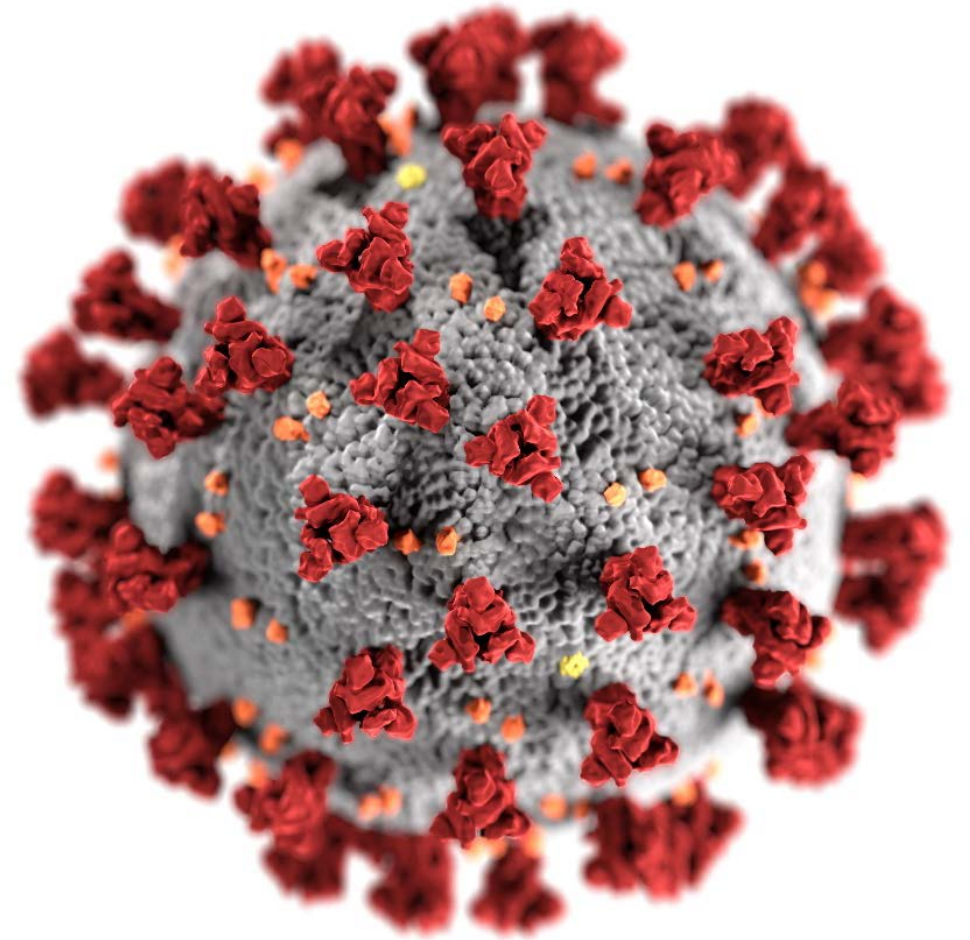


Pfizer-BioNTech COVID-19 vaccine and myocarditis in individuals aged 16-29 years: Benefits-Risk Discussion

Hannah Rosenblum, MD
ACIP Meeting
August 30, 2021



cdc.gov/coronavirus



Benefits and risks of Pfizer-BioNTech COVID-19 vaccine by age and sex in individuals aged 16-29 years

Benefits of Pfizer-BioNTech COVID-19 vaccination

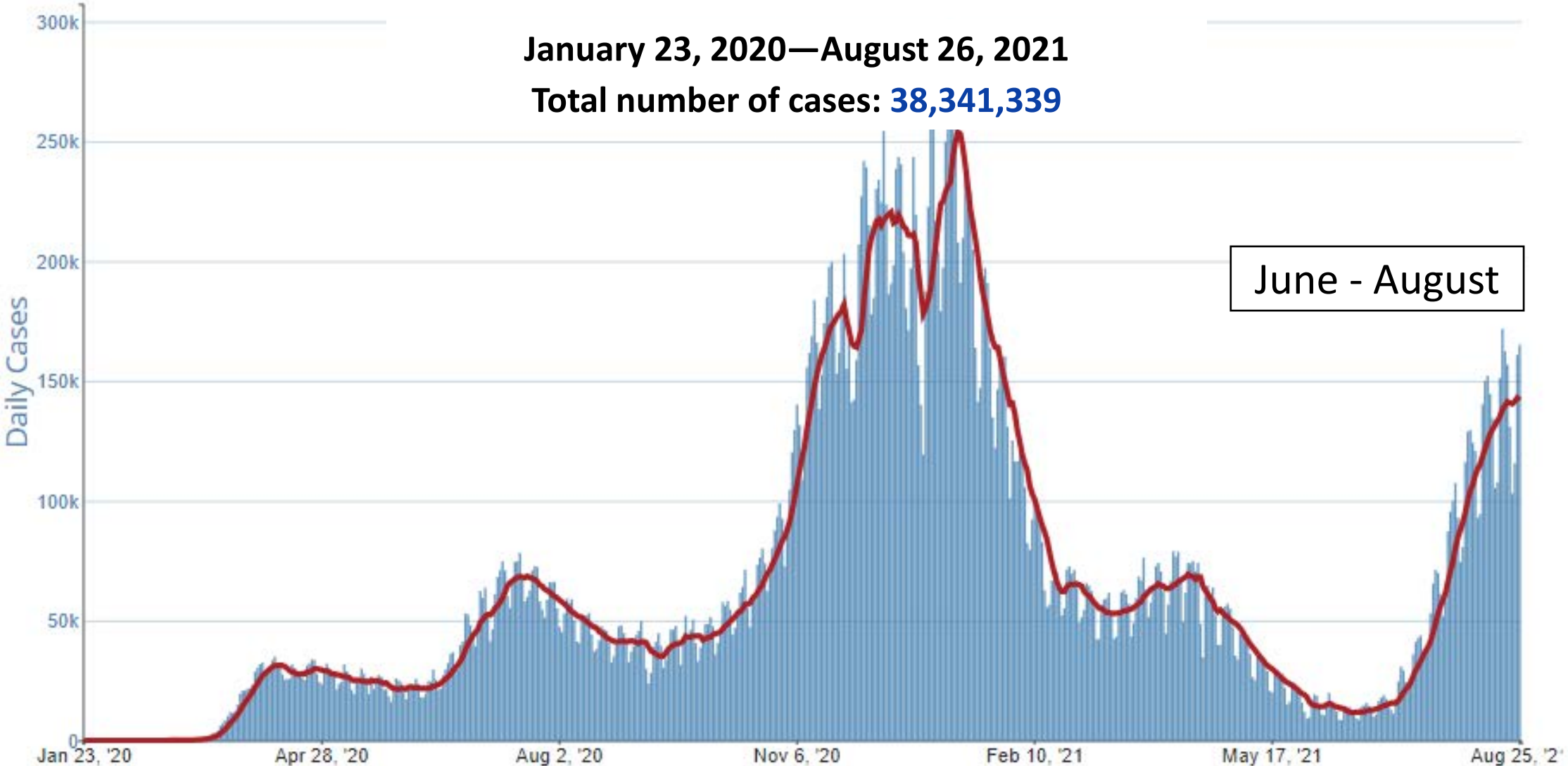


Risk of myocarditis after Pfizer-BioNTech COVID-19 vaccination

Background



There have been more than 38 million cases of COVID-19 in the United States since January 2020



<https://covid.cdc.gov/covid-data-tracker/#demographicsovertime>; accessed 8/27/21

New COVID-19 hospital admissions are increasing among young individuals

United States: 0-17 years

Total number of admissions Aug 1, 2020-Aug 24, 2021:

