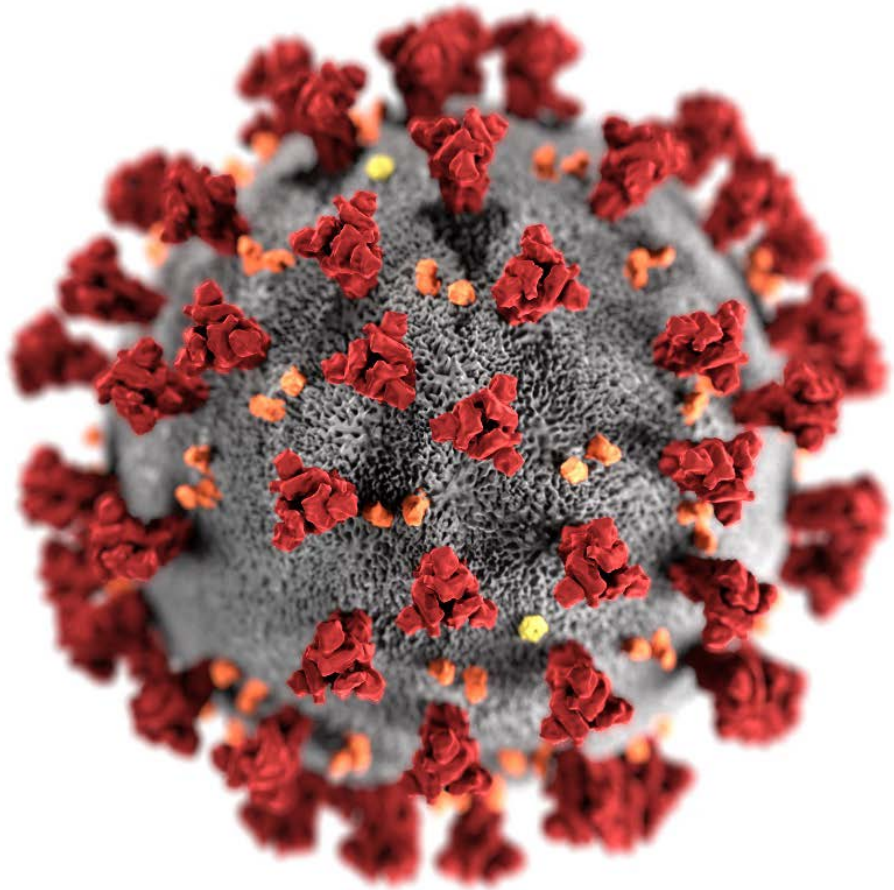
ACIP COVID-19 Vaccines



EtR Framework:
Moderna COVID-19 vaccine

Sara Oliver MD, MSPH
ACIP Meeting
December 19, 2020

Evidence to Recommendations Framework

Evidence to Recommendations (EtR) Framework

- Structure to describe information considered in moving from **evidence** to ACIP vaccine **recommendations**
- Provide **transparency** around the impact of additional factors on deliberations when considering a recommendation
- Highlight updates based on the Moderna COVID-19 vaccine

Evidence to Recommendations (EtR) Framework

Policy Question

- Should vaccination with the Moderna COVID-19 vaccine (2-doses, IM) be recommended for persons 18 years of age and older under an Emergency Use Authorization?

Evidence to Recommendations (EtR) Framework:
PICO Question

Population	Persons aged ≥18 years
Intervention	Moderna COVID-19 vaccine (mRNA-1273) 100 µg, 2 doses IM, 28 days apart
Comparison	No COVID-19 vaccine
Outcomes	Symptomatic laboratory-confirmed COVID-19 Hospitalization due to COVID-19 All-cause death SARS-CoV-2 seroconversion to a non-spike protein Asymptomatic SARS-CoV-2 infection Serious Adverse Events Reactogenicity grade ≥3

Evidence to Recommendations (EtR) Framework

EtR Domain	Question
Public Health Problem	• Is the problem of public health importance?
Benefits and Harms	• How substantial are the desirable anticipated effects? • How substantial are the undesirable anticipated effects? • Do the desirable effects outweigh the undesirable effects?
Values	• Does the target population feel the desirable effects are large relative to the undesirable effects? • Is there important variability in how patients value the outcomes?
Acceptability	• Is the intervention acceptable to key stakeholders?
Feasibility	• Is the intervention feasible to implement?
Resource Use	• Is the intervention a reasonable and efficient allocation of resources?
Equity	• What would be the impact of the intervention on health equity?

Evidence to Recommendations (EtR) Framework

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Feasibility	• Is the intervention feasible to implement?
Resource Use	• Is the intervention a reasonable and efficient allocation of resources?
Equity	• What would be the impact of the intervention on health equity?

“The vaccine” or “The intervention” = Moderna COVID-19 vaccine
“The problem” = COVID-19 disease

