

# Weekly COVID-19 Vaccine Updates

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# Introduction

This document summarises the vaccine efficacy and effectiveness, the vaccine specifications, the vaccine development pipeline and the timeline for World Health Organization (WHO) review of the various COVID-19 vaccines in late phase development. This document is updated weekly.

- Vaccine efficacy refers to the performance of a vaccine in a controlled clinical trial (study) situation
- Vaccine effectiveness refers to the performance of a vaccine in a population under real-world conditions

## Key messages









- COVID-19 vaccine efficacy results from different trials cannot be directly compared against each other. They must be interpreted in the context of study designs (including case definitions, clinical endpoints, access to testing), target populations, and COVID-19 epidemiologic conditions (including circulation of variants of concern)
- All COVID-19 vaccines in late phase development report high vaccine efficacy against severe COVID-19 and favourable safety profiles
- Pfizer/BioNTech and AstraZeneca both show high vaccine effectiveness in the UK and Israel where the B.1.1.7 (UK) variant is circulating. Both vaccines have shown they are similarly effective against transmission in UK. Sinovac has shown high vaccine effectiveness in Chile where the P1 and B.1.1.7 variants are circulating. Sinopharm has shown high vaccine effectiveness in Bahrain.
- The US FDA, UK MHRA, EU EMA NZ Medsafe, and Health Canada have authorised the Pfizer/BioNTech vaccine for emergency use in adolescents aged 12-15 years<sup>1-4</sup>
- Mixed vaccine schedules (i.e. delivering different types of vaccine for the first and second dose) are under investigation as these could facilitate better protection against variants of concern and enable vaccination programs to continue if a particular vaccine is unavailable.
- A very rare clotting disorder with low platelets (Thrombosis with Thrombocytopenia Syndrome – TTS) has been associated with the AstraZeneca and Johnson & Johnson vaccines.<sup>5-7</sup> The majority of cases fully recover with adequate treatment. The risk following the first dose of AstraZeneca vaccine has been estimated by the EMA as 1 in 100,000 and by the Australian Technical Advisory Group on Immunisation (ATAGI) as 1 in 66,000.<sup>8,9</sup> Risk of TTS is much lower following the *second* dose of AstraZeneca vaccine: estimate in the UK is 1 in 1.5 million second doses.<sup>10</sup>
- The risk of TTS following the first dose of Johnson & Johnson vaccine has been estimated as 1 in 319,000 in the USA<sup>11</sup>
- Appropriate communication on the benefit-risk profile of COVID-19 vaccines (Page 12) remains crucial to maintain confidence in immunisation programmes and to avoid vaccine hesitancy

## New updates

Key updates include (*also highlighted in yellow text in the document*):

- Effectiveness of Sinovac vaccine in Uruguay (Page 5):
  - Infection: 59.9% (59.1-60.7)
  - Hospitalisation: 90.9% (88.6-92.7)
  - Death: 94.7% (93.4-95.7)
- Effectiveness of Pfizer/BioNTech vaccine in Uruguay (Page 5):
  - Infection: 78.1% (77.0-79.1)
  - Hospitalisation: 97.8% (96.0-98.8)
  - Death: 96.2% (95.4-96.8)
- Effectiveness of Pfizer/BioNTech vaccine in Israel (Pages 5 and 7):
  - Infection:
    - Overall: 93.0% (92.6-93.4)
    - Hypertension: (89.7% (88.6-91.7)
    - Diabetes (88.9% (87.3-90.2)
    - Obesity (89.7% (88.6-90.7)
    - ≥70 years: 89.1% (83-93)
  - Hospitalisation: 93.4% (91.9-94.7)
  - Death: 91.1% (86.5-94.1)
- Effectiveness of single dose against symptomatic disease in those aged 15-39 years in the UK (Page 5):
  - Moderna: 72% (46-86)
  - Pfizer/BioNTech: 61% (56-66)
- Effectiveness against death in the UK in those aged ≥65 years (Page 7):
  - Single dose AstraZeneca: 83% (78-86)
  - Two doses AstraZeneca: 94% (80-98)
  - Single dose Pfizer/BioNTech: 77% (72-81)
  - Two doses Pfizer/BioNTech: 98% (94-99)
- Effectiveness of a single dose against symptomatic and asymptomatic infection in the UK:
  - AstraZeneca: 60% (49-68)
  - Pfizer/BioNTech: 72% (63-79)
- Effectiveness of mixed dose schedules in the UK (Page 9):
  - AstraZeneca followed by Pfizer/BioNTech (4 week dose interval): stronger antibody and cellular response than after 2 doses of AstraZeneca vaccine
  - Pfizer/BioNTech followed by AstraZeneca (4 week dose interval): weaker antibody response than after 2 doses of Pfizer/BioNTech vaccine (but stronger than after 2 doses of AstraZeneca vaccine)
- Robust antibody response reported with mixed schedule of AstraZeneca vaccine followed by Pfizer/BioNTech vaccine in Spain (Page 9)
- Phase 1/2 clinical trials indicate the Sinovac vaccine is well tolerated and produces a strong antibody response in children aged 3-17 years
- The UK JCVI has recommended that adults ≥70 years of age, and those who are vulnerable, receive a third booster dose of vaccine from September 2021, with those ≥50 years to be subsequently offered a third dose as soon as practicable

# COVID-19 Vaccine Specifications

	ASTRAZENECA	GAMALEYA	JOHNSON & JOHNSON	MODERNA	NOVAVAX	PFIZER/BIONTECH	SINOVAC	SINOPHARM
VACCINE TYPE	Viral vector (chimpanzee adenovirus ChAdOx1)	Viral vector (recombinant adenovirus types 5 and 26)	Viral vector (recombinant adenovirus type 26)	mRNA	Protein subunit	mRNA	Inactivated virus	Inactivated virus
Available Through COVAX	✓	-	✓	-	✓	✓	-	-
Doses Required	 8-12 weeks apart* 4 weeks apart (Product Information)	 3 weeks apart		 4 weeks apart*	 3 weeks apart	 3 weeks apart*	 2 weeks apart	 3 weeks apart
Shipping, Storage & Presentation	Normal cold chain requirements (2-8°C); 10-dose vials	-18.5°C (liquid form); 2-8°C (dry form)	Shipped at -20°C; 2-8°C for up to 3 months; 5-dose vials	-25°C to -15°C; 10-dose vials	2-8°C; 10-dose vials	-80°C to -60°C; 2-8°C for up to 1 month; 6-dose vials	2-8°C; Single-dose vials	2-8°C; Single-dose vials/pre-filled syringes
Approval by a Stringent Regulatory Authority (SRA)	WHO EUL, EMA, TGA, MHRA	Under review by WHO SAGE	WHO EUL, EMA, FDA, MHRA	WHO EUL, EMA, FDA	Under review by WHO SAGE	WHO EUL, EMA, FDA, TGA, MHRA	WHO EUL	WHO EUL

\*Based on WHO Strategic Advisory Group of Experts on Immunization (SAGE) recommendations

**WHO EUL:** WHO Emergency Use Listing  
**EMA:** European Medicines Agency  
**FDA:** Food and Drug Administration (US)  
**TGA:** Therapeutic Goods Administration (Australia)  
**MHRA:** Medicines and Healthcare Products Regulatory Agency (UK)

# COVID-19 Vaccine Efficacy

VACCINE	VACCINE EFFICACY			
	SYMPTOMATIC INFECTION	MODERATE-SEVERE	SEVERE	HOSPITALISATION/DEATH
<b>AstraZeneca</b>	UK: 66.7% (57.4-74.0) <sup>12</sup> USA, Chile, Peru: 76% <sup>13</sup> (not peer-reviewed) Single dose in UK (22-90 days post-vaccination): 76.0% (59.3 to 85.9) <sup>12</sup> Efficacy with different interval between doses in UK: 12+ weeks: 82.4% (2.7-91.7) <6 weeks: 54.9% (32.7-69.7) <sup>12</sup>	-	Severe/critical and hospitalisation in USA, Chile, Peru: 100% <sup>13</sup> (not peer-reviewed) UK: 100% (15 cases in the placebo group) <sup>12</sup>	Hospitalisation in UK: 100% (9 cases in placebo group) <sup>12</sup>
<b>Gamaleya</b>	Russia: 91.6% (85.6-95.2) <sup>14</sup> Single dose (Sputnik Light) in Argentina: 78.6% <sup>15</sup>	Moderate-severe: 100% (20 cases in the placebo group) <sup>14</sup>	-	-
<b>Johnson &amp; Johnson</b>	-	Moderate to severe/critical: All sites: 66.1% (55.0-74.8) USA: 72.0% (58.2-81.7) Latin America: 61.0% (46.9-71.8) South Africa: 64.0% (41.2-78.7) <sup>16</sup>	85.4% (54.2-96.9) <sup>16</sup>	100% (7 deaths in placebo group) <sup>16</sup>
<b>Moderna</b>	USA: 94.1% (89.3-96.8) <sup>17</sup> USA: >90% <sup>18</sup> 12-17 years in USA: 93% (1 case in vaccine arm) <sup>19</sup> UK: 89.7% (80.2-94.6) <sup>20</sup>	-	USA: 100% (30 cases in placebo group) <sup>17</sup> US: >95% <sup>18</sup>	USA: 100% (1 death in placebo group) <sup>17</sup>
<b>Novavax</b>	US and Mexico: 90.4% (82.9-94.6) <sup>21</sup>	US and Mexico: 100% (87.0-100) <sup>21</sup>	-	-
<b>Pfizer/BioNTech</b>	Argentina, Brazil, Germany, South Africa, Turkey and the USA: 94.6% (89.9-97.3) <sup>22</sup> 12-15 years in USA: 100% <sup>23</sup>	-	Argentina, Brazil, Germany, South Africa, Turkey and the USA: 88.9% (20.1-99.7) <sup>22</sup>	-
<b>Sinovac</b>	Brazil: 50.7% (35.9-62.0) Chile: 67% (65-69) Indonesia: 65% (20-85) Turkey: 84% (65-92) <sup>24</sup>	Requiring medical assistance in Brazil: 83.7% (58.0-93.7) Moderate-severe: 100% (56.4-100.0) <sup>25</sup>	-	Hospitalisation: Brazil: 100% (56-100) Chile: 85% (83-97) Turkey: 100% (20-100) <sup>24</sup>
<b>Sinopharm</b>	UAE, Bahrain, Egypt and Jordan: 78.1% (64.9-86.3) <sup>24</sup>	-	-	Hospitalisation in UAE, Bahrain, Egypt and Jordan: 78.7% (26.0-93.9) <sup>24</sup>

