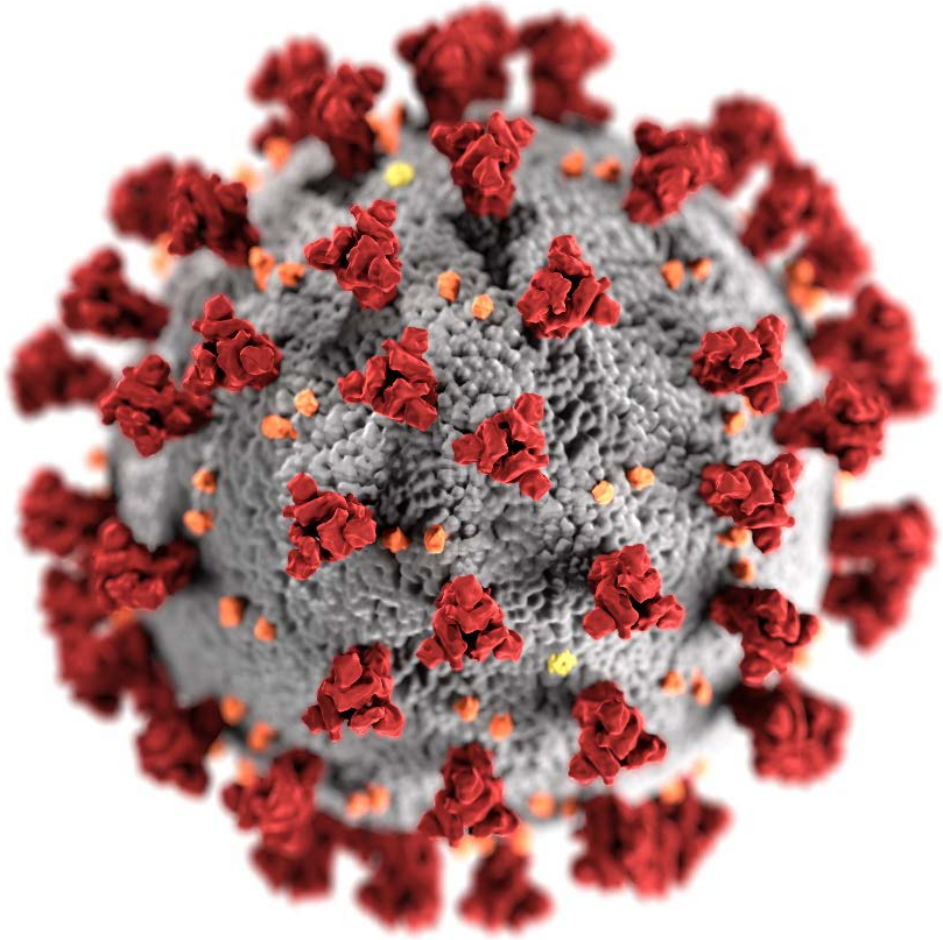
COVID-19 Vaccines in Adults: Benefit-Risk Discussion



Hannah Rosenblum, MD

ACIP Meeting

July 22, 2021

cdc.gov/coronavirus

Current COVID-19 vaccine policy

- Today's discussion will focus on the benefits and harms of COVID-19 vaccines in adults
- Three COVID-19 vaccines are recommended for persons aged 18 years and older in the United States under FDA's Emergency Use Authorization

Benefits and risks by vaccine, age and sex in adults

Benefits of COVID-19 Janssen and mRNA vaccines in adults

Risk after COVID-19 Janssen and mRNA vaccines in adults

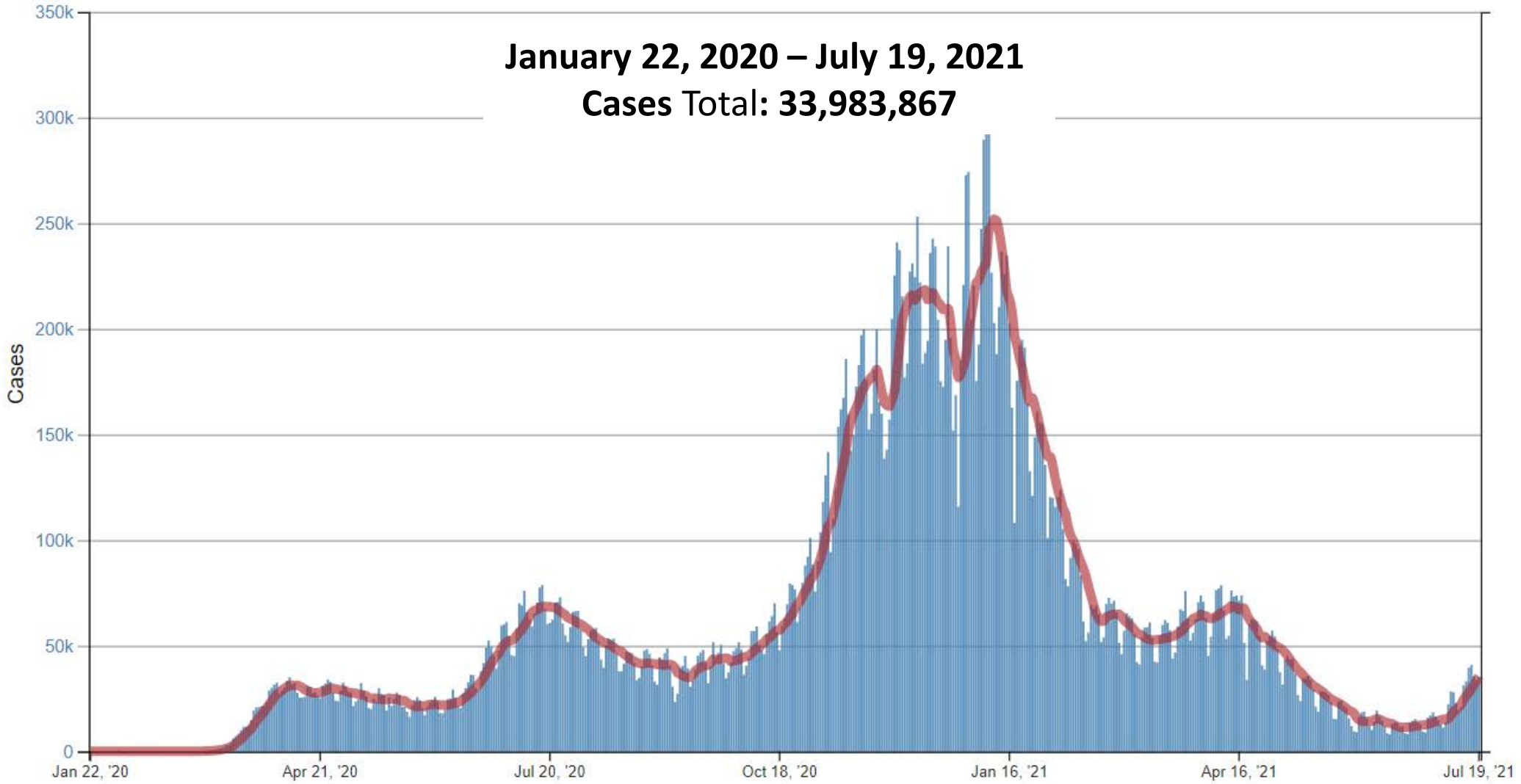
COVID-19 vaccines in adults: Benefit-risk discussion

- Public health problem
  - Recent COVID-19 epidemiology in adults
  - Adverse events reported after vaccination
    - Guillain-Barre Syndrome (GBS)
    - Thrombosis with Thrombocytopenia Syndrome (TTS)
    - Myocarditis

- Benefit/Risk assessment
  - Benefits of Janssen vaccine
  - Risk of GBS after Janssen vaccine
  - Risk of TTS after Janssen vaccine

