

Results of COVID-19 Vaccine Effectiveness Studies: An Ongoing Systematic Review

Duration of Protection Weekly Summary Table

Updated June 23, 2022

Prepared by:

International Vaccine Access Center,
Johns Hopkins Bloomberg School of Public Health

and

World Health Organization

and

Coalition for Epidemic Preparedness Innovations



For comments or questions, please contact: Anurima Baidya at abaidya1@jhmi.edu or
Karoline Walter at kwalte21@jhmi.edu

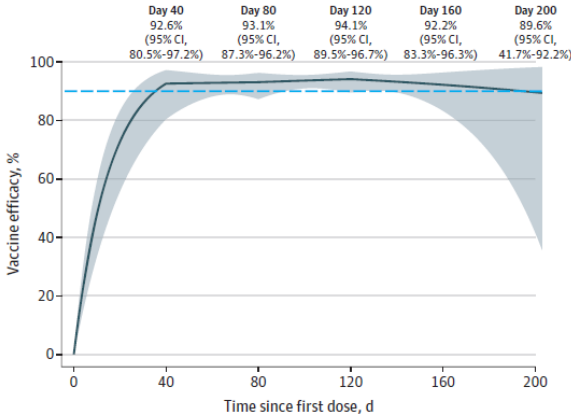
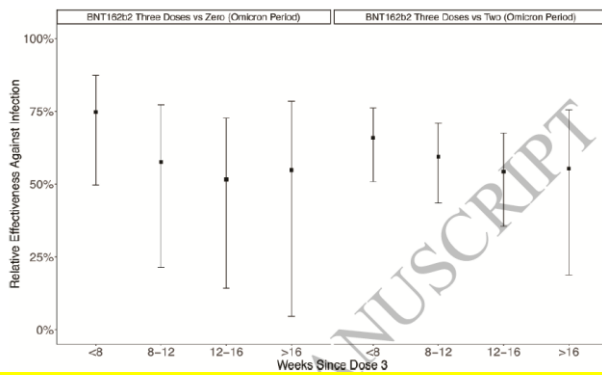
Duration of Protection Studies

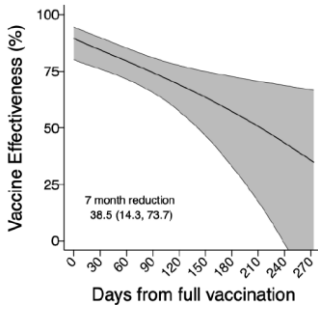
These are studies that assess duration of protection criteria as outlined above along with those studies that do not meet aforementioned criteria that are relevant to evaluating duration of protection. Some of these studies are also in the above table but duplicated here for ease. As of April 28, 2022, those studies that provide VE estimates at least 4 months after the primary series or at least 2 months after the booster series are included below.

We would like to highlight:

- Countries have implemented different dose intervals and vaccination strategies that can make comparisons across studies challenging.
- Persons who are vaccinated early in a program are different than those who are vaccinated later. For example, many who were vaccinated early were those at highest risk, and this could confound the results. Some of the older individuals also might have some degree of immunosenescence.

| # | Reference (date) | Country | Population | Dominant Variants | Vaccine product | Study Period | Descriptive Findings |
|-----|---|---------|------------|-------------------------|---------------------------------|----------------------------------|--|
| 177 | Adams et al (June 14, 2022) | USA | ≥18 years | Omicron | Comirnaty mRNA-1273 Ad26.COVS.2 | December 26, 2021–April 30, 2022 | Multi-center TND study evaluating VE against hospitalization. VE after a primary series for immunocompetent patients at 14–150 days (median 109 days) since the last vaccine dose was 54% (95% CI: 32–69), and at >150 days (median 279 days) was 42% (95% CI: 28–54%). VE after a booster dose for immunocompetent patients at 7–120 days (median 69 days) following the booster dose was 80% (95% CI: 74–84%) and at >120 days (median 147 days) was 65% (95% CI: 47–77%). For immunocompromised patients, VE for a primary series at 14–150 days (median 91 days) was 65% (95% CI: 46–77%) and at >150 days (median 172 days) was 48% (95% CI: 5–72%). |
| 176 | Al Kaabi et al (June 9, 2022) | UAE | ≥18 years | Ancestral, Alpha, Delta | BBIBP-CorV | October 2020–July 2021 | Cohort study based on medical records evaluating VE against severe outcomes. The effectiveness against COVID-19 hospitalization declined from 82.8% (95% CI, 80.5–84.8) at two months after complete vaccination to 62.1% (95% CI 60.2–64.0) at 6 months after complete vaccination. VE against ICU admission was 85.7% (95% CI, 80.3–89.6) at two months after complete vaccination to 72.8% (95% CI, 68.8–76.3) at six months post complete vaccination, without further decline from seven to twelve months post-vaccination. The vaccine effectiveness against mortality due to COVID-19 remained above 80% throughout and did not show significant decline over the 12-month follow-up period |
| 175 | Lewis et al (June 8, 2022) | USA | ≥18 years | Alpha, Delta | Ad26.COVS.2 | March 11–December 15, 2021 | TND study evaluating VE against hospitalization and VE against progression to invasive mechanical ventilation or death. VE was 14–90 days (73% [59%–82%]), 91–180 days (71% [60%–80%]), and 181–274 days (70% [54%–81%]). |

