Phased Allocation of COVID-19 Vaccines

Kathleen Dooling, MD, MPH
ACIP meeting
November 23, 2020
Objective

- Select groups for COVID-19 vaccine allocation in Phase 1a, Phase 1b & Phase 1c
Allocation of COVID-19 vaccine

Policy Question #2

Which groups should be recommended to receive COVID-19 vaccine ‘X’ during Phase 1?
Allocation of initial COVID-19 vaccine: Phase 1

Science:
- COVID-19 disease burden
- Balance of benefits & harms of vaccine

Implementation

Science

Ethics
Allocation of initial COVID-19 vaccine: Phase 1

Implementation:
- Values of target group
- Feasibility
Allocation of initial COVID-19 vaccine: Phase 1

Ethical Principles:
- Maximize benefits & minimize harms
- Promote justice
- Mitigate health inequities
- Promote transparency
Proposed Groups for Phase 1 vaccination

August ACIP meeting
Phase 1a:
- Healthcare Personnel
Phase 1b:
- Essential Workers
- High-Risk Med Conditions
- Adults ≥ 65 years old
## Proposed groups for Phase 1 vaccination

<table>
<thead>
<tr>
<th>Healthcare Personnel&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Essential Workers&lt;sup&gt;1&lt;/sup&gt; (non-healthcare)</th>
<th>Adults with high-risk medical conditions&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Adults age ≥65 years&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>(~21 million)</td>
<td>(~87 million)</td>
<td>(&gt;100 Million)</td>
<td>(53 Million)</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitals</td>
<td>Food &amp; Agriculture</td>
<td>Obesity</td>
<td>Community Dwelling</td>
</tr>
<tr>
<td>Long-term care facilities</td>
<td>Food Service</td>
<td>Severe Obesity</td>
<td>Congregate ~3M&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Outpatient</td>
<td>Transportation</td>
<td>Diabetes</td>
<td>-Skilled Nursing Facility (~1.3 M)</td>
</tr>
<tr>
<td>Home health care</td>
<td>Education</td>
<td>COP</td>
<td>-Assisted living Facilities (~0.8 M)</td>
</tr>
<tr>
<td>Pharmacies</td>
<td>Energy</td>
<td>Heart Condition</td>
<td>-Residential care communities (~0.6 M)</td>
</tr>
<tr>
<td>EMS</td>
<td>Police</td>
<td>Chronic kidney</td>
<td>-HUD Senior Housing (~0.3M)</td>
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<tr>
<td>Public health</td>
<td>Firefighters</td>
<td>Cancer</td>
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<tr>
<td></td>
<td>Manufacturing</td>
<td>Smoking</td>
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<tr>
<td></td>
<td>IT &amp; Communication</td>
<td>Solid Organ Transplant</td>
<td></td>
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<tr>
<td></td>
<td>Water &amp; Wastewater</td>
<td>Sickle cell disease</td>
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3. United States Census Bureau [https://www.census.gov/topics/population/older-aging.html](https://www.census.gov/topics/population/older-aging.html)
Summary of Work Group Considerations supporting vaccinating healthcare personnel in Phase 1a

Science
- As of Nov 21, at least 228,503 confirmed COVID-19 cases among HCP, with 822 deaths\(^1\)
- COVID-19 exposure (inside and outside the healthcare setting) results in absenteeism due to quarantine, infection and illness. Vaccination has the potential to reduce HCP absenteeism
- LTCF modeling demonstrates more cases and death averted at the facility by vaccinating staff compared to vaccinating residents\(^2\)

Implementation
- Acute care HCPs have high uptake of influenza vaccine\(^3\)– high vaccine acceptance
- Many acute healthcare facilities have the equipment and expertise to carry out large scale vaccination with a vaccine that requires ultra-cold storage

Ethics
- Preserves health care services essential to the COVID-19 response and the overall health care system
- HCP group is inclusive of all job types in healthcare settings and is racially and ethnically diverse

\(^1\)https://covid.cdc.gov/covid-data-tracker/#health-care-personnel
\(^3\)Influenza Vaccination Coverage Among Health Care Personnel- United States, 2018-2019 Influenza Season, https://www.cdc.gov/vaccines/acip/meetings/slides-2020-08.html
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COVID-19 incidence is highest in young adults

National Estimate of COVID-19 Incidence per 100,000 Population, by Age Group – Data through Nov 16, 2020