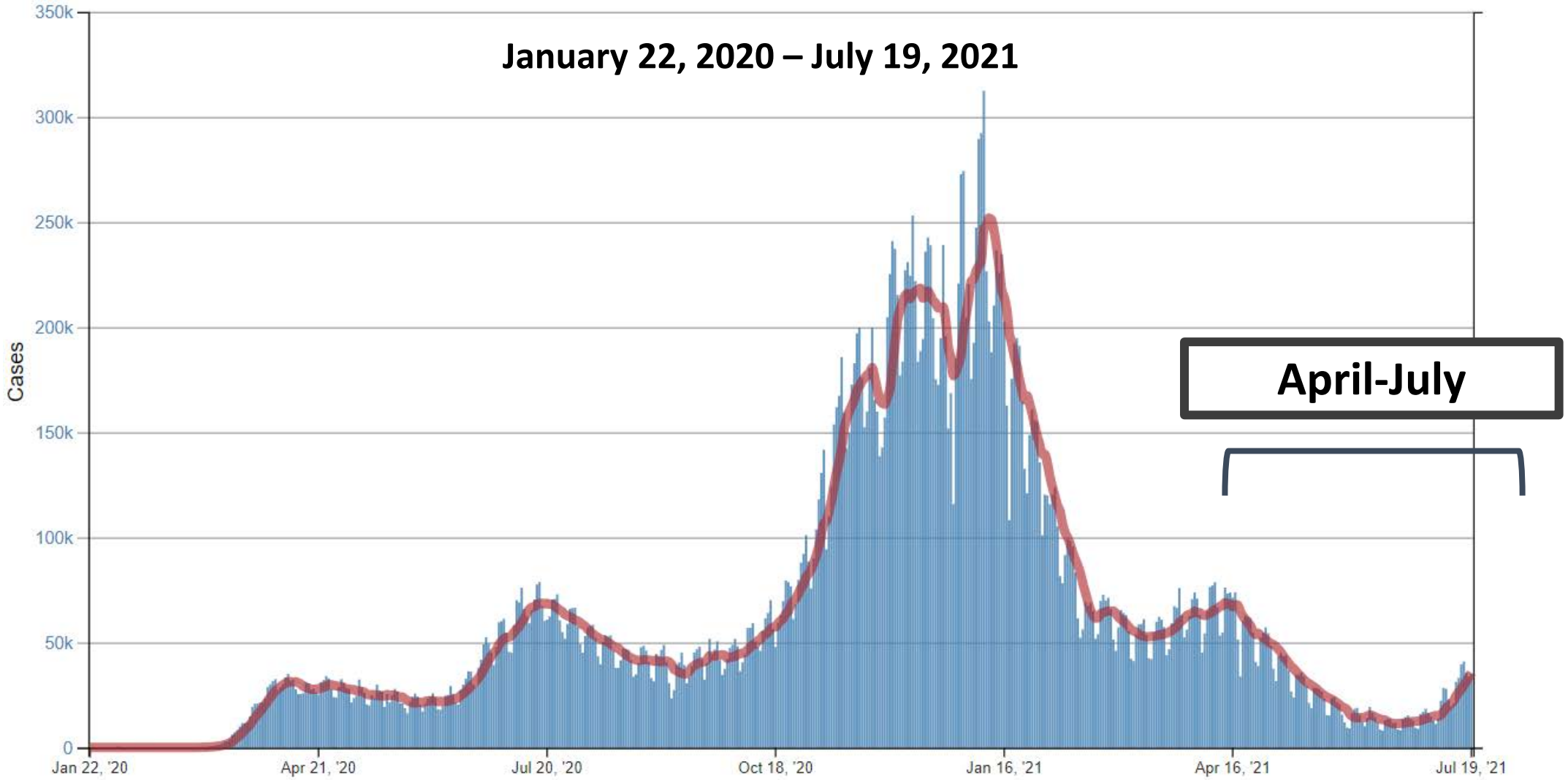
  - Benefits of mRNA vaccines
  - Risk of myocarditis after mRNA vaccines

Trends in number of U.S. COVID-19 cases reported to CDC



https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases; from July 21, 2021

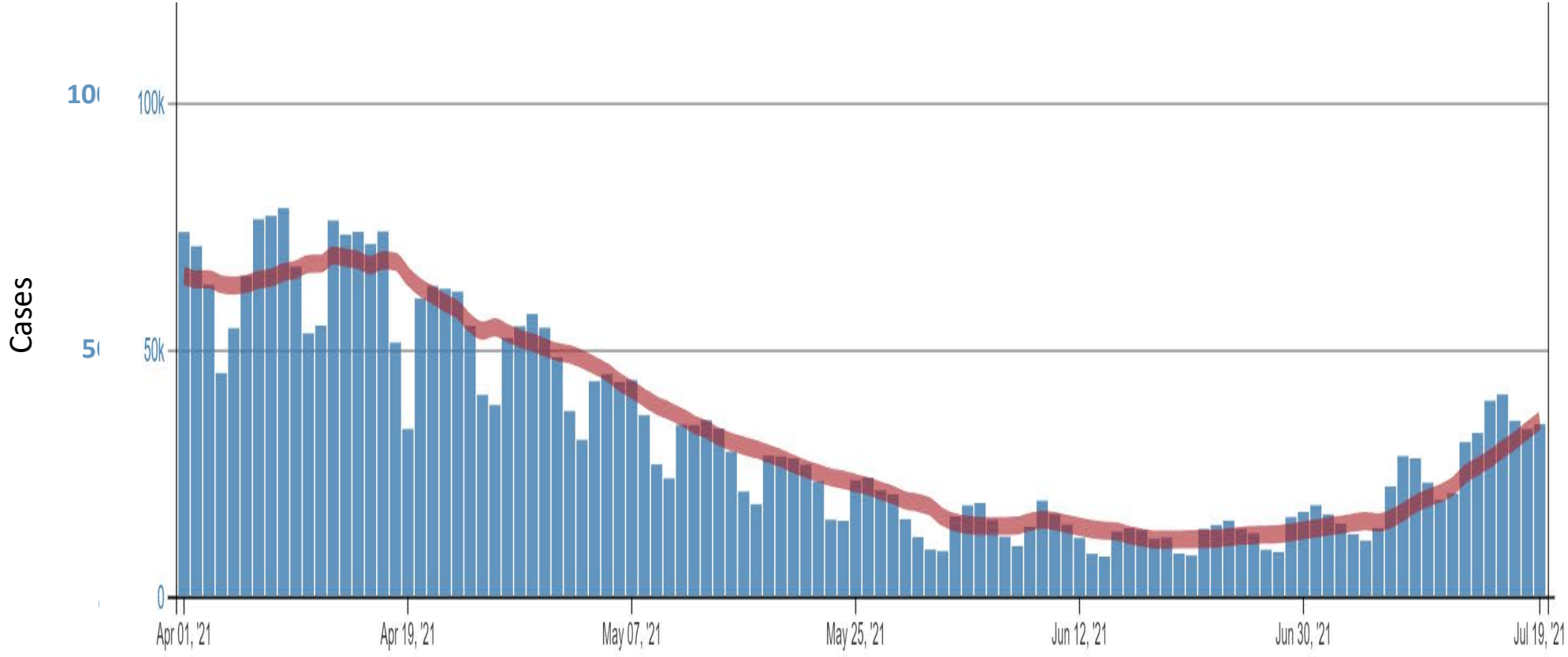
Trends in number of U.S. COVID-19 cases reported to CDC



https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases; from July 21, 2021