# COVID-19 Vaccine Effectiveness

VACCINE	SEVERE / HOSPITALISATION / DEATH	INFECTION AND OTHER OUTCOMES
<b>AstraZeneca</b>	<p>Single dose in Scotland: 94% (73-99)<sup>26</sup></p> <p>Risk of death in vaccine failures compared to unvaccinated cases in England reduced by: 55% (41-66)<sup>27</sup> (not peer reviewed)</p> <p>Single dose against hospitalisation in Spain: 92% (46-99)<sup>28</sup></p> <p>Pooled analysis of AstraZeneca, Pfizer/BioNTech and Moderna vaccines in Italy: Hospitalisation: 89% (85-91); Death: 93% (89-96)<sup>29</sup></p>	<p>Pooled analysis of Pfizer/BioNTech and AstraZeneca vaccines in elderly care home residents in UK: Reduction in risk of infection 4 weeks after single dose: 56% Reduction in risk of infection 5 weeks after single dose: 62%<sup>30</sup></p> <p>Pooled analysis of Pfizer/BioNTech and AstraZeneca vaccines: reduced odds of infection post-second dose: 70% (62-77)<sup>31</sup></p> <p>Single dose in Spain: Any infection: 44% (31-54); Symptomatic infection: 50% (37-61)<sup>28</sup></p> <p>Pooled analysis of AstraZeneca, Pfizer/BioNTech and Moderna vaccines in Italy: Infection: 78% (76-79)<sup>29</sup></p>
<b>Johnson &amp; Johnson</b>	-	USA: Any infection: 76.7% (30.3-95.3) <sup>32</sup>
<b>Moderna</b>	<p>Pooled analysis of AstraZeneca, Pfizer/BioNTech and Moderna vaccines in Italy: Hospitalisation: 89% (85-91); Death: 93% (89-96)<sup>29</sup></p>	<p>Pooled analysis of Moderna and Pfizer/BioNTech vaccines in USA: Infections in nonvaccinated: 234 of 8969; 2.61% (2.29-2.96) Fully vaccinated: 4/8121; 0.05% (0.01-0.13)<sup>33</sup></p> <p>Pooled analysis of Moderna and Pfizer/BioNTech vaccines against infection in USA: Fully vaccinated: 90% (68-97) Two weeks after first dose: 80% (59-90)<sup>34</sup></p> <p>Pooled analysis of AstraZeneca, Pfizer/BioNTech and Moderna vaccines in Italy: Infection: 78% (76-79)<sup>29</sup></p> <p><b>Single dose against symptomatic disease: Age 15-39 years: 72% (46-86)<sup>35</sup></b></p>
<b>Pfizer/BioNTech</b>	<p>Severe in Israel: 92% (75-100)<sup>36</sup></p> <p>Severe/critical in Israel: 97.5% (97.1-97.8)<sup>37</sup></p> <p>Single dose against hospitalisation in Scotland: 85% (76-91)<sup>26</sup></p> <p>Risk of death in vaccine failures compared to unvaccinated cases in England reduced by: Single dose: 44% (32-53) Fully vaccinated: 69% (31-86)<sup>27</sup> (not peer reviewed)</p> <p>Israel: Hospitalisation: 97.2% (96.8-97.5); Death: 96.7% (96.0-97.3)<sup>37</sup></p> <p>Hospitalisation in Spain: 94% (60-99)<sup>28</sup></p> <p>Priority groups in Denmark: Hospitalisation: 93% (89-96); Death: 94% (90-96)<sup>38</sup></p> <p>Pooled analysis of AstraZeneca, Pfizer/BioNTech and Moderna vaccines in Italy: Hospitalisation: 89% (85-91); Death: 93% (89-96)<sup>29</sup></p> <p>Uruguay: Hospitalisation: 97.8% (96.0-98.8); Death: 96.2 (95.4-96.8)<sup>39</sup></p> <p>Israel: Hospitalisation: 93.4% (91.9-94.7); Death: 91.1% (86.5-94.1)<sup>40</sup></p>	<p>Pooled analysis of Moderna and Pfizer/BioNTech vaccines in USA: Infections in nonvaccinated: 234 of 8969; 2.61% (2.29-2.96) Fully vaccinated: 4/8121; 0.05% (0.01-0.13)<sup>33</sup></p> <p>Pooled analysis of Moderna and Pfizer/BioNTech vaccines in USA: Fully vaccinated: 90% (68-97); Two weeks after first dose: 80% (59-90)<sup>34</sup></p> <p>Symptomatic infection in Israel: 94% (87-98)<sup>36</sup></p> <p>Any infection in Israel: 90% (79-95)<sup>41</sup></p> <p>Israel: Any infection: 95.3% (94.9-95.7); Symptomatic infection: 97.0% (96.7-97.2)<sup>37</sup></p> <p>Pooled analysis of Pfizer/BioNTech and AstraZeneca vaccines in elderly care home residents in UK: 4 weeks after first dose: 56%; 5 weeks after first dose: 62%<sup>30</sup></p> <p>Documented infection in Israel: incidence decreased from 9.4 infections per 1,000 HCWs in the week following first dose to &lt;1.0 infection per 1,000 HCWs per week from 1 week after the second dose<sup>42</sup></p> <p>Pooled analysis of Pfizer/BioNTech and AstraZeneca vaccines: reduced odds of infection post-second dose: 70% (62-77)<sup>31</sup></p> <p>Spain: Any infection: 65% (56-73); Symptomatic infection: 82% (73-88)<sup>28</sup></p> <p>Infection in priority groups in Denmark: 82% (79-84)<sup>38</sup></p> <p>USA: Symptomatic infection: 84% (75-90)<sup>43</sup></p> <p>Denmark: Infection in care facility residents: &gt;14 days after first dose: 17% (4-28); &gt;7 days after second dose: 64% (14-84)<sup>44</sup></p> <p>USA: Single dose against infection in 2 care facilities: 63% (33-79)<sup>45</sup></p> <p>A care facility in USA: Infection 66% (41-81); Symptomatic illness 87% (66-95); Death 94% (45-99)<sup>46</sup></p> <p>Pooled analysis of AstraZeneca, Pfizer/BioNTech and Moderna vaccines in Italy: Infection: 78% (76-79)<sup>29</sup></p> <p>Uruguay: Infection: 78.1% (77.0-79.1)<sup>39</sup></p> <p>Israel: Infection: 93.0% (92.6-93.4)<sup>40</sup></p> <p><b>Single dose against symptomatic disease: Age 15-39 years: 61% (56-66)<sup>35</sup></b></p>
<b>Sinovac</b>	<p>Chile: Hospital admission: 85% (83-87); ICU admission: 89% (84-92); Death: 80% (73-86)<sup>47</sup> (not peer reviewed)</p> <p>Uruguay: Hospitalisation: 90.9% (88.6-92.7); Death: 94.7% (93.4-95.7)<sup>39</sup></p>	<p>Symptomatic infection in Chile: 67% (65-69)<sup>47</sup> (not peer reviewed)</p> <p>Uruguay: Infection: 59.9% (59.1-60.7)<sup>39</sup></p>
<b>Sinopharm</b>	-	Symptomatic infection in Bahrain: 90% (88-91) <sup>24</sup>

# Vaccine Efficacy/Effectiveness Against Variants

Refer to previous table for vaccine effectiveness results for the Pfizer/BioNTech vaccine in Scotland, England and Israel, where all locations had predominant B.1.1.7 circulation. There are four Variants of Concern listed by WHO.<sup>48</sup> The WHO recommends labelling SARS-CoV-2 variants with letters of the Greek alphabet, as in the table below.<sup>49</sup>

VACCINE	VACCINE EFFICACY/EFFECTIVENESS							
	B.1.1.7 (ALPHA) VARIANT		B.1.351 (BETA) VARIANT		P.1 (GAMMA) VARIANT		B.1.617.2 (DELTA) VARIANT	
	ANY INFECTION	SEVERE	ANY INFECTION	SEVERE	ANY INFECTION	SEVERE	ANY INFECTION	SEVERE
<b>AstraZeneca</b>	70.4% (43.6-84.5) (vs. 81.5% (67.9-89.4) against wild variant in UK) <sup>50</sup> Effectiveness: ≥21 days after one dose: 51.4% (47.3-55.2); ≥14 days after two doses: 66.1% (54.0-75.0) <sup>51</sup> Scotland: 73% (66-78) <sup>52</sup>	-	10.4% (-76.8 to 54.8) <sup>53</sup>	Study underway <sup>16</sup>	-	-	Effectiveness: ≥21 days after one dose: 32.9% (19.3-44.3); ≥14 days after second dose: 59.8% (28.9-77.3) <sup>51</sup> Scotland: 60% (53-66) <sup>52</sup>	Hospitalisation in England: 1 dose: 71% (51-83); 2 doses: 92% (75-97) <sup>54</sup>
<b>Johnson &amp; Johnson</b>	-	-	-	Moderate to severe/critical: 64.0% (41.2-78.7) Severe/critical: 81.7% (46.2-95.4) <sup>16</sup>	-	Moderate to severe/critical: 68.1% (48.8-80.7) Severe/critical: 87.6% (7.8-99.7) <sup>16</sup>	-	-
<b>Novavax</b>	86.3% (71.3-93.5) (vs. 96.4% (73.8-99.5) against wild variant in UK) <sup>20</sup>	-	South Africa: 51.0% (-0.6 to 76.2) <sup>55</sup>	-	-	-	-	-
<b>Pfizer/BioNTech</b>	Case-control study in Israel: Vaccinees infected between 2 weeks after the first dose and 1 week after the second dose, were disproportionately infected with B.1.1.7 (OR: 26:10) <sup>56</sup> Effectiveness in Qatar: 89.5% (85.9-92.3) <sup>57</sup> Effectiveness: ≥21 days after one dose: 49.2% (42.6 to 55.0) ≥14 days after second dose: 93.4% (90.4-95.5) <sup>51</sup> Scotland: 92% (90-93) <sup>52</sup>	Effectiveness in Qatar: 100% (81.7-100) <sup>57</sup>	Israel case-control study: Vaccinees infected at least 1 week after the second dose were disproportionately infected with B.1.351 (odds ratio: 8:1) <sup>56</sup> Effectiveness in Qatar: 75.0% (70.5-78.9) <sup>57</sup>	Effectiveness in Qatar: 100% (73.7-100) <sup>57</sup>	-	-	Effectiveness: ≥21 days after one dose: 33.2% (8.3-51.4); ≥14 days after second dose: 87.9% (78.2-93.2) <sup>51</sup> Scotland: 79% (75-82) <sup>52</sup>	Hospitalisation in England: 1 dose: 94% (46-99); 2 doses: 96% (86-99) <sup>54</sup>
<b>Sinovac</b>	Chile: 67% (65-69) <sup>*24</sup>	-	-	-	Brazil: vaccine effectiveness 1 or 2 doses: 35.1% (-6.6-60.5) <sup>58</sup> Chile: 67% (65-69) <sup>*24</sup> Brazil: ≥70 years: 41.6% (26.9-53.3); 70-74 years: 61.8% (34.8-77.7); 75-79 years: 48.9% (23.3-66.0); ≥80 years: 28.0% (0.6-47.9) <sup>59</sup>	-	-	-