| 174 | Lin et al (June 8, 2022) | USA | Adults | Ancestral | mRNA-1273 | July 27, 2020-?May 2021 | <p>RCT participants followed up as a cohort study to evaluate VE against symptomatic disease.</p>  <table border="1"> <thead> <tr> <th>Day</th> <th>Vaccine efficacy, %</th> <th>95% CI</th> </tr> </thead> <tbody> <tr> <td>Day 40</td> <td>92.6%</td> <td>(95% CI, 80.5%-97.2%)</td> </tr> <tr> <td>Day 80</td> <td>93.1%</td> <td>(95% CI, 87.3%-96.2%)</td> </tr> <tr> <td>Day 120</td> <td>94.1%</td> <td>(95% CI, 89.5%-96.7%)</td> </tr> <tr> <td>Day 160</td> <td>92.2%</td> <td>(95% CI, 83.3%-96.3%)</td> </tr> <tr> <td>Day 200</td> <td>89.6%</td> <td>(95% CI, 41.7%-92.2%)</td> </tr> </tbody> </table> | Day | Vaccine efficacy, % | 95% CI | Day 40 | 92.6% | (95% CI, 80.5%-97.2%) | Day 80 | 93.1% | (95% CI, 87.3%-96.2%) | Day 120 | 94.1% | (95% CI, 89.5%-96.7%) | Day 160 | 92.2% | (95% CI, 83.3%-96.3%) | Day 200 | 89.6% | (95% CI, 41.7%-92.2%) | | | |
|---|--|--|--------|--------------------------|-----------|------------------------------|--|-------|------------------------------------|--|---|-------|-----------------------|--------|-------|-----------------------|---------|-------|-----------------------|--|-------|-----------------------|---------|-------|-----------------------|------|-----|------|
| Day | Vaccine efficacy, % | 95% CI | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Day 40 | 92.6% | (95% CI, 80.5%-97.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Day 80 | 93.1% | (95% CI, 87.3%-96.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Day 120 | 94.1% | (95% CI, 89.5%-96.7%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Day 160 | 92.2% | (95% CI, 83.3%-96.3%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Day 200 | 89.6% | (95% CI, 41.7%-92.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 173 | Richterman et al (June 6, 2022) | USA | HCW | Delta, Omicron | Comirnaty | July 1, 2021 - April 5, 2022 | <p>TND study evaluated relative VE infection.</p>  <table border="1"> <thead> <tr> <th>Study</th> <th>Time Interval (Weeks Since Dose 3)</th> <th>Relative Effectiveness Against Infection (%)</th> </tr> </thead> <tbody> <tr> <td rowspan="4">BNT162b2 Three Doses vs Zero (Omicron Period)</td> <td><8</td> <td>~75%</td> </tr> <tr> <td>8-12</td> <td>~60%</td> </tr> <tr> <td>12-16</td> <td>~55%</td> </tr> <tr> <td>>16</td> <td>~55%</td> </tr> <tr> <td rowspan="4">BNT162b2 Three Doses vs Two (Omicron Period)</td> <td><8</td> <td>~65%</td> </tr> <tr> <td>8-12</td> <td>~60%</td> </tr> <tr> <td>12-16</td> <td>~55%</td> </tr> <tr> <td>>16</td> <td>~55%</td> </tr> </tbody> </table> | Study | Time Interval (Weeks Since Dose 3) | Relative Effectiveness Against Infection (%) | BNT162b2 Three Doses vs Zero (Omicron Period) | <8 | ~75% | 8-12 | ~60% | 12-16 | ~55% | >16 | ~55% | BNT162b2 Three Doses vs Two (Omicron Period) | <8 | ~65% | 8-12 | ~60% | 12-16 | ~55% | >16 | ~55% |
| Study | Time Interval (Weeks Since Dose 3) | Relative Effectiveness Against Infection (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BNT162b2 Three Doses vs Zero (Omicron Period) | <8 | ~75% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 8-12 | ~60% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 12-16 | ~55% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | >16 | ~55% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BNT162b2 Three Doses vs Two (Omicron Period) | <8 | ~65% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 8-12 | ~60% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 12-16 | ~55% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | >16 | ~55% | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 172 | Andrejko et al (June 3, 2022) | USA | 12+ year olds | Pre-Omicron | Comirnaty mRNA-1273 | February 23-December 5, 2021 | <p>TND study evaluating VE against symptomatic disease. Note that vaccination data was self-reported. The figure belows shows VE over time among persons who were asked to reference their vaccination card for vaccination data.</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|----------------------------------|--------------------------------|----------------|------------------------------------|-----------------------------------|---|----------------------------|--------------|---------------------------|--------------------------------|-------------------------------------|----------------------------------|--------------|-----------------|----------------|-----------------------|---------------|----------------|---------------------------------|-----------------|----------------|----------------------|---------------------------|----------------|------------------|----------------|-------------------------------|-----------------------|---------------|-----|---------------------------------|-------|------|------------------|---------------------------|-------|------|------------------|---------------------|--|--|--|---------------------------------|-------|------|------------------|---------------------------|-------|------|------------------|----------------|--|--|--|---------------------------------|--------|------|------------------|---------------------------|---------|------|------------------|