Recent trends in number of U.S. COVID-19 cases

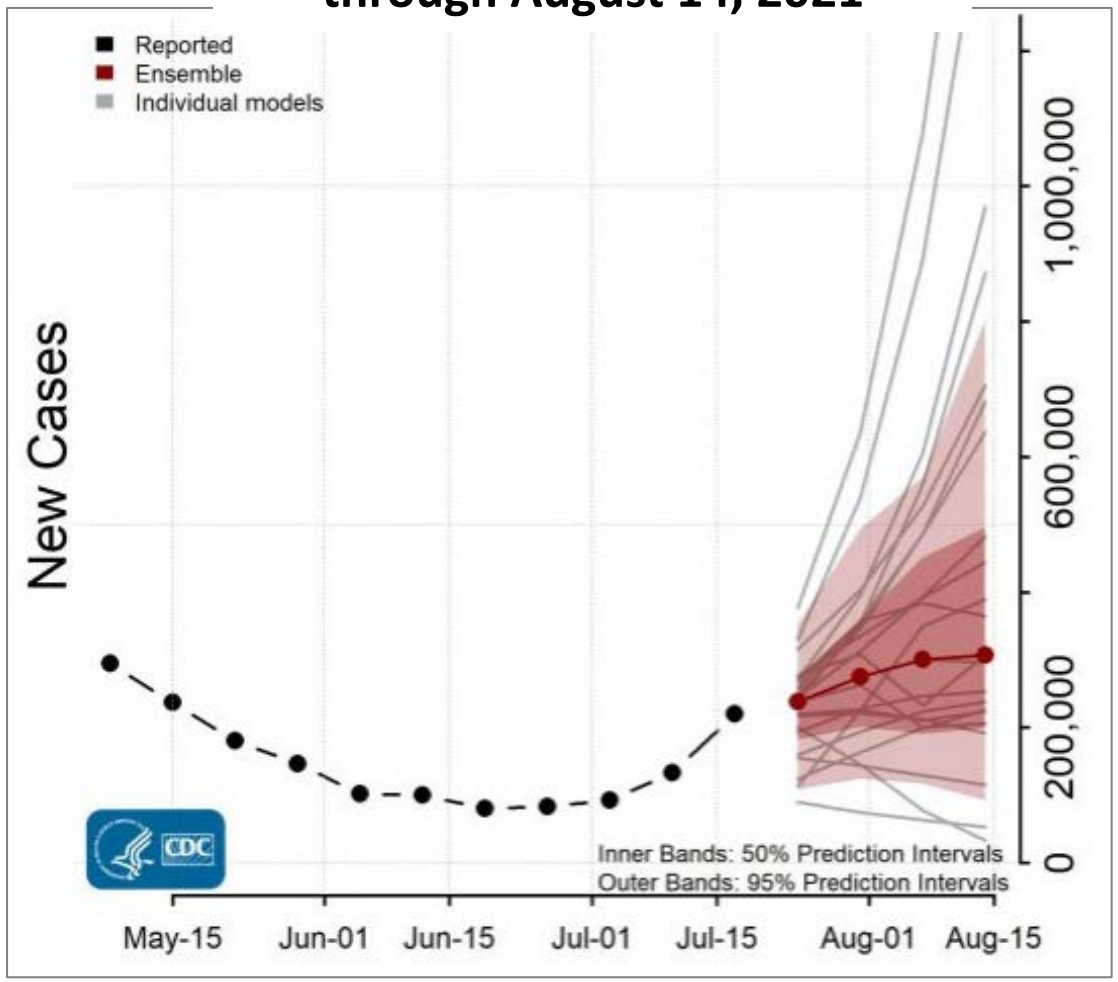
April 1, 2020 – July 19, 2021



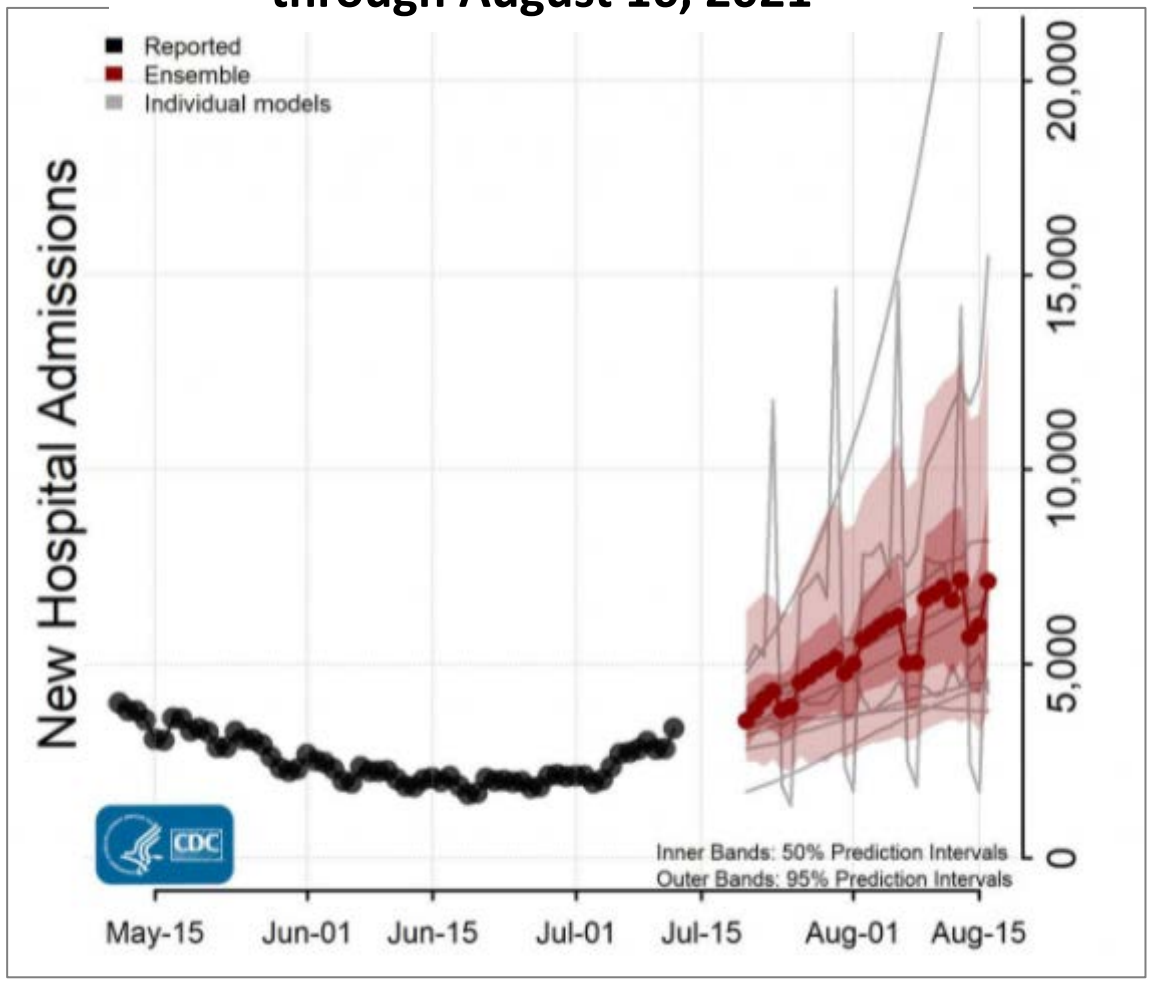
https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases; from July 21, 2021