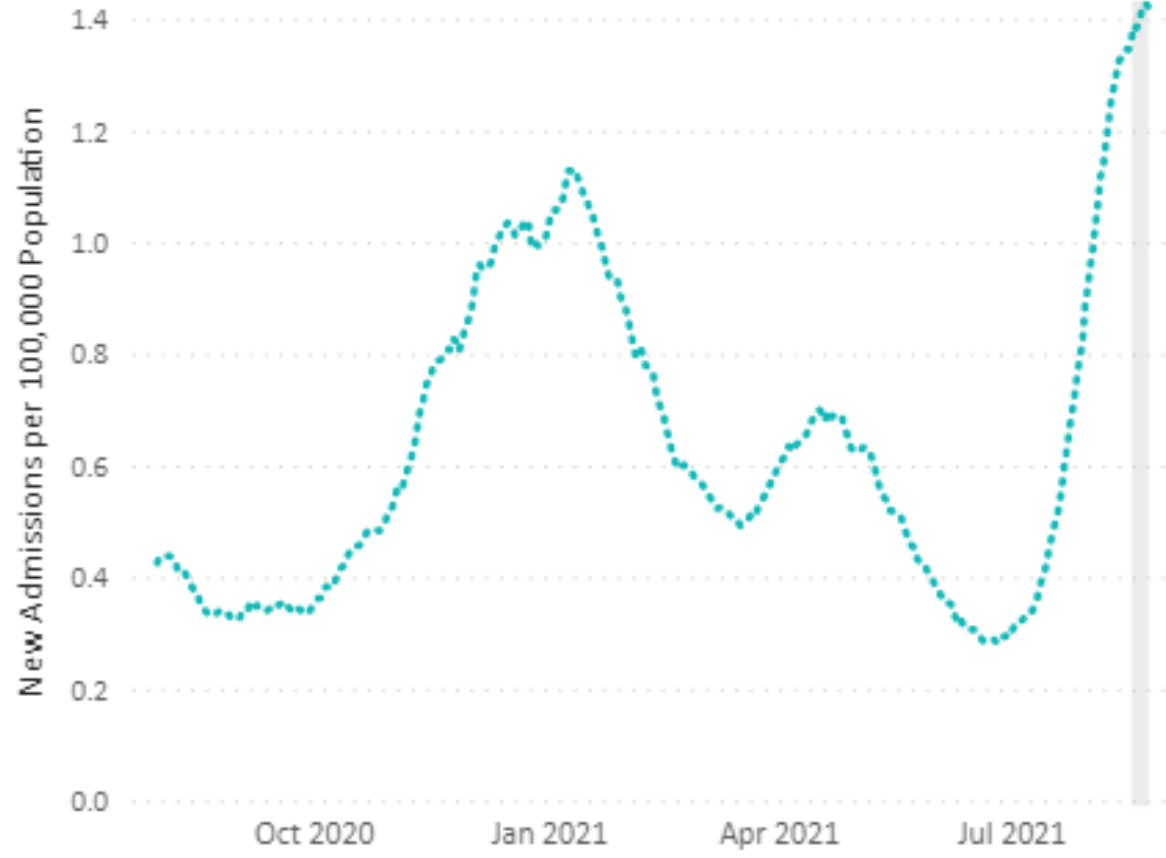
51,008



United States: 18-29 years

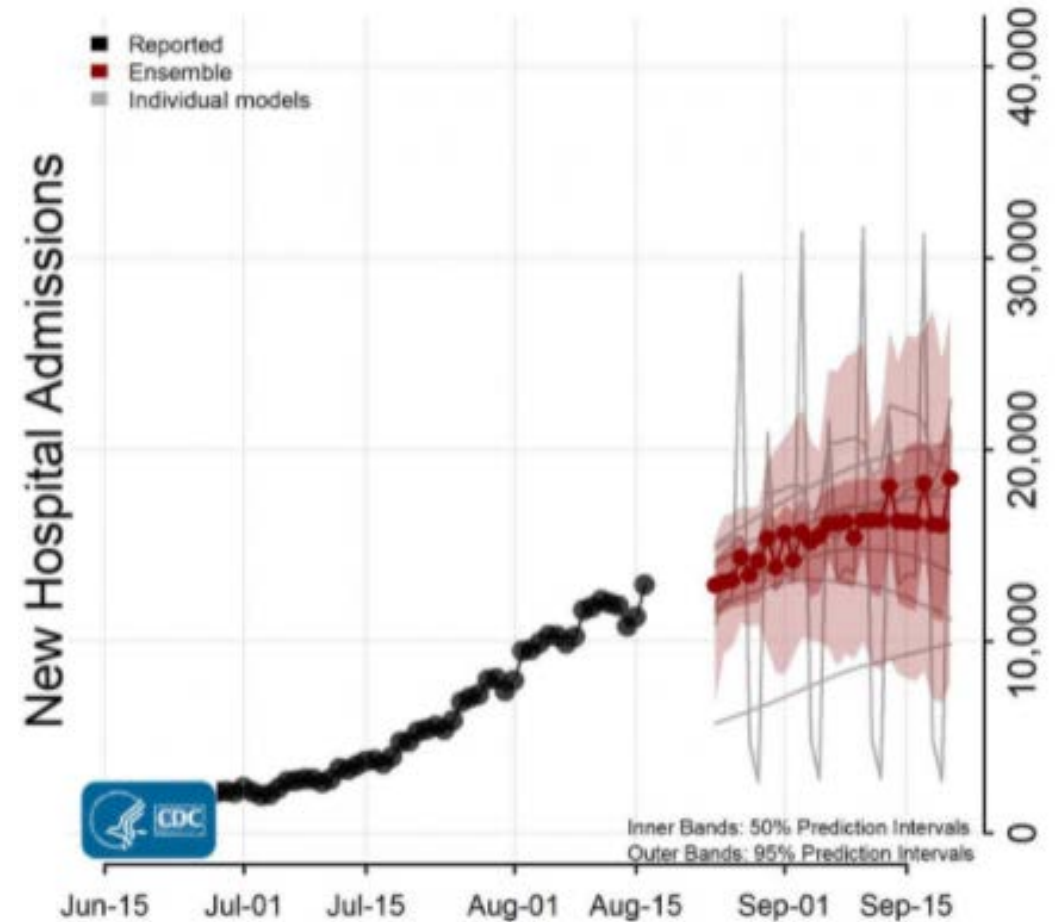
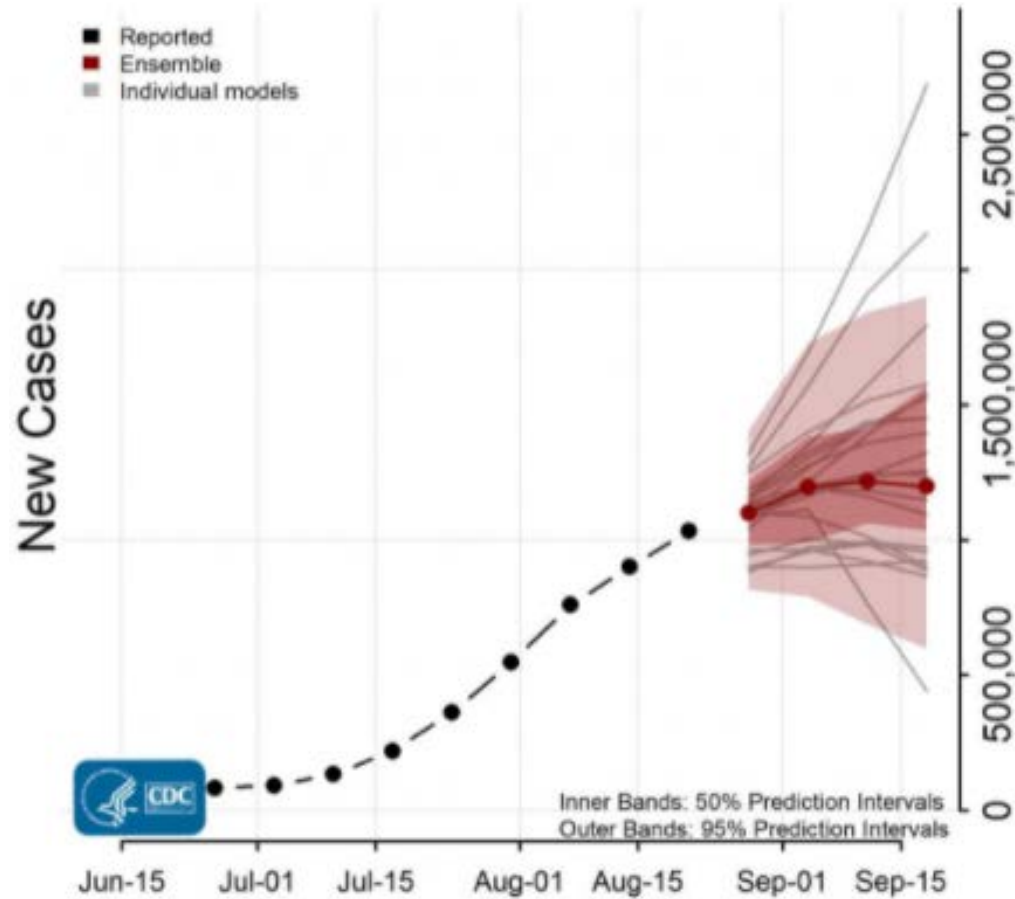
Total number of admissions Aug 1, 2020-Aug 24, 2021:

134,410



<https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions>; accessed 8/27/21