| 171 | Accorsi et al (May 25, 2022) | USA | 18+ year olds | Omicron | Comirnaty mRNA-1273 Ad26.COVID.2.S | January 2-March 23, 2022 | <p>TND study based on testing at national pharmacy chain. Note vaccination data by recall.</p> <table border="1"> <thead> <tr> <th>Vaccination Regimen</th> <th>No. of Tests</th> <th>Positive for SARS-CoV-2 %</th> <th>Vaccine Effectiveness (95% CI)</th> </tr> </thead> <tbody> <tr> <td>No vaccination</td> <td>207,784</td> <td>50.1</td> <td>Reference</td> </tr> <tr> <td>Ad26.COVID.2.S</td> <td></td> <td></td> <td></td> </tr> <tr> <td>14 days to 1 mo since last dose</td> <td>706</td> <td>47.2</td> <td>17.8 (4.3–29.5)</td> </tr> <tr> <td>2 to 4 mo since last dose</td> <td>3,100</td> <td>49.8</td> <td>8.4 (1.5–14.8)</td> </tr> <tr> <td>Ad26.COVID.2.S/Ad26.COVID.2.S</td> <td></td> <td></td> <td></td> </tr> <tr> <td>14 days to 1 mo since last dose</td> <td>1,017</td> <td>46.9</td> <td>27.9 (18.3–36.5)</td> </tr> <tr> <td>2 to 4 mo since last dose</td> <td>2,506</td> <td>41.5</td> <td>29.2 (23.1–34.8)</td> </tr> <tr> <td>Ad26.COVID.2.S/mRNA</td> <td></td> <td></td> <td></td> </tr> <tr> <td>14 days to 1 mo since last dose</td> <td>3,585</td> <td>31.5</td> <td>61.3 (58.4–64.0)</td> </tr> <tr> <td>2 to 4 mo since last dose</td> <td>9,752</td> <td>30.4</td> <td>54.3 (52.2–56.3)</td> </tr> <tr> <td>mRNA/mRNA/mRNA</td> <td></td> <td></td> <td></td> </tr> <tr> <td>14 days to 1 mo since last dose</td> <td>77,892</td> <td>27.3</td> <td>68.9 (68.3–69.5)</td> </tr> <tr> <td>2 to 4 mo since last dose</td> <td>206,586</td> <td>26.6</td> <td>62.8 (62.2–63.4)</td> </tr> </tbody> </table> | Vaccination Regimen | No. of Tests | Positive for SARS-CoV-2 % | Vaccine Effectiveness (95% CI) | No vaccination | 207,784 | 50.1 | Reference | Ad26.COVID.2.S | | | | 14 days to 1 mo since last dose | 706 | 47.2 | 17.8 (4.3–29.5) | 2 to 4 mo since last dose | 3,100 | 49.8 | 8.4 (1.5–14.8) | Ad26.COVID.2.S/Ad26.COVID.2.S | | | | 14 days to 1 mo since last dose | 1,017 | 46.9 | 27.9 (18.3–36.5) | 2 to 4 mo since last dose | 2,506 | 41.5 | 29.2 (23.1–34.8) | Ad26.COVID.2.S/mRNA | | | | 14 days to 1 mo since last dose | 3,585 | 31.5 | 61.3 (58.4–64.0) | 2 to 4 mo since last dose | 9,752 | 30.4 | 54.3 (52.2–56.3) | mRNA/mRNA/mRNA | | | | 14 days to 1 mo since last dose | 77,892 | 27.3 | 68.9 (68.3–69.5) | 2 to 4 mo since last dose | 206,586 | 26.6 | 62.8 (62.2–63.4) |
| Vaccination Regimen | No. of Tests | Positive for SARS-CoV-2 % | Vaccine Effectiveness (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No vaccination | 207,784 | 50.1 | Reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ad26.COVID.2.S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 days to 1 mo since last dose | 706 | 47.2 | 17.8 (4.3–29.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 to 4 mo since last dose | 3,100 | 49.8 | 8.4 (1.5–14.8) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ad26.COVID.2.S/Ad26.COVID.2.S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 days to 1 mo since last dose | 1,017 | 46.9 | 27.9 (18.3–36.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 to 4 mo since last dose | 2,506 | 41.5 | 29.2 (23.1–34.8) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ad26.COVID.2.S/mRNA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 days to 1 mo since last dose | 3,585 | 31.5 | 61.3 (58.4–64.0) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 to 4 mo since last dose | 9,752 | 30.4 | 54.3 (52.2–56.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| mRNA/mRNA/mRNA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 days to 1 mo since last dose | 77,892 | 27.3 | 68.9 (68.3–69.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 to 4 mo since last dose | 206,586 | 26.6 | 62.8 (62.2–63.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 170 | Amir et al (May 25, 2022) | Israel | 12-15 year olds | Omicron | Comirnaty | December 26, 2021-January 8, 2022 | <p>Cohort study conducted by linking admin databases looking at risk against infection.</p> <table border="1"> <thead> <tr> <th colspan="3">Ages 12-15 3rd dose effect</th> </tr> <tr> <th>Cohort</th> <th>Confirmed infections (at-risk days)</th> <th>Adjusted rate ratio vs. 3rd dose</th> </tr> </thead> <tbody> <tr> <td>Unvaccinated</td> <td>2,684 (834,149)</td> <td>5.0 [4.3, 5.9]</td> </tr> <tr> <td>2nd dose (14-60 days)</td> <td>153 (115,371)</td> <td>2.2 [1.8, 2.8]</td> </tr> <tr> <td>2nd dose (60-120 days)</td> <td>1,999 (815,036)</td> <td>3.8 [3.3, 4.5]</td> </tr> <tr> <td>2nd dose (120+ days)</td> <td>5,983 (2,003,011)</td> <td>4.2 [3.6, 4.9]</td> </tr> <tr> <td>Internal control</td> <td>494 (180,100)</td> <td>3.3 [2.8, 4.0]</td> </tr> <tr> <td>3rd dose (14-60 days)</td> <td>166 (171,281)</td> <td>Ref</td> </tr> </tbody> </table> | Ages 12-15 3rd dose effect | | | Cohort | Confirmed infections (at-risk days) | Adjusted rate ratio vs. 3rd dose | Unvaccinated | 2,684 (834,149) | 5.0 [4.3, 5.9] | 2nd dose (14-60 days) | 153 (115,371) | 2.2 [1.8, 2.8] | 2nd dose (60-120 days) | 1,999 (815,036) | 3.8 [3.3, 4.5] | 2nd dose (120+ days) | 5,983 (2,003,011) | 4.2 [3.6, 4.9] | Internal control | 494 (180,100) | 3.3 [2.8, 4.0] | 3rd dose (14-60 days) | 166 (171,281) | Ref | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ages 12-15 3rd dose effect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cohort | Confirmed infections (at-risk days) | Adjusted rate ratio vs. 3rd dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 2,684 (834,149) | 5.0 [4.3, 5.9] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2nd dose (14-60 days) | 153 (115,371) | 2.2 [1.8, 2.8] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2nd dose (60-120 days) | 1,999 (815,036) | 3.8 [3.3, 4.5] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2nd dose (120+ days) | 5,983 (2,003,011) | 4.2 [3.6, 4.9] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Internal control | 494 (180,100) | 3.3 [2.8, 4.0] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3rd dose (14-60 days) | 166 (171,281) | Ref | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