Forecast of cases and hospitalizations for the next four weeks

New COVID-19 cases forecasted through August 14, 2021



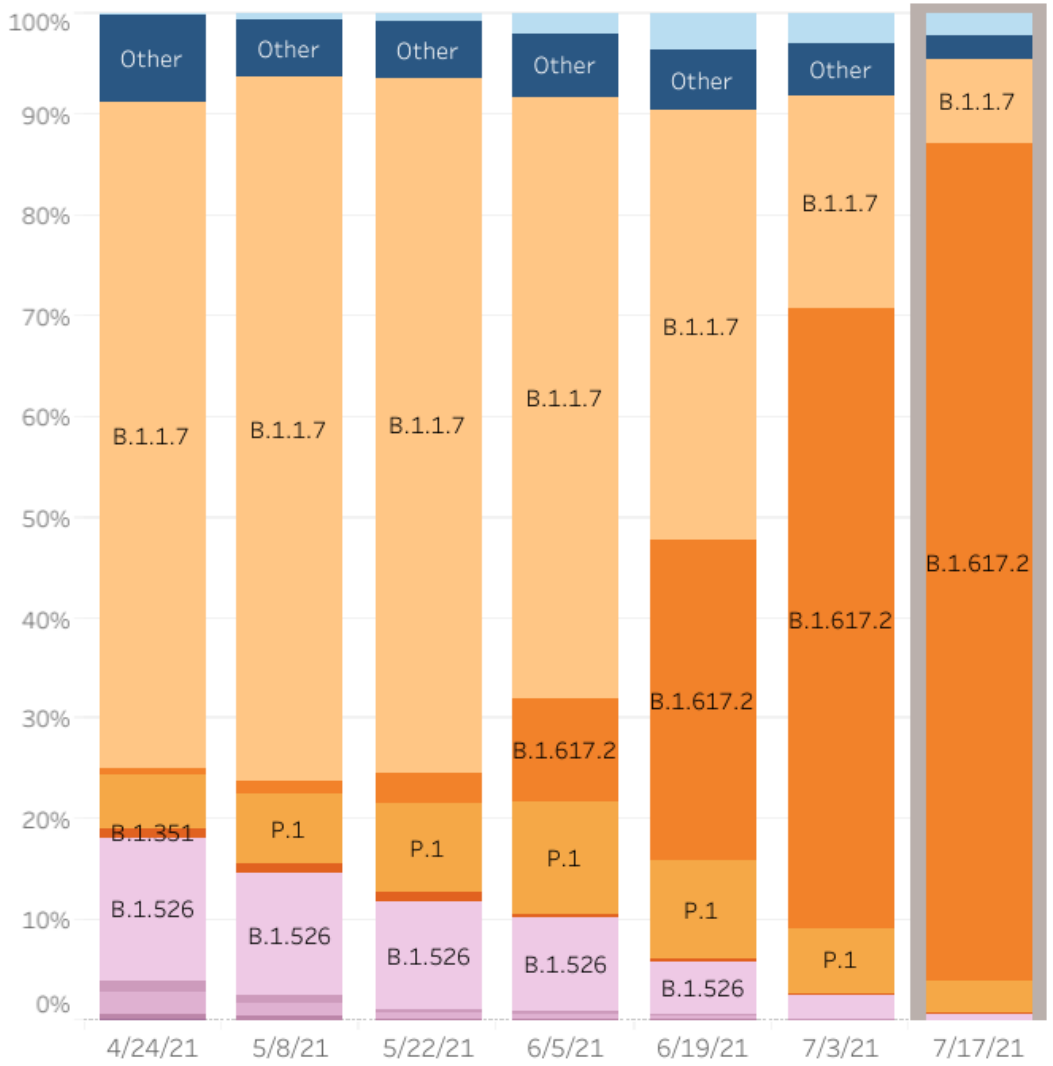
COVID-19 hospitalizations forecasted through August 16, 2021



https://www.cdc.gov/coronavirus/2019-ncov/science/forecasting/forecasts-cases.html; https://www.cdc.gov/coronavirus/2019-ncov/science/forecasting/hospitalizations-forecasts.html

SARS-CoV-2 variants circulating in the United States

April 11 – July 17, 2021



Alpha (B.1.1.7): 8%

Delta (B.1.617.2): 83.2%

Gamma (P.1): 3%

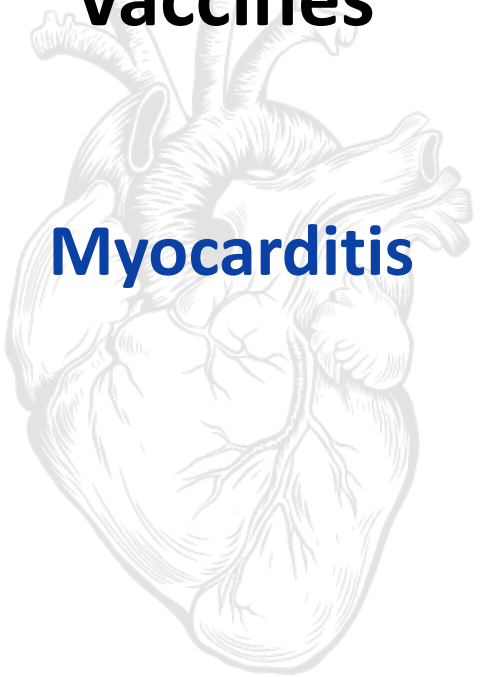
https://covid.cdc.gov/covid-data-tracker/#variant-proportions

Rare serious adverse events reported after COVID-19 vaccination

Janssen vaccine

- Thrombosis with thrombocytopenia syndrome (TTS)
- Guillain-Barré syndrome (GBS)

mRNA vaccines



- Myocarditis

Summary

- After a period of decline, COVID-19 cases and hospitalizations have begun to increase in recent weeks.
  - Variants continue to spread; Delta variant now found in >80% of cases in the United States

- Rare events have been observed after COVID-19 vaccination:
  - Janssen vaccine: TTS & GBS
  - mRNA vaccine: myocarditis

Benefits and Harms of Janssen COVID-19 Vaccine

Methods for assessment of benefit-risk balance – Janssen vaccine

Benefits

- Expected protection provided per 1 million Janssen vaccine doses by age/sex calculated using:
  - Most recent case incidence, COVID-NET hospitalization & severity data (through June 19th)
  - VE (90%) for hospitalization
  - VE (66%) for COVID-19 symptomatic cases
  - 120-day period

VE= Vaccine efficacy

Methods for assessment of benefit-risk balance – Janssen vaccine

Benefits

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  - 120-day period

Potential harms

- Estimated cases of **GBS** per 1 million Janssen vaccine doses, by age/sex using cases from VAERS through June 30, 2021
- Estimated cases of **TTS** per 1 million Janssen vaccine doses, by age/sex using cases reported to VAERS through July 8, 2021

VE= Vaccine efficacy; GBS = Guillain-Barré syndrome; TTS= Thrombosis with thrombocytopenia syndrome; VAERS = Vaccine Adverse Event Reporting System

Benefits of the Janssen COVID-19 vaccine

- The clinical trial demonstrated efficacy against symptomatic, laboratory-confirmed COVID-19. Overall efficacy was **66%**
- Against **severe** outcomes:
  - Vaccine efficacy against COVID-19-associated **hospitalization**: **93%**
  - VE against **deaths** due to COVID-19**: 100%**
- Persistence of antibody response & activity demonstrated against a variety of variants*

*Durable humoral and cellular immune responses months after Ad26.COV2.S vaccination NEJM https://www.nejm.org/doi/full/10.1056/NEJMc2108829?query=featured_home

Potential Harms of the Janssen COVID-19 vaccine:
Guillain-Barré Syndrome

- 12.6 million vaccine doses administered* and 98 GBS cases as of June 30, 2021

	Females n= 37			Males n=61		
Age group	**Cases**	**Doses admin**	**Reporting rate†**	**Cases**	**Doses admin**	**Reporting rate†**
18-29 years old	1	1,037,996	1.0 per million	3	1,258,963	2.4 per million
30-49 years old	13	1,957,663	6.6 per million	18	2,407,430	7.5 per million
50-64 years old	14	1,888,715	7.4 per million	**33**	**2,115,411**	**15.6 per million**
65+ years old	9	1,037,996	8.7 per million	7	932,764	7.5 per million

* Source of doses administered: FDA, through June 30, 2021; Some age- and sex-specific dose administered data were imputed

† Reporting rate = GBS cases per 1 million Janssen COVID-19 vaccine doses administered