EtR Domain: Public Health Problem

Public Health Problem

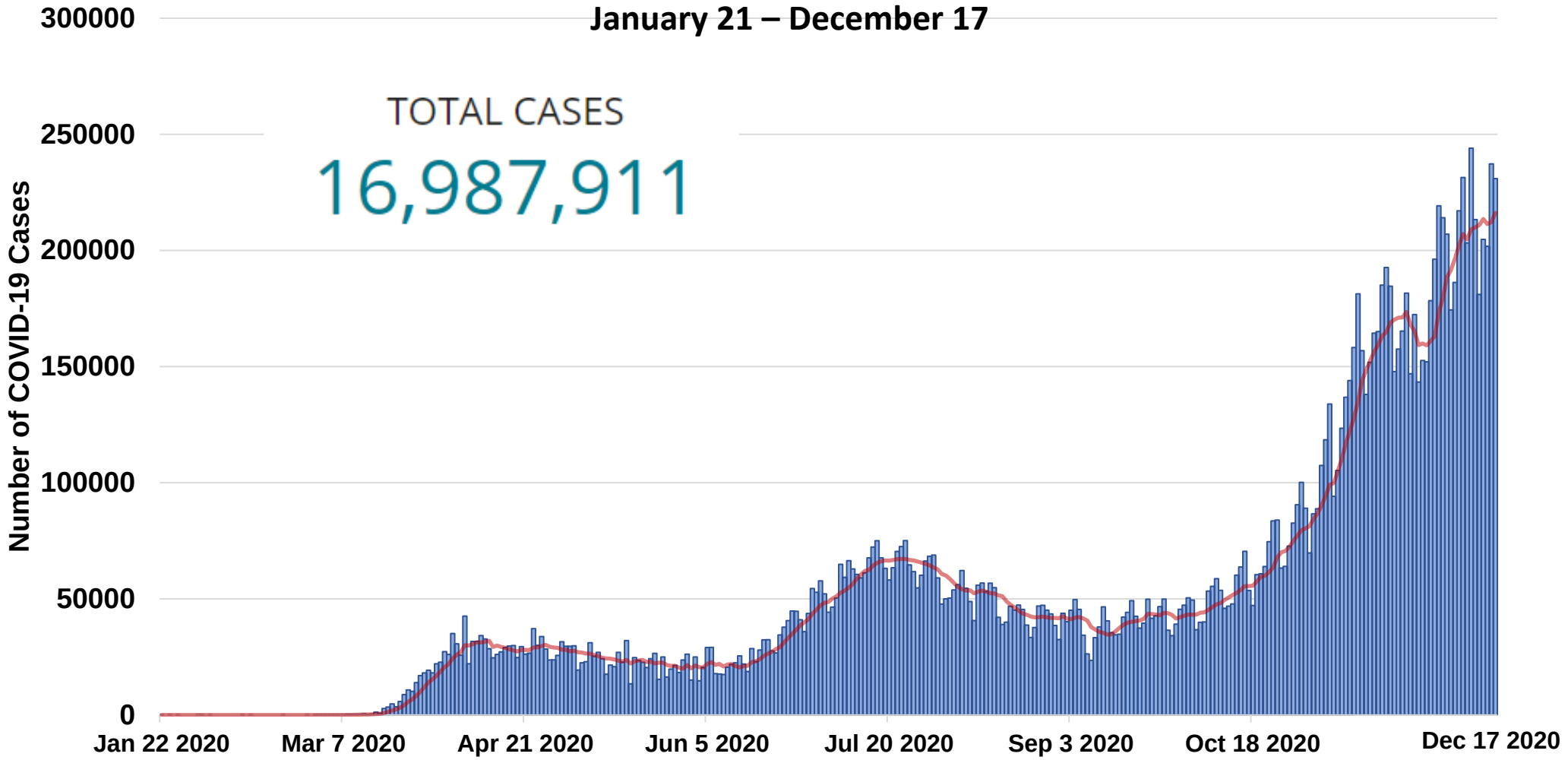
Is COVID-19 disease of public health importance?

- Are the consequences of COVID-19 serious?
- Is COVID-19 urgent?
- Are a large number of people affected by COVID-19?
- Are there populations disproportionately affected by COVID-19?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

Public Health Problem:

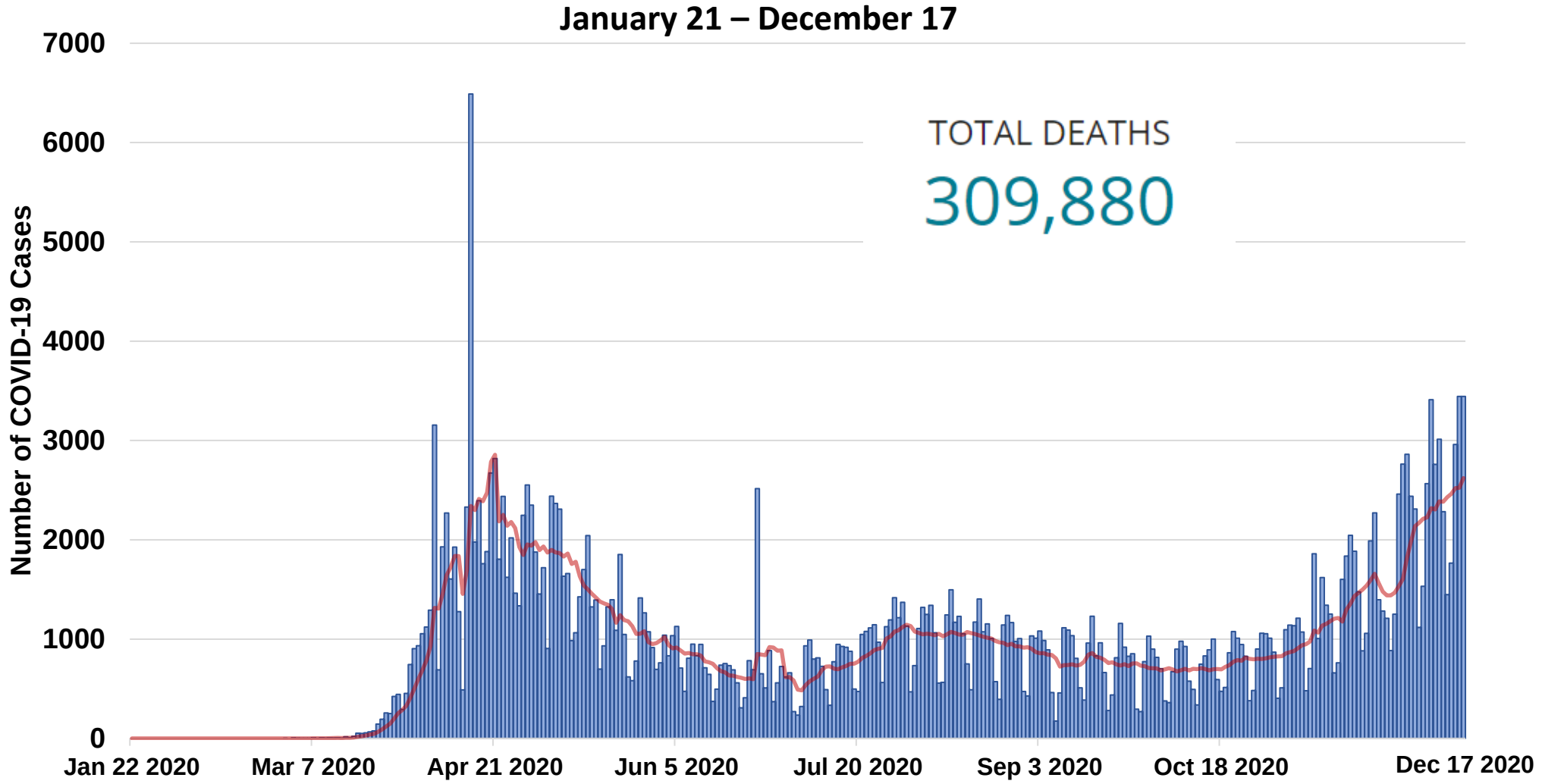
Review of the Available Evidence



https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases

Public Health Problem:

Review of the Available Evidence



https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases

Public Health Problem:
Summary of the Available Evidence

- **Hospitalization**
  - Cumulative hospitalization rate between March 1 and December 12, 2020 was **295.9** per 100,000 population
  - Among those hospitalized, **32**% required care in an intensive care unit and **15**% died

- **Mortality**
  - Estimates of the SARS-CoV-2 infection fatality ratio range from 0.5% to 1.4%

https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html .
https://gis.cdc.gov/grasp/COVIDNet/COVID19_5.html .
Hauser, A. et al. Estimation of SARS-CoV-2 mortality during the early stages of an epidemic: a modeling study in Hubei, China, and six regions in Europe. PLoS medicine, 17(7), p.e1003189
Yang, W. et al. Estimating the infection-fatality risk of SARS-CoV-2 in New York City during the spring 2020 pandemic wave: a model-based analysis. Lancet Infect Dis. 2020
DOI:https://doi.org/10.1016/S1473-3099(20)30769-6

Public Health Problem:

Work Group Interpretation

Is COVID-19 disease of public health importance?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

EtR Domain: Benefits and Harms

Benefits and Harms

How substantial are the desirable anticipated effects?

- How substantial is the anticipated effect for each main outcome for which there is a desirable effect?

○ Minimal ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know

Benefits and Harms

How substantial are the undesirable anticipated effects?

- How substantial is the anticipated effect for each main outcome for which there is an undesirable effect?

○ Minimal ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know

Benefits and Harms

Do the desirable effects outweigh the undesirable effects?

- What is the balance between the desirable effects relative to the undesirable effects?

- Favors intervention (Moderna COVID-19 vaccine)
- Favors comparison (no vaccine)
- Favors both
- Favors neither
- Unclear

Benefits and Harms:

Summary of the Available Evidence: Benefits

- The clinical trial demonstrated very high efficacy against symptomatic, laboratory-confirmed COVID-19. The overall efficacy was 94.1% (95% CI: 89.3%, 96.8%).

  High certainty of evidence

- For COVID-19 associated hospitalization, 10 events occurred, 9 in the placebo group, 1 in the vaccine group. Vaccine efficacy against hospitalization was 89% (95% CI: 13%, 99%).

  Moderate certainty of evidence

- Deaths were uncommon, 6 in the vaccine group and 7 in the placebo group.

  Very low certainty of evidence

Benefits and Harms:

Summary of the Available Evidence: Benefits

- The ability of the vaccine series to prevent **asymptomatic SARS-CoV-2 infection** has not been assessed to date in a large, prospective clinical trial. However, it can be informed by PCR screening among trial participants returning for second dose.
- Four weeks after the first dose of the Moderna COVID-19 vaccine, 14 participants (**0.1**%) had a positive SARS-CoV-2 PCR without symptoms of COVID-19, compared to 38 (**0.3**%) of those receiving placebo.

Very low certainty of evidence

Benefits and Harms:

Summary of the Available Evidence: Benefits

- Primary efficacy endpoint: subjects without evidence of prior infection
  - Efficacy: **94.1**% (89.3%, 96.8%)

- **High** efficacy for additional efficacy analysis, across age, sex, race, and ethnicity categories, and those with underlying medical conditions
  - Efficacy among adults 18-64 years of age: **95.6**% (90.6%, 97.9%)
  - Efficacy among adults ≥65 years of age: **86.4**% (61.4%, 95.5%)
    - Efficacy among adults ≥75 years of age: **100**%

- Most recipients received 2 doses of the Moderna COVID-19 vaccine
  - Efficacy of **69.5**% (43.5%, 84.5%) noted between dose 1 and dose 2

Benefits and Harms:

Summary of the Available Evidence: Benefits

- 30 cases of severe disease* noted in placebo group, 1 in vaccine group
  - VE estimate: **97**% (76%, 100%)

- Numbers of observed COVID-19 associated **hospitalization** or **death** are low
  - Nine COVID-19 associated hospitalizations in placebo recipient, 1 in vaccine recipient
  - One COVID-19 associated death occurred in placebo recipient

*__Definition__: Respiratory Rate ≥ 30, Heart Rate ≥125, SpO2≤ 93% on room air at sea level or PaO2/FIO2< 300 mm Hg; OR respiratory failure or Acute Respiratory Distress Syndrome (ARDS), defined as needing high-flow oxygen, non-invasive or mechanical ventilation, or ECMO; OR evidence of shock (systolic blood pressure <90mmHg, diastolic BP<60mmHg or requiring vasopressors); OR significant acute renal, hepatic or neurologic dysfunction; OR admission to an intensive care unit or death

Benefits and Harms:

Summary of the Available Evidence: Harms

- Serious adverse events were reported in a similar proportion among recipients of vaccine and placebo (1.0% vs 1.0%).

Moderate certainty of evidence

- Severe reactions were more common in vaccine recipients; any grade ≥3 reaction was reported by 21.5% of vaccinated versus 4.4% of placebo group.