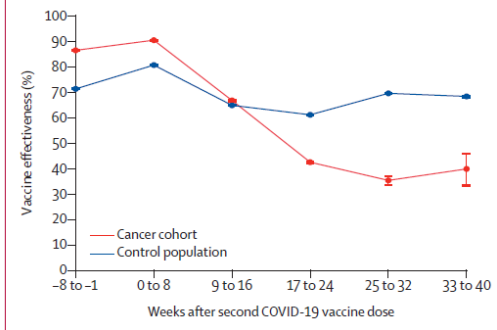
| 169 | Lee et al (May 23, 2022) | UK | Persons with cancer and general population | Alpha, Delta | ChAdOx1 Comirnaty | December 8, 2020- October 15, 2021 | <p>Two TND studies conducted in different populations with comparison of VE against infection, hospitalization, and death among the two groups.</p>  <table border="1"> <thead> <tr> <th rowspan="2">Outcome measure</th> <th colspan="4">Post-second dose (overall)</th> <th rowspan="2">Vaccine Effectiveness (%)</th> <th colspan="4">3-6 months post-second dose</th> </tr> <tr> <th>Exposed (PCR-positive) Post-2nd dose (n)</th> <th>Unvaccinate d (N)</th> <th>Not exposed (PCR-negative) Post-2nd dose (n)</th> <th>Unvaccinate d (N)</th> <th>Exposed (PCR-positive) Post-2nd dose (n)</th> <th>Unvaccinate d (N)</th> <th>Not exposed (PCR-negative) Post-2nd dose (n)</th> <th>Unvaccinate d (N)</th> </tr> </thead> <tbody> <tr> <td>Breakthrough Infections Coronavirus Hospitalisation</td> <td>18292</td> <td>31649</td> <td>780054</td> <td>465982</td> <td>65.5% (65.1-65.9)</td> <td>12513</td> <td>31649</td> <td>347414</td> <td>465982</td> <td>47.0% (46.3-47.6)</td> </tr> <tr> <td>Coronavirus Hospitalisation</td> <td>837</td> <td>3227</td> <td>780054</td> <td>465982</td> <td>84.5% (83.6-85.4)</td> <td>611</td> <td>3227</td> <td>347414</td> <td>465982</td> <td>74.6% (72.8-76.3)</td> </tr> <tr> <td>Coronavirus Death</td> <td>560</td> <td>5139</td> <td>780054</td> <td>465982</td> <td>93.5% (93.0-94.0)</td> <td>373</td> <td>5139</td> <td>347414</td> <td>465982</td> <td>90.3% (89.3-91.2)</td> </tr> </tbody> </table> | Outcome measure | Post-second dose (overall) | | | | Vaccine Effectiveness (%) | 3-6 months post-second dose | | | | Exposed (PCR-positive) Post-2 nd dose (n) | Unvaccinate d (N) | Not exposed (PCR-negative) Post-2 nd dose (n) | Unvaccinate d (N) | Exposed (PCR-positive) Post-2 nd dose (n) | Unvaccinate d (N) | Not exposed (PCR-negative) Post-2 nd dose (n) | Unvaccinate d (N) | Breakthrough Infections Coronavirus Hospitalisation | 18292 | 31649 | 780054 | 465982 | 65.5% (65.1-65.9) | 12513 | 31649 | 347414 | 465982 | 47.0% (46.3-47.6) | Coronavirus Hospitalisation | 837 | 3227 | 780054 | 465982 | 84.5% (83.6-85.4) | 611 | 3227 | 347414 | 465982 | 74.6% (72.8-76.3) | Coronavirus Death | 560 | 5139 | 780054 | 465982 | 93.5% (93.0-94.0) | 373 | 5139 | 347414 | 465982 | 90.3% (89.3-91.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|--|--------------------------|---|--|---|--|----------------------------|--------------------------|--|--|---------------------------|-----------------------------|--|----------|--|--|---|--|--------------------------|---|-------------------|--|---|---|--------------------------|--------------|--------|---------------------|-------------------|-------|---------------------|--------|--------|---------------------|-----------------------------|-----|------------|---------|---------------------|-------------------|------------------|---------------------|--------|-----------------|-------------------|-------------------|-----------------|-------|-------------------|--------|-------------------|------------------|-------|------------------|------------------|-------------------|------------------|-------|-------------------|-------|-----------------|------------------|-----|-----------------|------------------|-----|------------------|-------|-------------------|-------|-----------------|------------------|-----|------------------|------------------|-----|------------------|---------|--------------------|-------|------------------|-------------------|-----|----------------|------------------|-----|------------------|----------|---------------------|-----|-----------------|--------------------|-----|------------------|------------------|-----|------------------|---------|--------------------|-----|------------------|------------------|-----|------------------|------------------|----|-----------------|-------------|---------|---------------------|-----|-----------------|--------------------|-----|-----------------|--------------------|-----|------------------|----------|---------------------|-----|------------------|--------------------|-----|------------------|--------------------|----|------------------|-----------|---------------------|-----|------------------|--------------------|-----|------------------|--------------------|----|-----------------|-----------|---------------------|------|------------------|--------------------|------|-----------------|--------------------|-----|------------------|---------|--------------------|-------|-----------------|--------------------|-------|-----------------|--------------------|-----|------------------|