GBS = Guillain-Barré Syndrome

Potential Harms of the Janssen COVID-19 vaccine:
Thrombosis with Thrombocytopenia Syndrome

- 12.5 million vaccine doses administered* and 38 confirmed TTS cases as of July 8, 2021

	Females n= 28			Males n=10		
Age group	Cases	Doses admin	Reporting rate†	Cases	Doses admin	Reporting rate†
18-29 years old	4	946,358	4.2 per million	3	1,281,479	2.3 per million
30-49 years old	**17**	**1,934,574**	**8.8 per million**	4	2,440,773	1.6 per million
50-64 years old	7	1,865,372	3.8 per million	3	2,130,473	1.4 per million
65+ years old	0	1,028,190	0.0 per million	0	943,098	0.0 per million

* Source of doses administered: https://covid.cdc.gov/covid-data-tracker/#vaccinations through July 8, 2021; Some age- and sex-specific doses administered data were imputed

† Reporting rate = TTS cases per 1 million Janssen COVID-19 vaccine doses administered

TTS=Thrombosis with Thrombocytopenia Syndrome

Estimated predicted COVID-19 cases prevented vs. GBS cases for every million Janssen vaccinations over 120 days

Females 18–29 Years

8,900 COVID-19 cases prevented

700 hospitalizations prevented

50 ICU admissions prevented

5 deaths prevented

1 GBS case

Males 18–29 Years

6,600 COVID-19 cases prevented

300 hospitalizations prevented

60 ICU admissions prevented

3 deaths prevented

2 GBS cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021; GBS = Guillain-Barré Syndrome

Estimated predicted COVID-19 cases prevented vs. GBS & TTS cases for every million Janssen vaccinations over 120 days

Females 18–29 Years

8,900 COVID-19 cases prevented

700 hospitalizations prevented

50 ICU admissions prevented

5 deaths prevented

1 GBS case
4-5 TTS cases

Males 18–29 Years

6,600 COVID-19 cases prevented

300 hospitalizations prevented

60 ICU admissions prevented

3 deaths prevented

2 GBS cases
2-3 TTS cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021; GBS = Guillain-Barré Syndrome; TTS= Thrombosis with Thrombocytopenia Syndrome

Estimated predicted COVID-19 cases prevented vs. GBS & TTS cases for every million Janssen vaccinations over 120 days

Females 30–49 Years

10,100 COVID-19 cases prevented

900 hospitalizations prevented

140 ICU admissions prevented

20 deaths prevented

6-7 GBS cases
8-10 TTS cases

Males 30–49 Years

7,600 COVID-19 cases prevented

650 hospitalizations prevented

150 ICU admissions prevented

25 deaths prevented

7-8 GBS cases
1-2 TTS cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021; GBS = Guillain-Barré Syndrome; TTS= Thrombosis with Thrombocytopenia Syndrome

Estimated predicted COVID-19 cases prevented vs. GBS & TTS cases for every million Janssen vaccinations over 120 days

Females 50–64 Years

12,100 COVID-19 cases prevented

1,600 hospitalizations prevented

350 ICU admissions prevented

120 deaths prevented

7-8 GBS cases
3-4 TTS cases

Males 50–64 Years

10,100 COVID-19 cases prevented

1,800 hospitalizations prevented

480 ICU admissions prevented

140 deaths prevented

14-17 GBS cases
1-2 TTS cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021; GBS = Guillain-Barré Syndrome; TTS= Thrombosis with Thrombocytopenia Syndrome

Estimated predicted COVID-19 cases prevented vs. GBS & TTS cases for every million Janssen vaccinations over 120 days

Females 65+ Years

29,000 COVID-19 cases prevented

5,900 hospitalizations prevented

1,250 ICU admissions prevented

840 deaths prevented

8-10 GBS cases
0 TTS cases

Males 65+ Years

36,600 COVID-19 cases prevented

11,800 hospitalizations prevented

3,300 ICU admissions prevented

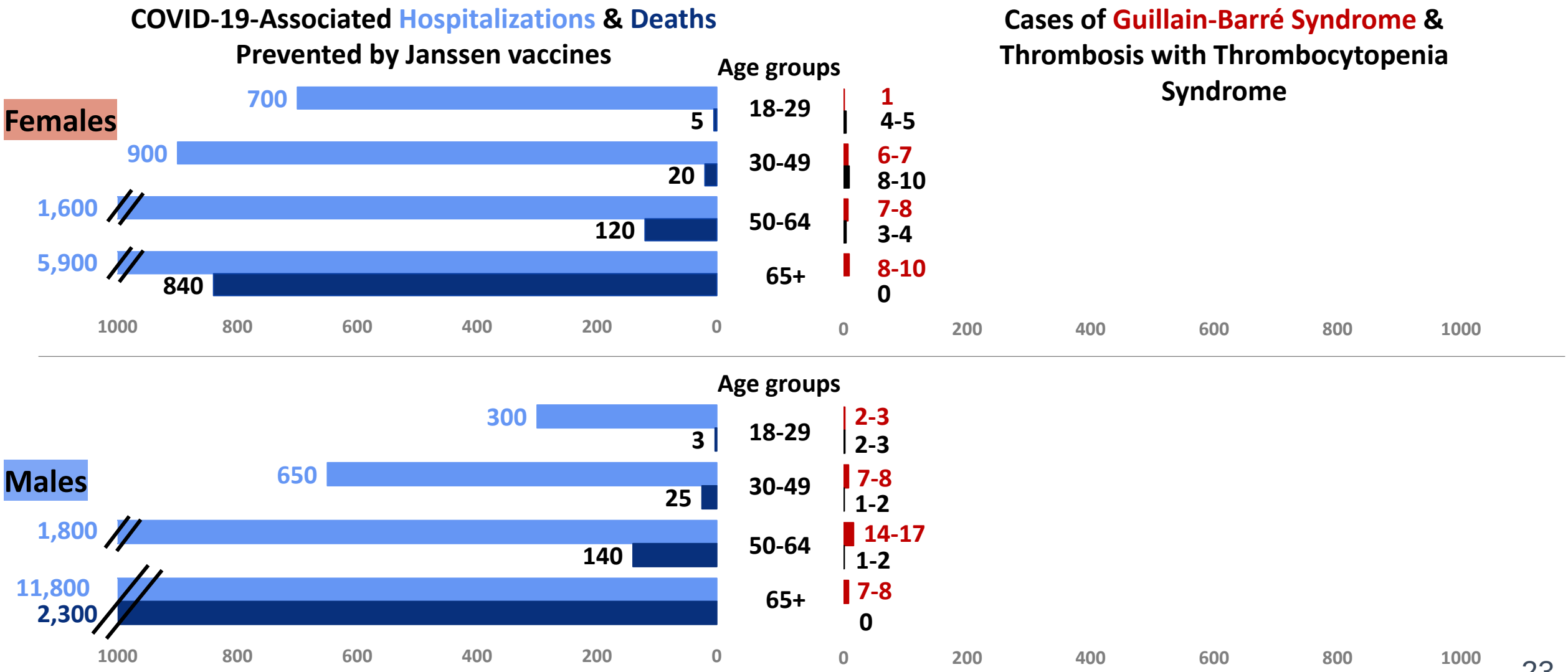
2,300 deaths prevented

7-8 GBS cases
0 TTS cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021; GBS = Guillain-Barré Syndrome; TTS= Thrombosis with Thrombocytopenia Syndrome

Benefits and risks after Janssen vaccine, by age group & sex

For every million doses of vaccine given with US exposure risk and hospitalization rates from June 19, 2021



Benefits and Harms of mRNA COVID-19 Vaccines

Methods for assessment of benefit-risk balance – mRNA COVID-19 vaccines in adults