High certainty of evidence

Benefits and Harms:
Summary of the Available Evidence: Harms

- **Local** reactions occurring within 7 days were common
  - Pain at the injection site most common
- **Systemic** reactions within 7 days were common
  - Fatigue, headache, and myalgia most common
- Symptom onset was usually **1-2 days** post-vaccine receipt
- Most symptoms resolved after **2-3 days** (median duration)

Benefits and Harms: Reactogenicity (Local)

Select local reactions in persons aged 18-64 years

	Dose 1		Dose 2	
	Moderna vaccine N=11401	**Placebo** N=11404	**Moderna vaccine** N=10357	**Placebo** N=10317
Local Reaction				
Any	9960 (87.4)	2432 (21.3)	9371 (90.5)	2134 (20.7)
Severe (Grade 3)	452 (4.0)	39 (0.3)	766 (7.4)	41 (0.4)
Pain at the injection site				
Any	9908 (86.9)	2179 (19.1)	9335 (90.1)	1942 (18.8)
Severe (Grade 3)	367 (3.2)	23 (0.2)	479 (4.6)	21 (0.2)

Select local reactions in persons aged ≥65 years

	Dose 1		Dose 2	
	Moderna Vaccine N=3762	**Placebo** N=3746	**Moderna Vaccine** N=3587	**Placebo** N=3549
Local Reaction				
Any	2805 (74.6)	566 (15.1)	3010 (83.9)	473 (13.3)
Severe (Grade 3)	77 (2.0)	39 (1.0)	212 (5.9)	29 (0.8)
Pain at the injection site				
Any	2782 (74.0)	481(12.8)	2990 (83.4)	421 (11.9)
Severe (Grade 3)	50 (1.3)	32 (0.9)	96 (2.7)	17 (0.5)

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Benefits and Harms: Reactogenicity (Systemic)

Select systemic reactions in persons aged 18-64 years

	Dose 1		Dose 2	
	Moderna vaccine N=11401	**Placebo** N=11404	**Moderna vaccine** N=10357	**Placebo** N=10317
Systemic Reaction				
Any	6503 (57.0)	5063 (44.4)	8484 (81.9)	3967 (38.4)
Grade 3 or 4	368 (3.2)	252 (2.2)	1811 (17.4)	217 (2.1)
Fever				
Any	105 (0.9)	39 (0.3)	1806 (17.4)	38 (0.4)
Grade 3	10 (<0.1)	1 (<0.1)	168 (1.6)	1 (<0.1)
Grade 4	4 (<0.1)	4 (<0.1)	10 (<0.1)	1 (<0.1)

Select systemic reactions in persons aged ≥65 years

	Dose 1		Dose 2	
	Moderna vaccine N=3761	**Placebo** N=3748	**Moderna vaccine** N=3589	**Placebo** N=10317
Systemic Reaction				
Any	1818 (48.3)	1335 (35.6)	2580 (71.9)	1102 (31.1)
Grade 3 or 4	84 (2.2)	63 (1.7)	389 (10.8)	59 (1.6)
Fever				
Any	10 (0.3)	7 (0.2)	366 (10.2)	5 (0.1)
Grade 3	1 (<0.1)	1 (<0.1)	18 (0.5)	0 (0)
Grade 4	0 (0)	2 (<0.1)	1 (<0.1)	1 (<0.1)

Grade 3 fever: 102.1–104.0°F
Grade 4 fever: >104.0°F

Benefits and Harms: Reactogenicity (Systemic)

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Any	10 (0.3)	7 (0.2)	366 (10.2)	5 (0.1)
Grade 3	1 (<0.1)	1 (<0.1)	18 (0.5)	0 (0)
Grade 4	0 (0)	2 (<0.1)	1 (<0.1)	1 (<0.1)

Grade 3 fever: 102.1–104.0°F
Grade 4 fever: >104.0°F

Benefits and Harms:
Summary of the Available Evidence: Harms

- **Lymphadenopathy**
  - Ipsilateral (same side) axillary swelling and tenderness was a **solicited** adverse event
  - More common among vaccine recipients <65 years of age

	Moderna vaccine	Placebo
Adults 18-64 years of age	21.4%	7.5%
Adults ≥65 years of age	12.4%	5.8%

  - Grade 3 axillary lymphadenopathy rare, but more common after second dose

	Moderna vaccine	Placebo
Dose 1	0.3%	0.2%
Dose 2	0.5%	0.1%

  - Duration after first dose: **1 day**. Duration after second dose: **2 days**

Grade 3 lymphadenopathy: Any use of prescription (narcotic) pain reliever or prevents daily activity

Benefits and Harms:
Summary of the Available Evidence: Harms

- **Bell's palsy**
  - Small imbalance between vaccine group (n=3) and placebo (n=1)
  - Currently available information is insufficient to determine a causal relationship with the vaccine
  - Post-authorization surveillance will help determine any possible causal relationship

- Serious adverse events similar between vaccine (1.0%) and placebo (1.0%)

Summary of GRADE

Outcome	Importance	Design (# of studies)	Findings	Evidence type
Benefits				
Symptomatic laboratory-confirmed COVID-19	Critical	RCT (1)	Moderna COVID-19 vaccine prevents symptomatic COVID-19	**1**
Hospitalization due to COVID-19	Critical	RCT (1)	Moderna COVID-19 vaccine prevents COVID-19-resulting in hospitalization	**2**
All-cause Death	Important	RCT (1)	Moderna COVID-19 vaccine may or may not prevent death; certainty is very low because this is a rare outcome	**4**
SARS-CoV-2 seroconversion	Important	No studies	Data not yet available from any studies	**ND**
Asymptomatic SARS-CoV-2 infection	Important	RCT (1)	Preliminary data consistent with a lower incidence of asymptomatic SARS-CoV-2 infection among vaccinated compared with placebo	**4**
Harms				
Serious adverse events	Critical	RCT (2)	SAEs were balanced between vaccine and placebo arms. 3 SAEs were judged by FDA to be related to vaccination	**2**
Reactogenicity	Important	RCT (2)	Severe reactions were almost 5 times more common in vaccinated vs. placebo; any grade ≥3 reaction was reported by 21.5% of vaccinated	**1**

Evidence type: 1=high; 2=moderate; 3=low; 4=very low; ND, no data.

Benefits and Harms

How substantial are the desirable anticipated effects?

- How substantial is the anticipated effect for each main outcome for which there is a desirable effect?

○ Minimal	○ Small	○ Moderate	○ Large	○ Varies	○ Don't know

Benefits and Harms

How substantial are the undesirable anticipated effects?

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Benefits and Harms

Do the desirable effects outweigh the undesirable effects?

- What is the balance between the desirable effects relative to the undesirable effects?