| Outcome measure | Post-second dose (overall) | | | | Vaccine Effectiveness (%) | 3-6 months post-second dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Exposed (PCR-positive) Post-2 nd dose (n) | Unvaccinate d (N) | Not exposed (PCR-negative) Post-2 nd dose (n) | Unvaccinate d (N) | | Exposed (PCR-positive) Post-2 nd dose (n) | Unvaccinate d (N) | Not exposed (PCR-negative) Post-2 nd dose (n) | Unvaccinate d (N) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Breakthrough Infections Coronavirus Hospitalisation | 18292 | 31649 | 780054 | 465982 | 65.5% (65.1-65.9) | 12513 | 31649 | 347414 | 465982 | 47.0% (46.3-47.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coronavirus Hospitalisation | 837 | 3227 | 780054 | 465982 | 84.5% (83.6-85.4) | 611 | 3227 | 347414 | 465982 | 74.6% (72.8-76.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coronavirus Death | 560 | 5139 | 780054 | 465982 | 93.5% (93.0-94.0) | 373 | 5139 | 347414 | 465982 | 90.3% (89.3-91.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 168 | Paranthaman et al (May 5, 2022) | England | ≥65 years living in LTCF | Alpha, Delta | ChAdOx1 Comirnaty | December 8, 2020- September 30, 2021 | <p>Cohort study conducted by linking administrative databases evaluating VE against infection and death.</p> <p>Table 2. Adjusted HRs for infection by vaccination status for LTCF residents, England</p> <table border="1"> <thead> <tr> <th rowspan="2">Vaccination status</th> <th rowspan="2">Time since dose</th> <th colspan="3">Any</th> <th colspan="3">ChAdOx-1</th> <th colspan="3">BNT162b2</th> </tr> <tr> <th>Person-time in days (unique individuals)^a</th> <th>Events</th> <th>Adjusted HR^b</th> <th>Person-time in days (unique individuals)^a</th> <th>Events</th> <th>Adjusted HR^b</th> <th>Person-time in days (unique individuals)^a</th> <th>Events</th> <th>Adjusted HR^b</th> </tr> </thead> <tbody> <tr> <td>Unvaccinated</td> <td></td> <td>6,958,732 (190,202)</td> <td>26,765</td> <td></td> <td>6,958,732 (190,202)</td> <td>26,765</td> <td></td> <td>6,958,732 (190,202)</td> <td>26,765</td> <td></td> </tr> <tr> <td rowspan="7">First dose</td> <td>1-2 wks</td> <td>2,070,258 (153,883)</td> <td>8,190</td> <td>0.68 (0.62-0.74)</td> <td>1,427,012 (105,580)</td> <td>5,256</td> <td>0.67 (0.6-0.75)</td> <td>643,246 (47,803)</td> <td>2,934</td> <td>0.68 (0.6-0.78)</td> </tr> <tr> <td>3 wks</td> <td>990,274 (143,432)</td> <td>2,762</td> <td>0.64 (0.57-0.73)</td> <td>684,527 (99,045)</td> <td>1,731</td> <td>0.73 (0.63-0.86)</td> <td>305,247 (44,387)</td> <td>1,031</td> <td>0.56 (0.48-0.67)</td> </tr> <tr> <td>4 wks</td> <td>965,091 (139,327)</td> <td>1,554</td> <td>0.5 (0.43-0.59)</td> <td>671,379 (96,744)</td> <td>921</td> <td>0.58 (0.48-0.7)</td> <td>293,712 (42,583)</td> <td>635</td> <td>0.48 (0.39-0.59)</td> </tr> <tr> <td>5 wks</td> <td>948,533 (136,601)</td> <td>1,057</td> <td>0.47 (0.4-0.56)</td> <td>660,612 (95,140)</td> <td>654</td> <td>0.59 (0.47-0.73)</td> <td>287,921 (41,321)</td> <td>403</td> <td>0.44 (0.36-0.55)</td> </tr> <tr> <td>6-7 wks</td> <td>185,2109 (134,595)</td> <td>1,190</td> <td>0.46 (0.38-0.56)</td> <td>129,0208 (93,718)</td> <td>642</td> <td>0.5 (0.4-0.62)</td> <td>561,901 (40,877)</td> <td>548</td> <td>0.52 (0.41-0.66)</td> </tr> <tr> <td>8-10 wks</td> <td>2,472,998 (130,173)</td> <td>815</td> <td>0.64 (0.5-0.82)</td> <td>1,715,549 (90,634)</td> <td>347</td> <td>0.51 (0.38-0.68)</td> <td>737,449 (39,539)</td> <td>468</td> <td>0.79 (0.59-1.06)</td> </tr> <tr> <td>11+ wks</td> <td>1,112,436 (86,502)</td> <td>254</td> <td>0.83 (0.62-1.11)</td> <td>768,455 (57,780)</td> <td>181</td> <td>0.94 (0.67-1.33)</td> <td>343,981 (28,718)</td> <td>73</td> <td>0.63 (0.44-0.9)</td> </tr> <tr> <td rowspan="5">Second dose</td> <td>1-4 wks</td> <td>3,432,288 (124,173)</td> <td>239</td> <td>0.4 (0.29-0.55)</td> <td>2,401,640 (86,845)</td> <td>119</td> <td>0.39 (0.26-0.6)</td> <td>1,030,648 (37,328)</td> <td>120</td> <td>0.38 (0.27-0.54)</td> </tr> <tr> <td>5-10 wks</td> <td>5,037,822 (122,400)</td> <td>179</td> <td>0.47 (0.34-0.64)</td> <td>3,521,278 (85,615)</td> <td>134</td> <td>0.54 (0.37-0.78)</td> <td>1,516,544 (36,785)</td> <td>45</td> <td>0.34 (0.21-0.55)</td> </tr> <tr> <td>11-15 wks</td> <td>4,635,312 (117,409)</td> <td>384</td> <td>0.45 (0.34-0.59)</td> <td>2,810,444 (81,979)</td> <td>327</td> <td>0.48 (0.36-0.64)</td> <td>1,224,868 (35,430)</td> <td>57</td> <td>0.31 (0.2-0.48)</td> </tr> <tr> <td>16-20 wks</td> <td>3,757,167 (111,858)</td> <td>1384</td> <td>0.66 (0.54-0.81)</td> <td>2,599,430 (77,664)</td> <td>1090</td> <td>0.72 (0.58-0.9)</td> <td>1,157,737 (34,094)</td> <td>294</td> <td>0.55 (0.39-0.78)</td> </tr> <tr> <td>21+ wks</td> <td>3,381,529 (99,696)</td> <td>2,104</td> <td>0.6 (0.49-0.74)</td> <td>2,070,748 (68,221)</td> <td>1,474</td> <td>0.71 (0.57-0.9)</td> <td>1,310,781 (31,475)</td> <td>630</td> <td>0.53 (0.42-0.68)</td> </tr> </tbody> </table> <p>^aNumber of unique individuals at risk for any duration of time within each time period. ^bAdjusted for gender, age group, case rate in local authority and deprivation, along with a cluster term for care home postcode. See Supplementary Figure S4, Supplementary Tables S1 and S2 in Supplementary data.