Benefits

- Expected protection provided per 1 million mRNA vaccine doses using:
  - Most recent case incidence, COVID-NET hospitalization and severity data (through June 19th)
  - VE for hospitalization (95%)
  - VE for COVID-19 symptomatic cases (95%)
  - 120-day period

Potential harms

- Estimated cases of **myocarditis** per 1 million second doses of mRNA COVID-19 vaccine, by age/sex using data from VAERS through June 30, 2021

VE= Vaccine efficacy; VAERS = Vaccine Adverse Event Reporting System

Benefits of mRNA vaccines

- Clinical trial data demonstrated high efficacy against symptomatic, laboratory-confirmed COVID-19 among adults with both mRNA vaccines (Pfizer-BioNTech and Moderna)
  - Overall efficacy was **94-95%**
  - Vaccine efficacy against COVID-19 associated hospitalization was **89-100%**

- Persistence of antibody response & activity demonstrated against a variety of variants*

Polack FP et al. N Engl J Med 2020; DOI: 10.1056/NEJMoa2034577; Frenck RW et al. N Engl J Med 2021; DOI: 10.1056/NEJMoa2107456;
Baden LR et al. N Engl J Med 2021; DOI: 10.1056/NEJMoa2035389
*https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html

Potential Harms of the mRNA COVID-19 vaccines:
Myocarditis

- 141 million 2nd mRNA vaccine doses administered* and 497 myocarditis cases as of June 30, 2021 in age 18+

	Females n= 105			Males n= 392		
Age group	**Cases**	**Doses admin**	**Reporting rate†**	**Cases***	**Doses admin**	**Reporting rate†**
18-29 years old§	34	10,491,212	3.2 per million	**248**	**10,212,647**	**24.3 per million**
30-49 years old	38	20,875,708	1.8 per million	117	20,154,577	5.8 per million
50-64 years old	23	19,714,915	1.2 per million	15	18,514,388	0.8 per million
65+ years old	10	22,274,470	0.4 per million	12	19,518,324	0.6 per million

*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

§Myocarditis cases in 18-29-year-olds are confirmed cases meeting CDC's case definition

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

Females 18-29 Years

12,800 COVID-19 cases prevented

750 hospitalizations prevented

50 ICU admissions prevented

5 deaths prevented

3-4 myocarditis cases

Males 18-29 Years

9,600 COVID-19 cases prevented

300 hospitalizations prevented

60 ICU admissions prevented

3 deaths prevented

22-27 myocarditis cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021

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

Females 30-49 Years

14,600 COVID-19 cases prevented

950 hospitalizations prevented

140 ICU admissions prevented

20 deaths prevented

1-2 myocarditis cases

Males 30-49 Years

11,000 COVID-19 cases prevented

700 hospitalizations prevented

160 ICU admissions prevented

25 deaths prevented

5-6 myocarditis cases

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021

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

Females 50-64 Years

17,500 COVID-19 cases prevented

1,700 hospitalizations prevented

375 ICU admissions prevented

125 deaths prevented

1 myocarditis case

Males 50-64 Years

14,700 COVID-19 cases prevented

1,900 hospitalizations prevented

500 ICU admissions prevented

150 deaths prevented

1 myocarditis case

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021

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

Females 65+ Years

32,000 COVID-19 cases prevented

6,200 hospitalizations prevented

1,300 ICU admissions prevented

900 deaths prevented

<1 myocarditis case

Males 65+ Years

52,700 COVID-19 cases prevented

12,500 hospitalizations prevented

3,500 ICU admissions prevented

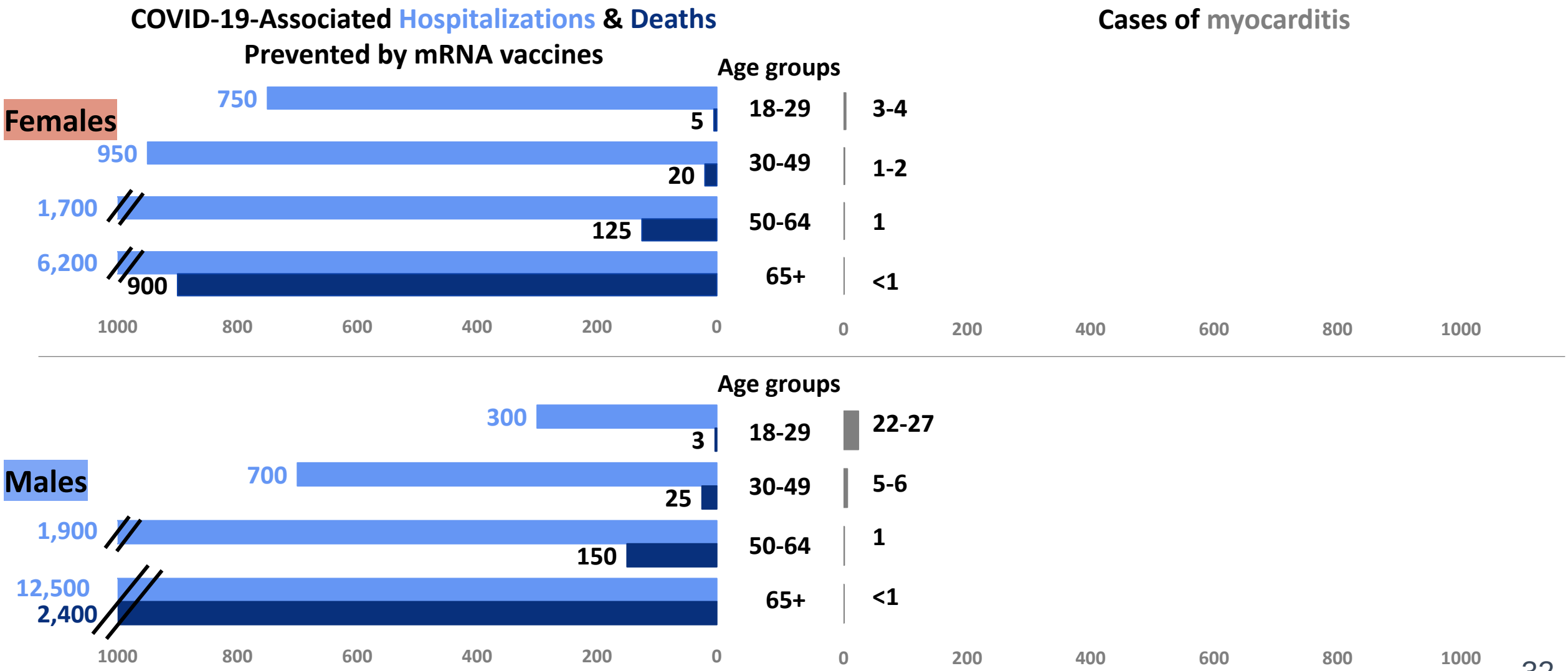
2,400 deaths prevented

<1 myocarditis case

Hospitalizations, ICU admissions and deaths based on data for week of June 19, 2021

Benefits and risks after mRNA vaccine, by age group & sex

For every million doses of vaccine given with US exposure risk and hospitalization rates from June 19, 2021