- ○ Favors intervention (Moderna COVID-19 vaccine)
- ○ Favors comparison (no vaccine)
- ○ Favors both
- ○ Favors neither
- ○ Unclear

EtR Domain: Values

Values

Criteria 1:
Does the target population feel that the desirable effects are large relative to undesirable effects?

-How does the target population view the balance of desirable versus undesirable effects?
-Would patients feel that the benefits outweigh the harms and burden?
-Does the population appreciate and value the Moderna COVID-19 vaccine?

○ No ○ Probably no ○ Probably yes ○ Yes ○ Varies ○ Don't know

Values

Criteria 2:
Is there important uncertainty about, or variability in, how much people value the main outcomes?

-How much do individuals value each outcomes in relation to the other outcomes?
-Is there evidence to support those value judgments?
-Is there evidence that the variability is large enough to lead to different decisions?

- Important uncertainty or variability
- Probably important uncertainty or variability
- Probably not important uncertainty or variability
- No important uncertainty or variability
- No known undesirable outcomes

Values:
Review of the Available Evidence

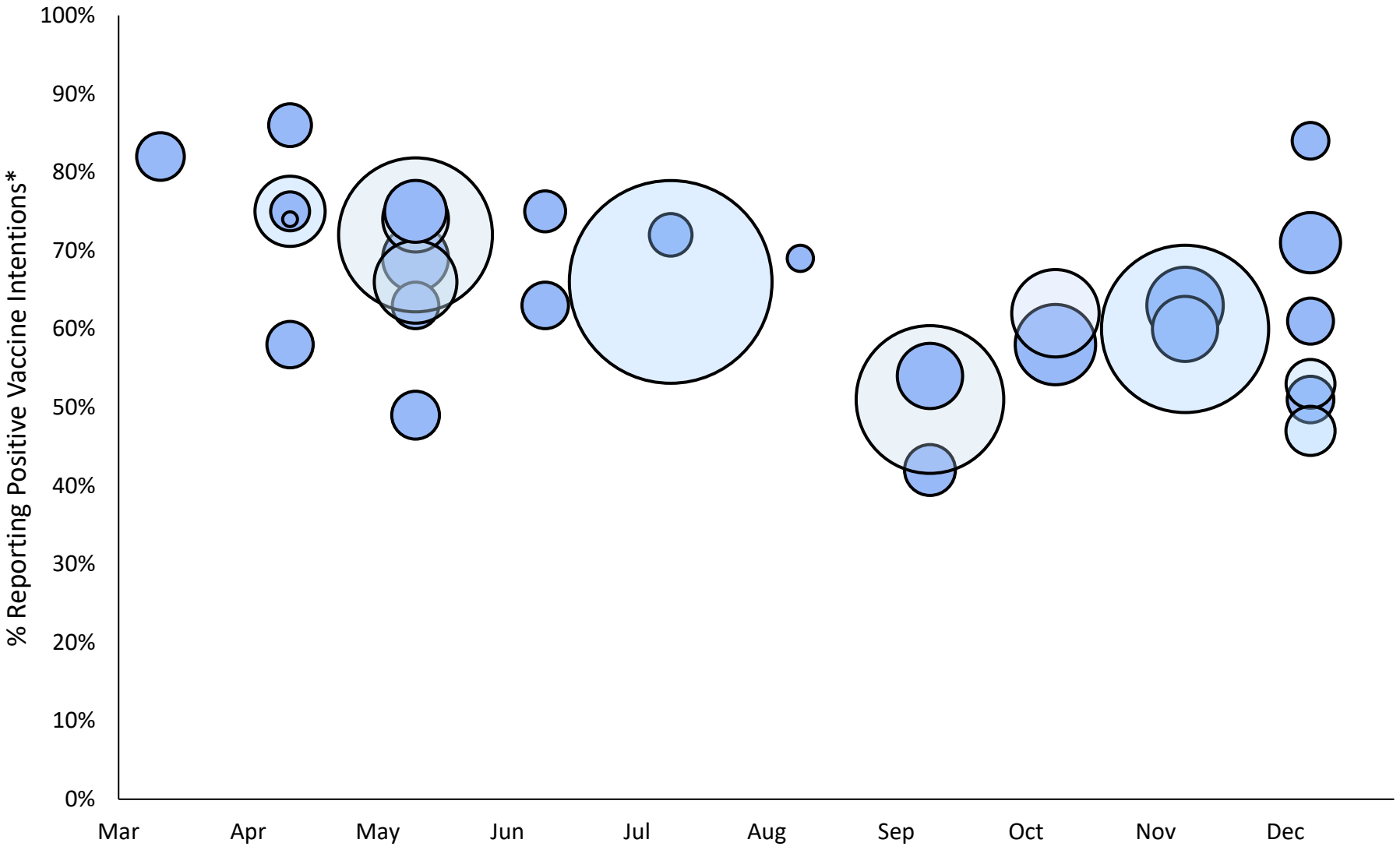
- Review of scientific literature, news media, and reports
  - Databases: Medline, Embase, Psycinfo, Global Health Ovid, CINAHL, ProQuest Coronavirus Research, Scopus, WHO COVID-19
  - Search terms: SARS-CoV-2/COVID-19 string; vaccine string; intent, confidence, hesitancy, attitude, belief, accept, choice, decision, refusal
  - News media and reports: SEAN COVID-19 Survey Archive, Google
  - Last search date: **December 18, 2020**
- Inclusion criteria
  - Data collection in 2020 related to COVID-19 vaccine beliefs, attitudes, and intentions
  - Population: Adults in the U.S.
- Preliminary findings from CDC vaccine intent survey and focus group discussions

Values:
Summary of the Available Evidence

- Overall acceptability of a COVID-19 vaccine was **moderate**[1]
  - Proportion intending to receive vaccine ranged across surveys: **42-86**%
  - Attitudes towards Pfizer-BioNTech COVID-19 vaccine with news reports of 90% efficacy: 71% believed effective, 68% safe
  - November survey: **70**% likely if proven safe and effective by public health officials
  - December survey: 40% will get as soon as available, 44% wait a bit, 15% never get

1. APNORC; Harris; Fisher *Ann Intern Med*.; ICF; Kreps *JAMA Netw Open*.; Lazarus *Nature Med*.; Malik *EClinicalMedicine*.; Pogue *Vaccines*.; Reiter *Vaccine*.; Thunstrom *SSRN*. Axios-IPSOS. Pew. KFF. ABC News-IPSOS.

