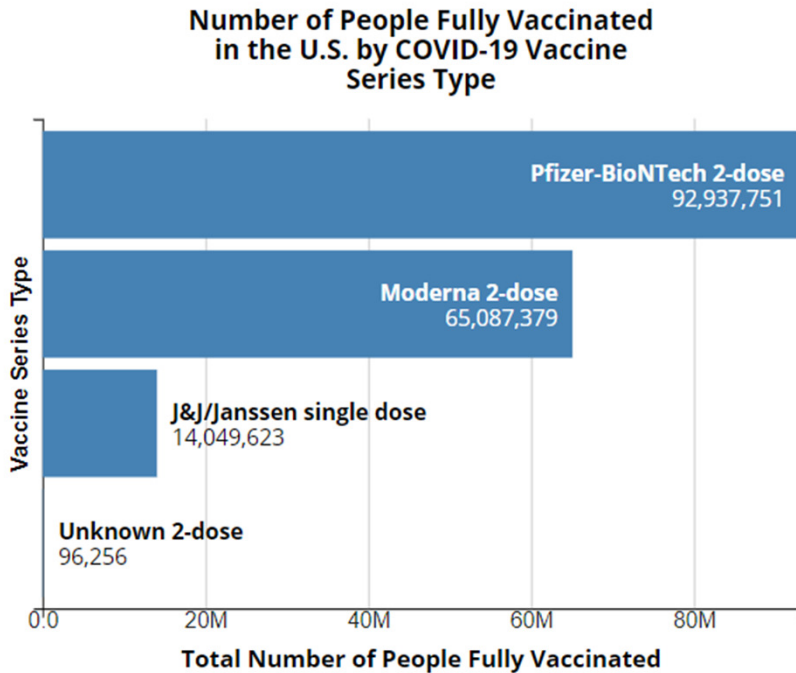


# COVID-19 vaccines administered

As of August 26, 2021

**Total Vaccine Doses Administered:  
365,767,674**

**% of Population  
Fully Vaccinated:**



**≥12 years of age:  
60.7%**



**≥18 years of age:  
62.8%**

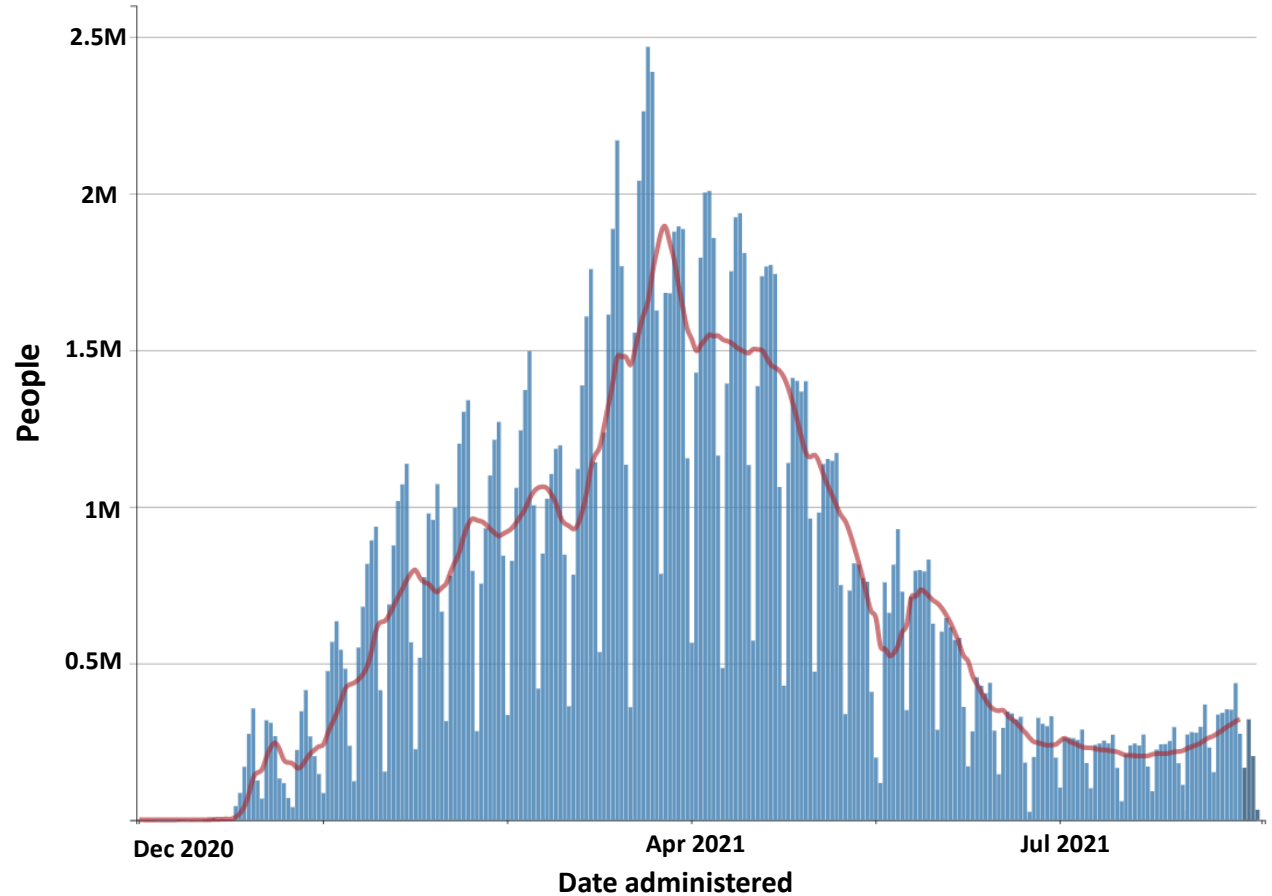


**≥65 years of age:  
81.4%**

# COVID-19 vaccines

As of August 26, 2021

## Daily Count of Newly Fully Vaccinated People

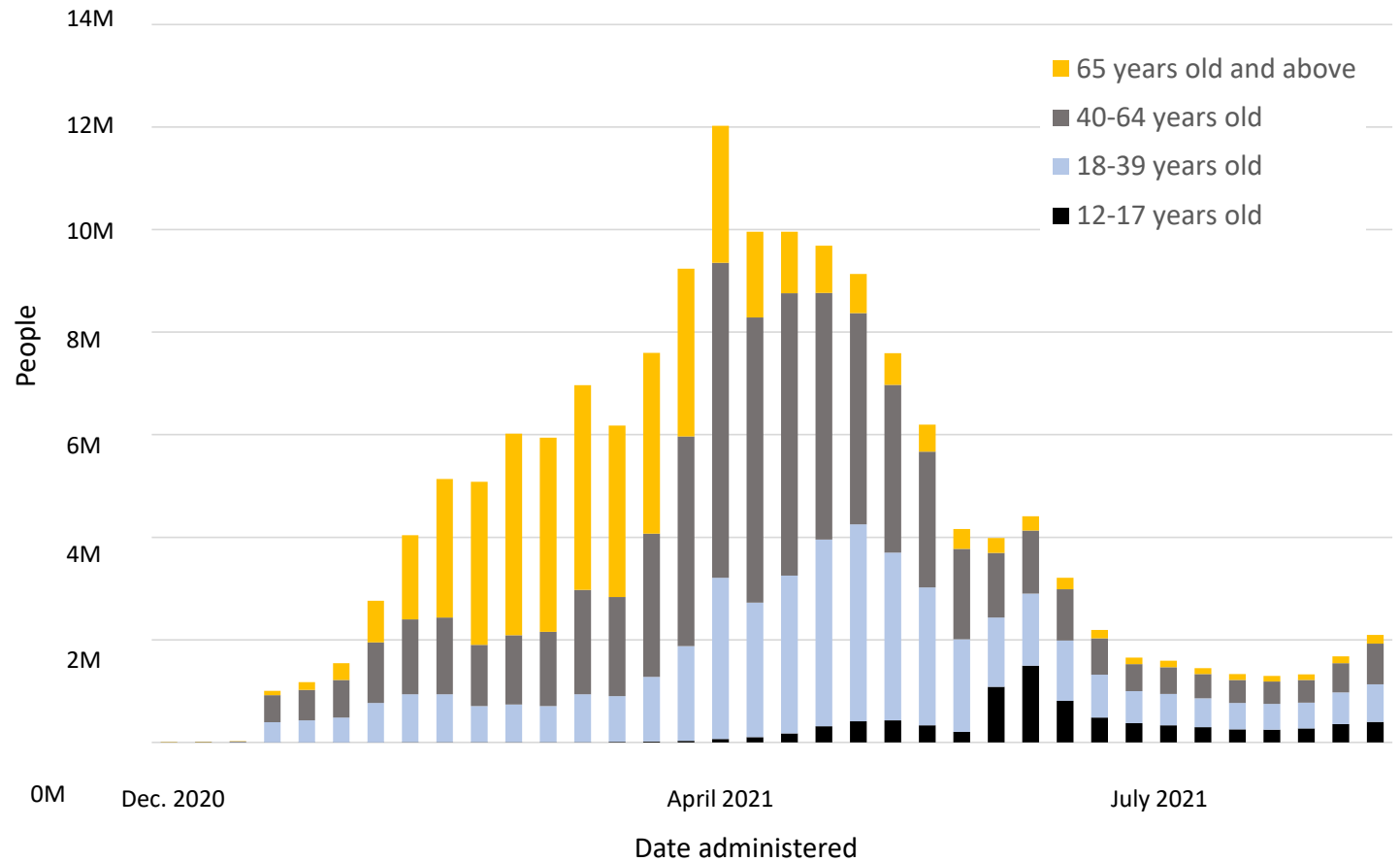


A person is considered fully vaccinated against COVID-19  $\geq 2$  weeks after receipt of the second dose in a two-dose series (Pfizer-BioNTech and Moderna) or  $\geq 2$  weeks after receipt of the single dose of the Janssen vaccine; CDC. <https://covid.cdc.gov/covid-data-tracker>

# COVID-19 vaccines

As of August 11, 2021

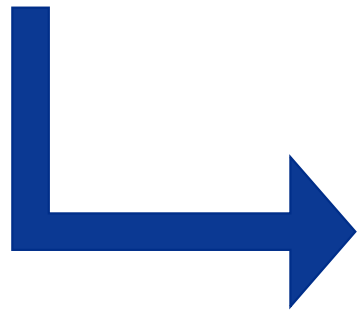
## Weekly Count of Newly Fully Vaccinated People in US, by age group



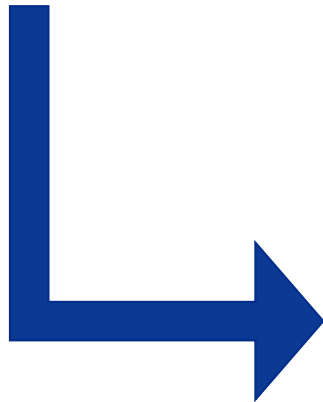
A person is considered fully vaccinated against COVID-19  $\geq 2$  weeks after receipt of the second dose in a two-dose series (Pfizer-BioNTech and Moderna) or  $\geq 2$  weeks after receipt of the single dose of the Janssen vaccine; CDC. <https://covid.cdc.gov/covid-data-tracker>

# Booster doses of COVID-19 vaccines

What are the **key considerations** for decision making?