\* While it is known P.1. and B.1.1.7 were circulating at the time of the study, the extent is unknown based on available surveillance

# Vaccine Efficacy/Effectiveness in the Elderly and Against Comorbidities

VACCINE	VACCINE EFFICACY UNLESS OTHERWISE STATED			
	DIABETES	OBESITY	AT RISK FOR SEVERE COVID-19	ELDERLY
<b>AstraZeneca</b>	-	-	76% against symptomatic infection in a sample where 60% had comorbidities, including diabetes, severe obesity or cardiac disease <sup>13</sup> (not peer-reviewed)	In ≥65 years: 85% <sup>13</sup> (not peer-reviewed) Effectiveness against hospitalisation at 28-34 days after a single dose (pooled analysis of AstraZeneca and Pfizer vaccines): 18-64 years: 85% (68-93); 65-79 years: 79% (17-95); ≥80 years: 81% (65-90) <sup>26</sup> Effectiveness of single dose against hospitalisation in England: ≥80 years: 73% (60-81) <sup>60</sup> Effectiveness in England: Symptomatic infection ≥70 years: 73% (27-90); Hospitalisation ≥80 years: 37% (3-59) <sup>61</sup> Hospitalisation following single dose in the UK: ≥80 years: 80.4% (36.4-94.5) <sup>62</sup> Single dose in Spain: ≥60 years: 53% (19-72) vs. 18-59 years: 50% (34-62) <sup>28</sup> <b>Effectiveness against death in the UK: ≥65 years: Single dose: 83% (78-86); Two doses: 94% (80-98)<sup>35</sup></b>
<b>Gamaleya</b>	-	-	-	Against symptomatic infection in >60 years: 91.8% (67.1-98.3) <sup>14</sup>
<b>Johnson &amp; Johnson</b>	Against moderate to severe/critical: 23.0% (-90.1-69.8) <sup>16</sup>	Against moderate to severe/critical: 65.9% (47.8-78.3) <sup>16</sup>	Against moderate to severe/critical: With any comorbidity: 58.6% (40.6-71.6) <sup>16</sup> No comorbidity: 68.8% (59.0-76.6) <sup>16</sup>	Against moderate-severe/critical disease ≥28 post vaccination: 18-59 years: 66.1% (53.3-75.8) 60+ years: 66.2% (36.7-83.0) <sup>16</sup>
<b>Moderna</b>	-	-	Against symptomatic infection, comorbidities, including diabetes and obesity: In low risk: 95.1% (89.6-97.7) In high risk: 90.9% (74.7-96.7) <sup>17</sup>	Against symptomatic infection: 18-64 years: 95.6% (90.6-97.9) ≥65 years: 86.4% (61.4-95.2) <sup>17</sup> Pooled Moderna and Pfizer vaccines against hospitalisation ≥65 years: 94% (49-99) <sup>63</sup>
<b>Pfizer/BioNTech</b>	Effectiveness in Israel: Diabetes or cardiovascular disease: 82% (62-92) <sup>41</sup> Effectiveness against infection in Israel: (88-9% (87.3-90.2) <sup>40</sup>	<b>Effectiveness against infection in Israel: (89-7% (88.6-90.7)<sup>40</sup></b>	Against symptomatic infection: With any comorbidity or obesity: 95.3% With no comorbidity: 94.7% <sup>22</sup> Denmark: Infection: 71% (58-80); Hospitalisation: 81% (49-93) <sup>38</sup> <b>Effectiveness against infection in Israel: Hypertension: (89-7% (88.6-91.7)<sup>40</sup></b>	Against symptomatic infection: >55 years: 93.7% (80.6-98.8); >65 years: 94.7% (66.7-99.9); >75 years: 100% (-13.1-100) <sup>22</sup> Effectiveness against hospitalisation 28-34 days after a single dose (pooled analysis of AstraZeneca and Pfizer vaccines): 18-64 years: 85% (68-93); 65-79 years: 79% (17-95); ≥80 years: 81% (65-90) <sup>26</sup> England 80-83 years: Documented infection: 70.1% (55.1-80.1) Hospital attendance: 78.9% (60.0-89.9); Hospital admission: 75.6% (52.8-87.6) <sup>64</sup> Reduction in incidence of infection in vaccinated people aged >60 years and unvaccinated people aged 20-39 years, respectively: Documented infection: 45% versus 28%; Hospitalisation: 68% versus 22% <sup>65</sup> Pooled Moderna and Pfizer vaccines against hospitalisation ≥65 years: 94% (49-99) <sup>63</sup> Effectiveness in England: Symptomatic infection ≥70 years: 61% (51-69); Hospitalisation ≥80 years: 43% (33-52); Death ≥80 years (vaccine failure vs non-vaccinated): 51% (37-62) <sup>61</sup> Effectiveness against hospitalisation in England ≥80 years: Single dose: 81% (76-85) Fully vaccinated: 93% (89-95) <sup>60</sup> (not peer reviewed) Effectiveness in Israel: 65-74 years: 82% (63-92); ≥75 years: 82% (61-91) <sup>41</sup> Hospitalisation following single dose in the UK: ≥80 years: 71.4% (43.1-86.2) <sup>62</sup> Single dose in Spain: ≥60 years: 76% (55-87) vs. 18-59 years: 85% (74-91) <sup>28</sup> Effectiveness against infection in Denmark: ≥80 years: 77% (50-89) <sup>38</sup> <b>Effectiveness against infection in Israel: ≥70 years: 89-1% (83-93)<sup>40</sup></b> <b>Effectiveness against death in the UK: ≥65 years: Single dose: 77% (72-81); Two doses: 98% (94-99)<sup>35</sup></b>
<b>Novavax</b>	-	-	Against any infection with comorbidity, age ≥65 years or frequent COVID-19 exposure in USA and Mexico: 91.0% (83.6-95.0) <sup>21</sup>	-
<b>Sinovac</b>	-	74.9% (53.7-86.4) <sup>24</sup>	Any comorbidity: 48.9% (26.6-64.5) <sup>24</sup>	-
<b>Sinopharm</b>	-	80.7% (56.7-91.4) <sup>24</sup>	-	Effectiveness against symptomatic infection in Bahrain: ≥60 years: 91% (87-94) <sup>24</sup>



# Vaccine Efficacy/Effectiveness Against Transmission

There are limitations related to the analysis and comparison of transmission data between studies and vaccines. Criteria for testing vary between studies and may include, for example, random testing, testing at defined intervals, or retrospective serology.

VACCINE	EFFICACY/EFFECTIVENESS AGAINST ASYMPTOMATIC INFECTION	OTHER OUTCOMES
AstraZeneca	<p>Asymptomatic (UK only): 22.2% (-9.9-45.0) Symptomatic and asymptomatic combined (UK, South Africa and Brazil): 54.1% (44.7-61.9)<sup>12</sup></p> <p>Odds ratio for household contacts of vaccinated health workers vs non-vaccinated health workers testing positive in England: 0.52 (0.43-0.62)<sup>66</sup></p> <p>Pooled analysis of AstraZeneca and Pfizer/BioNTech in Scotland: Hazard ratio for household contacts of vaccinated health workers vs non-vaccinated health workers testing positive: 0.70 (0.63-0.78)<sup>67</sup></p> <p>Hazard ratio for single dose in vaccinated vs. unvaccinated care facility residents in England: 0.32 (0.15-0.66)<sup>68</sup></p> <p>Following regular testing of randomly selected UK households: 79% (65-88)<sup>69</sup></p> <p><b>Single dose against symptomatic and asymptomatic infection in the UK: 60% (49-68)<sup>70</sup></b></p>	-
Johnson & Johnson	<p>Asymptomatic: 59.7% (32.8-76.6)<sup>16</sup></p>	-
Moderna	<p>US: Pooled analysis of Pfizer/BioNTech and Moderna vaccines: 88.7% (68.4-97.1)<sup>41</sup></p> <p>Pooled analysis of Pfizer/BioNTech and Moderna vaccines in USA (weekly testing for 13 weeks): 2 weeks after single dose: 80% (59-90); 2 weeks after second dose: 90% (68%-97)<sup>72</sup></p> <p>Pooled analysis of Pfizer/BioNTech and Moderna vaccines in USA: compared to unvaccinated residents, relative risk of infection in asymptomatic pre-surgical patients &gt;10 days after first dose: 0.21 (0.12-0.37)<sup>73</sup></p> <p>Following mRNA vaccination in nursing homes in USA, incident cases in <i>unvaccinated</i> residents decreased from 4.3% within 14 days of the first vaccination clinic to 0.3% after 42 days<sup>44</sup></p> <p>Reduced potential for transmission (from modelling): at least 61%<sup>75</sup></p>	-
Pfizer/BioNTech	<p>England: 86% (76-97) 7 days after 2 doses; 72% (58-86) 21 days after 1 dose<sup>76</sup></p> <p>Israel: 75% (72-84) 15-28 days after single dose<sup>77</sup>; 92% (88-95)<sup>86</sup></p> <p>Israel: 91.5% (90.7-92.2)<sup>37</sup></p> <p>USA: Pooled analysis of Pfizer/BioNTech and Moderna vaccines: 88.7% (68.4-97.1)<sup>71</sup></p> <p>UK, single dose: 4-fold decrease in risk amongst HCWs ≥12 days post-vaccination<sup>78</sup></p> <p>Pooled analysis of Pfizer/BioNTech and Moderna vaccines in US (weekly testing for 13 weeks): 2 weeks after single dose: 80% (59-90); 2 weeks after second dose: 90% (68%-97)<sup>72</sup></p> <p>Pooled analysis of Pfizer/BioNTech and Moderna vaccines in USA: compared to unvaccinated residents, relative risk of infection in asymptomatic pre-surgical patients &gt;10 days after first dose: 0.21 (0.12-0.37)<sup>73</sup></p> <p>Following mRNA vaccination in nursing homes in USA, incident cases in <i>unvaccinated</i> residents decreased from 4.3% within 14 days of the first vaccination clinic to 0.3% after 42 days<sup>44</sup></p> <p>Effectiveness in unvaccinated household contacts of vaccinated health workers: 2 weeks after first dose: 8.7% (-28.9-35.4); 10 weeks after first dose: 42.9% (22.3-58.1)<sup>79</sup></p> <p>Following regular testing of randomly selected UK households: 80% (73-85)<sup>89</sup></p> <p>USA: Asymptomatic screening: 90% (78-96)<sup>43</sup></p> <p>Israel: 65% (45-79%)<sup>80</sup></p> <p>* By May 2021, 82% and 42% of adults aged ≥65 and 18-49 years, respectively, had received at least one dose of vaccine. From before the vaccination program (29 Nov-12 Dec 2020) to late April 2021, the rate ratios among adults aged ≥65 compared to 18-49 years were: Infection: 40%; Emergency visits: 59%; Hospitalisation: 65%; Death: 66%<sup>81</sup></p> <p><b>Single dose against symptomatic and asymptomatic infection in the UK: 72% (63-79)<sup>70</sup></b></p>	<p>Lower viral load in vaccine failure cases 12-37 days after the first dose of vaccine compared to within the first 11 days, indicating potentially lower infectiousness<sup>82</sup></p> <p>Data from 223 communities in Israel: strong correlation between community vaccination rate and a later decline in infection among children under 16 years of age who were unvaccinated<sup>83</sup></p> <p>Substantially decreased viral load for infections occurring 12-37 days after the first dose of vaccine in Israel, indicating likely lower infectiousness<sup>82</sup></p> <p>Detectable transmission in long-term care facilities in Spain reduced by 90% (76-93)<sup>84</sup></p> <p>Odds ratio for household contacts of vaccinated health workers vs non-vaccinated health workers testing positive in England: 0.54 (0.47-0.62)<sup>86</sup></p> <p>Pooled analysis of AstraZeneca and Pfizer/BioNTech in Scotland: Hazard ratio for household contacts of vaccinated health workers vs non-vaccinated health workers testing positive: 0.70 (0.63-0.78)<sup>67</sup></p> <p>Hazard ratio for single dose in vaccinated vs. unvaccinated care facility residents: 0.35 (0.17-0.71)<sup>88</sup></p>