<table>
<thead>
<tr>
<th>Age Group (Years)</th>
<th>COVID-19 Incidence per 100,000 Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>80+</td>
<td>2949.9</td>
</tr>
<tr>
<td>65 - 79</td>
<td>2009</td>
</tr>
<tr>
<td>55 - 64</td>
<td>2526.5</td>
</tr>
<tr>
<td>35 - 54</td>
<td>3073.3</td>
</tr>
<tr>
<td>25 - 34</td>
<td>3236.3</td>
</tr>
<tr>
<td>18 - 24</td>
<td>3965.2</td>
</tr>
<tr>
<td>14 - 17</td>
<td>1830.4</td>
</tr>
<tr>
<td>6 - 13</td>
<td>949.3</td>
</tr>
<tr>
<td>0 - 5</td>
<td>727.4</td>
</tr>
</tbody>
</table>

*Data sources: CDC COVID-19 case reports from jurisdictions. Population estimates from 2019 US Census Bureau. Data provisional, subject to change, incomplete for some jurisdictions. Age missing for 1% of case reports*
COVID-19 mortality rates are highest in older adults

National Estimate of COVID-19 Deaths per 100,000 Population, by Age Group – Data through Nov 13, 2020

<table>
<thead>
<tr>
<th>Age Group (Years)</th>
<th>Death Rate per 100,000 Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>80+</td>
<td>648.8</td>
</tr>
<tr>
<td>65 - 79</td>
<td>149</td>
</tr>
<tr>
<td>55 - 64</td>
<td>51.5</td>
</tr>
<tr>
<td>35 - 54</td>
<td>15.2</td>
</tr>
<tr>
<td>25 - 34</td>
<td>3.3</td>
</tr>
<tr>
<td>18 - 24</td>
<td>1.3</td>
</tr>
<tr>
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<td>0.2</td>
</tr>
<tr>
<td>6 - 13</td>
<td>0.1</td>
</tr>
<tr>
<td>0 - 5</td>
<td>0.2</td>
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*Data sources: CDC COVID-19 case reports from jurisdictions. Population estimates from 2019 US Census Bureau. Data provisional, subject to change, incomplete for some jurisdictions. Age missing for 21% of deaths. No deaths have been reported since 11/13/2020.*
The majority of COVID-associated hospitalized patients older than 75 years, were admitted from a LTCF*

*LTCF= Nursing home/skilled nursing facility, rehabilitation facility, assisted living/residential care, LTACH, group home/retirement, psychiatric facility, or other long-term care facility

Data Source: COVID-19 associated hospitalizations reported to Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET) surveillance system. COVID-NET is a population-based surveillance system that collects data on laboratory-confirmed COVID-19-associated hospitalizations among children and adults through a network of over 250 acute-care hospitals in 14 states.
Risk for COVID-19 associated hospitalization increased with the number of underlying medical conditions

<table>
<thead>
<tr>
<th>Number of conditions</th>
<th>Unadjusted Rate Ratio (95%CI)</th>
<th>Adjusted Rate Ratioa (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.8 (2.7, 3.1)</td>
<td>2.5 (2.1, 3.0)</td>
</tr>
<tr>
<td>2</td>
<td>5.6 (5.2, 6.1)</td>
<td>4.5 (3.7, 5.5)</td>
</tr>
<tr>
<td>3+</td>
<td>7.2 (6.6, 7.9)</td>
<td>5.0 (3.9, 6.3)</td>
</tr>
<tr>
<td>Age 45-64 years</td>
<td>-----</td>
<td>1.8 (1.5, 2.2)</td>
</tr>
<tr>
<td>Age 65+ years</td>
<td>-----</td>
<td>2.6 (2.1, 3.1)</td>
</tr>
<tr>
<td>Male sex</td>
<td>-----</td>
<td>1.2 (1.1, 1.4)</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>-----</td>
<td>3.9 (3.3, 4.7)</td>
</tr>
<tr>
<td>Other race/ethnicity</td>
<td>-----</td>
<td>3.3 (2.8, 3.9)</td>
</tr>
</tbody>
</table>

CI: Confidence Interval; COVID-NET: Coronavirus Disease 2019-Associated Hospitalization Surveillance Network

aModel for number of conditions (variable) is adjusted for age, sex, and race/ethnicity

bReference group is no underlying medical condition; Number of conditions is a sum of underlying medical conditions excluding hypertension; the most recent year of available BRFSS data for hypertension was 2017.