What **data** are available for decision making?



Does ACIP **recommend** booster doses of COVID-19 vaccines in any populations?

# Booster doses of COVID-19 vaccines

What are the **key considerations** for decision making?

ACIP Meeting Aug 13: Framework for COVID-19 booster doses presented



What **data** are available for decision making?

ACIP Meeting Aug 30: Begin to provide data to inform booster dose policy



Does ACIP **recommend** booster doses of COVID-19 vaccines in any populations?



## Booster doses of COVID-19 vaccines

Do we need them?

Public  
Health  
Problem

Is vaccine effectiveness (VE) **waning** over time?

Is VE **reduced** for the **Delta variant**?

Does the need vary by **sub-population**?

Do they work?

Benefits  
and  
Harms

Are booster doses of COVID-19 vaccines **safe** and **immunogenic**?

Will booster doses reduce COVID-19 **incidence, hospitalization** and/or **mortality**?

Do booster doses **improve VE** against the Delta variant?

## Booster doses of COVID-19 vaccines: Data to inform recommendations



Public  
Health  
Problem

Is vaccine effectiveness (VE) waning over time?

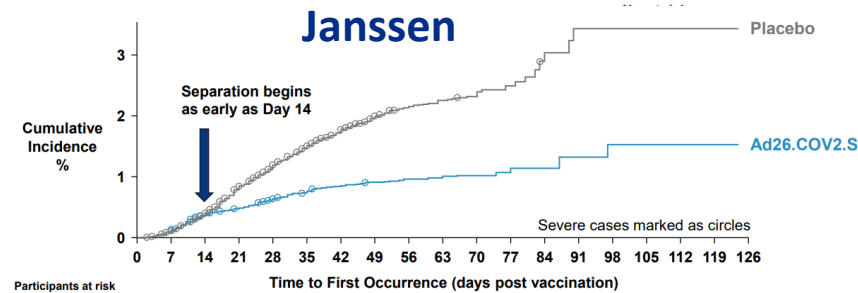
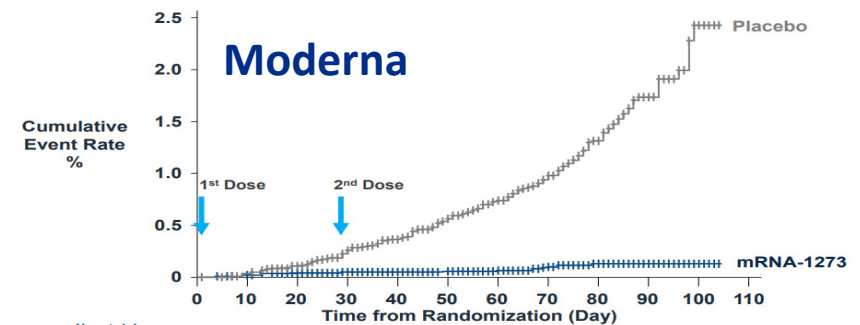
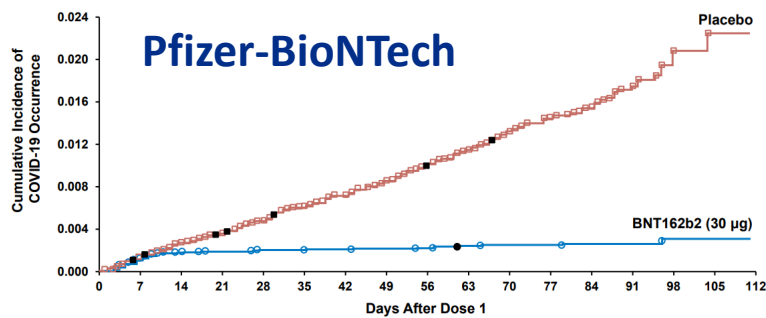
Is VE **recently** similar to what was noted at  
**2 months** after vaccination?

How do these data vary by **severity** of disease?

How do these data vary by **vaccine**?

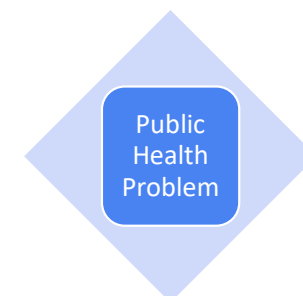
# Booster doses of COVID-19 vaccines: Is vaccine effectiveness waning over time?

- Initial VE reviewed during EUA application



- Will work with manufacturers to review longer-term follow up from clinical trials

# Recent U.S. Publications



Author	Publication (Date)	Population	Outcomes	Time Assessed
Tenforde et al.	MMWR (8/18/21)	Multi-state network of hospitalized adults	Hospitalization	March – July 2021
Rosenberg et al.	MMWR (8/18/21)	Adult residents of NY	Documented infection Hospitalization	May – July 2021
Nanduri et al.	MMWR (8/18/21)	Nursing home residents	Documented infection	March – July 2021
Fowlkes et al.	MMWR (8/25/21)	Healthcare workers and first responders in six states	Documented infection	Dec 2020 – July 2021
Puranik et al.	Preprint (8/9/21)	Adults within the Mayo Clinic health system	Documented infection Hospitalization	February – July 2021

Tenforde MW, Self WH, Naioti EA, et al. Sustained Effectiveness of Pfizer-BioNTech and Moderna Vaccines Against COVID-19 Associated Hospitalizations Among Adults — United States, March–July 2021. MMWR Morb Mortal Wkly Rep. ePub: 18 August 2021.

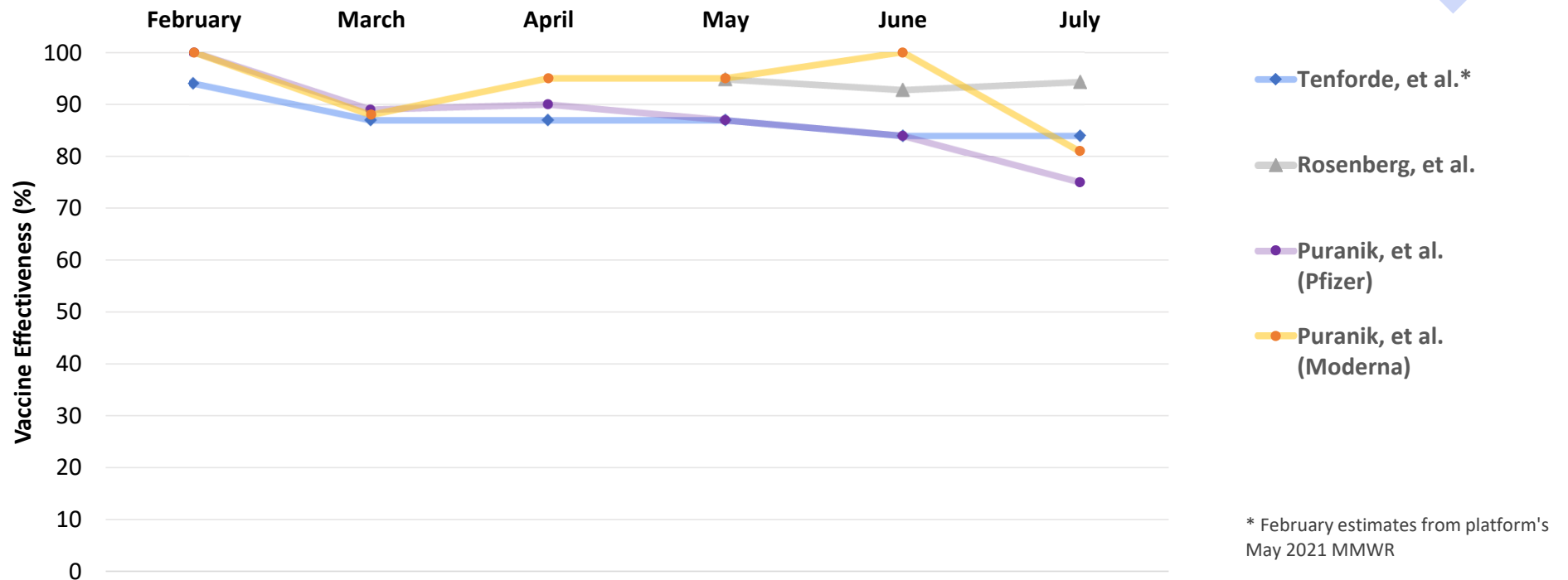
Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 Cases and Hospitalizations Among Adults, by Vaccination Status — New York, May 3–July 25, 2021. MMWR Morb Mortal Wkly Rep. ePub: 18 August 2021.

Nanduri S. Effectiveness of Pfizer-BioNTech and Moderna Vaccines in Preventing SARS-CoV-2 Infection Among Nursing Home Residents Before and During Widespread Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — National Healthcare Safety Network, March 1–August 1, 2021. MMWR Morbidity and Mortality Weekly Report. 2021 2021;70.

Fowlkes A, Gaglani M, Groover K, et al. Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance — Eight U.S. Locations, December 2020–August 2021. MMWR Morb Mortal Wkly Rep. ePub: 24 August 2021.