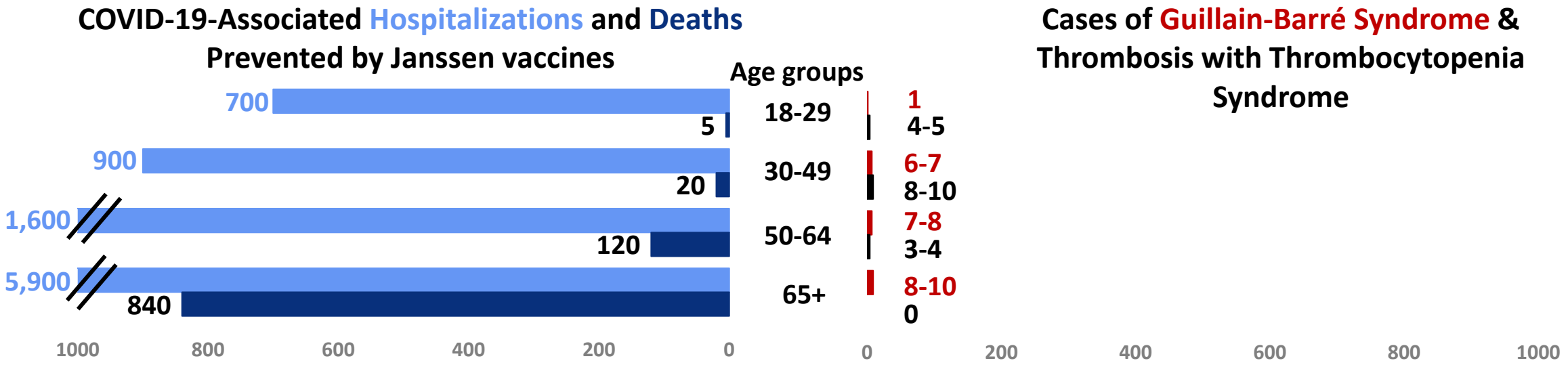


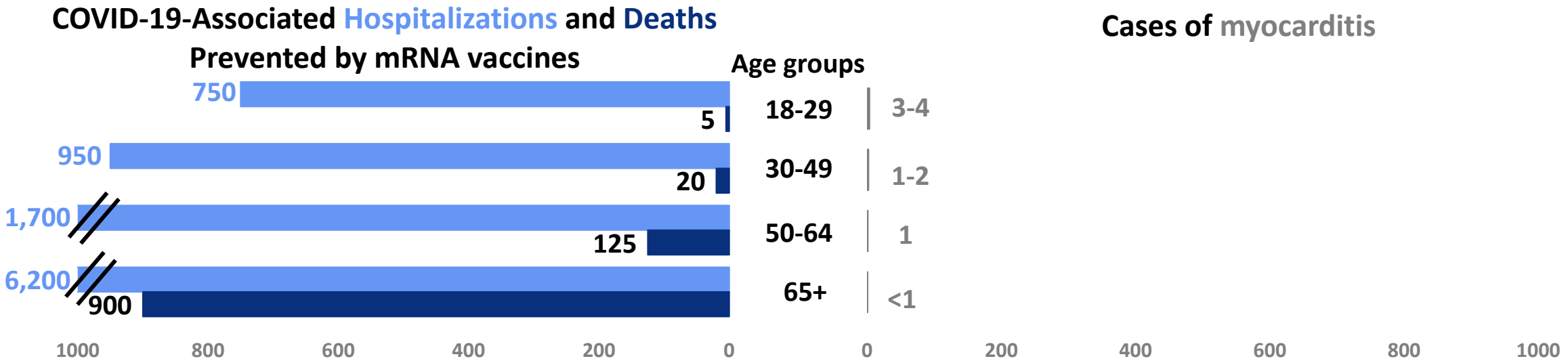
Summary


DEPARTMENT OF HEALTH & HUMAN SERVICES USA
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Benefits and risks after COVID-19 vaccine, by age group- females

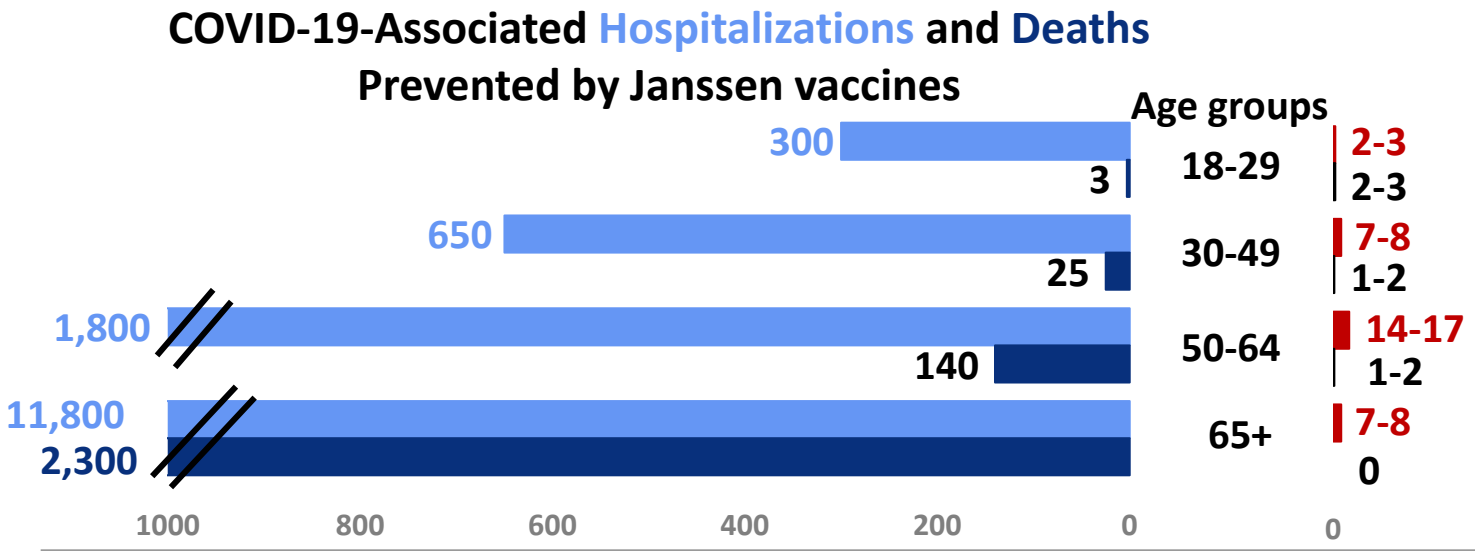
For every million doses of vaccine given with US exposure risk and hospitalization rates from June 19, 2021