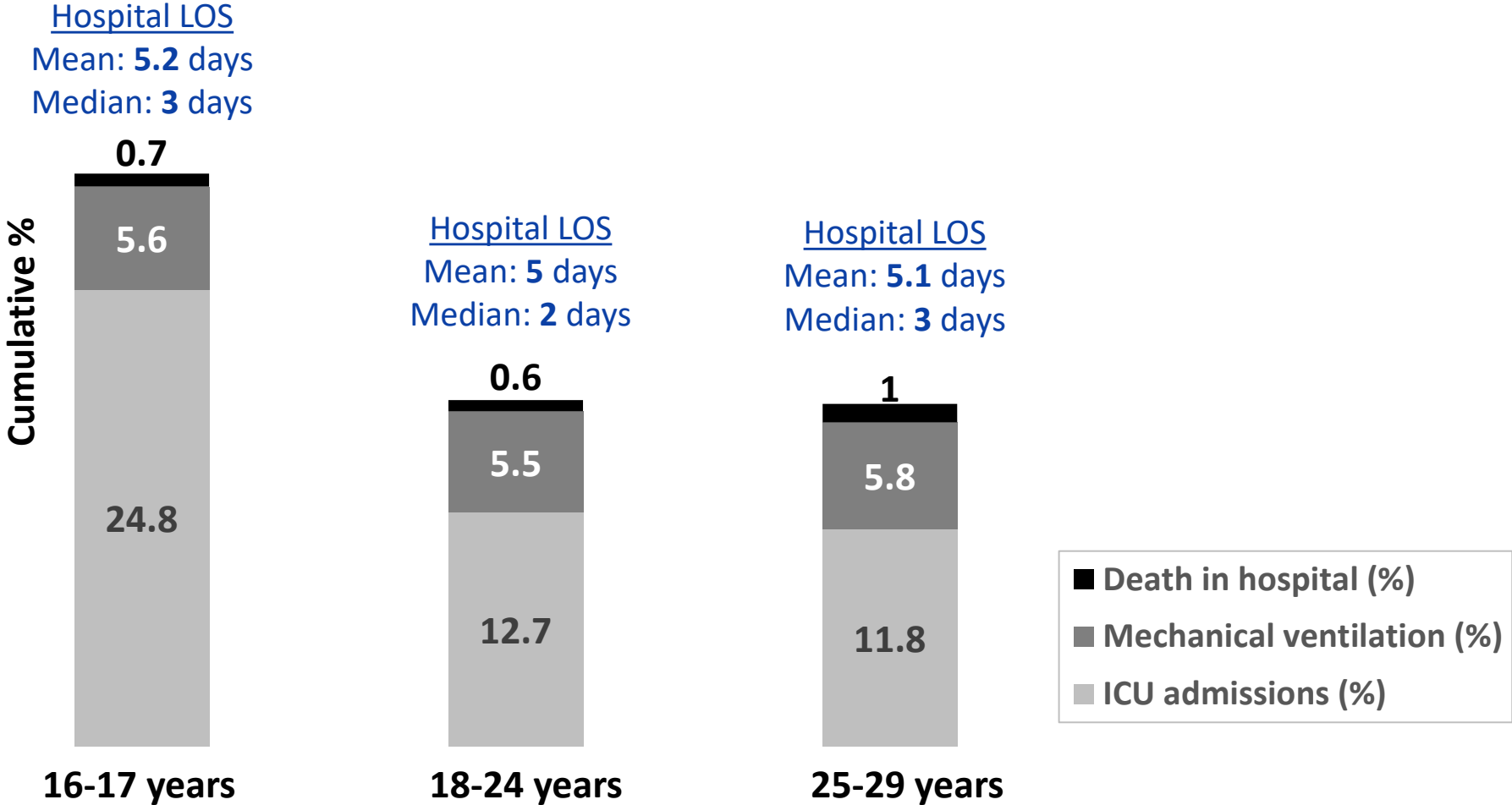
Forecasts of U.S. COVID-19 cases and hospitalizations project ongoing increases



<https://www.cdc.gov/coronavirus/2019-ncov/science/forecasting/forecasts-cases.html>, accessed 8/27/2021

<https://www.cdc.gov/coronavirus/2019-ncov/science/forecasting/hospitalizations-forecasts.html>, accessed 8/27/2021

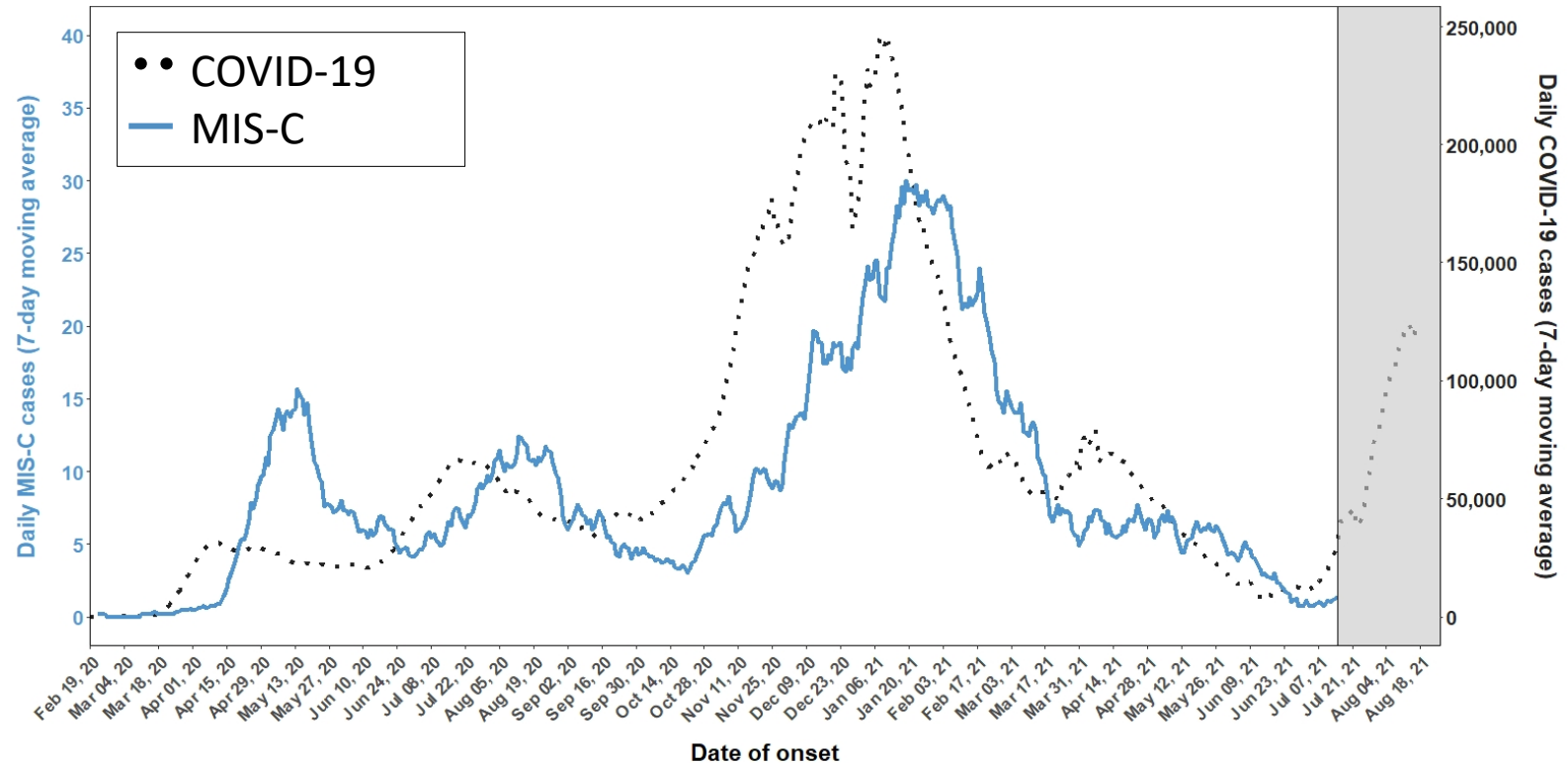
Severe outcomes among patients hospitalized for COVID-19 in COVID-NET*, by age



*Source: COVID-NET March 1, 2020—June 30, 2021; LOS = Length of stay

MIS-C and MIS-A are severe inflammatory disorders occurring after SARS-CoV-2 and affecting younger individuals

- 4,573* cases of multisystem inflammatory syndrome in children (MIS-C) reported in the United States
- MIS-C cases trends follow SARS-CoV-2 infections by 2-6 weeks
- With rising cases, a rise in MIS-C and multisystem inflammatory syndrome in adults (MIS-A) cases is expected to be reported



Risk of myocarditis following SARS-CoV-2 infection is described in several recent studies

- Patients with SARS-CoV-2 infection had **16-18 times higher risk for myocarditis** compared with patients without SARS-CoV-2; risk varied by age and sex
 - Retrospective cohort using administrative data from >800 U.S. hospitals¹
 - In a large national study from Israel²
- Risk of myocarditis in individuals post-SARS-CoV-2 infection was **6-34 times higher** compared to those who received mRNA vaccine
 - Administrative dataset analysis of 48 large healthcare organizations in the U.S.³
 - Retrospective cohort using EHR data from 42 U.S. healthcare systems⁴

¹Boehmer & Kompaniyets, et al., Association between COVID-19 and myocarditis using hospital-based administrative data. Pre-publication; CDC authors.