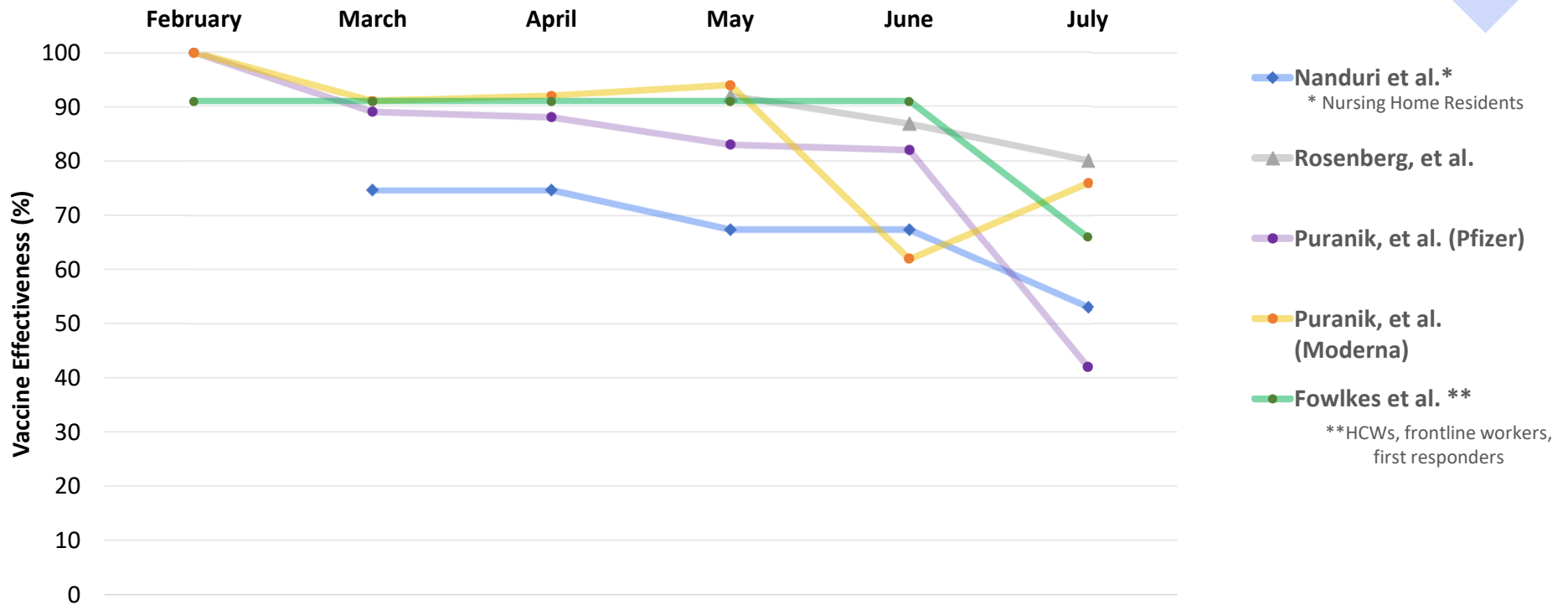
Puranik A, Lenehan PJ, Silvert E, et al. Comparison of two highly-effective mRNA vaccines for COVID-19 during periods of Alpha and Delta variant prevalence. medRxiv 2021.08.06.21261707.

# Booster doses of COVID-19 vaccines: Vaccine effectiveness against hospitalization



Tenforde MW, Self WH, Naioti EA, et al. Sustained Effectiveness of Pfizer-BioNTech and Moderna Vaccines Against COVID-19 Associated Hospitalizations Among Adults — United States, March–July 2021. MMWR Morb Mortal Wkly Rep. ePub: 18 August 2021.  
 Tenforde MW, Olson SM, Self WH, et al. Effectiveness of Pfizer-BioNTech and Moderna Vaccines Against COVID-19 Among Hospitalized Adults Aged ≥65 Years — United States, January–March 2021. MMWR Morb Mortal Wkly Rep 2021;70:674–679.  
 Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 Cases and Hospitalizations Among Adults, by Vaccination Status — New York, May 3–July 25, 2021. MMWR Morb Mortal Wkly Rep. ePub: 18 August 2021.  
 Puranik A, Lenehan PJ, Silvert E, et al. Comparison of two highly-effective mRNA vaccines for COVID-19 during periods of Alpha and Delta variant prevalence. medRxiv 2021.08.06.21261707.

# Booster doses of COVID-19 vaccines: Vaccine effectiveness against infection



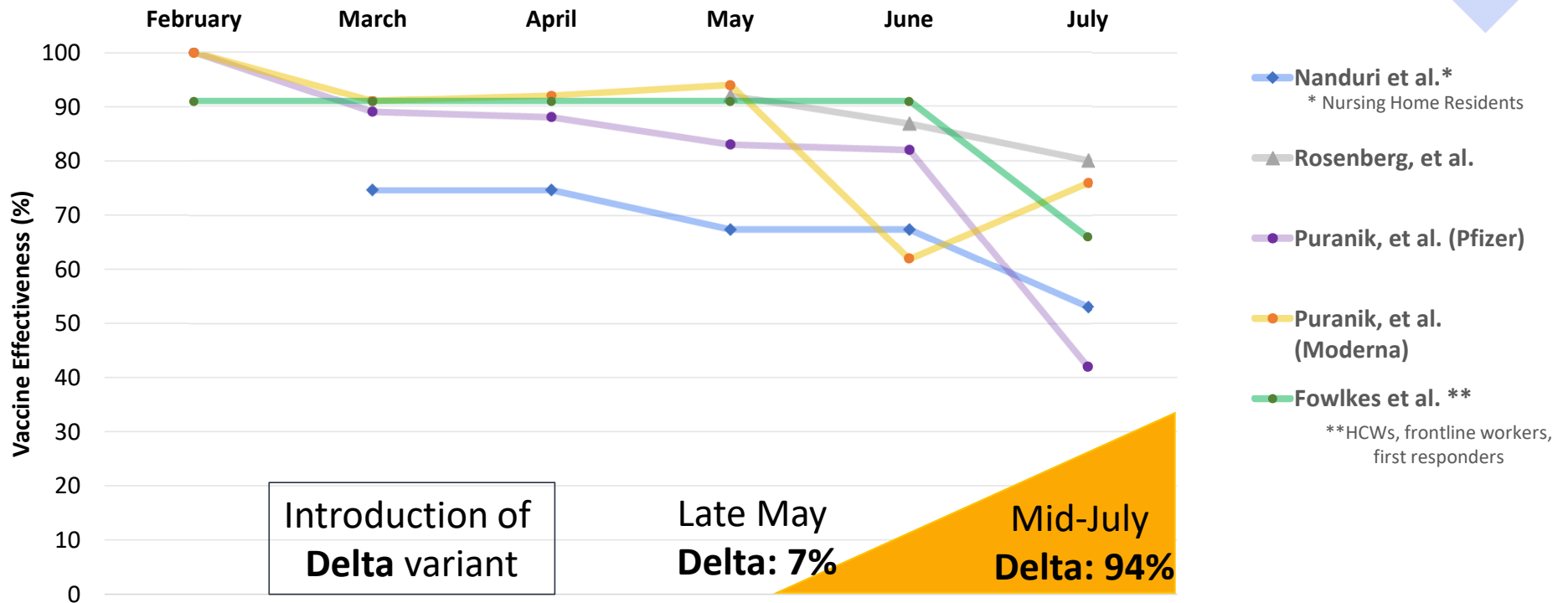
Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 Cases and Hospitalizations Among Adults, by Vaccination Status — New York, May 3–July 25, 2021. MMWR Morb Mortal Wkly Rep. ePub: 18 August 2021.

Nanduri S. Effectiveness of Pfizer-BioNTech and Moderna Vaccines in Preventing SARS-CoV-2 Infection Among Nursing Home Residents Before and During Widespread Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — National Healthcare Safety Network, March 1–August 1, 2021. MMWR Morbidity and Mortality Weekly Report. 2021 2021;70.

Fowlkes A, Gaglani M, Groover K, et al. Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance — Eight U.S. Locations, December 2020–August 2021. MMWR Morb Mortal Wkly Rep. ePub: 24 August 2021.

Puranik A, Lenehan PJ, Silvert E, et al. Comparison of two highly-effective mRNA vaccines for COVID-19 during periods of Alpha and Delta variant prevalence. medRxiv 2021.08.06.21261707.

# Booster doses of COVID-19 vaccines: Vaccine effectiveness against infection



Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 Cases and Hospitalizations Among Adults, by Vaccination Status — New York, May 3–July 25, 2021. MMWR Morb Mortal Wkly Rep. ePub: 18 August 2021.

Nanduri S. Effectiveness of Pfizer-BioNTech and Moderna Vaccines in Preventing SARS-CoV-2 Infection Among Nursing Home Residents Before and During Widespread Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — National Healthcare Safety Network, March 1–August 1, 2021. MMWR Morbidity and Mortality Weekly Report. 2021 2021;70.

Fowlkes A, Gaglani M, Groover K, et al. Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance — Eight U.S. Locations, December 2020–August 2021. MMWR Morb Mortal Wkly Rep. ePub: 24 August 2021.

Puranik A, Lenehan PJ, Silvert E, et al. Comparison of two highly-effective mRNA vaccines for COVID-19 during periods of Alpha and Delta variant prevalence. medRxiv 2021.08.06.21261707.

## Booster doses of COVID-19 vaccines: Data to inform recommendations



Public  
Health  
Problem

Is VE **reduced** for the **Delta variant**?