\* Nationwide vaccination program including Pfizer/BioNTech, Moderna and Johnson & Johnson vaccines



# Mixed Dose Vaccine Safety and Immune Responses

Mixed vaccine schedules (i.e. delivering different types of vaccine for the first and second dose) could be particularly useful to facilitate better protection against variants of concern and enable vaccination programs to continue if a particular vaccine is unavailable.

SCHEDULE	SAFETY	IMMUNE RESPONSES	COUNTRIES USING SCHEDULE
<b>AstraZeneca followed by Pfizer/BioNTech</b>	<p>Spain: Similar side effects to those receiving 2 doses of the same vaccine; no safety concerns (not peer reviewed)<sup>85</sup></p> <p>UK: Greater systemic side effects (mild-moderate symptoms) following the booster dose than with 2 doses of the same vaccine; no safety concerns<sup>86</sup></p> <p>Germany: greater reactogenicity with first dose of AstraZeneca than with the Pfizer/BioNTech booster<sup>87</sup></p>	<p>Spain: ≥8 week dose interval: Stronger immune response following Pfizer/BioNTech than after 2 doses of AstraZeneca vaccine (not peer reviewed)<sup>85</sup></p> <p>Spain: 8-12 week dose interval: robust antibody response<sup>88</sup></p> <p>UK: 4 week dose interval: stronger antibody and cellular response than after 2 doses of AstraZeneca vaccine<sup>89</sup></p> <p>Germany: 9-12 week dose interval: Significantly stronger immune response following Pfizer/BioNTech booster than AstraZeneca, and slightly stronger than after 2 doses of Pfizer/BioNTech (not peer reviewed)<sup>90</sup></p> <p>Germany: 4-fold greater immune response following Pfizer/BioNTech booster than AstraZeneca<sup>91</sup></p>	Canada, Denmark, Finland, France, Germany, Sweden, Norway, Spain and South Korea <sup>92</sup>
<b>Pfizer/BioNTech followed by AstraZeneca</b>	<p>UK: Greater systemic side effects (mild-moderate symptoms) following the booster dose than with 2 doses of the same vaccine; no safety concerns<sup>86</sup></p> <p>Greater reactogenicity with first of homologous and heterologous prime-boost immunisation with BNT162b2 and ChAdOx1-nCoV19: a prospective cohort study</p>	<p>UK: 4 week dose interval: weaker antibody response than after 2 doses of Pfizer/BioNTech vaccine (but stronger than after 2 doses of AstraZeneca vaccine)<sup>89</sup></p>	-
<b>Pfizer/BioNTech or Johnson &amp; Johnson followed by Moderna</b>	-	USA: Trial underway with 12-20 week dose interval <sup>93</sup>	-
<b>AstraZeneca, Moderna and Pfizer/BioNTech</b>	-	Canada: Trial underway mixing and matching all three vaccines with study arms assessing 4 week and 16 week dose intervals <sup>94</sup>	AstraZeneca followed by either Moderna or Pfizer/BioNTech: Denmark, Finland, France, Germany, Sweden, Norway and Spain <sup>92</sup>

# Adverse Events Following Immunization with WHO EUL Vaccines

Adverse events following immunisation (AEFIs) are any reactions occurring after immunisation. They can be either expected or unexpected. The vaccine may not actually cause the AEFI; it may occur coincidentally as millions of people are being vaccinated so some people may get sick after vaccination but this does not necessarily mean that it is due to the vaccine. Special investigations determine whether they are due to the vaccine. Adverse events of special interest (AESIs) are of scientific and medical concern that are found through active surveillance, that have the potential to be causally associated with a vaccine and that need to be carefully monitored and confirmed by further special studies.

For all injectable vaccines, appropriate medical treatment and supervision should always be readily available in case of an anaphylactic event following administration.

	ASTRAZENECA	MODERNA	PFIZER/BIONTECH	JOHNSON & JOHNSON	SINOPHARM	SINOVAC
Adverse events following immunisation (AEFIs)*	Very common (more than 1 in 10 people): headache, nausea, muscle pain, joint pain, injection site tenderness/ pain/ warmth/ itch, fatigue, malaise, fever, chills Common (between 1 in 10 and 1 in 100 people): injection site swelling/ redness <sup>95</sup>	Injection site pain (92%)/ swelling (15%)/ redness (10%), fatigue (70%), headache (65%), muscle pain (62%), joint pain (46%), fever (16%), chills (45%), nausea/vomiting (23%), axillary swelling/tenderness (20%) <sup>96</sup>	Very common: headache, muscle pain, joint pain, injection site pain/ swelling, fatigue, fever, chills; Common: nausea, injection site redness <sup>95</sup> Uncommon (between 1 in 100 and 1 in 1000 people): lymphadenopathy, insomnia, pain in extremity of vaccinated arm, malaise, injection site itch; Rare: (between 1 in 1000 and 1 in 10,000): acute peripheral facial paralysis <sup>97</sup>	Injection site pain/ redness/ swelling, headache, fatigue, muscle pain, nausea, fever <sup>98</sup>	Injection site pain (16%)/ itch (1%)/ swelling (2%)/ redness (1%), fever (4%), fatigue (3%), nausea (1%), headache (1%), diarrhoea (1%), muscle pain (<1%), itch (non-injection site) (1%) <sup>99</sup>	Fatigue (8.3%), fever (3.3%), diarrhoea (0.8%), nausea (1.7%), headache (2.5%), muscle pain (1.7%), injection site pain (10.0%)/ redness (0%)/ swelling (0%) <sup>100</sup>
Adverse events of special interest (AESIs)	Thrombosis with thrombocytopenia syndrome (TTS) (see page 11 for estimated risk); Guillain-Barre syndrome <sup>101</sup>	Myocarditis; <sup>102</sup> USA: Myocarditis/pericarditis occurring in more than 1 in 20,000 males under 25 years of age following second dose of mRNA vaccine <sup>103</sup> Immune thrombocytopenia (ITP)** <sup>104</sup>	USA: Myocarditis or myopericarditis in 7 males aged 14-19 years within 4 days of the second dose – all cases resolved <sup>105</sup> USA: Myocarditis/pericarditis occurring in more than 1 in 20,000 males under 25 years of age following second dose of mRNA vaccine <sup>103</sup> Israel: Myocarditis estimated to occur in 1 in 3,000 to 1 in 6,000 men aged 16-24 following the second dose – mostly mild and resolved <sup>106</sup> ITP** <sup>104</sup>	TTS (see page 11 for estimated risk)	-	-

\*Details for AstraZeneca, Moderna, Pfizer/BioNTech and Johnson & Johnson from product information sheets in SRA countries, based on data from clinical trials; Sinopharm and Sinovac details from published clinical trials

\*\*The ITP cases are mostly without the thrombotic events characteristic of TTS

# Serious Adverse Events

Caution is required when comparing safety profiles as definitions and reporting systems vary in trials and in particular phase IV studies

VACCINE	VACCINE SAFETY
<b>AstraZeneca</b>	<p>108 SAEs in 12,282 (0.9%) vaccine recipients and 127 in 11,962 (1.1%) placebo recipients            12 thromboembolic events (4 vaccine; 8 placebo)            7 deaths, all considered unrelated to vaccination (2 vaccine, 5 placebo)<sup>12</sup></p> <p>US Phase III study: No serious safety concerns involving 32,449 participants<sup>13</sup> (not peer-reviewed)</p> <p>EMA investigation: possible link between the AstraZeneca vaccine and Thrombosis with Thrombocytopenia Syndrome (TTS)            Blood clots affected the brain (central venous sinus thrombosis, CVST) and abdomen (splanchnic vein thrombosis)            There have been reports of 169 cases of CVST and 53 cases of splanchnic vein thrombosis in ~34 million vaccinated people in Europe            The EMA confirmed the overall benefits of the vaccine in preventing COVID-19 outweigh the risks of side effects<sup>6</sup></p> <p>TTS reported to occur in ~1 in 66,000 vaccinated adults in Australia<sup>9</sup></p> <p>Several countries have recommended that only older adults should receive the vaccine (including only those aged over 60 years in Germany and Australia; over 55 years in France and Canada; and over 40 years in the UK<sup>107-109</sup>)</p> <p>EMA has started a review of reports of capillary leak syndrome following 5 cases of this very rare disorder post vaccination<sup>110</sup></p>
<b>Gamaleya</b>	<p>45 SAEs in 16,427 (0.3%) vaccine recipients and 23 in 5,435 (0.4%) placebo recipients; all SAEs considered unrelated to vaccination;            4 deaths, all considered unrelated to vaccination (3 vaccine, 1 placebo)<sup>14</sup></p>
<b>Johnson &amp; Johnson</b>	<p>83 SAEs in 21,895 (0.4%) vaccine recipients and 96 SAEs in 21,888 placebo recipients (0.4%)            19 deaths all considered unrelated to vaccination (3 vaccine, 16 placebo)<sup>16</sup></p> <p>EMA investigation of 8 reports of TTS: possible link between the Johnson &amp; Johnson vaccine and TTS. Most cases occurred in women &lt;60 years of age but specific risk factors have not been confirmed<sup>7</sup></p> <p>The CDC and FDA have now recommenced the vaccination program in the USA following a thorough safety review<sup>111</sup>            15 cases of TTS have been reported in 7.98 million people vaccinated in USA<sup>5</sup></p>
<b>Moderna</b>	<p>153 SAEs in 15,166 (1.0%) placebo recipients and 147 in 15,185 (1.0%) vaccine recipients            5 deaths considered unrelated to vaccine (2 vaccine, 3 placebo)<sup>17</sup></p> <p>Anaphylaxis reported in the US at a rate of 2.5 per million doses<sup>112</sup></p> <p>No obvious safety signals among pregnant women who received mRNA COVID-19 vaccines in USA<sup>113</sup></p> <p>Myocarditis/pericarditis reported in more than 1 in 20,000 males under 25 years of age following second dose of mRNA vaccine<sup>103</sup></p>
<b>Novavax</b>	<p>SAEs at low levels and similar between vaccine and placebo groups<sup>114</sup></p>
<b>Pfizer/BioNTech</b>	<p>SAEs and deaths were low and comparable between vaccine and placebo groups (total 37,586 participants)<sup>22</sup>            Anaphylaxis reported in the US at a rate of 4.7 per million doses<sup>112</sup></p> <p>No obvious safety signals among pregnant women who received mRNA COVID-19 vaccines in USA<sup>113</sup></p> <p>Myocarditis/pericarditis reported in more than 1 in 20,000 males under 25 years of age following second dose of mRNA vaccine<sup>103</sup></p>