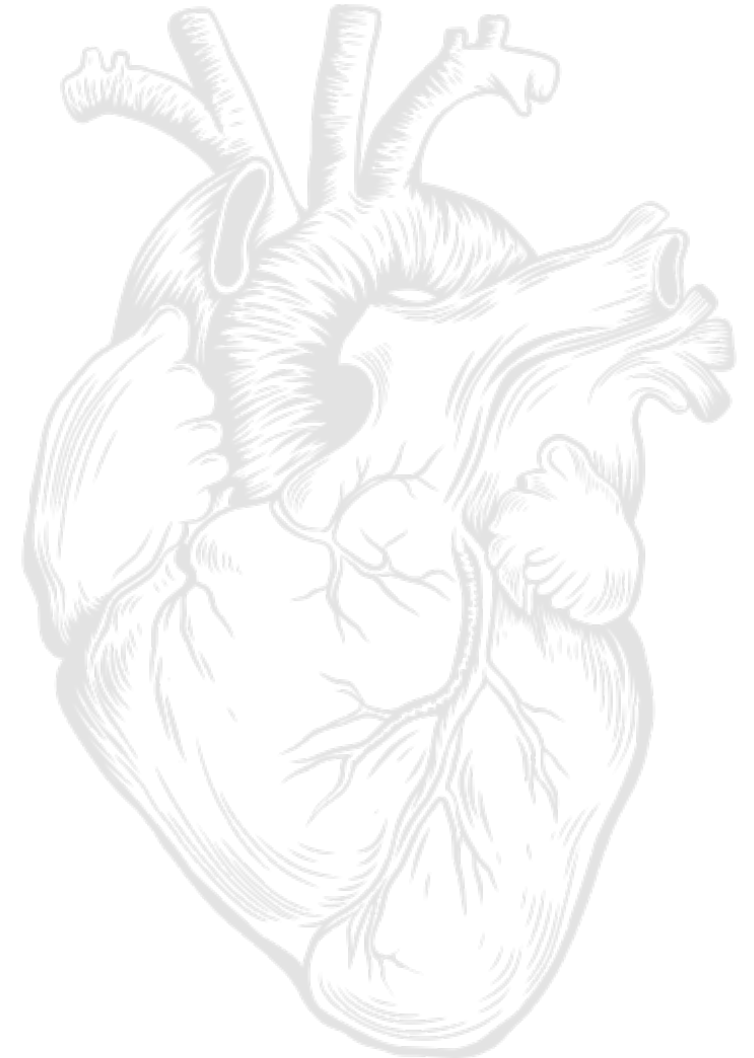
²Barda et al. Safety of the BNT162b2 mRNA COVID-19 Vaccine in a Nationwide Setting. *NEJM*. August 25, 2021

³Singer ME, et al., Risk of Myocarditis from COVID-19 Infection in People Under Age 20: A Population-Based Analysis. *medRxiv*. Pre-print. July 2021.

⁴Block et al., Occurrence of myocarditis, pericarditis, and anaphylaxis in children and young adults after COVID-19 vaccination compared to SARS-CoV-2 infection. Pre-publication; CDC and university-affiliated authors.

Rare reports of myocarditis after mRNA COVID-19 vaccines

- **Myocarditis** following mRNA COVID-19 vaccination is a rare event observed primarily in males aged < 30 years, particularly after the second dose
- Benefit-risk assessment presented for adolescents (Pfizer-BioNTech) and young adults (Pfizer-BioNTech and Moderna) to ACIP June 23, 2021; benefits outweigh risks
- Benefit-risk assessment presented for adults 18+ to ACIP on July 22, 2021; benefits outweigh risks



Clinical outcomes of patients hospitalized with myocarditis after mRNA vaccination in recent preprint/publications

- Case series (n=7) of hospitalized patients¹
 - All 7 resolved their symptoms rapidly; all discharged home
- Case series of children <19 years (n=15) hospitalized with myocarditis following Pfizer-BioNTech vaccination²
 - No ICU admissions; authors conclude these individuals had benign short-term clinical course
- Retrospective multi-center study across 16 hospitals (n=63) comparing 12-20-year-old patients with post-vaccination myocarditis to a cohort with MIS-C³
 - Post-vaccination myocarditis patients had a mild hospital course with quick clinical recovery. Of patients followed up, all had normal ventricular function on echocardiography

¹Marshall, et al. Symptomatic Acute Myocarditis in 7 Adolescents After Pfizer-BioNTech COVID-19 Vaccination. *Pediatrics*. August 2021.

²Dionne, et al. Association of Myocarditis with BNT162b2 Messenger RNA COVID-19 Vaccine in a Case Series of Children. *JAMA Cardiology* 2021; Aug 10; epub ahead of print.

³Jain, et al. COVID-19 Vaccination-Associated Myocarditis in Adolescents *Pediatrics* Aug 2021. *prepublication ahead of print*

Clinical outcomes of patients hospitalized with myocarditis after Pfizer-BioNTech vaccination in safety surveillance systems

■ Vaccine Adverse Event Reporting System (VAERS)*

- 16-29-year-olds, N=368:
 - 93% (344/368) hospitalized
 - › 4% (16/368) admitted to ICU
 - › 95% discharged to home
 - 0 deaths
 - Additional follow up ongoing

■ Vaccine Safety Datalink (VSD)

- 16-29-year-olds, N=16:
 - 94%(15/16) hospitalized; mean LOS: 1.9 days
 - › 25% (4/16) admitted to ICU
 - › 100% discharged to home
 - 0 deaths
 - Additional follow up ongoing

Source: Vaccine Safety Team; CDC and VSD. ICU = Intensive Care Unit; LOS = Length of Stay;

*VAERS reports received 8/18/21, reviewed through 8/25/21, following dose 1 or 2 within 21 days of vaccination

Background summary

- COVID-19 incidence and hospitalization rates are increasing rapidly
- Rare myocarditis occurs after mRNA vaccination, at higher rates in young males <30 years
- Myocarditis can occur in patients with SARS-CoV-2 infection and at higher rates than in those who received mRNA vaccination
- Hospitalization, COVID-19 in young adults:
 - Mean length of stay: **5** days, ~5% required mechanical ventilation; deaths occur
- Hospitalization, post-vaccination myocarditis in young adults:
 - Mean length of stay: **1-2** days; no deaths

Benefits-Risk Analysis for Pfizer-BioNTech COVID-19 Vaccine



Methods for assessment of benefit-risk balance similar to prior presentations to ACIP

Benefits

- Expected protection provided per 1 million second doses of Pfizer-BioNTech COVID-19 vaccine using:
 - Case incidence data and COVID-NET hospitalization and severity data through July 31 and projected hospitalization rates from CDC forecasts
 - Phase 3 trial VE for hospitalization (95%) and for COVID-19 symptomatic cases (95%)
 - 120-day period assumed



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 - 120-day period assumed



Potential harms

- Estimated cases of **myocarditis** per 1 million second doses of Pfizer-BioNTech COVID-19 vaccine dose, by age and sex using VAERS data received and reviewed through August 18
- 21-day risk window for myocarditis used

Methods were adjusted to account for rising COVID-19 cases

- Cases increasing at rates not seen with previous benefit-risk analyses
- Adjustments made to account for increases:
 - Multiplied by ratio of current case incidence compared to July 31: 1.5 times higher
 - Four-week average for hospitalizations allows for more robust estimates by age and sex
 - Multiplied by ratio of current hospitalizations (August 22) compared to July 31: 3 times higher
- Estimated benefits over longer periods of time to account for future benefits likely to accrue

Current Policy Discussion:

Use of Pfizer-BioNTech COVID-19 vaccine in individuals ≥ 16 years of age

- Will update with additional ages and/or vaccines for future policy questions

Myocarditis cases and reporting rates after Pfizer-BioNTech COVID-19 vaccination

- Over 17 million 2nd Pfizer-BioNTech vaccine doses administered and 327 confirmed myocarditis cases in VAERS as of August 18, 2021 in persons aged 16-29 years