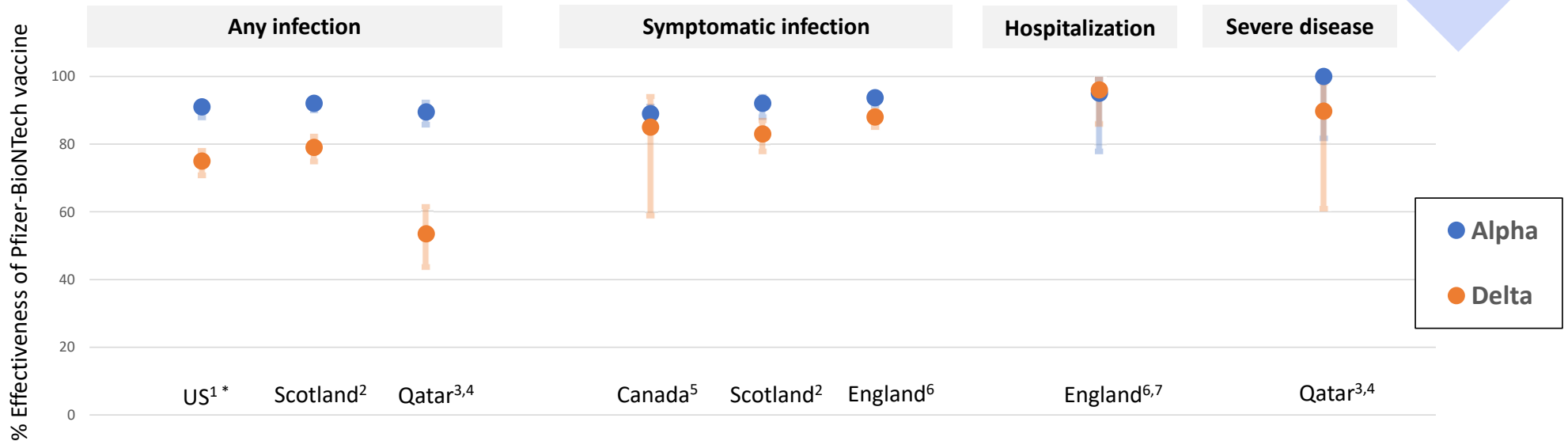
How does this vary by **severity** of disease?

How would this information impact VE  
for **future variants**?



# Booster doses of COVID-19 vaccines: Is effectiveness reduced because of the Delta variant?

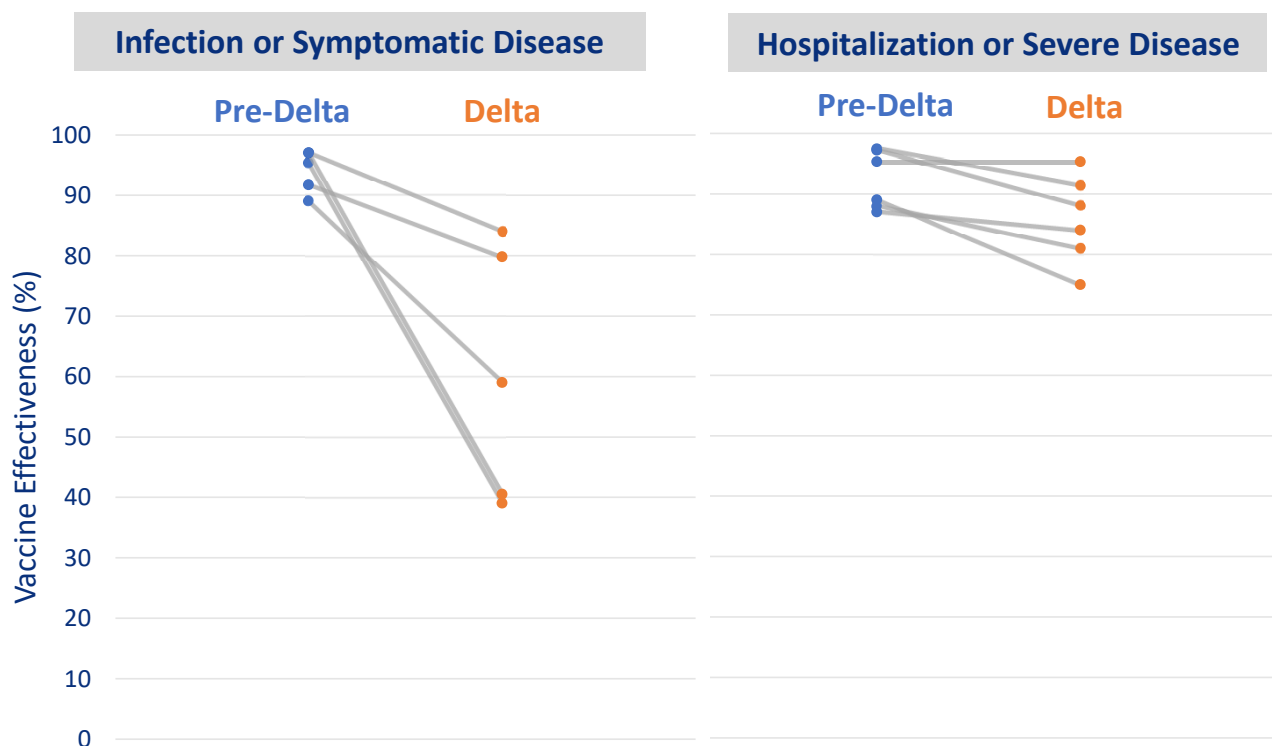
Public Health Problem



- Globally, among studies assessing infections with Alpha vs Delta: mild decrease in Delta VE<sup>1-7</sup>
- Other factors may include study methods, **interval** between doses, and **timing** with vaccination and variant increases

References: 1. Tartof et al. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3909743](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3909743) 2. Sheikh A, et al. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)01358-1/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)01358-1/fulltext) 3. Tang et al. <https://www.medrxiv.org/content/10.1101/2021.08.11.21261885v1> 4. Abu-Raddad et al. <https://www.nejm.org/doi/full/10.1056/NEJMc2104974> 5. Nasreen S, et al. <https://www.medrxiv.org/content/10.1101/2021.06.28.21259420v2> 6. Bernal Lopez et al. <https://www.medrxiv.org/content/10.1101/2021.05.22.21257658v1> 7. Stowe et al. [https://khub.net/web/ph-national/public-library/-/document\\_library/v2WsRK3ZIEig/view/479607266](https://khub.net/web/ph-national/public-library/-/document_library/v2WsRK3ZIEig/view/479607266) \*Included other variants

## Vaccine effectiveness in the Pre-Delta and Delta Periods

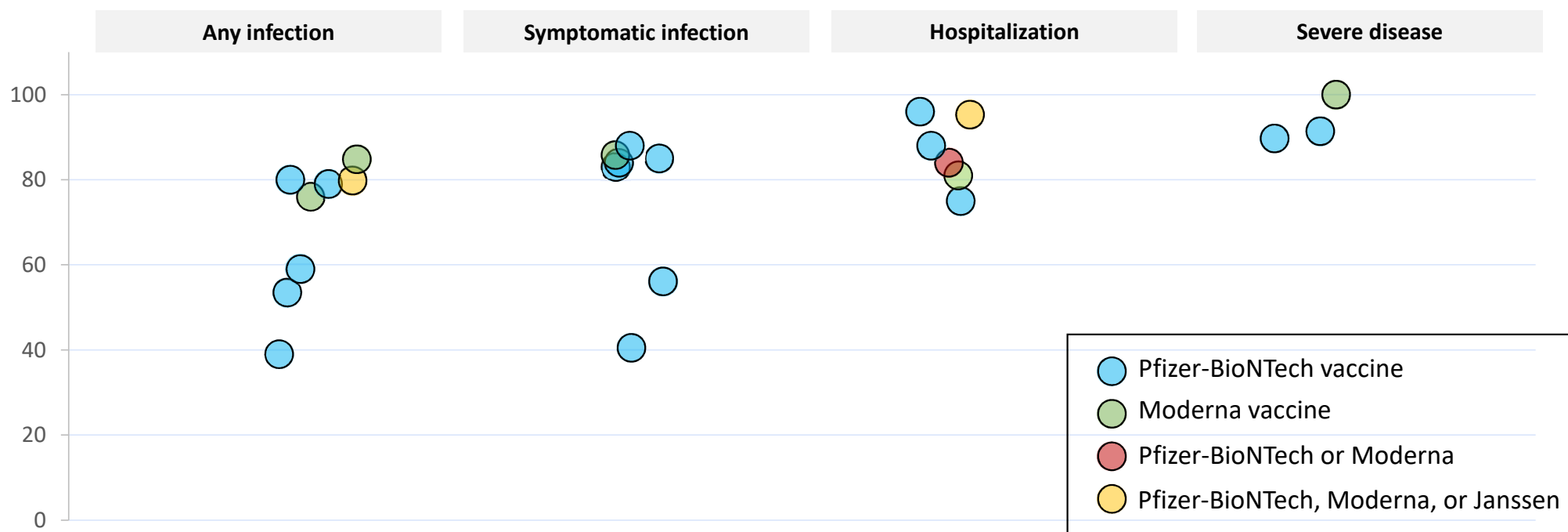


In studies comparing the 'Pre-Delta' and 'Delta' periods:

- Pre-Delta vaccine effectiveness estimates high (**87% or higher**)
- Since the introduction of the Delta variant (varies by region)
  - VE against **infection** ranges from **39–84%**
  - VE against **hospitalization** ranges from **75–95%**

References: 1. Israel Ministry of Health (committee/he/files\_publications\_corona\_two-dose-vaccination-data.pdf) 2. Haas et al. (Israel) [https://doi.org/10.1016/S0140-6736\(21\)00947-8](https://doi.org/10.1016/S0140-6736(21)00947-8) 3. Pouwels et al. (UK) [survey/finalfinalcombinedve20210816.pdf](https://www.medrxiv.org/content/10.1101/2021.08.06.21261707v2) 4. Puranik <https://www.medrxiv.org/content/10.1101/2021.08.06.21261707v2> 5. Rosenberg (US) <https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e1.htm> 6. Tenforde (US) <https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e2.htm>

## Summary of vaccine effectiveness estimates since introduction of the Delta variant



- Vaccines remain effective in preventing **hospitalization** and **severe disease** but might be less effective in preventing **infection** or milder symptomatic illness
- Reasons for lower effectiveness likely include both **waning over time** and **Delta variant**

See reference list in later slides

## Booster doses of COVID-19 vaccines: Data to inform recommendations

Public  
Health  
Problem

Does the need vary by **sub-population**?