</p> | Vaccination status | Time since dose | Any | | | ChAdOx-1 | | | BNT162b2 | | | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Unvaccinated | | 6,958,732 (190,202) | 26,765 | | 6,958,732 (190,202) | 26,765 | | 6,958,732 (190,202) | 26,765 | | First dose | 1-2 wks | 2,070,258 (153,883) | 8,190 | 0.68 (0.62-0.74) | 1,427,012 (105,580) | 5,256 | 0.67 (0.6-0.75) | 643,246 (47,803) | 2,934 | 0.68 (0.6-0.78) | 3 wks | 990,274 (143,432) | 2,762 | 0.64 (0.57-0.73) | 684,527 (99,045) | 1,731 | 0.73 (0.63-0.86) | 305,247 (44,387) | 1,031 | 0.56 (0.48-0.67) | 4 wks | 965,091 (139,327) | 1,554 | 0.5 (0.43-0.59) | 671,379 (96,744) | 921 | 0.58 (0.48-0.7) | 293,712 (42,583) | 635 | 0.48 (0.39-0.59) | 5 wks | 948,533 (136,601) | 1,057 | 0.47 (0.4-0.56) | 660,612 (95,140) | 654 | 0.59 (0.47-0.73) | 287,921 (41,321) | 403 | 0.44 (0.36-0.55) | 6-7 wks | 185,2109 (134,595) | 1,190 | 0.46 (0.38-0.56) | 129,0208 (93,718) | 642 | 0.5 (0.4-0.62) | 561,901 (40,877) | 548 | 0.52 (0.41-0.66) | 8-10 wks | 2,472,998 (130,173) | 815 | 0.64 (0.5-0.82) | 1,715,549 (90,634) | 347 | 0.51 (0.38-0.68) | 737,449 (39,539) | 468 | 0.79 (0.59-1.06) | 11+ wks | 1,112,436 (86,502) | 254 | 0.83 (0.62-1.11) | 768,455 (57,780) | 181 | 0.94 (0.67-1.33) | 343,981 (28,718) | 73 | 0.63 (0.44-0.9) | Second dose | 1-4 wks | 3,432,288 (124,173) | 239 | 0.4 (0.29-0.55) | 2,401,640 (86,845) | 119 | 0.39 (0.26-0.6) | 1,030,648 (37,328) | 120 | 0.38 (0.27-0.54) | 5-10 wks | 5,037,822 (122,400) | 179 | 0.47 (0.34-0.64) | 3,521,278 (85,615) | 134 | 0.54 (0.37-0.78) | 1,516,544 (36,785) | 45 | 0.34 (0.21-0.55) | 11-15 wks | 4,635,312 (117,409) | 384 | 0.45 (0.34-0.59) | 2,810,444 (81,979) | 327 | 0.48 (0.36-0.64) | 1,224,868 (35,430) | 57 | 0.31 (0.2-0.48) | 16-20 wks | 3,757,167 (111,858) | 1384 | 0.66 (0.54-0.81) | 2,599,430 (77,664) | 1090 | 0.72 (0.58-0.9) | 1,157,737 (34,094) | 294 | 0.55 (0.39-0.78) | 21+ wks | 3,381,529 (99,696) | 2,104 | 0.6 (0.49-0.74) | 2,070,748 (68,221) | 1,474 | 0.71 (0.57-0.9) | 1,310,781 (31,475) | 630 | 0.53 (0.42-0.68) |
| Vaccination status | Time since dose | Any | | | ChAdOx-1 | | | | | BNT162b2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | | 6,958,732 (190,202) | 26,765 | | 6,958,732 (190,202) | 26,765 | | 6,958,732 (190,202) | 26,765 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| First dose | 1-2 wks | 2,070,258 (153,883) | 8,190 | 0.68 (0.62-0.74) | 1,427,012 (105,580) | 5,256 | 0.67 (0.6-0.75) | 643,246 (47,803) | 2,934 | 0.68 (0.6-0.78) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 wks | 990,274 (143,432) | 2,762 | 0.64 (0.57-0.73) | 684,527 (99,045) | 1,731 | 0.73 (0.63-0.86) | 305,247 (44,387) | 1,031 | 0.56 (0.48-0.67) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4 wks | 965,091 (139,327) | 1,554 | 0.5 (0.43-0.59) | 671,379 (96,744) | 921 | 0.58 (0.48-0.7) | 293,712 (42,583) | 635 | 0.48 (0.39-0.59) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5 wks | 948,533 (136,601) | 1,057 | 0.47 (0.4-0.56) | 660,612 (95,140) | 654 | 0.59 (0.47-0.73) | 287,921 (41,321) | 403 | 0.44 (0.36-0.55) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 6-7 wks | 185,2109 (134,595) | 1,190 | 0.46 (0.38-0.56) | 129,0208 (93,718) | 642 | 0.5 (0.4-0.62) | 561,901 (40,877) | 548 | 0.52 (0.41-0.66) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 8-10 wks | 2,472,998 (130,173) | 815 | 0.64 (0.5-0.82) | 1,715,549 (90,634) | 347 | 0.51 (0.38-0.68) | 737,449 (39,539) | 468 | 0.79 (0.59-1.06) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 11+ wks | 1,112,436 (86,502) | 254 | 0.83 (0.62-1.11) | 768,455 (57,780) | 181 | 0.94 (0.67-1.33) | 343,981 (28,718) | 73 | 0.63 (0.44-0.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Second dose | 1-4 wks | 3,432,288 (124,173) | 239 | 0.4 (0.29-0.55) | 2,401,640 (86,845) | 119 | 0.39 (0.26-0.6) | 1,030,648 (37,328) | 120 | 0.38 (0.27-0.54) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5-10 wks | 5,037,822 (122,400) | 179 | 0.47 (0.34-0.64) | 3,521,278 (85,615) | 134 | 0.54 (0.37-0.78) | 1,516,544 (36,785) | 45 | 0.34 (0.21-0.55) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 11-15 wks | 4,635,312 (117,409) | 384 | 0.45 (0.34-0.59) | 2,810,444 (81,979) | 327 | 0.48 (0.36-0.64) | 1,224,868 (35,430) | 57 | 0.31 (0.2-0.48) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 16-20 wks | 3,757,167 (111,858) | 1384 | 0.66 (0.54-0.81) | 2,599,430 (77,664) | 1090 | 0.72 (0.58-0.9) | 1,157,737 (34,094) | 294 | 0.55 (0.39-0.78) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 21+ wks | 3,381,529 (99,696) | 2,104 | 0.6 (0.49-0.74) | 2,070,748 (68,221) | 1,474 | 0.71 (0.57-0.9) | 1,310,781 (31,475) | 630 | 0.53 (0.42-0.68) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 3. Adjusted HRs for COVID-related death by vaccination status among LTCF residents, England