Age group	Females			Males		
	Cases	Doses admin	Reporting rate [†]	Cases	Doses admin	Reporting rate [†]
16-17 years old	15	1,834,838	8.2	124	1,689,086	73.4
18-24 years old	12	4,279,917	2.8	140	3,635,284	38.5
25-29 years old	4	3,056,893	1.3	32	2,713,481	11.8

*Source of doses administered: <https://covid.cdc.gov/covid-data-tracker/#vaccinations>; some age- and sex-specific doses administered data were imputed

[†]Reporting rate = myocarditis cases per 1 million mRNA COVID-19 mRNA second vaccine doses administered

Estimated COVID-19 cases prevented vs. myocarditis cases for every million Pfizer-BioNTech COVID-19 vaccinations over 120 days

Females 16-17 Years

 **77,800** COVID-19 cases prevented

 **520** hospitalizations prevented

 **100** ICU admissions prevented

4 deaths prevented

 **8** myocarditis cases

Males 16-17 Years

 **56,700** COVID-19 cases prevented

 **500** hospitalizations prevented

 **170** ICU admissions prevented

4 deaths prevented

 **73** myocarditis cases

Estimated COVID-19 cases prevented vs. myocarditis cases for every million Pfizer-BioNTech COVID-19 vaccinations over 120 days

Females 18-24 Years

 **107,000** COVID-19 cases prevented

 **3,000** hospitalizations prevented

 **240** ICU admissions prevented

21 deaths prevented

 **3** myocarditis cases

Males 18-24 Years

 **75,200** COVID-19 cases prevented

 **1,000** hospitalizations prevented

 **230** ICU admissions prevented

2 deaths prevented

 **39** myocarditis cases

Estimated COVID-19 cases prevented vs. myocarditis cases for every million Pfizer-BioNTech COVID-19 vaccinations over 120 days

Females 25-29 Years

 **105,000** COVID-19 cases prevented

 **4,100** hospitalizations prevented

 **240** ICU admissions prevented

16 deaths prevented

 **1** myocarditis cases

Males 25-29 Years

 **76,600** COVID-19 cases prevented

 **2,200** hospitalizations prevented

 **490** ICU admissions prevented

44 deaths prevented

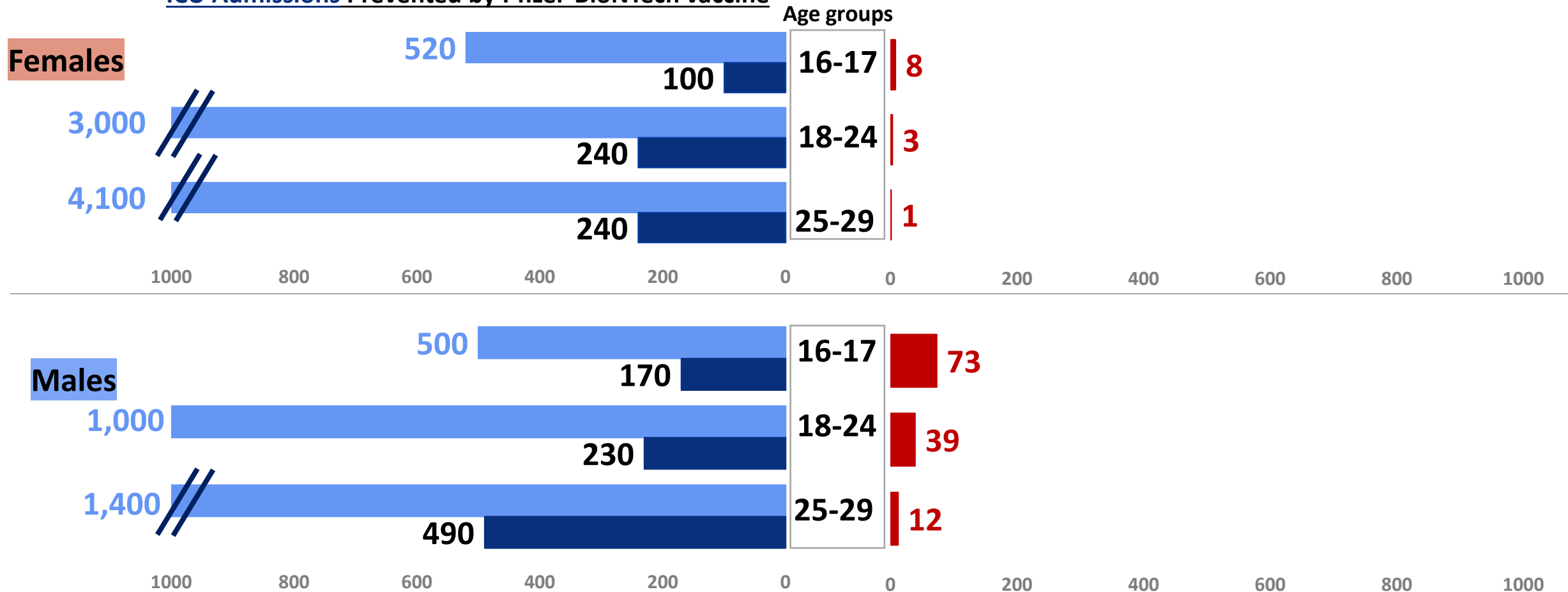
 **12** myocarditis cases

Benefits and risks after Pfizer-BioNTech COVID-19 vaccination

For every million doses of vaccine given with US exposure risk and hospitalization rates projected through August 2021

COVID-19-Associated Hospitalizations & ICU Admissions Prevented by Pfizer-BioNTech vaccine

Cases of myocarditis

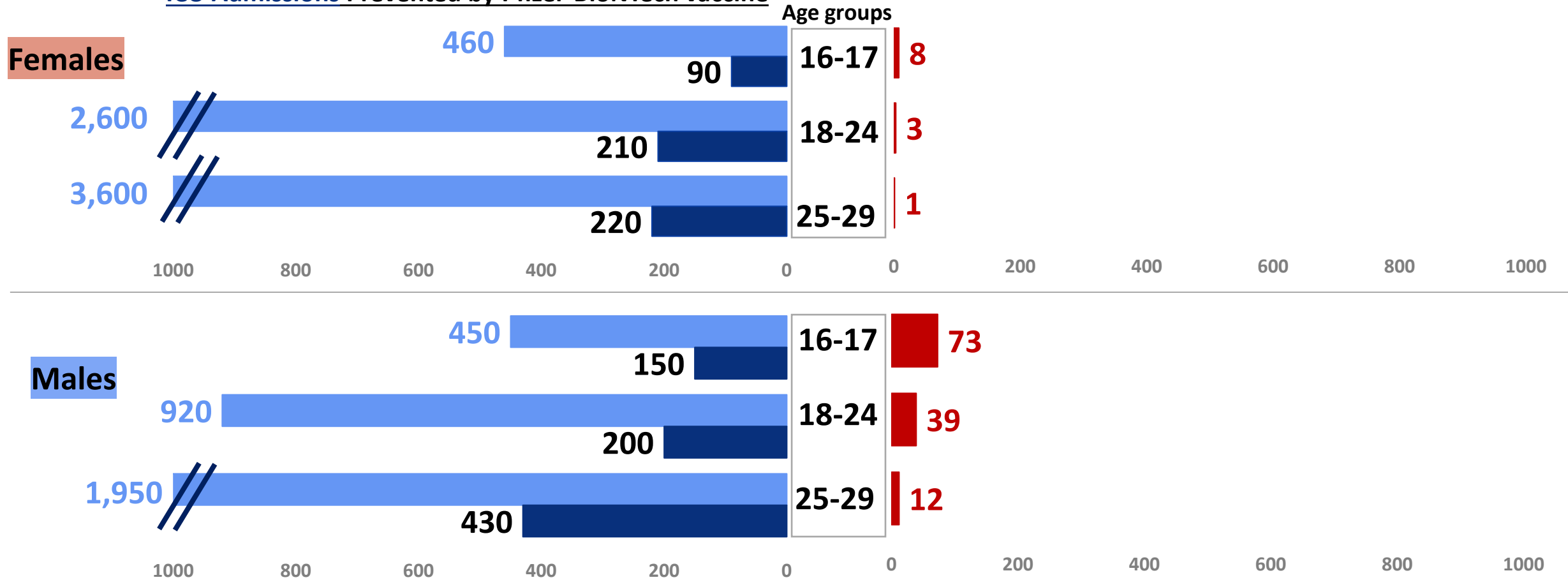


Benefits and risks after Pfizer-BioNTech COVID-19 vaccination, *lower VE*

For every million doses of vaccine given with US exposure risk and hospitalization rates projected through August 2021, assuming vaccine effectiveness (VE) for cases: 74.6%¹; VE for hospitalizations: 84%²