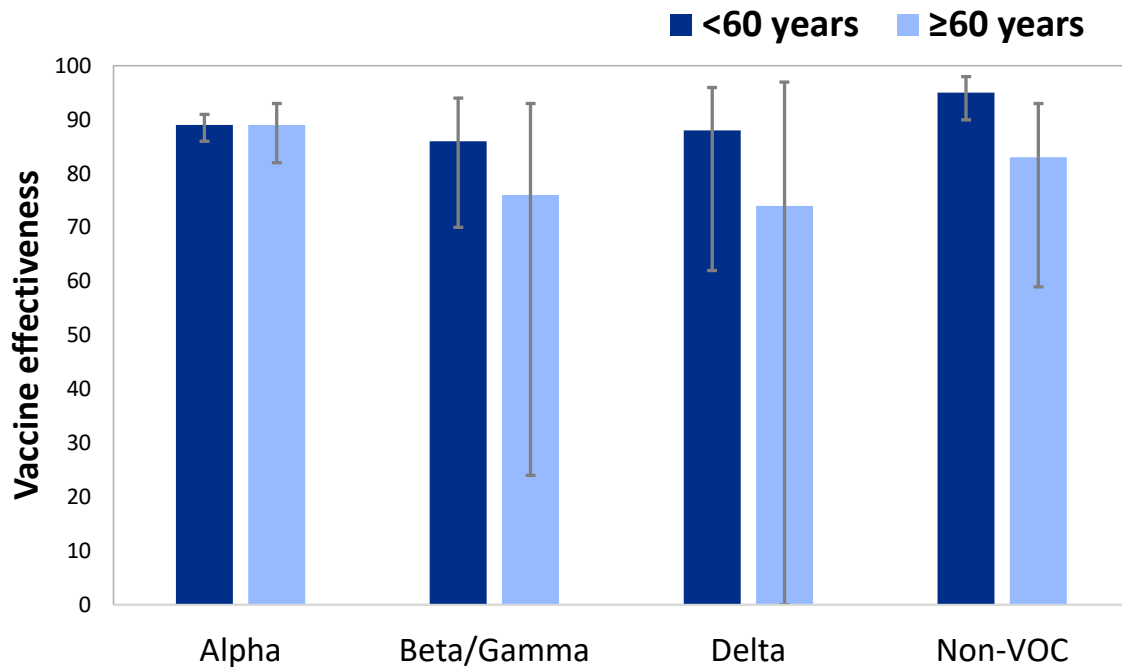
Adults  $\geq 65$   
years of age

Residents of  
long-term  
care facilities

Healthcare  
personnel

# Booster doses of COVID-19 vaccines: Adults $\geq 60$ years of age

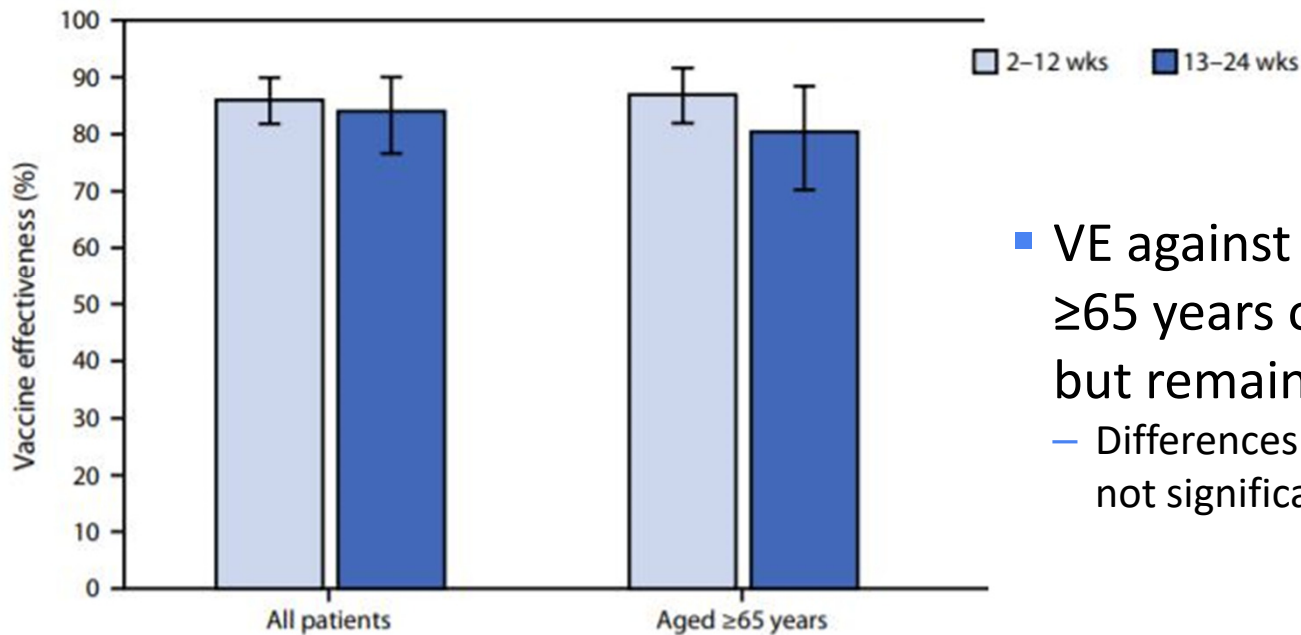
VE for **symptomatic infection**  
 $\geq 7$  days after dose 2, Pfizer-BioNTech vaccine



- VE against **symptomatic infection** in adults  $\geq 60$  years of age is high, but some decreases noted against VoC
  - Differences were not significantly different: small numbers and wide confidence intervals

## Booster doses of COVID-19 vaccines: Adults $\geq 65$ years of age

FIGURE 2. Sustained vaccine effectiveness\* against COVID-19 among hospitalized adults, by patient status<sup>†,§</sup> and interval since vaccination — 21 medical centers in 18 states,<sup>¶</sup> March–July 2021

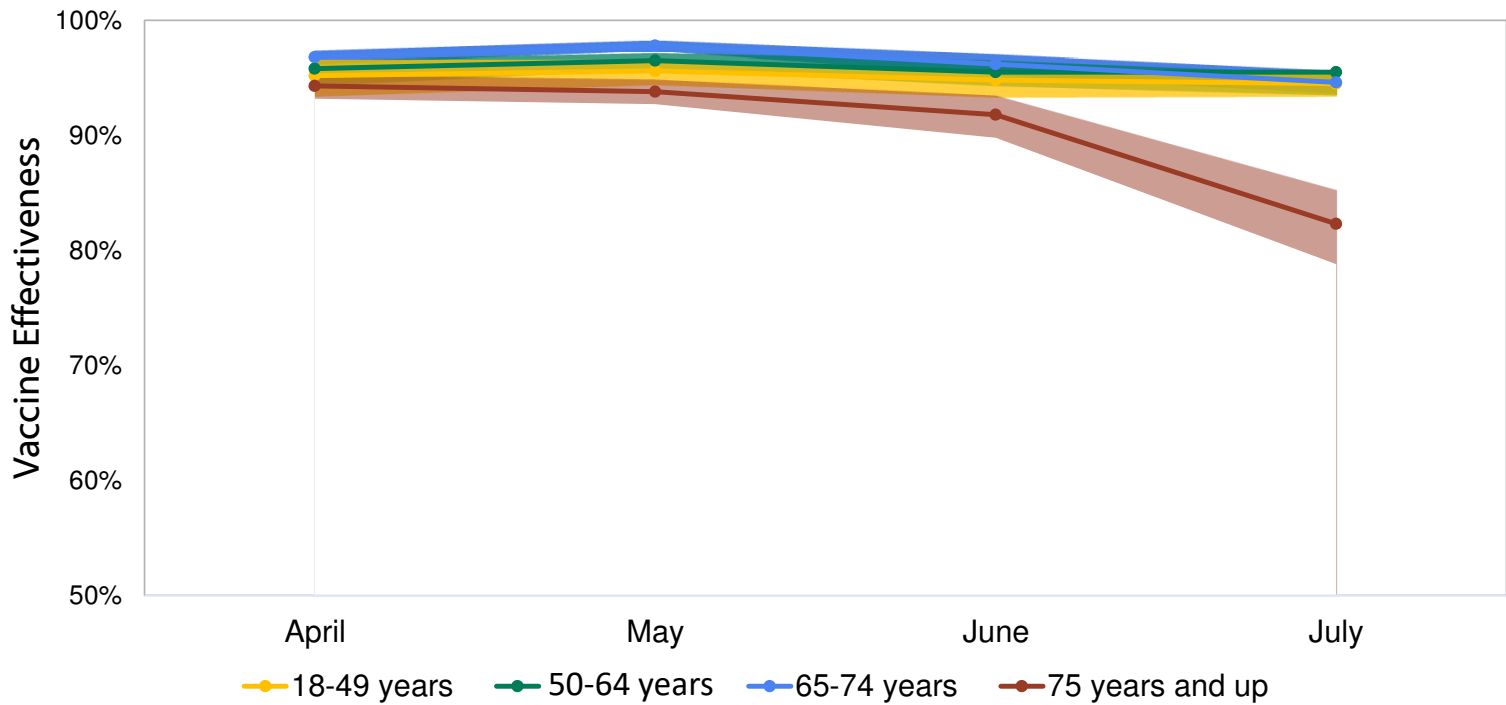


- VE against **hospitalization** in adults  $\geq 65$  years of age decreases over time but remained high
  - Differences by interval since vaccination were not significantly different

# Booster doses of COVID-19 vaccines: Adults $\geq 65$ years of age



Preliminary VE against COVID-19–associated **hospitalization** among fully vaccinated† patients aged  $\geq 18$  years, by age group and month — COVID-NET