COVID-19 Vaccination Intentions Varied by Survey Month



Reference	Date	N	% Intent
Romer	Mar	1,050	82%
Fisher	Apr	991	58%
Earnshaw	Apr	845	86%
Southwell	Apr	2,279	75%
Roozenbeek	Apr	700	75%
Hogan	Apr	101	74%
Malik	May	672	67%
Taylor	May	1,772	75%
Reiter	May	2,006	69%
APNORC	May	1,056	49%
ICF	May	1,000	63%
Pew	May	10,957	72%
CUNY	May	1,999	74%
Head	May	3,159	66%
Lazarus	Jun	773	75%
ICF	Jun	1,000	63%
Perlis	Jul	19,027	66%
Romer	Jul	840	72%
Pogues	Aug	316	69%
KFF	Sep	1,199	42%
Pew	Sep	10,093	51%
Harris	Sep	1,971	54%
Gallup	Oct	2,985	58%
IPSOS	Oct	3,541	62%
USC	Nov	2,703	63%
Harris	Nov	1,963	60%
Pew	Nov	12.948	60%
Axios-Ipsos	Nov	1,002	51%
Axios-Ipsos	Dec	1,101	53%
APNORC	Dec	1,117	47%
Quinnipiac	Dec	978	61%
KFF	Dec	1,676	71%
ABC News/IPSOS	Dec	621	84%

*Positive vaccine intentions includes persons reporting definitely, probably, or somewhat likely to get vaccinated.

Values:
Summary of the Available Evidence

- Many adults reported intentions to receive COVID-19 vaccine
  - Common desirable effects included protecting self, family, community from SARS-CoV-2 infection and severe illness and return to normalcy
  - Common concerns included vaccine side effects, uncertainty of vaccine efficacy, and speed of vaccine approval process
- Vaccination intentions varied substantially by race or ethnicity and socioeconomic status of respondents
- Limitations:
  - Most surveys conducted prior to availability of information on Moderna COVID-19 vaccine
  - Convenience samples may not be representative

Values: Work Group Interpretation

Criteria 1:
Does the target population feel that the desirable effects are large relative to undesirable effects?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

Values: Work Group Interpretation

Criteria 2:

Is there important uncertainty about, or variability in, how much people value the main outcomes?

- ○ Important uncertainty or variability
- ○ Probably important uncertainty or variability
- ○ Probably not important uncertainty or variability
- ○ No important uncertainty or variability
- ○ No known undesirable outcomes

EtR Domain: Acceptability

Acceptability

Is the Moderna COVID-19 vaccine acceptable to key stakeholders?

- Are there key stakeholders that would not accept the distribution of benefits and harms?
- Are there key stakeholders that would not accept the undesirable effects in the short term for the desirable effects (benefits) in the future?

○ No ○ Probably no ○ Probably yes ○ Yes ○ Varies ○ Don't know

Acceptability:
Review of the Available Evidence

- Review of scientific literature
- Preliminary findings from CDC evaluations of COVID-19 vaccine attitudes
  - Survey with State Health Officers (n=34)
  - Focus group discussions with nurses (7 focus groups)
  - National online survey: sub-group analysis for healthcare providers (n=216)
- Review of news media, professional society and workers' unions websites
  - AAFP, AFT, AFSCME, AGS, ANA, AMA, IDSA, SEIU
  - American Nurses Foundation (ANF) survey (n=12,939)
- Consideration of programmatic, financial, and ethical aspects
  - State/jurisdiction and partner planning for vaccine implementation
  - Anticipated out-of-pocket costs

Acceptability:
Summary of the Available Evidence

- No published provider knowledge, attitudes, and practices surveys
- CDC evaluations
  - State health officers, Oct: concerns with rollout included vaccine hesitancy (53%), vaccine safety (32%), and communications (26%)[1]
  - Focus groups with nurses (n=7 groups), Jun-Aug: most supported prioritizing nurses, some reluctant to get vaccinated, and many do not want to get it right away[2]
  - Vaccine intent survey, Sep-Oct: **63**% healthcare providers would get COVID-19 vaccine[3]
- ANF nurses survey, Oct: moderate acceptability of COVID-19 vaccine[4]
  - **63**% somewhat or very confident vaccine will be safe and effective
  - **57**% comfortable discussing COVID-19 vaccines with patients

1. CDC COVID-19 Response Team. 2. Jorgenson. *CDC Presentation to ACIP Working Group*. 3 Sep 2020. 3. Lindley *et al*, CDC COVID-19 Response Team: Report in progress.
4. ANF, 16 Nov 2020. https://www.nursingworld.org/practice-policy/work-environment/health-safety/disaster-preparedness/coronavirus/what-you-need-to-know/covid-19-vaccine-survey/

Acceptability

HEALTHCARE & PHARMA DECEMBER 13, 2020 / 12:09 AM / UPDATED 4 DAYS AGO

U.S. vaccine campaign launches with first shipments 'delivering hope' to millions

By Lisa Baertlein

REUTERS

"At Northwell Health, New York state's largest hospital system, **more than 1,600 people had been vaccinated** by midday Thursday. **Only two people had declined or deferred**, said Joe Kemp, a spokesman for the hospital."

Petrona Ennis-Welch, a nurse, was the first person from Mount Sinai Hospital to receive a vaccine.
Kirsten Luce for The New York Times

Goldstein J, NYTimes, 18 Dec 2020. https://www.nytimes.com/2020/12/18/nyregion/coronavirus-vaccine-new-york.html

Acceptability:
Summary of the Available Evidence

- Jurisdictions implementing COVID-19 vaccine implementation plans
- Large and small pharmacy chains working to launch COVID-19 vaccination program in long-term care facilities

Acceptability:

Work Group Interpretation

Is the Moderna COVID-19 vaccine acceptable to key stakeholders?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

EtR Domain: Feasibility

Feasibility

Is the Moderna COVID-19 vaccine feasible to implement?