COVID-19-Associated Hospitalizations & ICU Admissions Prevented by Pfizer-BioNTech vaccine

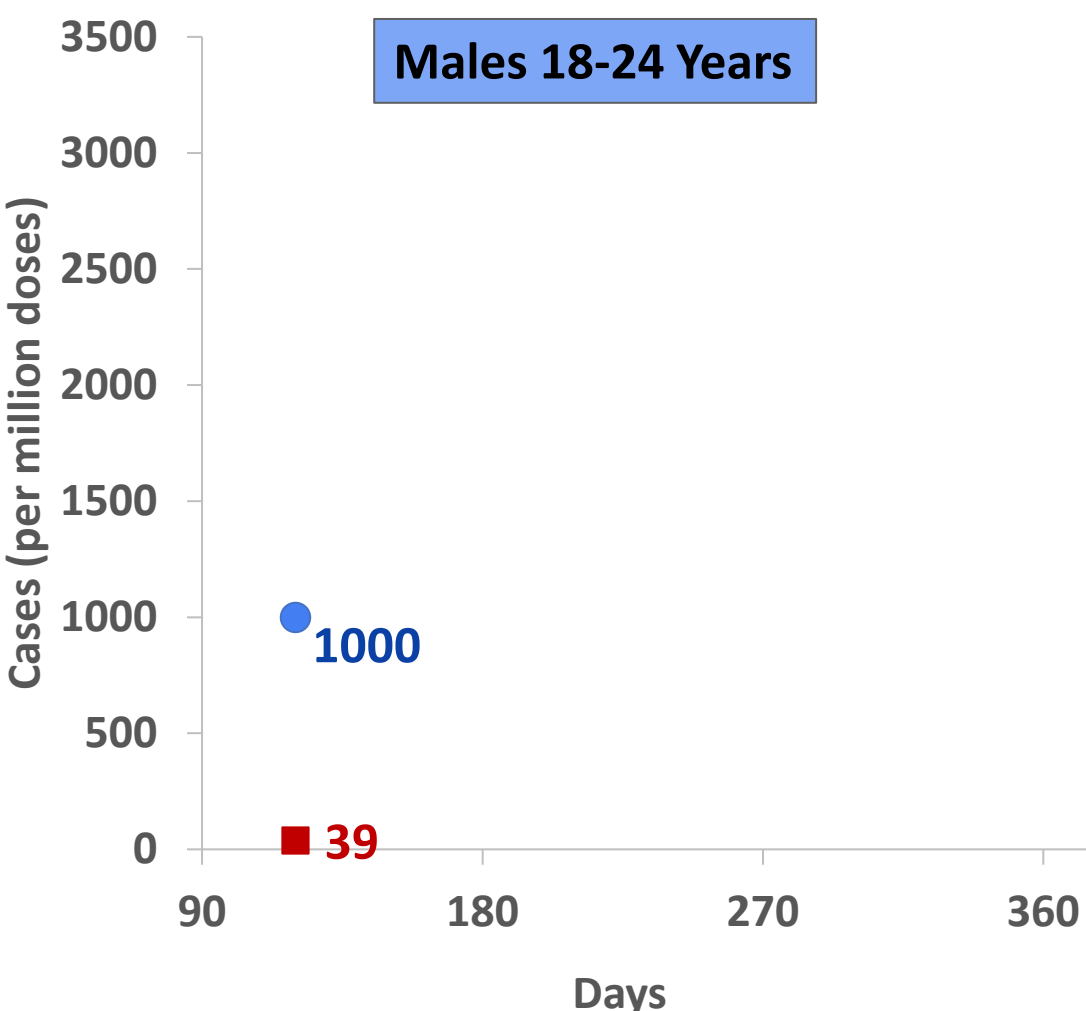
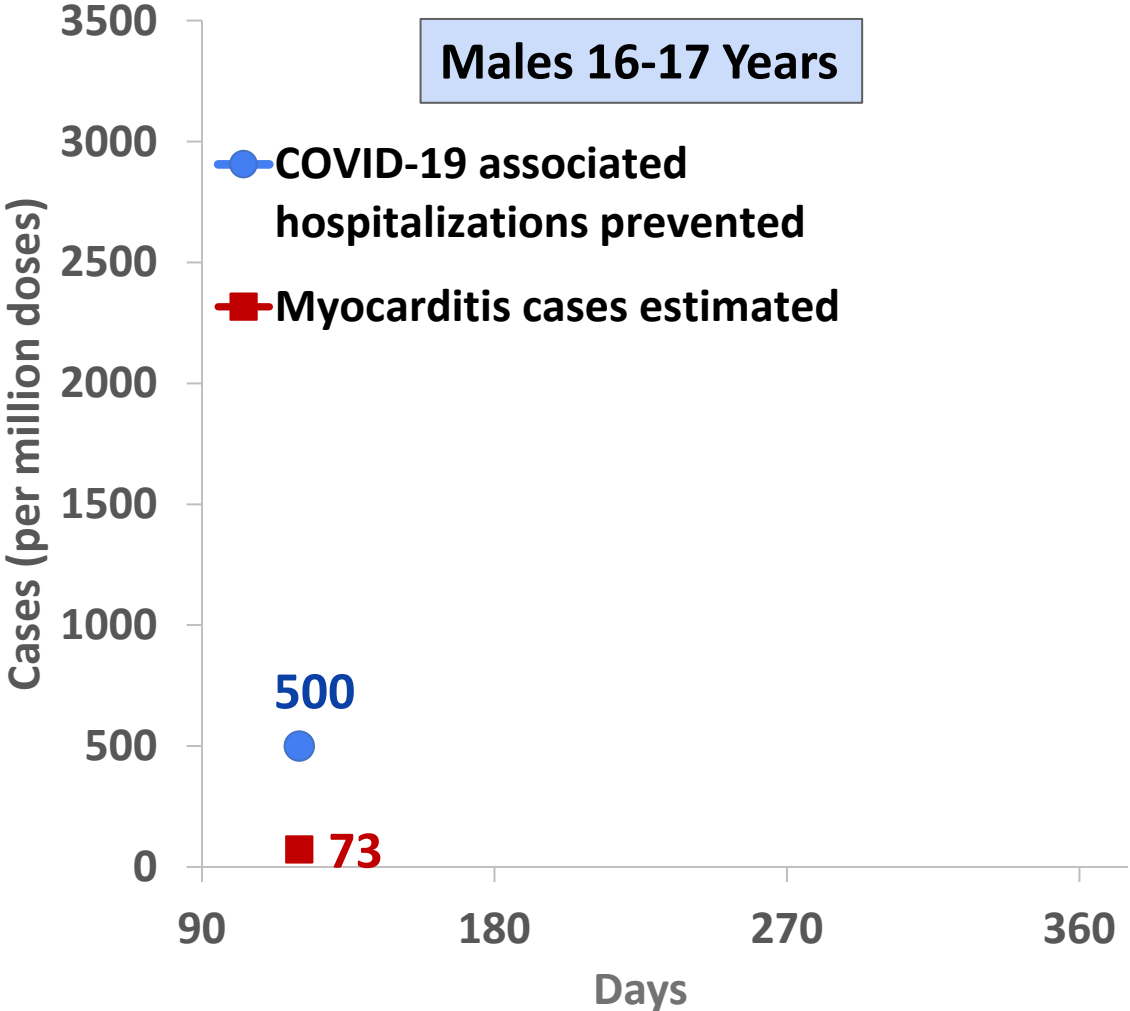
Cases of myocarditis



¹Rosenberg ES, 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;
²Tenforde MW, 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.