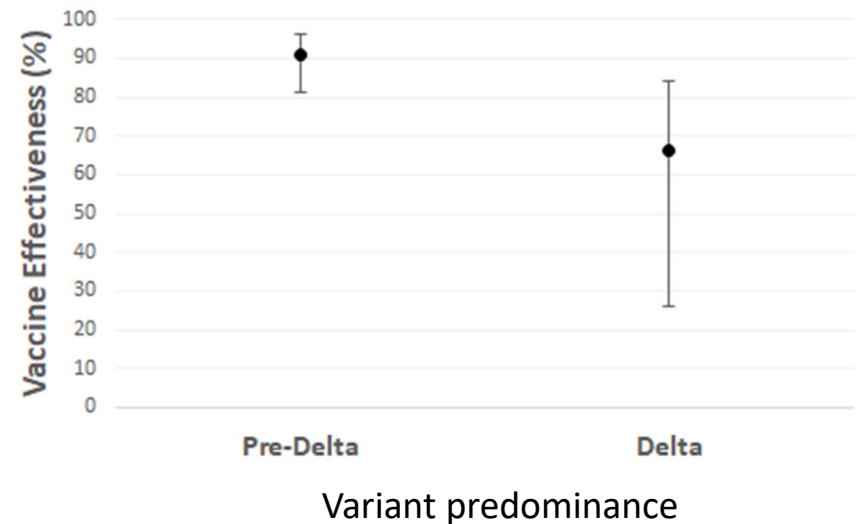
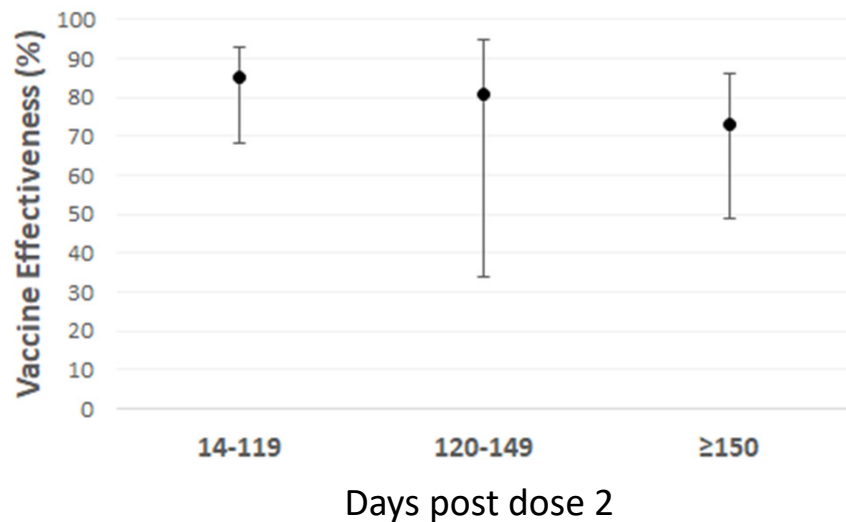
- Preliminary VE against **hospitalization** in adults  $\geq 75$  years of age decreased in July, but remains  $>80\%$

Source: Unpublished COVID-NET data

†Fully vaccinated patients received both doses of Moderna or Pfizer-BioNTech vaccine, with second dose received  $\geq 14$  days before hospitalization, or a single dose of Janssen (Johnson & Johnson) vaccine  $\geq 14$  days before hospitalization

## Booster doses of COVID-19 vaccines: Healthcare personnel

- VE against **infection** among **frontline workers** (including healthcare personnel) declined somewhat over time and from the pre-Delta period to Delta period
  - VEs were not significantly different



Data from HEROES-RECOVER Cohort

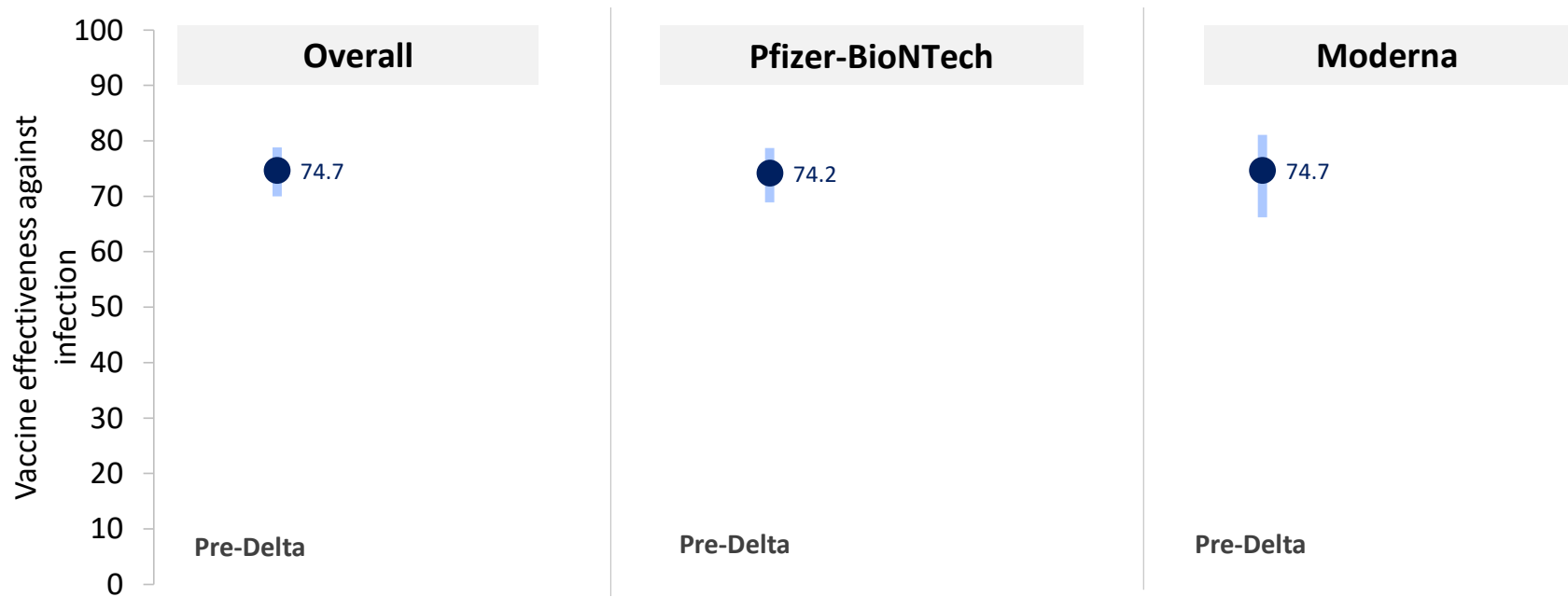
Fowlkes A, Gaglani M, Groover K, et al. Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance — Eight U.S. Locations, December 2020–August 2021. MMWR Morb Mortal Wkly Rep. ePub: 24 August 2021. DOI: <http://dx.doi.org/10.15585/mmwr.mm7034e4>.



# Booster doses of COVID-19 vaccines: Long-term care facility residents

Public  
Health  
Problem

- Initially, VE against **infection** among long-term care facility residents was high

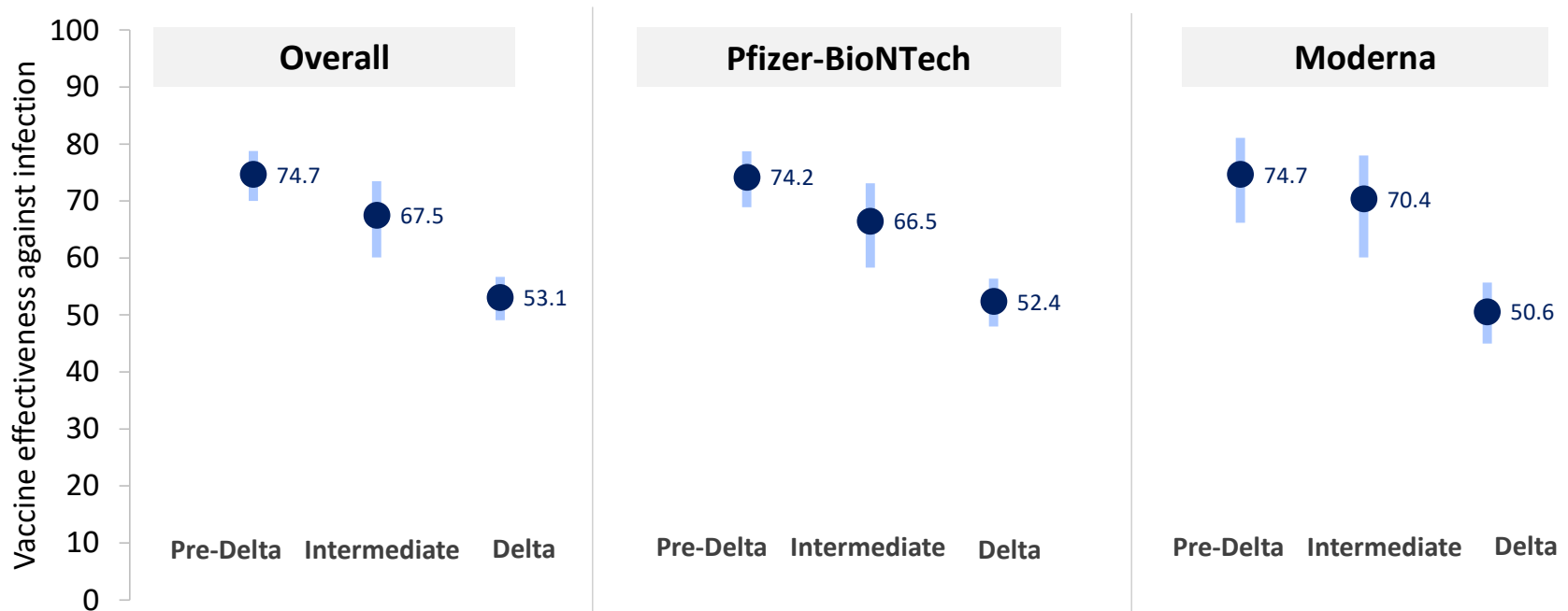


Data from National Healthcare Safety Network (NHSN)

Adapted from: Nanduri S. Effectiveness of Pfizer-BioNTech and Moderna Vaccines in Preventing SARS-CoV-2 Infection Among Nursing Home Residents Before and During Widespread Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — National Healthcare Safety Network, March 1–August 1, 2021. MMWR Morbidity and Mortality Weekly Report. 2021 2021;70. Slide courtesy of Ian Plumb.