# Risk of Rare Unusual Blood Clotting with Low Blood Platelets (Thrombosis with Thrombocytopenia Syndrome – TTS)

Estimated number of TTS that potentially might occur in Pacific Island Countries if all adults received the AstraZeneca or Johnson & Johnson vaccines, based on most recent official estimate of the adult population in each country and the incidence of these events in Europe and Australia.

COUNTRY	TOTAL POPULATION	ESTIMATED POPULATION AGED 18 YEARS AND OVER*	POTENTIAL NUMBER OF TTS CASES IF ALL ADULTS IN EACH COUNTRY RECEIVED ASTRAZENECA VACCINE**	POTENTIAL NUMBER OF TTS CASES IF ALL ADULTS IN EACH COUNTRY RECEIVED JOHNSON & JOHNSON VACCINE***
American Samoa	55,519	33,311	<1	<1
Cook Islands	15,300	9,180	<1	<1
Federated States of Micronesia	102,300	61,380	0.6-1.0	<1
Fiji	867,000	520,200	5.2-8.3	1.6
French Polynesia	275,918	165,551	1.7-2.6	<1
Guam	159,358	95,615	1.0-1.5	<1
Kiribati	113,400	68,040	0.7-1.1	<1
Marshall Islands	54,900	32,940	<1	<1
Nauru	10,900	6,540	<1	<1
New Caledonia	271,407	162,844	1.6-2.6	<1
Niue	1,611	967	<1	<1
Northern Mariana Islands	53,883	32,330	<1	<1
Palau	18,000	10,800	<1	<1
Papua New Guinea	7,744,700	4,646,820	46.5-73.8	14.6
Samoa	195,979	117,587	1.2-1.9	<1
Solomon Islands	642,000	385,200	3.9-6.1	1.2
Tokelau	1,160	696	<1	<1
Tonga	99,419	59,651	<1	<1
Tuvalu	10,507	6,304	<1	<1
Vanuatu	272,173	163,304	1.6-2.6	<1
Wallis and Futuna	11,558	6,935	<1	<1
<b>All Pacific Island Countries</b>	<b>10,976,992</b>	<b>6,586,195</b>	<b>65.9-104.5</b>	<b>20.8</b>

\* Based on estimate of 60% of population aged ≥18 years<sup>115</sup>

\*\* Based on estimates of TTS occurring in ~1 in 100,000 vaccinated adults by the European Medicines Agency and ~1 in 66,000 in Australia<sup>8,9</sup>

\*\*\* Based on estimates of TTS occurring in ~1 in 319,000 vaccinated adults in USA (may be an underestimate as only cerebral venous sinus thrombosis are reported)<sup>11</sup>

# Who Can be Vaccinated Based on WHO SAGE Recommendations?

So far, WHO SAGE have made recommendations for use of AstraZeneca, Moderna, Pfizer/BioNTech, Johnson & Johnson and Sinopharm vaccines:  
<https://www.who.int/groups/strategic-advisory-group-of-experts-on-immunization/covid-19-materials>

	ASTRAZENECA	MODERNA	PFIZER/BIONTECH	JOHNSON & JOHNSON	SINOPHARM	SINOVAC
Minimum Age	18 years	18 years	12 years	18 years	18 years	18 years
Maximum Age (SAGE WHO)	None	None	None	None	None	None
Pregnancy	Yes if high priority group & approved by health provider	Yes if high priority group & approved by health provider	Yes if high priority group & approved by health provider	Yes if high priority group & approved by health provider	Yes if high priority group & approved by health provider	Yes if high priority group & approved by health provider
Breastfeeding	Yes	Yes	Yes	Yes	Yes	Yes
Immunocompromised Including HIV	✓	✓	✓	✓	✓	✓
People Previously Infected by SARS-CoV-2 (PCR Confirmed)	Yes, although that person may choose to delay vaccination by 6 months	Yes, although that person may choose to delay vaccination by 6 months	Yes, although that person may choose to delay vaccination by 6 months	Yes, although that person may choose to delay vaccination by 6 months	Yes, although that person may choose to delay vaccination by 6 months	Yes, although that person may choose to delay vaccination by 6 months
History of Anaphylaxis (Severe Allergy)	Yes (unless the allergy is to the vaccine or its components)	Yes (unless the allergy is to the vaccine or its components)	Yes (unless the allergy is to the vaccine or its components)	Yes (unless the allergy is to the vaccine or its components)	Yes (unless the allergy is to the vaccine or its components)	Yes (unless the allergy is to the vaccine or its components)

# Vaccine Development Pipeline

WHO has recommended that vaccines adopted by countries have WHO SAGE EUL and/or Stringent Regulatory Approval.

VACCINE TYPE	NUMBER OF VACCINE CANDIDATES AT EACH PHASE OF DEVELOPMENT				
	PRE-CLINICAL	PHASE I/II	PHASE III	PHASE IV	IN USE*
RNA	25	10	2	2	2 (Pfizer/BioNTech, Moderna)
DNA	17	7	3	0	0
Vector (non-replicating)	27	7	2	3	4 (CanSino, Gamaleya, Johnson & Johnson, AstraZeneca)
Vector (replicating)	18	6	0	0	0
Inactivated	8	6	8	2	8 (Sinopharm/BIBP; Sinopharm/WIBP; Sinovac; Bharat; Chumakov; Research Institute for Biological Safety Problems; Shenzhen Kangtai Biological Products; Shifa Pharmed)
Live-attenuated	2	1	0	0	0
Protein subunit	73	20	9	1	4 (Vector institute; Anhui Zhifei Longcom Biopharmaceutical Chinese Academy of sciences; Center for Genetic Engineering and Biotechnology; Instituto Finlay de Vacunas Cuba)
Virus-like particle	20	4	1	0	0
Other/unknown	33	5	0	0	0

\*Not all vaccines in use have SRA (as recognised by WHO) approval (see Vaccine specifications table and WHO SAGE Emergency Use Listing and prequalification timeline for approval status of vaccines).

Source: London School of Hygiene and Tropical Medicine COVID-19 vaccine tracker.

# WHO SAGE Emergency Use Listing and Prequalification Timeline

MANUFACTURER	NAME OF VACCINE	PLATFORM	STATUS OF ASSESSMENT	ANTICIPATED DECISION DATE
Pfizer/BioNTech	BNT162b2/COMIRNATY Tozinameran (INN)	mRNA	Final decision made	Authorised 31/12/20
AstraZeneca	AZD1222	Adenoviral vector	Final decision made	SK Bio: Authorised 15/02/21 EU nodes: Authorised 16/04/21
Serum Institute of India	Covishield (ChAdOx1_nCoV19)	Adenoviral vector	Final decision made	Authorised 15/02/21
Sinopharm/Beijing Institute of Biological Products (BIBP)	SARS-CoV-2 Vaccine (Vero Cell), Inactivated (InCoV)	Inactivated	In progress	Authorised: 07/05/2021
Sinovac	SARS-CoV-2 Vaccine (Vero Cell), Inactivated	Inactivated	In progress	Authorised 01/06/2021
Moderna	mRNA-1273	mRNA	In progress (to use abridged procedure relying on EMA)	Authorised 30/04/2021
Johnson & Johnson	Ad26.COV2.S	Adenoviral vector	Final decision made	Authorised 12/03/21
The Gamaleya National Center	Sputnik V	Adenoviral vector	Additional data required; review ongoing	Will be determined when all data are submitted
CanSinoBIO	Ad5-nCoV	Adenoviral vector	Rolling data assessment starting June 2021	-
Novavax	NVX-CoV2373	Protein subunit	Expression of interest accepted; Pre-submission meeting held	-
CureVac	Zorecimeran	mRNA	Expression of interest accepted; Pre-submission meeting planned for 28 July 2021	-

Source: WHO Guidance Document: Status of COVID-19 Vaccines within WHO EUL/PQ evaluation process. Available at: <https://www.who.int/teams/regulation-prequalification/eul/covid-19>