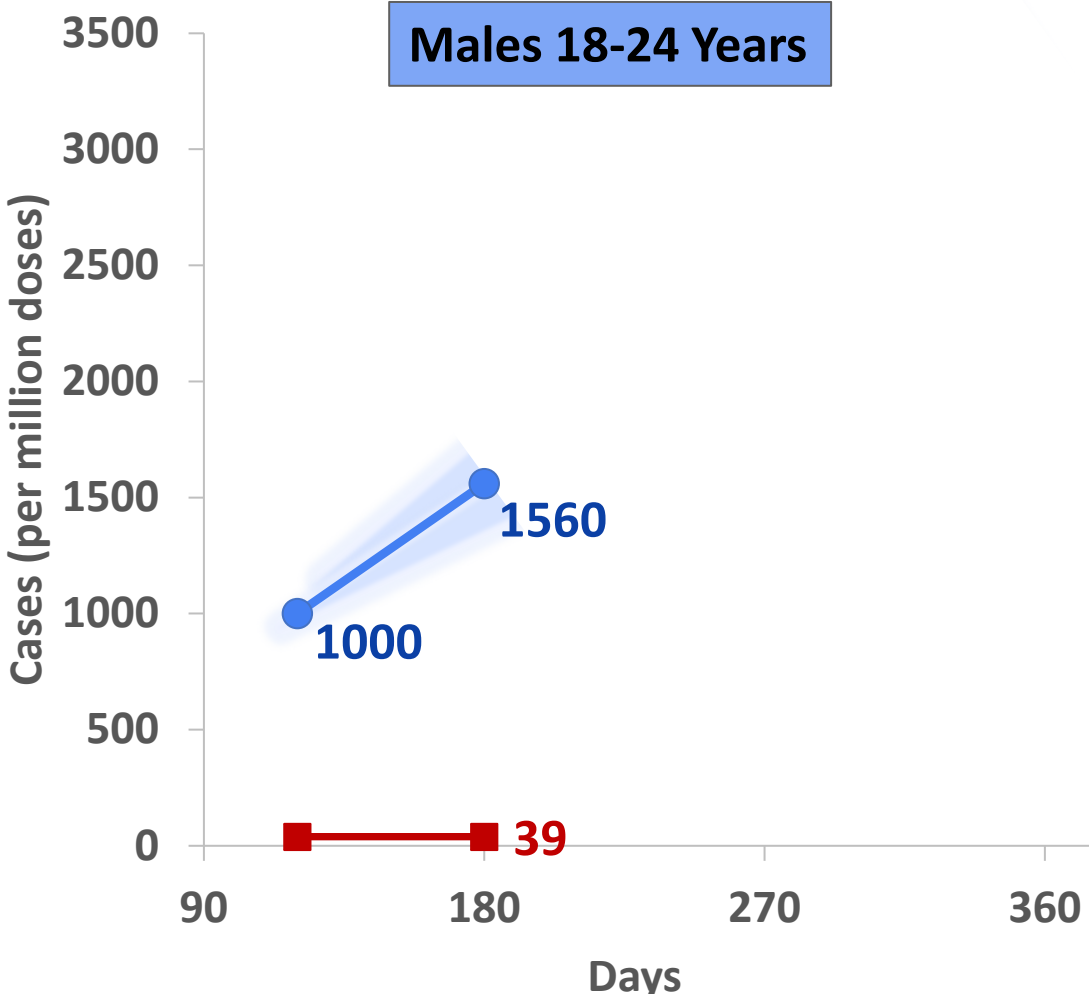
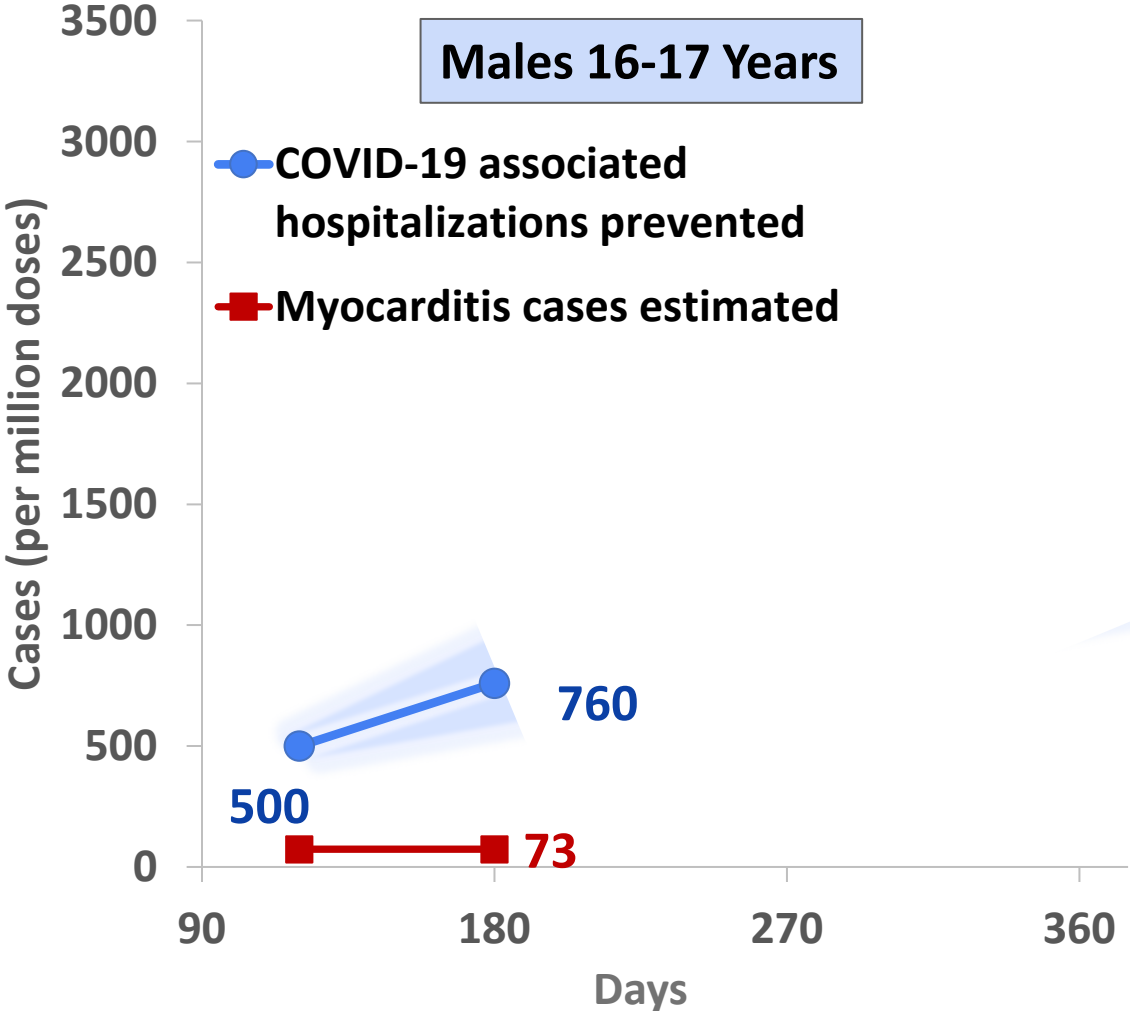
Benefits and risks after Pfizer-BioNTech COVID-19 vaccination among males, over longer periods of time: 120 days

For every million doses of vaccine given with US exposure risk and hospitalization rates projected through August 2021