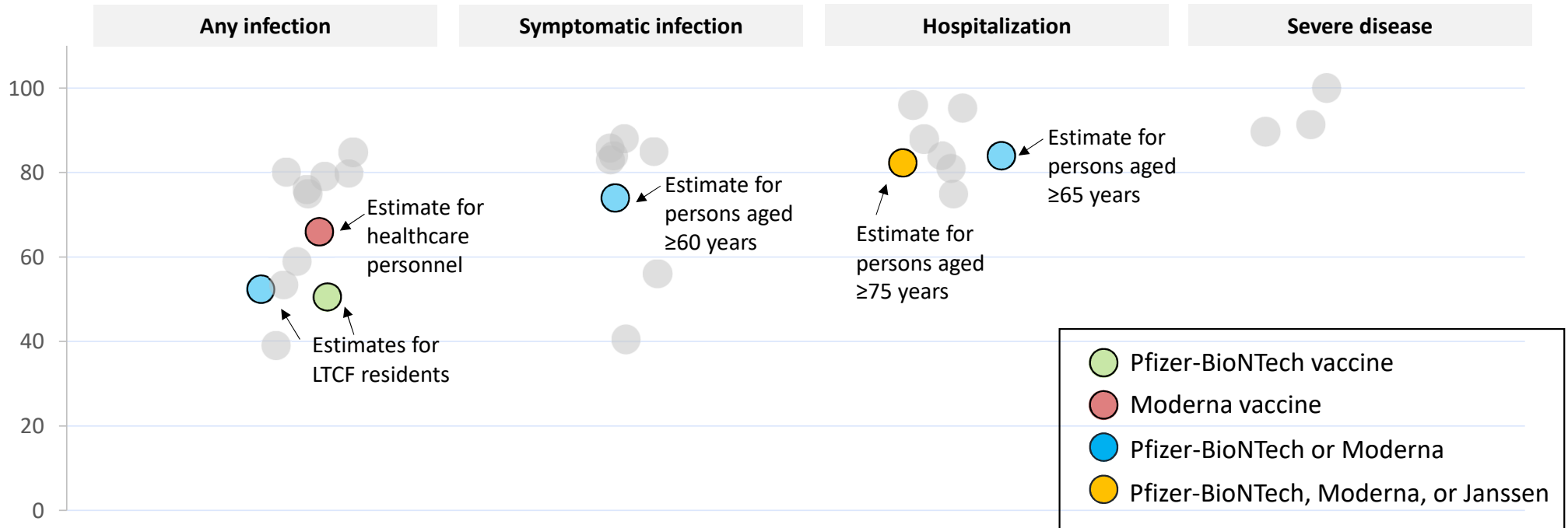
## Booster doses of COVID-19 vaccines: Long-term care facility residents

- VE against **infection** among long-term care facility residents differed significantly from pre-Delta period to Delta period



Adapted from: Nanduri S. Effectiveness of Pfizer-BioNTech and Moderna Vaccines in Preventing SARS-CoV-2 Infection Among Nursing Home Residents Before and During Widespread Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — National Healthcare Safety Network, March 1–August 1, 2021. MMWR Morbidity and Mortality Weekly Report. 2021 2021;70. Slide courtesy of Ian Plumb.

## Summary of vaccine effectiveness estimates since introduction of the Delta variant



- Lower vaccine effectiveness estimated against **infection** for long term care facility resident
- Vaccine effectiveness among older age groups and healthcare personnel comparable with other subgroups; follow up needed to monitor VE estimates over time

See reference list in later slides

## Booster doses of COVID-19 vaccines: Data to inform recommendations

Are booster doses of COVID-19 vaccines **safe** and **immunogenic**?

Do COVID-19 vaccines provide a **boost** in neutralizing antibody response?

How do neutralizing antibodies correlate to **clinical protection** from COVID-19?



Benefits  
and  
Harms

## Booster doses of COVID-19 vaccines: Are booster doses safe and immunogenic?



- Pfizer-BioNTech, Moderna, and Janssen (Johnson & Johnson) conducting studies to evaluate **safety** and **immunogenicity** of COVID-19 vaccine booster doses
- Important to include sufficient **safety** data for booster doses

## Booster doses of COVID-19 vaccines: Data to inform recommendations

Will booster doses of COVID-19 vaccines reduce COVID-19 **incidence**, **hospitalization** and/or **mortality**?



Benefits  
and  
Harms

## Booster doses of COVID-19 vaccines:

Will booster doses reduce COVID-19 morbidity and mortality?



Benefits  
and  
Harms

- Evaluating data available to assess the potential **impact** of COVID-19 booster doses in a variety of populations and settings

## Booster doses of COVID-19 vaccines: Data to inform recommendations

Do boosters **improve VE** against the  
Delta variant and other  
variants of concern (VoC)?

How can we use this data to inform VE  
for **future variants**?



Benefits  
and  
Harms



## Booster doses of COVID-19 vaccines:

Do booster doses improve VE against Delta and other VoC?



Benefits  
and  
Harms

- **Immunogenicity** data (including sera from study participants who received a booster dose) can evaluate neutralizing antibody data for variants of concern (including Delta)
- No correlate of protection available, but growing understanding around impact of **neutralizing antibodies**
  - Can infer impact of booster doses on neutralizing antibodies to clinical protection (VE) against Delta and other VoC

## Booster doses of COVID-19 vaccines: Data to inform recommendations



Feasibility

Are booster doses of COVID-19  
feasible to implement?

# Booster doses of COVID-19 vaccines:

## Are booster doses feasible to implement?



- Some aspects of implementation will be **more feasible** than primary series roll-out:
  - Supply and number of vaccination sites not a serious limitation
- Some aspects of implementation will be **more complex**:
  - Different primary series
    - Individuals received a variety of primary series
    - Upcoming data will evaluate booster response for same (homologous) and different (heterologous) series
    - Booster dose policy will need to address individuals who received **all primary series**
  - Different doses
    - Some COVID-19 vaccine booster studies have evaluated various doses for booster vaccines for the same product

# Summary and Work Group Considerations



## Booster doses of COVID-19 vaccines: Summary

- Not uncommon for a vaccine series to require several doses
- Vaccines that require >1 dose do not necessarily mean annual boosters needed
  - For many vaccines, the final dose is given at least 6 months after the initial dose

Sample of adult vaccines requiring >1 dose	1 <sup>st</sup> dose	2 <sup>nd</sup> dose	3 <sup>rd</sup> dose
Herpes zoster (shingles)	Initial	2-6 months	
Hepatitis A	Initial	6 months	
Hepatitis B	Initial	1-2 months	6-18 months
Human papillomavirus (HPV) (Age ≥15 at initial vaccination)	Initial	1-2 months	6 months

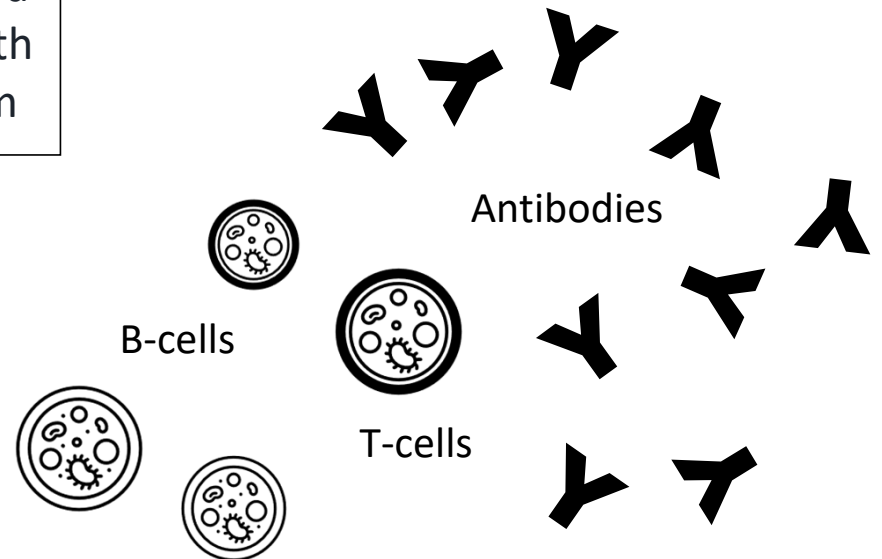
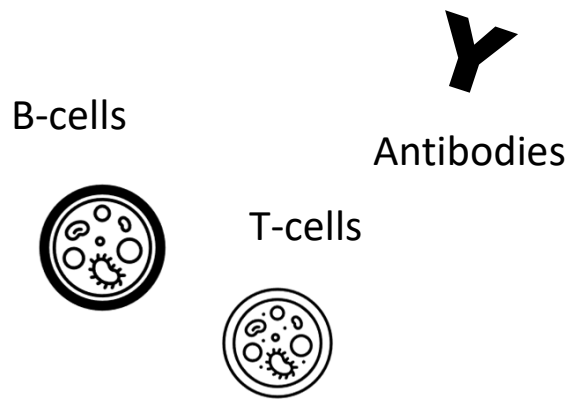
# Booster doses of COVID-19 vaccines: Summary



Initial dose(s) of vaccine:  
**Prime**

**Time** between the doses can allow for a 'boosting' effect with the immune system

Subsequent doses of vaccine:  
**'Boost' Effect**



# Booster doses of COVID-19 vaccines:

## Summary

- COVID-19 vaccines continue to maintain **high protection** against severe disease, hospitalization, and death
- Protection against infection (including asymptomatic or mild infections) appears lower in recent months
  - Difficult to distinguish role of **time** since primary series and **Delta variant**
- Reported data through July; data through August shown at future ACIP meetings
  - Important to monitor **trends** of effectiveness by severity of disease over time
- Policy around booster doses requires **continued evaluation** of effectiveness, monitoring impact of both **time** and **variants**, and ability of booster doses to **improve** protection

## Recommendations for Allocation of Initial Doses of COVID-19 Vaccines December 2020–Early 2021

### Phase 1a

LTCF Residents  
Healthcare Personnel

### Phase 1b

Adults  $\geq 75$  years of age  
Frontline Essential Workers

### Phase 1c

Adults  $\geq 65$  years of age  
All Essential Workers  
Adults 16-64 years of age with  
high-risk medical conditions



**Highest Risk  
Individuals**

- Early in vaccine roll-out, ACIP voted for a **risk-based approach** to allocation of COVID-19 vaccines
- **Variation in implementation** across states/jurisdictions



## Booster doses of COVID-19 vaccines: Work Group considerations

- **Top priority** should be **continued vaccination of unvaccinated individuals**
  - Planning for delivery of booster doses to vaccinated individuals should not deter outreach for delivery of primary series to unvaccinated individuals
- Priority for booster dose policy:  
Prevention of **severe disease** in **at-risk populations**
- **Simplicity** and **flexibility** will be important to support equitable and efficient delivery of booster doses

## Booster doses of COVID-19 vaccines: Work Group considerations

- Important to ensure **global vaccine availability**
  - Uncontrolled spread globally that could result in new variants threaten control of the pandemic everywhere
- Policy around booster doses should also consider **equity** in the U.S. population
  - Access to booster doses may vary by population and setting
  - **Lessons learned** around equitable access in early primary series roll-out