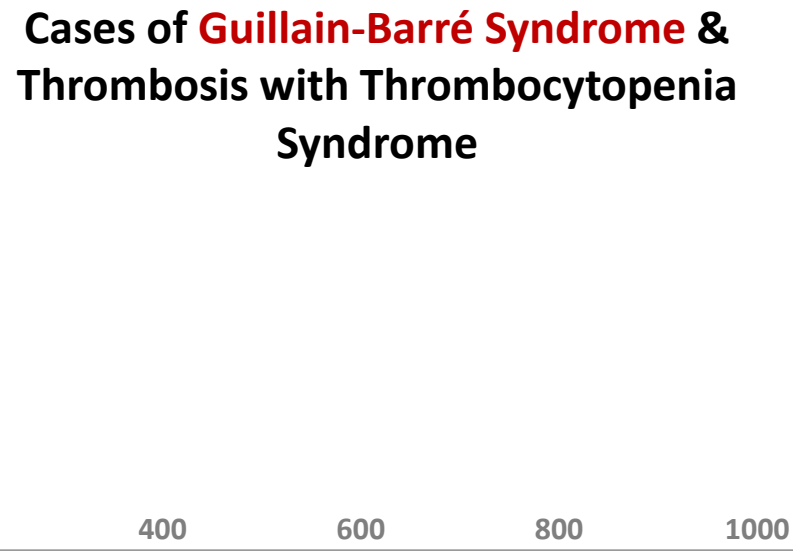


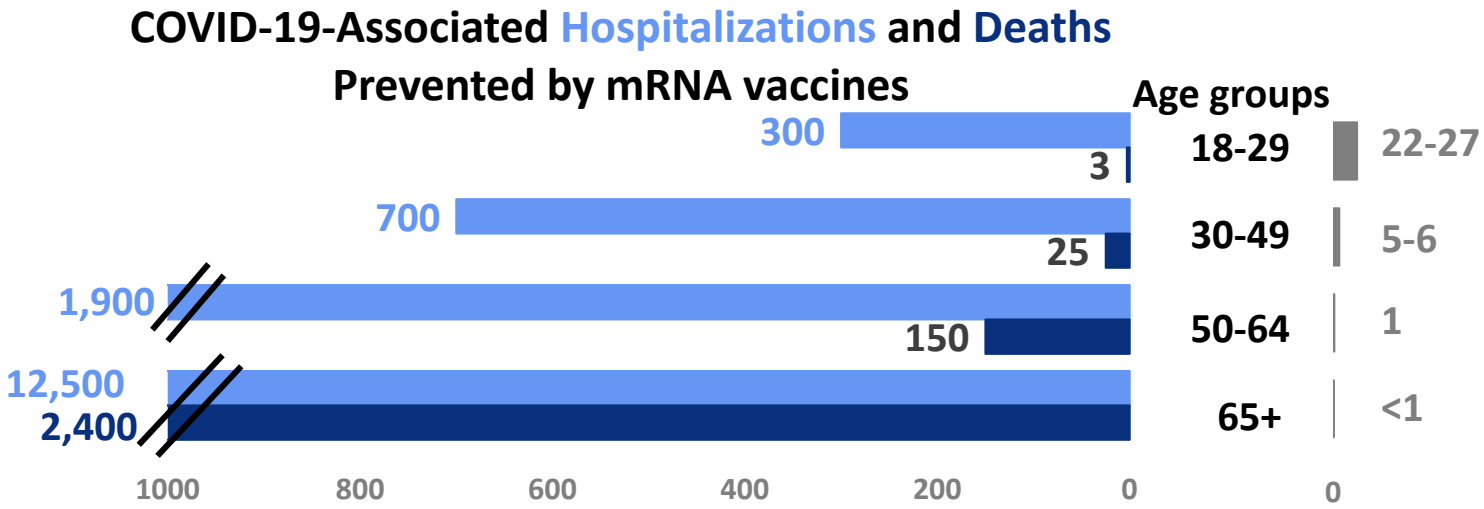


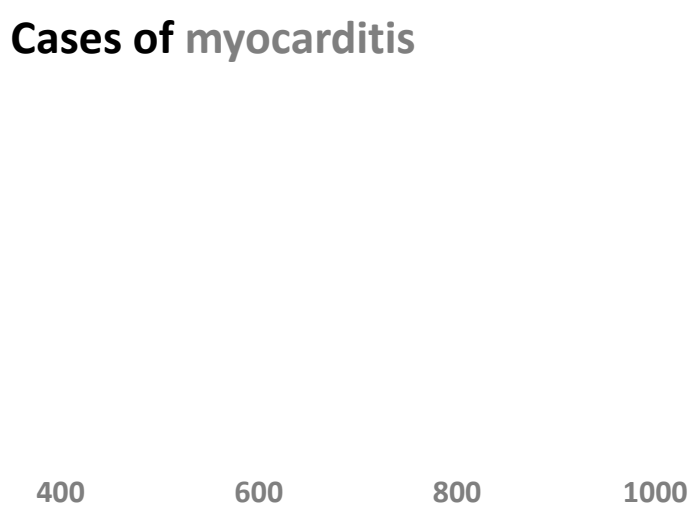
Benefits and risks after COVID-19 vaccine, by age group- males

For every million doses of vaccine given with US exposure risk and hospitalization rates from June 19, 2021









Benefits and risks after COVID-19 vaccine, by age group & sex

For every million doses of vaccine given with US exposure risk and hospitalization rates from June 19, 2021

Age	Janssen COVID-19 vaccine					mRNA COVID-19 vaccines			
	Prevented COVID-19 Outcomes			GBS Cases	TTS Cases	Prevented COVID-19 Outcomes			Myocarditis Cases
	Hospitalization	ICU	Death			Hospitalization	ICU	Death	
FEMALES									
18-29 years	700	50	5	1	4-5	750	50	5	3-4
30-49 years	900	140	20	6-7	8-10	950	140	20	1-2
50-64 years	1600	350	120	7-8	3-4	1,700	375	125	1
65+ years	5,900	1250	840	8-10	0	6,200	1300	900	<1
MALES									
18-29 years	300	60	3	2	2-3	300	60	3	22-27
30-49 years	650	150	25	7-8	1-2	700	160	25	5-6
50-64 years	1,800	480	140	14-17	1-2	1,900	500	150	1
65+ years	11,800	3300	2300	7-8	0	12,500	3500	2400	<1

Potential harms reported overall after COVID-19 vaccination

Janssen vaccine

Thrombosis with thrombocytopenia syndrome:

3.0 cases per million doses among adults

Guillain-Barré syndrome:

7.8 cases per million doses among adults

mRNA vaccines

Myocarditis:

3.5 cases per million doses among adults

- Risk for each potential harm varies by age and by sex

Limitations of benefit-risk estimates

- Benefits of vaccination likely even greater than shown
  - Model uses current case estimates; does not account for underreporting or rising case counts
  - Benefits are estimated over 120 days following vaccination, but protection likely lasts longer
  - Does not account for post-COVID-19 conditions

- Some hospitalizations (COVID-NET) may be related to diagnoses other than COVID-19
- Vaccine efficacy from clinical trials rather than real-world data
- Crude numbers of potential harms were used for some estimates

Benefit-risk interpretation and summary

- An assessment of the individual benefits and individual risks of vaccination is an important tool to help inform vaccination policy

- **This assessment demonstrates that the benefits of COVID-19 vaccination far outweigh the potential risks**

- The relative balance of benefits-risks varies by age/sex

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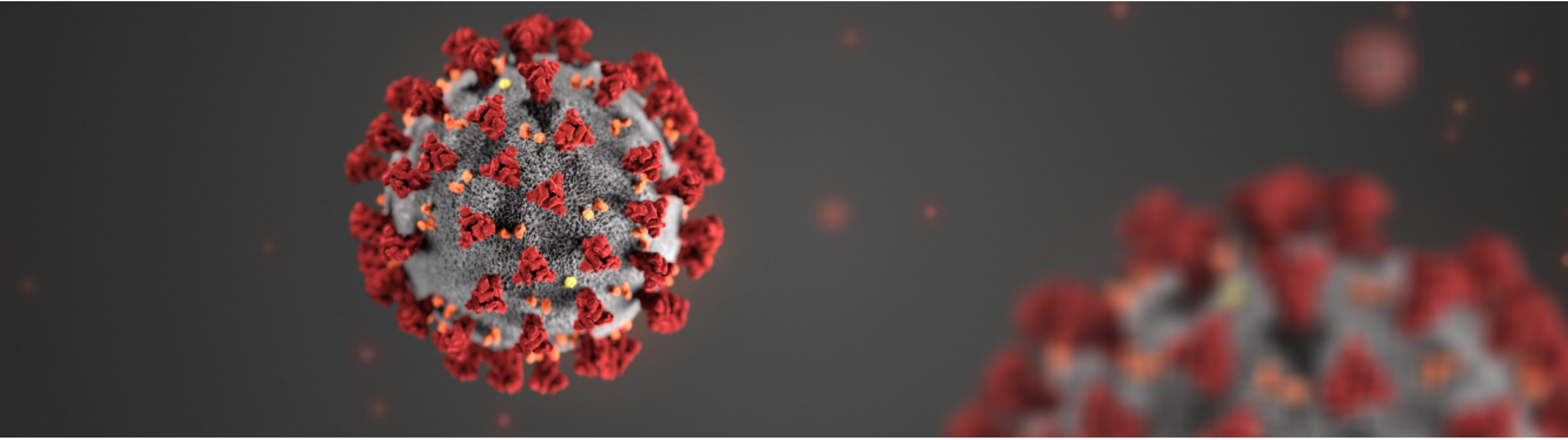
- Epidemiology and Surveillance Task Force
- Vaccine Task Force



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

Thank you

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