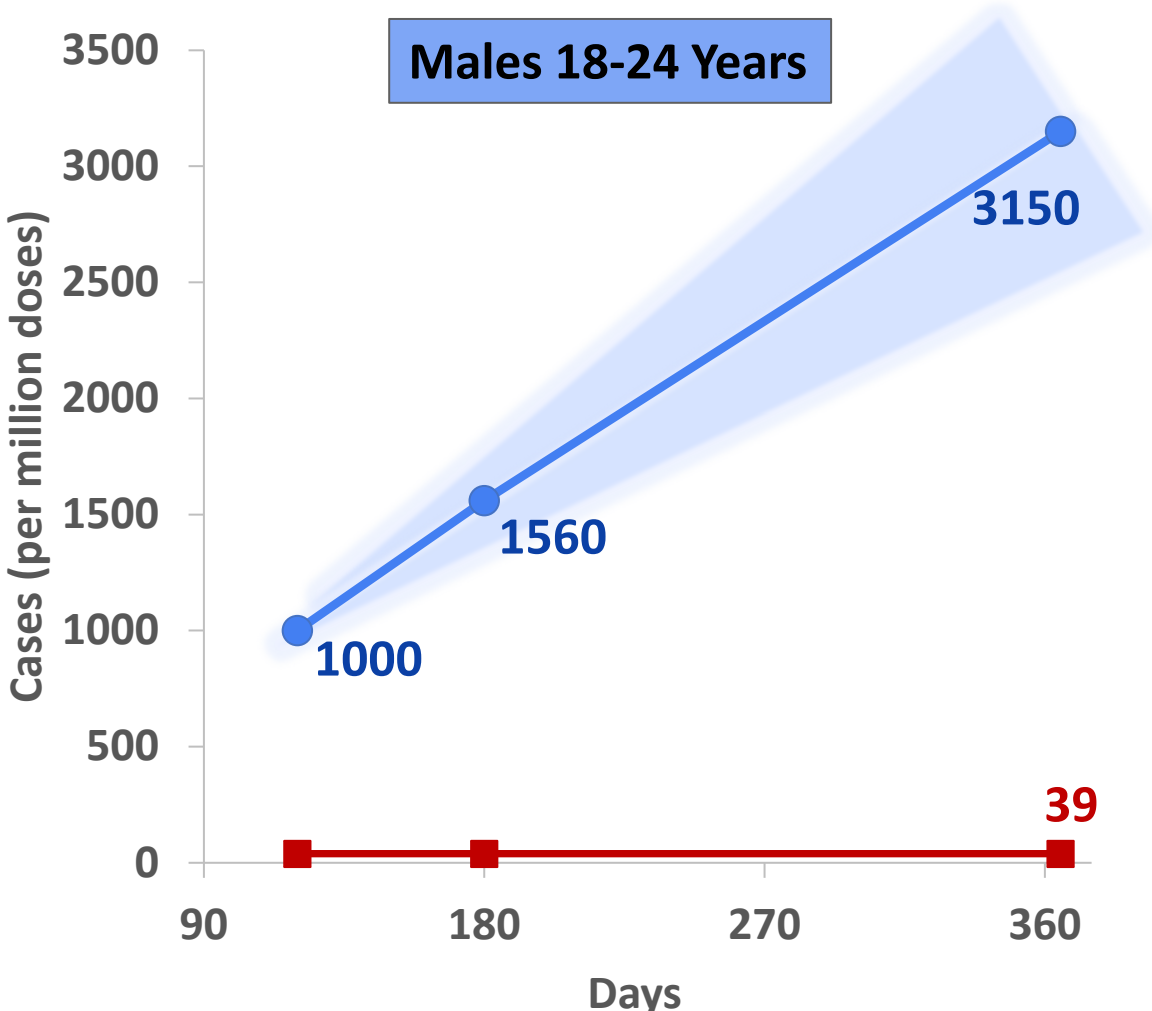
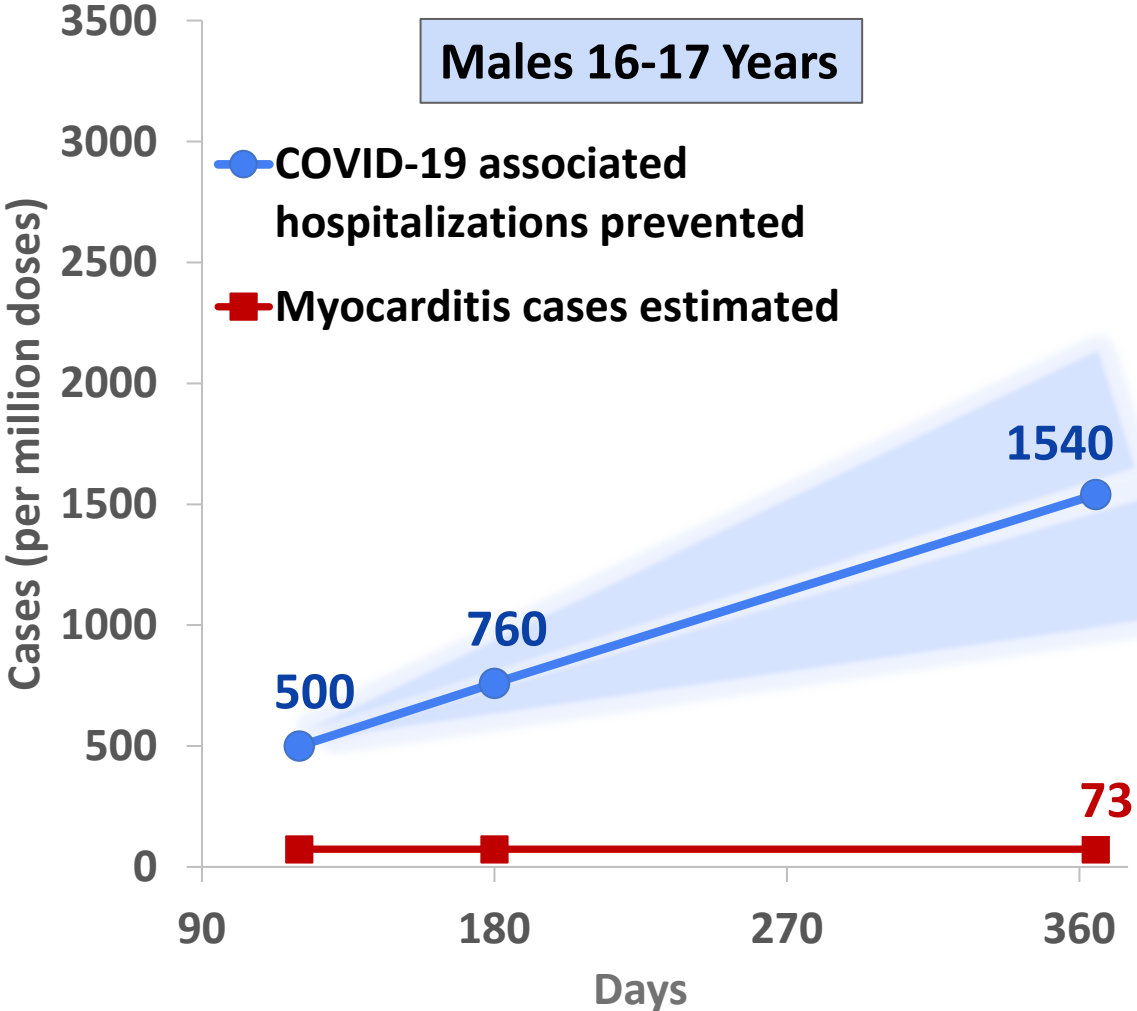
Benefits and risks after Pfizer-BioNTech COVID-19 vaccination among males, over longer periods of time: 180 days

For every million doses of vaccine given with US exposure risk and hospitalization rates projected through August 2021



Benefits and risks after Pfizer-BioNTech COVID-19 vaccination among males, over longer periods of time: 365 days

For every million doses of vaccine given with US exposure risk and hospitalization rates projected through August 2021



Benefits and risks after Pfizer-BioNTech COVID-19 vaccination

For every million doses of vaccine given with US exposure risk and hospitalization rates projected through August 2021

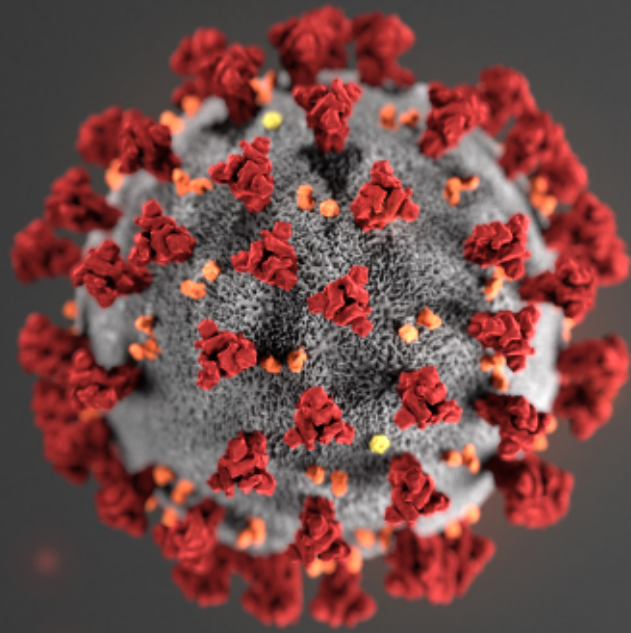
	COVID-19 outcomes prevented per million doses			Myocarditis cases expected per million
	COVID-19 cases prevented	COVID-19 hospitalizations Prevented	COVID-19 ICU admissions prevented	Pfizer-BioNTech COVID-19 vaccine
FEMALES				
16-17 years	77,800	520	100	8
18-24 years	107,000	3,000	240	3
25-29 years	105,000	4,100	240	1
MALES				
16-17 years	56,700	500	170	73
18-24 years	75,200	1,000	230	39
25-29 years	76,600	2,200	490	12

Summary of benefit-risk balance for Pfizer-BioNTech COVID-19 vaccination and myocarditis in individuals aged 16-29 years

- Direct risk assessment for Pfizer-BioNTech COVID-19 vaccine & myocarditis
 - Considers individual benefits of vaccination vs. individual risks
 - Considers receipt of vaccine versus no vaccine
 - Indirect benefits of vaccine were not considered in this analysis
- The Work Group assessed that the **benefits** of vaccination **outweigh** the risks for each age/sex group evaluated
 - As with previous analyses, balance of benefits and risks varies by age/sex

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- Vaccine Safety Team
- Epidemiology and Surveillance Task Force
- Vaccine Task Force
- FDA



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

Thank you

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.