## Booster doses of COVID-19 vaccines: Work Group considerations

- In addition to immunogenicity data, need to review available **safety** data for booster doses
- Balance of **benefits** and **risks** for booster doses may vary by age
  - Policy for booster doses needs to take this **benefit/risk balance** into account
- Critical to wait for additional **safety data** and **regulatory allowance** for booster doses

## Booster doses of COVID-19 vaccines:

### Work Group considerations

- At this time, the Work Group discussed a **risk-based approach** for booster dose recommendations
  - Prevent **severe disease** in the most at-risk populations:
    - LTCF residents
    - Older adults ( $\geq 65$  or  $\geq 75$  years of age)
  - Support **strained healthcare infrastructure**:
    - Healthcare personnel with mild disease cannot work, so prevention of mild disease takes on greater importance as a public health goal in this population
- **Time since vaccination** with primary series also important
  - For many vaccines, a minimum interval beneficial for full ‘boosting effect’
  - Ability to benefit from ‘boosting effect’ extends well beyond the minimum interval

# Booster doses of COVID-19 vaccines

Recommendations for Allocation of Initial Doses of COVID-19 Vaccines

## Phase 1a

LTCF Residents  
Healthcare Personnel

## Phase 1b

Adults  $\geq 75$  years of age  
Frontline Essential Workers

## Phase 1c

Adults  $\geq 65$  years of age  
All Essential Workers  
Adults 16-64 years of age with  
high-risk medical conditions

**Highest Risk Individuals**

Time since recommendation

# Booster doses of COVID-19 vaccines

## Recommendations for Allocation of Initial Doses of COVID-19 Vaccines

### Phase 1a

LTCF Residents  
Healthcare Personnel

### Phase 1b

Adults  $\geq 75$  years of age  
Frontline Essential Workers

### Phase 1c

Adults  $\geq 65$  years of age  
All Essential Workers  
Adults 16-64 years of age with  
high-risk medical conditions

**Highest Risk Individuals**

Time since recommendation

## Possible Recommendations for Initial Booster Doses

**Highest Risk Individuals**

LTCF Residents  
Healthcare Personnel  
Adults  $\geq 65/75$  years of age

Time interval since receipt of last dose

# Booster doses of COVID-19 vaccines

- ACIP will continue to review additional data:
  - Manufacturer data on safety + immunogenicity of booster doses
  - Effectiveness, breakthrough infections and epi data through August
- Further discussions around feasibility, implementation, and balance of benefit and risks by age group and population

# Booster doses of COVID-19 vaccines

What are the **key considerations** for decision making?

ACIP Meeting Aug 13: Framework for COVID-19 booster doses presented



What **data** are available for decision making?

ACIP Meeting Aug 30: Begin to provide data to inform booster dose policy



Does ACIP **recommend** booster doses of COVID-19 vaccines in any populations?



# Booster doses of COVID-19 vaccines

What are the **key considerations** for decision making?

ACIP Meeting Aug 13: Framework for COVID-19 booster doses presented



What **data** are available for decision making?

ACIP Meeting Aug 30: Begin to provide data to inform booster dose policy

ACIP Meeting mid-September: Additional data to inform policy



Does ACIP **recommend** booster doses of COVID-19 vaccines in any populations?

ACIP Meeting after FDA authorization: Possible vote

# Acknowledgements

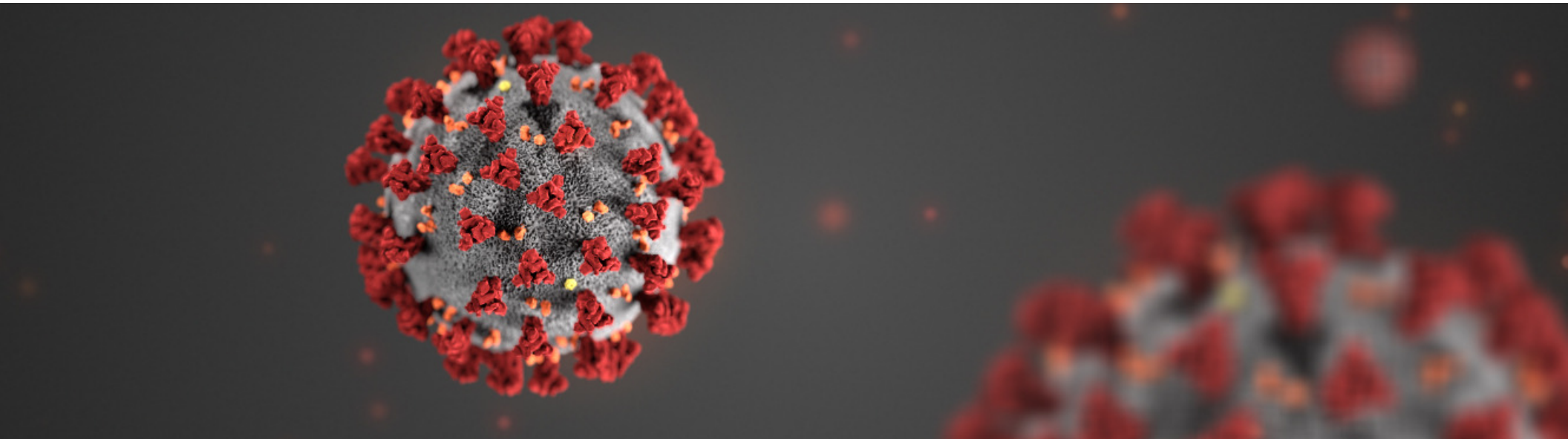
- Kathleen Dooling
- Heidi Moline
- Ian Plumb
- Danielle Moulia
- Amy Blain
- Mary Chamberland
- Jennifer Collins
- Julia Gargano
- Jack Gersten
- Monica Godfrey
- Stephen Hadler
- Hannah Rosenblum
- Heather Scobie
- Eddie Shanley
- Megan Wallace
- Neela Goswami
- Kristine Schmidt
- Vaccine Task Force
- Epi Task Force
- Respiratory Viruses Branch

## Questions for ACIP

1. Does ACIP agree with the proposed risk-based approach for COVID-19 booster dose recommendations?
2. What other questions would be important for ACIP to address?

# Reference list for recent estimates of vaccine effectiveness against the Delta variant

1. Fowlkes A, Gaglani M, Groover K, et al. Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance — Eight U.S. Locations, December 2020–August 2021. *MMWR Morb Mortal Wkly Rep* 2021;70:1167-1169.
2. Bernal JL, Andrews N, Gower C, Gallagher E, Simmons R, Thelwall S, et al. Effectiveness of COVID-19 vaccines against the B.1.617.2 variant. *medRxiv*. 2021:2021.05.22.21257658
3. Israel Ministry of Health. COVID-19 Weekly Data (8/11/21). [https://www.gov.il/BlobFolder/reports/vaccine-efficacy-safety-follow-up-committee/he/files\\_publications\\_corona\\_two-dose-vaccination-data.pdf](https://www.gov.il/BlobFolder/reports/vaccine-efficacy-safety-follow-up-committee/he/files_publications_corona_two-dose-vaccination-data.pdf)
4. Lopez Bernal J, Andrews N, Gower C, Gallagher E, Simmons R, Thelwall S, et al. Effectiveness of Covid-19 Vaccines against the B.1.617.2 (Delta) Variant. *New England Journal of Medicine*. 2021 2021/08/12;385(7):585-94.
5. Nanduri S, Pilishvili T, Derado G, et al. Effectiveness of Pfizer-BioNTech and Moderna Vaccines in Preventing SARS-CoV-2 Infection Among Nursing Home Residents Before and During Widespread Circulation of the SARS-CoV-2 B.1.617.2 (Delta) Variant — National Healthcare Safety Network, March 1–August 1, 2021. *MMWR Morb Mortal Wkly Rep* 2021;70:1163-1166.
6. Nasreen S, Chung H, He S, Brown KA, Gubbay JB, Buchan SA, et al. Effectiveness of COVID-19 vaccines against variants of concern in Ontario, Canada. *medRxiv*. 2021:2021.06.28.21259420.
7. Pouwels KB, Pritchard E, Matthews P, Stoesser N, Eyre D, Vihta K-D, et al. Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK. Preprint. 2021. <https://www.ndm.ox.ac.uk/files/coronavirus/covid-19-infection-survey/finalfinalcombinedve20210816.pdf>
8. Puranik A, Lenehan PJ, Silvert E, Niesen MJM, Corchado-Garcia J, O'Horo JC, et al. Comparison of two highly-effective mRNA vaccines for COVID-19 during periods of Alpha and Delta variant prevalence. *medRxiv*. 2021:2021.08.06.21261707.
9. Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 Cases and Hospitalizations Among Adults, by Vaccination Status — New York, May 3–July 25, 2021. *MMWR Morb Mortal Wkly Rep* 2021;70:1150-1155.
10. Sheikh A, McMenamin J, Taylor B, Robertson C. SARS-CoV-2 Delta VOC in Scotland: demographics, risk of hospital admission, and vaccine effectiveness. *The Lancet*. 2021 2021/06/26;397(10293):2461-2.
11. Stowe J, Andrews N, Gower C, Gallagher E, Utsi L, Simmons R, et al. Effectiveness of COVID-19 vaccines against hospital admission with the Delta (B.1.617.2) variant. 2021. [https://khub.net/web/phe-national/public-library/-/document\\_library/v2WsRK3ZIEig/view/479607266](https://khub.net/web/phe-national/public-library/-/document_library/v2WsRK3ZIEig/view/479607266)
12. Tang P, Hasan MR, Chemaitelly H, Yassine HM, Benslimane FM, Khatib HAA, et al. BNT162b2 and mRNA-1273 COVID-19 vaccine effectiveness against the Delta (B.1.617.2) variant in Qatar. *medRxiv*. 2021:2021.08.11.21261885.
13. Tartof SY, Slezak JM, Fischer H, Hong V, Ackerson BK, Ranasinghe ON, et al. Six-month effectiveness of BNT162b2 mRNA COVID-19 vaccine in a large US integrated health system: a retrospective cohort study. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3909743](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3909743)
14. Tenforde MW, Self WH, Naioti EA, et al. Sustained Effectiveness of Pfizer-BioNTech and Moderna Vaccines Against COVID-19 Associated Hospitalizations Among Adults — United States, March–July 2021. *MMWR Morb Mortal Wkly Rep* 2021;70:1156-1162.



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