| Vaccination status | Time since dose | Any | | | ChAdOx1 | | | BNT162b2 | | |
|--------------------|--------------------|---|------------------|--------------------------|---|-----------------|--------------------------|---|-----------------|--------------------------|
| | | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b | Person-time in days (unique individuals) ^a | Events | Adjusted HR ^b |
| Unvaccinated | | 6,931,978 (190,109) | 7,425 | | 6,931,978 (190,109) | 7,425 | | 6,931,978 (190,109) | 7,425 | |
| First dose | 1-2 wks | 2,070,228 (153,379) | 2,125 | 0.59 (0.52-0.66) | 1,426,998 (105,578) | 1,364 | 0.58 (0.5-0.66) | 643,230 (47,801) | 761 | 0.6 (0.51-0.7) |
| | 3-4 wks | 1,955,305 (143,880) | 812 | 0.41 (0.35-0.48) | 1,355,906 (99,324) | 485 | 0.49 (0.4-0.61) | 599,459 (44,556) | 327 | 0.35 (0.29-0.43) |
| | 5-8 wks | 3,697,628 (137,419) | 347 | 0.33 (0.26-0.41) | 2,575,162 (95,636) | 178 | 0.37 (0.27-0.5) | 1,122,466 (41,783) | 169 | 0.34 (0.26-0.45) |
| Second dose | 9+ wks | 2,668,668 (124,523) | 71 | 0.44 (0.3-0.63) | 1,844,561 (86,556) | 36 | 0.43 (0.26-0.71) | 824,107 (37,967) | 35 | 0.5 (0.32-0.78) |
| | 1-4 wks | 343,2248 (124,168) | 18 | 0.15 (0.07-0.3) | 240,1617 (86,843) | 9 | 0.17 (0.06-0.42) | 1,030,631 (37,325) | 9 | 0.14 (0.06-0.33) |
| | 5-10 wks | 5,037,675 (122,994) | 15 | 0.19 (0.09-0.41) | 3,521,162 (85,610) | 10 | 0.18 (0.07-0.47) | 1,516,513 (36,784) | 5 | 0.19 (0.09-0.7) |
| | 11-15 wks | 4,035,166 (117,399) | 43 | 0.21 (0.13-0.34) | 2,810,271 (81,971) | 39 | 0.22 (0.13-0.38) | 1,224,835 (35,428) | 4 | 0.09 (0.03-0.25) |
| | 16-20 wks | 3,756,005 (111,804) | 193 | 0.35 (0.24-0.52) | 2,598,423 (77,717) | 155 | 0.39 (0.26-0.58) | 1,157,582 (34,687) | 38 | 0.27 (0.16-0.46) |
| 21+ wks | 3,146,624 (94,716) | 280 | 0.37 (0.25-0.53) | 1,916,253 (64,662) | 196 | 0.44 (0.3-0.67) | 1,230,371 (30,954) | 84 | 0.31 (0.2-0.49) | |