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# References

- Wallace M, Woodworth KR, Gargano JW, et al. The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine in Adolescents Aged 12–15 Years — United States, May 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70(20):749–752. doi:10.15585/mmwr.mm7020e1
- UK Government Medicines and Healthcare Products Regulatory Agency (MHRA). The MHRA concludes positive safety profile for Pfizer/BioNTech vaccine in 12- to 15-year-olds. 4 June 2021. Available at: <https://www.gov.uk/government/news/the-mhra-concludes-positive-safety-profile-for-pfizerbiontech-vaccine-in-12-to-15-year-olds>.
- European Medicines Agency (EMA). AstraZeneca's COVID-19 vaccine approved for children aged 12 to 15 in EU 28 May 2021. Available at: <https://www.ema.europa.eu/en/news/first-covid-19-vaccine-approved-children-aged-12-15-eu>.
- Government of Canada. Health Canada authorizes use of the Pfizer-BioNTech COVID-19 vaccine in children 12 to 15 years of age - 5 May 2021. Available at: <https://www.canada.ca/en/health-canada/news/2021/05/health-canada-authorizes-use-of-the-pfizer-biontech-covid-19-vaccine-in-children-12-to-15-years-of-age.html>.
- Center for Disease Control (CDC) Advisory Committee on Immunization Practices (ACIP). Thrombosis with thrombocytopenia syndrome (TTS) following Janssen COVID-19 vaccine 23 April 2021. Available at: <https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-04-23/03-COVID-Shimabukuro-508.pdf>.
- European Medicines Agency (EMA). AstraZeneca's COVID-19 vaccine: EMA finds possible link to very rare cases of unusual blood clots with low blood platelets 7 April 2021. Available at: <https://www.ema.europa.eu/en/news/astrazenecas-covid-19-vaccine-ema-finds-possible-link-very-rare-cases-unusual-blood-clots-low-blood>.
- European Medicines Agency (EMA). COVID-19 Vaccine Janssen: EMA finds possible link to very rare cases of unusual blood clots with low blood platelets 20 April 2021. Available at: <https://www.ema.europa.eu/en/news/covid-19-vaccine-janssen-ema-finds-possible-link-very-rare-cases-unusual-blood-clots-low-blood>.
- European Medicines Agency (EMA) press release. AstraZeneca's COVID-19 vaccine: benefits and risks in context 23 April 2021. Available at: <https://www.ema.europa.eu/en/news/astrazenecas-covid-19-vaccine-benefits-risks-context>.
- Australian Government Therapeutic Goods Administration (TGA). COVID-19 vaccine weekly safety report - 17-06-2021. Available at: <https://www.tga.gov.au/periodic/covid-19-vaccine-weekly-safety-report-17-06-2021>.
- UK Government Medicines and Healthcare Products Regulatory Agency. Coronavirus vaccine - weekly summary of Yellow Card reporting 17 June 2021. <https://www.gov.uk/government/publications/coronavirus-covid-19-vaccine-adverse-reactions/coronavirus-vaccine-summary-of-yellow-card-reporting>.
- Centers for Disease Control and Prevention (CDC). Selected Adverse Events Reported after COVID-19 Vaccination. Updated 27 May 2021. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/adverse-events.html>.
- Voysey M, Costa Clemens SA, Madhi SA, et al. Single-dose administration and the influence of the timing of the booster dose on immunogenicity and efficacy of ChAdOx1 nCoV-19 (AZD1222) vaccine: a pooled analysis of four randomised trials. *Lancet.* 2021;397(10277):881–891. doi:10.1016/S0140-6736(21)00432-3
- AstraZeneca press release. AZD1222 US Phase III primary analysis confirms safety and efficacy 25 March 2021. Available at: <https://www.astrazeneca.com/media-centre/press-releases/2021/azd1222-us-phase-iii-primary-analysis-confirms-safety-and-efficacy.html#:~:text=Positive high-level results from, on Monday 22 March 2021.&text=The vaccine was well tolerated, to the vaccine were>.
- Logunov DY, Dolzhikova I V, Shchepilyakov D V, et al. Safety and efficacy of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine. *Lancet.* 2021.
- Russian Direct Investment Fund Press Release 2 June 2021. Sputnik Light (the first component of Sputnik V vaccine) demonstrates 78.6–83.7% efficacy among the elderly in Argentina. Available at: <https://sputnikvaccine.com/newsroom/pressreleases/sputnik-light-vaccine-the-first-component-of-sputnik-v-vaccine-demonstrates-78-6-83-7-efficacy-among/>.
- US federal Drug Administration (FDA) Briefing Document Janssen Ad26.COV2.S Vaccine for the Prevention of COVID-19. Vaccines and Related Biological Products Advisory Committee Meeting February 26, 2021. Available at: <https://www.fda.gov/media/146217/download>.
- Baden LR, El Sahly HM, Essink B, et al. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine. *N Engl J Med.* 2021. doi:10.1056/nejmoa2035389
- Moderna press release. Moderna Provides Clinical and Supply Updates on COVID-19 Vaccine Program Ahead of 2nd Annual Vaccines Day 13 April 2021. Available at: <https://investors.modernatx.com/news-releases/news-release-details/moderna-provides-clinical-and-supply-updates-covid-19-vaccine>.
- Moderna press release. Moderna Announces TeenCOVE Study of its COVID-19 Vaccine in Adolescents Meets Primary Endpoint and Plans to Submit Data to Regulators in Early June 25 May 2021. Available at: <https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-teencove-study-its-covid-19-vaccine>.
- Heath PT, Galiza EP, Baxter DN, et al. Safety and Efficacy of NVX-CoV2373 Covid-19 Vaccine. *N Engl J Med.* June 2021;NEJMoa2107659. doi:10.1056/NEJMoa2107659
- Novavax press release. Novavax COVID-19 Vaccine Demonstrates 90% Overall Efficacy and 100% Protection Against Moderate and Severe Disease in PREVENT-19 Phase 3 Trial. 14 June 2021. Available at: <https://ir.novavax.com/news-releases/news-release-details/novavax-covid-19-vaccine-demonstrates-90-overall-efficacy-and>.
- World Health Organisation (WHO). *Background Document on the mRNA Vaccine BNT162b2 (Pfizer-BioNTech) against COVID-19.*; 2021. [https://www.who.int/publications/i/item/background-document-on-mrna-vaccine-bnt162b2-\(pfizer-biontech\)-against-covid-19](https://www.who.int/publications/i/item/background-document-on-mrna-vaccine-bnt162b2-(pfizer-biontech)-against-covid-19).
- Mahase E. Covid-19: Pfizer reports 100% vaccine efficacy in children aged 12 to 15. *BMJ.* April 2021:n881. doi:10.1136/bmj.n881
- World Health Organisation Extraordinary meeting of the Strategic Advisory Group of Experts on Immunization (SAGE) – 29 April 2021. Available at: [https://www.who.int/news-room/events/detail/2021/04/29/default-calendar/extraordinary-meeting-of-the-strategic-advisory-group-of-experts-on-immunization-\(sage\)-29-april-2021](https://www.who.int/news-room/events/detail/2021/04/29/default-calendar/extraordinary-meeting-of-the-strategic-advisory-group-of-experts-on-immunization-(sage)-29-april-2021).
- Palacios R, Batista AP, Albuquerque CSN, et al. Efficacy and Safety of a COVID-19 Inactivated Vaccine in Healthcare Professionals in Brazil: The PROFISCOV Study. *SSRN Electron J.* 2021.
- Vasileiou E, Simpson CR, Robertson C, et al. Effectiveness of First Dose of COVID-19 Vaccines Against Hospital Admissions in Scotland: National Prospective Cohort Study of 5.4 Million People. *SSRN Electron J.* 2021. doi:10.2139/ssrn.3789264
- Bernal J, Andrews N, Gower C, et al. Effectiveness of BNT162b2 mRNA vaccine and ChAdOx1 adenovirus vector vaccine on mortality following COVID-19. *Prepr medRxiv.* doi:10.1101/2021.05.14.21257218
- Martinez-Baz I, Miqueleiz A, Casado I, et al. Effectiveness of COVID-19 vaccines in preventing SARS-CoV-2 infection and hospitalisation, Navarre, Spain, January to April 2021. *Eurosurveillance.* 2021;26(21). doi:10.2807/1560-7917.ES.2021.26.21.2100438
- Mateo-Urdiales A, Spila Alegiani S, Fabiani M, et al. Risk of SARS-CoV-2 infection and subsequent hospital admission and death at different time intervals since first dose of COVID-19 vaccine administration, Italy, 27 December 2020 to mid-April 2021. *Eurosurveillance.* 2021;26(25). doi:10.2807/1560-7917.ES.2021.26.25.2100507
- University College London press release. Covid-19 vaccine: care home residents gain 62% protection from one dose. 29 March 2021.
- Pritchard E, Matthews PC, Stoesser N, et al. Impact of vaccination on SARS-CoV-2 cases in the community: a population-based study using the UK's COVID-19 Infection Survey. *medRxiv.* January 2021:2021.04.22.21255913. doi:10.1101/2021.04.22.21255913
- Corchado-Garcia J, Puyraimond-Zemmour D, Hughes T, et al. Real-world effectiveness of Ad26.COV2.S adenoviral vector vaccine for COVID-19. *medRxiv.* January 2021:2021.04.27.21256193. doi:10.1101/2021.04.27.21256193
- Daniel W, Nivet M, Warner J, Podolsky DK. Early Evidence of the Effect of SARS-CoV-2 Vaccine at One Medical Center. *N Engl J Med.* March 2021;NEJM2102153. doi:10.1056/NEJM2102153
- Thompson MG, Burgess JL, Naleway AL, et al. Interim Estimates of Vaccine Effectiveness of BNT162b2 and mRNA-1273 COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Health Care Personnel, First Responders, and Other Essential and Frontline Workers — Eight U.S. Locations, December 2020–March . *MMWR Morb Mortal Wkly Rep.* 2021;70(13):495–500. doi:10.15585/mmwr.mm7013e3
- Public Health England. COVID-19 vaccine surveillance report: 1 July 2021 (week 26). Available at: <https://www.gov.uk/government/publications/covid-19-vaccine-surveillance-report>.
- Dagan N, Barda N, Kepten E, et al. BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Mass Vaccination Setting. *N Engl J Med.* February 2021;NEJMoa2101765. doi:10.1056/NEJMoa2101765
- Haas EJ, Angulo FJ, McLaughlin JM, et al. Impact and effectiveness of mRNA BNT162b2 vaccine against SARS-CoV-2 infections and COVID-19 cases, hospitalisations, and deaths following a nationwide vaccination campaign in Israel: an observational study using national surveillance data. *Lancet.* 2021;397(10287):1819–1829. doi:10.1016/S0140-6736(21)00947-8
- Emborg H-D, Valentiner-Branth P, Schelde AB, et al. Vaccine effectiveness of the BNT162b2 mRNA COVID-19 vaccine against RT-PCR confirmed SARS-CoV-2 infections, hospitalisations and mortality in prioritised risk groups. *medRxiv.* January 2021:2021.05.27.21257583. doi:10.1101/2021.05.27.21257583
- Uruguay Ministry of Public Health. Third study of effectiveness of vaccination against SARS-CoV-2 in Uruguay as of June 30, 2021. Press release 3 July 2021. Available at: <https://www.gub.uy/ministerio-salud-publica/comunicacion/noticias/segundo-estudio-efectividad-vacunacion-anti-sars-cov-2-uruguay-8-junio-2021>.
- Saciuk Y, Kertes J, Mandel M, Hemo B, Shamir Stein N, Zohar AE. Pfizer-BioNTech Vaccine Effectiveness Against SARS-CoV-2 Infection: Findings From a Large Observational Study in Israel. *SSRN Electron J.* 2021. doi:10.2139/ssrn.3868853