cReference group is 18-44 years

dReference group is female

eReference group is non-Hispanic white

Ko, Sept 2020, doi: 10.1093/cid/ciaa1419
Risk of in-hospital death among persons hospitalized for COVID-19 increased with age

Risk of in-hospital death among patients with COVID-19 associated hospitalization, COVID-NET March 1 - May 2, 2020

- 85+ years vs 18–39 years: Adjusted Rate Ratio 10.98
- 75–84 years vs 18–39 years: Adjusted Rate Ratio 7.67
- 65–74 years vs 18–39 years: Adjusted Rate Ratio 5.77
- 50–64 years vs 18–39 years: Adjusted Rate Ratio 3.11

Older adults in congregate settings are disproportionately affected by COVID-19

- Long-Term Care Facility (LTCF) residents and staff accounted for 6% of cases and 39% of deaths in the U.S.¹ (Nov 6, 2020)

  - Skilled Nursing Facilities (~1.3M) (as of Nov 8, 2020)²
    - ~470,000 confirmed + probable cases
    - >67,000 deaths
  - Assisted Living Facilities (~0.8M) (as of Oct 15/2020)³
    - 27,965 confirmed + suspected cases (based on 23 states)
    - 5,469 deaths (based on 20 states)

Modeling: What is the potential impact on preventing COVID-19 infections and deaths, of initially allocating vaccine to one of the following groups after vaccinating healthcare personnel in Phase 1a?

Updated: 90% VE (younger and older adults)

Biggerstaff, Modeling Strategies for the Initial Allocation of SARS-CoV-2 Vaccines, Oct ACIP:
Population-Wide Averted Infections: Infection-Blocking Vaccine

- Initially vaccinating high-risk adults or essential workers in Phase 1b averts approximately 1–3% more infections, compared to targeting age ≥65
  - This difference is greatest in the scenario where the vaccine is introduced before incidence peaks
- Findings are robust to assumptions of reduced VE in older populations
Population-Wide Averted Deaths: Infection-Blocking Vaccine

- Initially vaccinating age $\geq 65$ in Phase 1b averts approximately 0.5–2% more deaths, compared to targeting high-risk adults or essential workers.
  - As before, this difference is greatest in the scenario where the vaccine is introduced before incidence peaks.
Population-Wide Averted Deaths: Disease-Blocking Vaccine

- Initially vaccinating age ≥65 in Phase 1b averts approximately 2–6.5% more deaths, compared to targeting high-risk adults or essential workers.
  - As before, this difference is greatest in the scenario where the vaccine is introduced before incidence peaks.
- Findings robust to assumptions of reduced VE in older populations but percentage averted drops.

<table>
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<tr>
<th>Initial Phase 1b Target:</th>
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<tbody>
<tr>
<td>Age ≥65</td>
</tr>
<tr>
<td>High-Risk Adults</td>
</tr>
<tr>
<td>Essential Workers</td>
</tr>
</tbody>
</table>

Initial Phase 1b Target:

- Age ≥65
- High-Risk Adults
- Essential Workers

% Deaths Averted by Vaccination (6 Months Following Introduction)

- As Incidence Rises
- As Incidence Falls

Vaccine Introduction Time

- ~6.5%
- ~2%
Summary of Work Group interpretation: Modeling

- Differences among 3 strategies is minimal
  - Ethical principles and implementation considerations may greatly contribute to selecting the optimal sequence in Phase Ib

- Largest impact in averted deaths and infections is the timing of vaccine introduction in relation to increases in COVID-19 cases
  - Emphasizes the need to continue non-pharmaceutical interventions (e.g. wearing a mask, social distancing)

- Many factors will inform interpretation of modeling data and allocation decisions
  - VE in older adults
  - Vaccine’s ability to prevent asymptomatic infection & transmission
## Work Group assessment: Science

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<td>++++</td>
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<td></td>
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<tr>
<td><strong>Ethics</strong></td>
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<td></td>
</tr>
</tbody>
</table>
Implementation
Intent to receive COVID-19 vaccine, September, 2020

Non-essential workers

- Absolutely certain: 21
- Very likely: 20
- Somewhat likely: 22
- Not likely: 37

Essential (non-HCP)

- Absolutely certain: 18
- Very likely: 20
- Somewhat likely: 22
- Not likely: 41

≥1 high-risk condition

- Absolutely certain: 21
- Very likely: 21
- Somewhat likely: 23
- Not likely: 34 *