- Is the Moderna COVID-19 vaccine program sustainable?
- Are there barriers that are likely to limit the feasibility of implementing the Moderna COVID-19 vaccine or require consideration when implementing it?
- Is access to the Moderna COVID-19 vaccine an important concern?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

Feasibility:
Summary of the Available Evidence

- Barriers to implementation may include:
  1) Financial barriers
  2) Complexity of recommendations
  3) Vaccine storage and handling requirements

Feasibility:
Summary of the Available Evidence

1) Financial barriers

- All COVID-19 vaccines will be provided to U.S. population **free of charge**
- Health systems or health departments could incur costs for vaccine implementation or clinics

Feasibility:
Summary of the Available Evidence

2) Complexity of recommendations

- Two mRNA vaccines under an EUA with different dosing intervals, storage and handling requirements may make vaccine recommendations more complex

Feasibility:
Summary of the Available Evidence

3) Vaccine storage and handling requirements

- Vaccine must be maintained at standard freezer temperatures (-25°C to -15°C) for shipping and long-term storage
- Vaccine is stable up to 30 days at refrigerator temperatures
- Minimum size of orders (currently 100 doses)
- Requirements for two-dose series

Feasibility:

Work Group Interpretation

Is the Moderna COVID-19 vaccine feasible to implement?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

EtR Domain: Resource Use

Resource Use

Is the Moderna COVID-19 vaccine a reasonable and efficient allocation of resources?

- What is the cost-effectiveness of the Moderna COVID-19 vaccine?
- How does the cost-effectiveness of the Moderna COVID-19 vaccine change in response to changes in context, assumptions, etc?

○ No ○ Probably no ○ Probably yes ○ Yes ○ Varies ○ Don't know

Resource Use:
Summary of the Available Evidence

Costs associated with COVID-19 disease

- If 20% of the U.S. population is infected with COVID-19, the direct medical costs could be $**163 billion**[1]

- Health-related costs (including premature deaths, long-term health impairment and mental health impairment) have been estimated at $**8.5 trillion**[2]

1. Bartsch et al. 2020. Health Affairs “The Potential Health Care Costs And Resource Use Associated With COVID-19 In The United States”.
2. Cutler and Summers. 2020. JAMA. “The COVID-19 pandemic and the $16 trillion virus.”

Resource Use:
Summary of the Available Evidence

Costs associated with COVID-19 disease

- If 20% of the U.S. population is infected with COVID-19, the direct medical costs could be $**163 billion**
- Health-related costs (including premature deaths, long-term health impairment and mental health impairment) have been estimated at $**8.5 trillion**

Costs associated with COVID-19 vaccines

- U.S. Government has committed $**10 billion** to Operation Warp Speed for the provision of vaccines[1]
- Vaccine doses purchased with U.S. taxpayer dollars will be given to the American people at **no cost**[2]

1. https://www.hhs.gov/about/news/2020/05/15/trump-administration-announces-framework-and-leadership-for-operation-warp-speed.html
2. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/faq.html

Resource Use:
Work Group Interpretation

- No published cost-effectiveness analyses currently available
- Precise cost-effectiveness analysis and economic impact of vaccination depend on number of factors that are currently unknown:
  - Duration of vaccine protection
  - Vaccination coverage levels
  - Implementation costs associated with large vaccination program
- The Work Group concluded that cost-effectiveness may not be a primary driver for decision-making during a pandemic and for vaccine used under EUA
  - Will need to be reassessed for future recommendations

Resource Use:

Work Group Interpretation

Is the Moderna COVID-19 vaccine a reasonable and efficient allocation of resources?

○ No	○ Probably no	○ Probably yes	○ Yes	○ Varies	○ Don't know

EtR Domain: Equity

Equity

What would be the impact of the Moderna COVID-19 vaccine on health equity?

- Are there groups or settings that might be disadvantaged in relation to COVID-19 disease burden or receipt of the Moderna COVID-19 vaccine?
- Are there considerations that should be made when implementing the Moderna COVID-19 vaccine program to ensure that inequities are reduced whenever possible, and that they are not increased?

○ Reduced ○ Probably reduced ○ Probably no impact
○ Probably increased ○ Increased ○ Varies ○ Don't know

Equity:
Review of the Available Evidence

- Identification of groups that might be disadvantaged in relation to COVID-19 disease burden or receipt of the Moderna COVID-19 vaccine
  - PROGRESS-Plus Framework:[1] place of residence, race or ethnicity, occupation, gender or sex, religion, education, socioeconomic status, social capital, disability, other
- Review of the scientific and gray literature
- Review of CDC COVID-19 response data and resources
  - CDC COVID Data Tracker & COVID-19-Associated Hospitalization Surveillance Network (COVID-NET)
  - National Center for Health Statistics
  - COVID-19 Disproportionately Affected Populations Team critical populations review

[1] PROGRESS-Plus is an acronym to identify factors associated with unfair differences in disease burden and the potential for interventions to reduce these differential effects. See O'Neill J, Tabish H, Welch V, et al. Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. J Clin Epi. 2014;67: 56-64; Welch VA, Akl EA, Guyatt G, et al. GRADE equity guidelines 1: considering health equity in GRADE guideline development: introduction and rationale. J Clin Epidemiol. 2017;90:59-67.

Equity: Groups who might be unfairly disadvantaged in relation to COVID-19 disease burden or receipt of the Moderna COVID-19 vaccine

- Racial and ethnic minority populations
- People living in poverty or with high social vulnerability
- Essential workers
  - Some racial/ethnic minority populations disproportionately represented in subsets of essential workers, e.g., public transit, building cleaning services, construction, food and agriculture[1-3]
  - Almost one quarter live in low-income families[1]
- Residents in congregate settings, such as long-term care facilities, prisons, homeless shelters, and group homes for people with intellectual/developmental disabilities
- People with substance abuse disorders
- Sexual and gender minorities
  - Face social or structural inequities that can lead to health disparities

[1]Rho HJ, Brown H, Fremstad S. A basic demographic profile of workers in frontline industries. April 2020. Washington, DC: Center for Economic and Policy Research;2020. https://cepr.net/a-basic-demographic-profile-of-workers-in-frontline-industries
[2]Bui DP, McCaffrey K, Friedrichs M, et al. Racial and ethnic disparities among COVID-19 Cases in workplace outbreaks by industry sector — Utah, March 6–June 5, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1133–8. DOI: http://dx.doi.org/10.15585/mmwr.mm6933e3
[3]Waltenburg MA, Rose CE, Victoroff T, et al. Coronavirus disease among workers in food processing, food manufacturing, and agriculture workplaces Emerg Infect Dis. 2021 Jan. https://wwwnc.cdc.gov/eid/article/27/1/20-3821_article