41. Chodick G, Tene L, Rotem RS, et al. The effectiveness of the TWO-DOSE BNT162b2 vaccine: analysis of real-world data. *Clin Infect Dis*. May 2021. doi:10.1093/cid/ciab438
42. Benenson S, Oster Y, Cohen MJ, Nir-Paz R. BNT162b2 mRNA Covid-19 Vaccine Effectiveness among Health Care Workers. *N Engl J Med*. March 2021;NEJMc2101951. doi:10.1056/NEJMc2101951
43. Tang L, Hijano DR, Gaur AH, et al. Asymptomatic and Symptomatic SARS-CoV-2 Infections After BNT162b2 Vaccination in a Routinely Screened Workforce. *JAMA*. May 2021. doi:10.1001/jama.2021.6564
44. Moustsen-Helms IR, Emborg H-D, Nielsen J, et al. Vaccine effectiveness after 1st and 2nd dose of the BNT162b2 mRNA Covid-19 Vaccine in long-term care facility residents and healthcare workers – a Danish cohort study. *medRxiv*. January 2021;2021.03.08.21252200. doi:10.1101/2021.03.08.21252200
45. Britton A, Jacobs Slika KM, Edens C, et al. Effectiveness of the Pfizer-BioNTech COVID-19 Vaccine Among Residents of Two Skilled Nursing Facilities Experiencing COVID-19 Outbreaks — Connecticut, December 2020–February 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(11):396–401. doi:10.15585/mmwr.mm7011e3
46. Cavanaugh AM, Fortier S, Lewis P, et al. COVID-19 Outbreak Associated with a SARS-CoV-2 R.1 Lineage Variant in a Skilled Nursing Facility After Vaccination Program — Kentucky, March 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(17):639–643. doi:10.15585/mmwr.mm7017e2
47. Government of Chile Ministry of Health. Effectiveness of the inactivated CoronaVac vaccine against SARSCoV-2 in Chile Preliminary report April 16 2021.
48. World Health Organisation (WHO). Weekly epidemiological update on COVID-19 - 11 May 2021. Available at: <https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---11-may-2021>.
49. World Health Organisation (WHO). Tracking SARS-CoV-2 variants. Available at: <https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/>.
50. Emary KRW, Golubchik T, Aley PK, et al. Efficacy of ChAdOx1 nCoV-19 (AZD1222) vaccine against SARS-CoV-2 variant of concern 202012/01 (B.1.1.7): an exploratory analysis of a randomised controlled trial. *Lancet*. March 2021. doi:10.1016/S0140-6736(21)00628-0
51. Bernal J, Andrews N, Gower C, et al. Effectiveness of COVID-19 vaccines against the B.1.617.2 variant. *Khuf Preprint*. Available at: <https://khuf.net/documents/135939561/430986542/Effectiveness+of+COVID-19+vaccines+against+the+B.1.617.2+variant.pdf/204c11a4-e02e-11f2-db19-b3664107ac42>.
52. Sheikh A, McMennamin J, Taylor B, Robertson C. SARS-CoV-2 Delta VOC in Scotland: demographics, risk of hospital admission, and vaccine effectiveness. *Lancet*. June 2021. doi:10.1016/S0140-6736(21)01358-1
53. Madhi SA, Baillie V, Cutland CL, et al. Safety and efficacy of the ChAdOx1 nCoV-19 (AZD1222) Covid-19 vaccine against the B.1.351 variant in South Africa. *Alex Sigal*. 2021.
54. Public Health England (PHE) press release. Vaccines highly effective against hospitalisation from Delta variant. Available at: <https://www.gov.uk/government/news/vaccines-highly-effective-against-hospitalisation-from-delta-variant>.
55. Shinde V, Bhikha S, Hoosain Z, et al. Efficacy of NVX-CoV2373 Covid-19 Vaccine against the B.1.351 Variant. *N Engl J Med*. May 2021;NEJMoa2103055. doi:10.1056/NEJMoa2103055
56. Kustin T, Harel N, Finkel U, et al. Evidence for increased breakthrough rates of SARS-CoV-2 variants of concern in BNT162b2 mRNA vaccinated individuals. *medRxiv*. January 2021;2021.04.06.21254882. doi:10.1101/2021.04.06.21254882
57. Abu-Raddad LJ, Chemaitelly H, Butt AA. Effectiveness of the BNT162b2 Covid-19 Vaccine against the B.1.1.7 and B.1.351 Variants. *N Engl J Med*. May 2021;NEJMc2104974. doi:10.1056/NEJMc2104974
58. Hitchings MDT, Ranzani OT, Scaramuzzini Torres MS, et al. Effectiveness of CoronaVac in the setting of high SARS-CoV-2 P.1 variant transmission in Brazil: A test-negative case-control study. *medRxiv*. January 2021;2021.04.07.21255081. doi:10.1101/2021.04.07.21255081
59. Ranzani OT, Hitchings M, Nieto MD, et al. Effectiveness of the CoronaVac vaccine in the elderly population during a P.1 variant-associated epidemic of COVID-19 in Brazil: A test-negative case-control study. *medRxiv*. January 2021;2021.05.19.21257472. doi:10.1101/2021.05.19.21257472
60. Ismail S, Vilaplana T, Elgohari S, et al. Effectiveness of BNT162b2 mRNA and ChAdOx1 adenovirus vector COVID-19 vaccines on risk of hospitalisation among older adults in England: an observational study using surveillance data. *Khuf Prepr* <https://khuf.net/documents/135939561/430986542/Effectiveness%2Bof%2BBNT162b2%2BmRNA%2BAnd%2BChAdOx1%2BAdenovirus%2Bvector%2BCOVID-19%2Bvaccines%2BOn%2Brisk%2Bof%2Bhospitalisation%2BAmong%2Bolder%2BAdults%2Bin%2BEngland.pdf/9e18c525-dde6-5ee4>.
61. Lopez Bernal J, Andrews N, Gower C, et al. Effectiveness of the Pfizer-BioNTech and Oxford-AstraZeneca vaccines on covid-19 related symptoms, hospital admissions, and mortality in older adults in England: test negative case-control study. *BMJ*. May 2021;n1088. doi:10.1136/bmj.n1088
62. Hyams C, Marlow R, Maseko Z, et al. Effectiveness of BNT162b2 and ChAdOx1 nCoV-19 COVID-19 vaccination at preventing hospitalisations in people aged at least 80 years: a test-negative, case-control study. *Lancet Infect Dis*. June 2021. doi:10.1016/S1473-3099(21)00330-3
63. 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(18). doi:10.15585/mmwr.mm7018e1
64. Mason T, Whitton M, Hodgson J, et al. Effects of BNT162b2 mRNA vaccine on Covid-19 infection and hospitalisation among older people: matched case control study for England. *medRxiv*. January 2021;2021.04.19.21255461. doi:10.1101/2021.04.19.21255461
65. Rossman H, Shilo S, Meir T, Gorfine M, Shalit U, Segal E. COVID-19 dynamics after a national immunization program in Israel. *Nat Med*. April 2021. doi:10.1038/s41591-021-01337-2
66. Harris RJ, Hall JA, Zaidi A, Andrews NJ, Dunbar JK, Dabrera G. Effect of Vaccination on Household Transmission of SARS-CoV-2 in England. *N Engl J Med*. June 2021;NEJMc2107717. doi:10.1056/NEJMc2107717
67. V Shah AS, Gribben C, Bishop J, et al. Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households. *medRxiv*. January 2021;2021.03.11.21253275. doi:10.1101/2021.03.11.21253275
68. Shrotri M, Krutikov M, Palmer T, et al. Vaccine effectiveness of the first dose of ChAdOx1 nCoV-19 and BNT162b2 against SARS-CoV-2 infection in residents of long-term care facilities in England (VIVALDI): a prospective cohort study. *Lancet Infect Dis*. June 2021;2021.03.26.21254391. doi:10.1016/S1473-3099(21)00289-9
69. Pritchard E, Matthews PC, Stoesser N, et al. Impact of vaccination on new SARS-CoV-2 infections in the United Kingdom. *Nat Med*. June 2021. doi:10.1038/s41591-021-01410-w
70. Menni C, Klaser K, May A, et al. Vaccine side-effects and SARS-CoV-2 infection after vaccination in users of the COVID Symptom Study app in the UK: a prospective observational study. *Lancet Infect Dis*. 2021;71(7):939–949. doi:10.1016/S1473-3099(21)00224-3
71. Pawlowski C, Lenehan P, Puranik A, et al. FDA-authorized COVID-19 vaccines are effective per real-world evidence synthesized across a multi-state health system. *medRxiv*. January 2021;2021.02.15.21251623. doi:10.1101/2021.02.15.21251623
72. Thompson MG, Burgess JL, Naleway AL, et al. Interim Estimates of Vaccine Effectiveness of BNT162b2 and mRNA-1273 COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Health Care Personnel, First Responders, and Other Essential and Frontline Workers.
73. Tande AJ, Pollock BD, Shah ND, et al. Impact of the COVID-19 Vaccine on Asymptomatic Infection Among Patients Undergoing Pre-Procedural COVID-19 Molecular Screening. *Clin Infect Dis*. March 2021. doi:10.1093/cid/ciab229
74. White EM, Yang X, Blackman C, Feifer RA, Gravenstein S, Mor V. Incident SARS-CoV-2 Infection among mRNA-Vaccinated and Unvaccinated Nursing Home Residents. *N Engl J Med*. May 2021;NEJMc2104849. doi:10.1056/NEJMc2104849
75. Lipsitch M, Kahn R. Interpreting vaccine efficacy trial results for infection and transmission. *Vaccine*. June 2021. doi:10.1016/j.vaccine.2021.06.011
76. Hall VJ, Foulkes S, Saei A, et al. COVID-19 vaccine coverage in health-care workers in England and effectiveness of BNT162b2 mRNA vaccine against infection (SIREN): a prospective, multicentre, cohort study. *Lancet*. 2021;397(10286):1725–1735. doi:10.1016/S0140-6736(21)00790-X
77. Amit S, Regev-Yochay G, Afek A, Kreiss Y, Leshem E. Early rate reductions of SARS-CoV-2 infection and COVID-19 in BNT162b2 vaccine recipients. *Lancet*. 2021;397(10277):875–877. doi:10.1016/S0140-6736(21)00448-7
78. Michael Weekes, Nick K Jones, Lucy Rivett, et al. Single-dose BNT162b2 vaccine protects against asymptomatic SARS-CoV-2 infection. *Authora*. February 24, 2021. doi:10.22541/au.161420511
79. Salo J, Hägg M, Kortelainen M, et al. The indirect effect of mRNA-based Covid-19 vaccination on unvaccinated household members. *medRxiv*. January 2021;2021.05.27.21257896. doi:10.1101/2021.05.27.21257896
80. Regev-Yochay G, Amit S, Bergwerk M, et al. Decreased Infectivity Following BNT162b2 Vaccination. *SSRN Electron J*. 2021. doi:10.2139/ssrn.3815668
81. Christie A, Henley SJ, Mattocks L, et al. Decreases in COVID-19 Cases, Emergency Department Visits, Hospital Admissions, and Deaths Among Older Adults Following the Introduction of COVID-19 Vaccine — United States, September 6, 2020–May 1, 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(23):858–864. doi:10.15585/mmwr.mm7023e2
82. Levine-Tiefenbrun M, Yelin I, Katz R, et al. Initial report of decreased SARS-CoV-2 viral load after inoculation with the BNT162b2 vaccine. *Nat Med*. 2021;27(5):790–792. doi:10.1038/s41591-021-01316-7
83. Milman O, Yelin I, Aharony N, et al. SARS-CoV-2 infection risk among unvaccinated is negatively associated with community-level vaccination rates. *medRxiv*. January 2021;2021.03.26.21254394. doi:10.1101/2021.03.26.21254394
84. De Salazar PM, Link N, Lamarca K, Santillana M. High coverage COVID-19 mRNA vaccination rapidly controls SARS-CoV-2 transmission in Long-Term Care Facilities. *medRxiv*. January 2021;2021.04.08.21255108. doi:10.1101/2021.04.08.21255108
85. Government of Spain Ministry of Health and Innovation. The combined use of AstraZeneca and Pfizer vaccines against SARS-CoV-2 offers a powerful immune response. Press release 18 May 2021. Available at: <https://www.isciii.es/Noticias/Noticias/Paginas/Noticias/Presentación-resultados-preliminares-CombivacS.aspx>.
86. Shaw RH, Stuart A, Greenland M, Liu X, Van-Tam JSN, Snape MD. Heterologous prime-boost COVID-19 vaccination: initial reactogenicity data. *Lancet*. 2021;397(10289):2043–2046. doi:10.1016/S0140-6736(21)01115-6