No HR condition

- Absolutely certain: 19
- Very likely: 19
- Somewhat likely: 22
- Not likely: 40

<65 years old

- Absolutely certain: 18
- Very likely: 18
- Somewhat likely: 23
- Not likely: 40

≥65 years old

- Absolutely certain: 24
- Very likely: 25
- Somewhat likely: 21
- Not likely: 30 *

* Statically significant at p<0.05 of “not likely” response vs comparator

Survey respondents supported early allocation to groups proposed for Phase 1

Which of the following groups should receive priority when a COVID-19 vaccine is available?
The Harris Poll, n=1399 U.S. Adults, August 14-16, 2020

- Healthcare Workers: 73%
- Seniors (age 55+): 71%
- Immunocompromised people: 68%
- Essential workers: 60%
- Fire/Rescue/Police: 56%
- Teachers: 44%
- Higest incidence areas: 34%
- Children: 28%
- Young adults (18-30): 16%

Feasibility

**Essential workers**
- Challenging to reach workers in rural locations, shift workers, those with multiple jobs or working in small cohorts
- Jurisdictions approaches include on site occupational clinics/pharmacies/Health Dept POD strike teams
- Most jurisdictions have an allocation “microplan” which includes prioritization among non-healthcare essential workers when vaccine supply is limited

**Adults with high-risk medical conditions**
- Determining eligibility: healthcare homes, such as provider offices or pharmacies, could be better suited to verifying underlying medical conditions
- Minimum size of vaccine orders may preclude involvement of small clinics

**Adults ≥65 years**
- Long distances to central clinics and high throughput of clinics
- Pharmacy program already established to reach LTCF residents
## Work Group assessment: Implementation

<table>
<thead>
<tr>
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<tr>
<td>Feasibility</td>
<td>++</td>
<td>+</td>
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<td>++</td>
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## Overall

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Science

Implementation

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<tr>
<td><strong>Maximize benefits and minimize harms</strong></td>
<td>Preserves services essential to the COVID-19 response and overall functioning of society “Multiplier effect”</td>
<td>Reduces morbidity and mortality in persons with high burden of COVID-19 disease and death</td>
<td>Reduces morbidity and mortality in persons with highest burden of COVID-19 hospitalization and death</td>
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<td><strong>Promote justice</strong></td>
<td>-Workers unable to work from home (↑exposure risk) -Promotes access to vaccine and may reduce barriers for workers with low vaccine uptake</td>
<td>Will require focused outreach to those with limited or no access to healthcare</td>
<td>Will require focused outreach to those who experience barriers to access healthcare</td>
</tr>
<tr>
<td><strong>Mitigate Health inequities</strong></td>
<td>-Racial and ethnic minority groups disproportionately represented in many essential industries -~1/4 of essential workers live in low-income families</td>
<td>Increased prevalence of some medical conditions in race/ethnic minority groups &amp; persons in rural areas -Diagnosis of medical conditions requires access to healthcare</td>
<td>-Highest incidence and mortality in congregate living --Racial and ethnic minority groups under-represented among adults ≥65</td>
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Proposed Interim Phase 1 Sequence

Phase 1c
Adults with high-risk medical conditions
Adults 65+

Phase 1b
Essential workers
(examples: Education Sector, Food & Agriculture, Utilities, Police, Firefighters, Corrections Officers, Transportation)

Phase 1a
HCP
LTCF residents

Time
Example of a possible Phase 1 sequence
Additional Work Group considerations

- This represents an interim Phase 1 sequence—allocation policy will need to be dynamic and adapt as new information such as vaccine performance and supply and demand become clear.

- Gating criteria will be necessary to move expeditiously from one Phase to the next, demand saturates.

- Reaching essential workers (non-healthcare personnel) will require jurisdictions to identify critical sectors at risk and optimal strategies to reach them.

- Following vaccination, measures to stop the possible spread of SARS-CoV-2, such as masks and social distancing, will still be needed.

- The U.S. government is committed to making COVID-19 vaccines available to all residents who want them, as soon as possible.
Proposed Interim Phase 1 Sequence

1) Do ACIP members agree with healthcare personnel and LTCF residents in Phase 1a?

2) Do ACIP members agree with essential workers (non healthcare) in Phase 1b?

3) Do ACIP members agree with adults with high-risk medical conditions and adults 65 years and older in Phase 1c?
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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.