Equity: Characteristics of the Moderna COVID-19 vaccine that could impact health equity

- Storage, handling and administration requirements
  - Refrigerator-stable vaccine will facilitate the availability of the Moderna COVID-19 vaccine in most community settings, once supply allows
- Need for 2-dose series
  - Follow-up may be challenging for some disadvantaged groups, e.g., those who are homeless, live in rural locations, have no/limited access to healthcare
  - Will likely reduce access of the Moderna COVID-19 vaccine to some groups who bear an unfair burden of COVID-19-related morbidity and mortality

Equity:
Additional Considerations

- Although COVID-19 vaccines will be provided at no cost, personal investments in time and travel to obtain vaccine may be a barrier for some groups
- Equity and vaccination program implementation are closely linked
- Advancing health equity will require efforts to **identify** and **reduce** access-related barriers to vaccination among groups who experience disproportionate COVID-19-related morbidity and mortality

Equity:

Work Group Interpretation

What would be the impact of the Moderna COVID-19 vaccine on health equity?

○ Reduced ○ Probably reduced ○ Probably no impact ○ Probably increased
○ Increased ○ Varies ○ Don't know

Summary

EtR Domain	Question	Work Group Judgments
Public Health Problem	Is COVID-19 disease of public health importance?	Yes
Benefits and Harms	How substantial are the desirable anticipated effects?	Large
	How substantial are the undesirable anticipated effects?	Small
	Do the desirable effects outweigh the undesirable effects?	Favors Moderna COVID-19 vaccine
	What is the overall certainty of the evidence for the critical outcomes?	1 (high) for prevention of symptomatic COVID-19 2 (moderate) for hospitalization 2 (moderate) for safety
Values	Does the target population feel the desirable effects are large relative to the undesirable effects?	Probably yes
	Is there important variability in how patients value the outcomes?	Probably important uncertainty
Acceptability	Is the Moderna COVID-19 vaccine acceptable to key stakeholders?	Probably yes
Feasibility	Is the Moderna COVID-19 vaccine feasible to implement?	Yes
Resource Use	Is the Moderna COVID-19 vaccine a reasonable and efficient allocation of resources?	Yes
Equity	What would be the impact of the intervention on health equity?	Probably increased

Evidence to Recommendations Framework

Summary: Work Group Interpretations

Balance of consequences	Undesirable consequences *clearly outweigh* desirable consequences in most settings	Undesirable consequences *probably outweigh* desirable consequences in most settings	The balance between desirable and undesirable consequences is *closely balanced* or *uncertain*	Desirable consequences *probably outweigh* undesirable consequences in most settings	Desirable consequences *clearly outweigh* undesirable consequences in most settings	There is insufficient evidence to determine the balance of consequences

Evidence to Recommendations Framework

Summary: Work Group Interpretations

Balance of consequences	Undesirable consequences *clearly outweigh* desirable consequences in most settings	Undesirable consequences *probably outweigh* desirable consequences in most settings	The balance between desirable and undesirable consequences is *closely balanced* or *uncertain*	Desirable consequences *probably outweigh* undesirable consequences in most settings	**Desirable consequences *clearly outweigh* undesirable consequences in most settings**	There is insufficient evidence to determine the balance of consequences

Evidence to Recommendations Framework

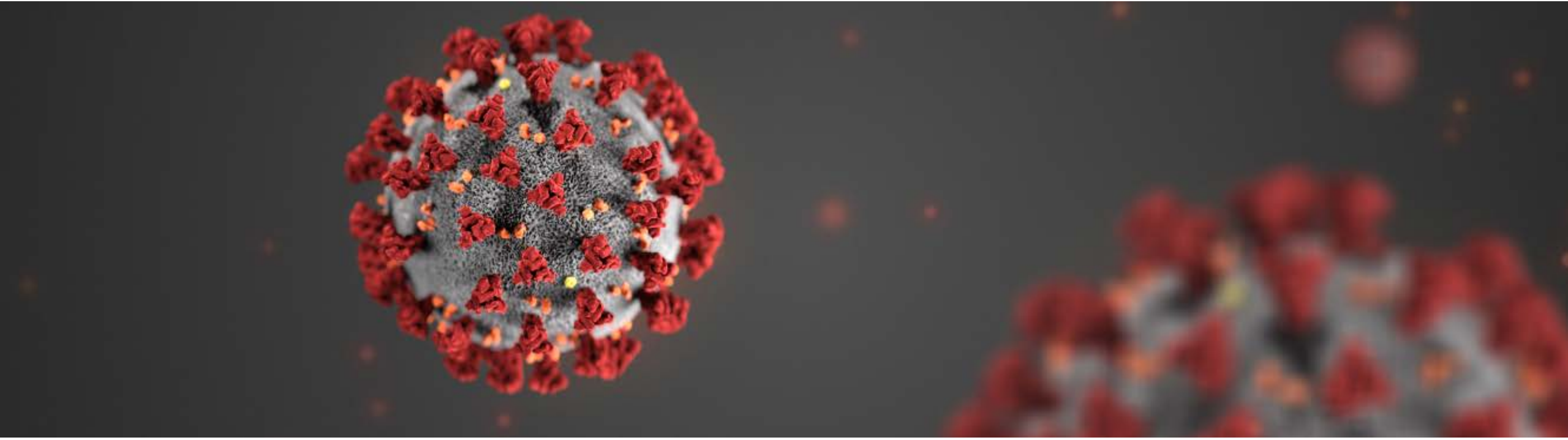
Summary: Work Group Interpretations

Type of recommendation	We do not recommend the intervention	We recommend the intervention for individuals based on shared clinical decision-making	We recommend the intervention

Evidence to Recommendations Framework

Summary: Work Group Interpretations

Type of recommendation	We do not recommend the intervention	We recommend the intervention for individuals based on shared clinical decision-making	**We recommend the intervention**



For more information, contact CDC
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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.