87. Hillus D. Reactogenicity of homologous and heterologous prime-boost immunisation with BNT162b2 and ChAdOx1-nCoV19: a prospective cohort study. *medRxiv Prepr*. doi:doi.org/10.1101/2021.05.19.21257334
88. Borobia AM, Carcas AJ, Pérez Olmeda MT, et al. Reactogenicity and Immunogenicity of BNT162b2 in Subjects Having Received a First Dose of ChAdOx1s: Initial Results of a Randomised, Adaptive, Phase 2 Trial (CombiVacS). *SSRN Electron J*. 2021. doi:10.2139/ssrn.3854768
89. Liu X, Shaw RH, Stuart AS, et al. Safety and Immunogenicity Report from the Com-COV Study – a Single-Blind Randomised Non-Inferiority Trial Comparing Heterologous And Homologous Prime-Boost Schedules with An Adenoviral Vectored and mRNA COVID-19 Vaccine. *SSRN Electron J*. 2021. doi:10.2139/ssrn.3874014
90. Schmidt T, Klemis V, Schub D, et al. Immunogenicity and reactogenicity of a heterologous COVID-19 prime-boost vaccination compared with homologous vaccine regimens. *medRxiv*. January 2021:2021.06.13.21258859. doi:10.1101/2021.06.13.21258859
91. Barros-Martins J, Hammerschmidt SI, Cossmann A, et al. Humoral and cellular immune response against SARS-CoV-2 variants following heterologous and homologous ChAdOx1 nCoV-19/BNT162b2 vaccination. *medRxiv*. January 2021:2021.06.01.21258172. doi:10.1101/2021.06.01.21258172
92. Public Health Agency of Canada. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI) Recommendations on the use of COVID-19 Vaccines. 17 June 2021. Available at: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/recommendations-use-covid-19-vaccines-en.pdf>.
93. United States National Institutes of Health (NIH) press release. NIH clinical trial evaluating mixed COVID-19 vaccine schedules begins. Available at: <https://clinicaltrials.gov/ct2/show/NCT04894435?term=mixed+schedule%2C+covid19%2C+vaccine&draw=2&rank=1>.
94. US National Library of Medicine ClinicalTrials.gov. Mix and Match of the Second COVID-19 Vaccine Dose for Safety and Immunogenicity (MOSAIC). Available at: <https://clinicaltrials.gov/ct2/show/NCT04894435?term=mixed+schedule%2C+covid19%2C+vaccine&draw=2&rank=1>.
95. Australian Government Therapeutic Goods Administration (TGA). Australian Product Information - COVID-19 Vaccine AstraZeneca (ChAdOx1-S) solution for injection. Available at: <https://www.ebs.tga.gov.au/ebs/picmi/picmirepository.nsf/pdf?OpenAgent&id=CP-2021-PI-01194-1&d=202105261016933>.
96. US Federal Drug Administration (FDA). Fact sheet for healthcare providers administering vaccine (vaccination providers) emergency use authorisation (EUA) of the Moderna COVID-19 vaccine to prevent coronavirus disease 2019 (COVID-19). Available at: <https://www.modernatx.com/covid19vaccine-eua/eua-fact-sheet-providers.pdf>.
97. Australian Government Therapeutic Goods Administration (TGA). Australian Product Information - Comirnaty (BNT162b2 [mRNA]) COVID-19 Vaccine. Available at: <https://www.ebs.tga.gov.au/ebs/picmi/picmirepository.nsf/pdf?OpenAgent&id=CP-2021-PI-01092-1>.
98. US Federal Drug Administration (FDA). Fact sheet for healthcare providers administering vaccine (vaccination providers). Emergency use authorisation (EUA) of the Janssen COVID-19 vaccine to prevent coronavirus disease 2019 (COVID-19). Available at: <https://www.janssenlabels.com/emergency-use-authorization/Janssen+COVID-19+Vaccine-HCP-fact-sheet.pdf>.
99. Xia S, Zhang Y, Wang Y, et al. Safety and immunogenicity of an inactivated SARS-CoV-2 vaccine, BBIBP-CorV: a randomised, double-blind, placebo-controlled, phase 1/2 trial. *Lancet Infect Dis*. 2021;21(1):39-51. doi:10.1016/S1473-3099(20)30831-8
100. Zhang Y, Zeng G, Pan H, et al. Safety, tolerability, and immunogenicity of an inactivated SARS-CoV-2 vaccine in healthy adults aged 18–59 years: a randomised, double-blind, placebo-controlled, phase 1/2 clinical trial. *Lancet Infect Dis*. 2021;21(2):181-192. doi:10.1016/S1473-3099(20)30843-4
101. European Medicines Agency (EMA). Meeting highlights from the Pharmacovigilance Risk Assessment Committee (PRAC) 3-6 May 2021. Available at: <https://www.ema.europa.eu/en/news/meeting-highlights-pharmacovigilance-risk-assessment-committee-prac-3-6-may-2021>.
102. World Health Organisation (WHO). COVID-19 subcommittee of the WHO Global Advisory Committee on Vaccine Safety (GACVS) reviews cases of mild myocarditis reported with COVID-19 mRNA vaccines. Available at: <https://www.who.int/news/item/26-05-2021-gacvs-myocarditis-reported-with-covid-19-mrna-vaccines>.
103. United States Advisory Committee on Immunization Practices (ACIP). ACIP Presentation Slides: June 23-25, 2021 Meeting. Available at:
104. Welsh KJ, Baumblatt J, Chege W, Goud R, Nair N. Thrombocytopenia including immune thrombocytopenia after receipt of mRNA COVID-19 vaccines reported to the Vaccine Adverse Event Reporting System (VAERS). *Vaccine*. 2021;96(5):534-537. doi:10.1016/j.vaccine.2021.04.054
105. Marshall M, Ferguson ID, Lewis P, et al. Symptomatic Acute Myocarditis in Seven Adolescents Following Pfizer-BioNTech COVID-19 Vaccination. *Pediatrics*. June 2021:e2021052478. doi:10.1542/peds.2021-052478
106. Vogel G. Israel reports link between rare cases of heart inflammation and COVID-19 vaccination in young men. *Science (80- )*. June 2021. doi:10.1126/science.abcj7796
107. Government of Canada National Advisory Committee on Immunization (NACI) statement. NACI rapid response: Recommended use of AstraZeneca COVID-19 vaccine in younger adults.
108. Australian Technical Advisory Group on Immunisation (ATAGI) ATAGI statement on revised recommendations on the use of COVID-19 Vaccine AstraZeneca, 17 June 2021. Available at: <https://www.health.gov.au/news/atagi-statement-on-revised-recommendations-on-the-use-of-covid-19-vaccine-astrazeneca-17-june-2021>.
109. UK Government press release. JCVI advises on COVID-19 vaccine for people aged under 40. 7 May 2021. Available at: <https://www.gov.uk/government/news/jcvi-advises-on-covid-19-vaccine-for-people-aged-under-40>.
110. European Medicines Agency (EMA). Meeting highlights from the Pharmacovigilance Risk Assessment Committee (PRAC) 6-9 April 2021. Available at: <https://www.ema.europa.eu/en/news/meeting-highlights-pharmacovigilance-risk-assessment-committee-prac-6-9-april-2021>.
111. US Food and Drug Administration (FDA) press release. FDA and CDC Lift Recommended Pause on Johnson & Johnson (Janssen) COVID-19 Vaccine Use Following Thorough Safety Review 23 April 2021. Available at: <https://www.fda.gov/news-events/press-announcements/fda-and-cdc-lift-recommended-pause-johnson-johnson-janssen-covid-19-vaccine-use-following-thorough>.
112. Shimabukuro TT, Cole M, Su JR. Reports of Anaphylaxis After Receipt of mRNA COVID-19 Vaccines in the US—December 14, 2020–January 18, 2021. *JAMA*. 2021;325(11):1101. doi:10.1001/jama.2021.1967
113. Shimabukuro TT, Kim SY, Myers TR, et al. Preliminary Findings of mRNA Covid-19 Vaccine Safety in Pregnant Persons. *N Engl J Med*. April 2021:NEJMoa2104983. doi:10.1056/NEJMoa2104983
114. Novavax COVID-19 Vaccine Demonstrates 89.3% Efficacy in UK Phase 3 Trial. Novavax press release 28 January 2021. <https://ir.novavax.com/news-releases/news-release-details/novavax-covid-19-vaccine-demonstrates-893-efficacy-uk-phase-3>.
115. United Nations Children's Fund (UNICEF), Pacific Office. Situation Analysis of Children in the Pacific Island Countries. December 2017.

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Compiled by Dr John Hart

Technical leads: Professor Fiona Russell and Professor Kim Mulholland

Quality checks: Professor Julie Bines, Associate Professor Nigel Crawford and Associate Professor Margie Danchin

## Other resources on COVID-19 vaccines:

WHO COVID-19 vaccines website: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines>

EMA COVID-19 vaccines website: <https://www.ema.europa.eu/en/human-regulatory/overview/public-health-threats/coronavirus-disease-covid-19/treatments-vaccines/covid-19-vaccines>

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Murdoch Children's Research Institute  
50 Flemington Rd, Parkville  
Victoria 3052 Australia  
ABN 21 006 566 972

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