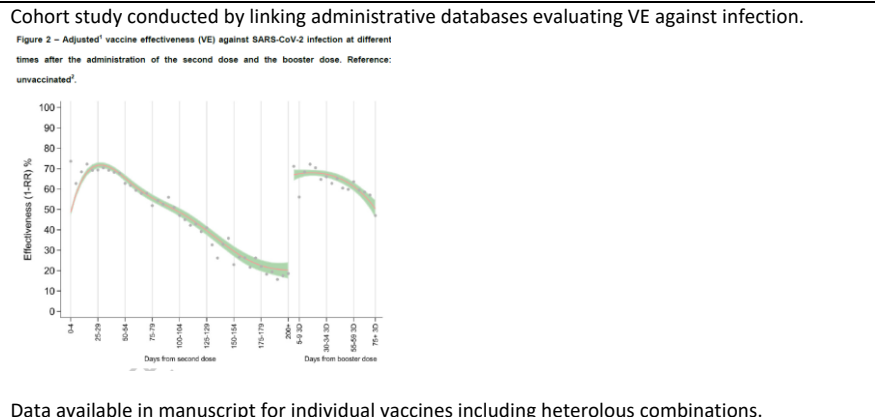
^aNumber of unique individuals at risk for any duration of time within each time period. ^bAdjusted for gender, age group, case rate in local authority and deprivation, along with a cluster term for care home postcode. See Supplementary Figure S5, Supplementary Tables S3 and S4 in Supplementary data.

| | | | | | | |
|-----|--|-------|--------------------|------------------------------|--|---------------------------------------|
| 167 | Martellucci et al (April 22, 2022) | Italy | General population | Alpha, Delta, Omicron | ChAdOx1 Comirnaty mRNA-1273 Ad26.COV2.S | January 2, 2021- December 18, 2021 |
|-----|--|-------|--------------------|------------------------------|--|---------------------------------------|

Cohort study conducted by linking administrative databases evaluating VE against infection, hospitalization, and death.

| Variables | COVID-19 Hospitalization ^A | COVID-19-Related Death |
|---------------------------------|---------------------------------------|------------------------|
| Follow-up duration ^B | OR (95% CI) | OR (95% CI) |
| ≤6 months of follow-up | | |
| Unvaccinated | 1 (Ref. cat.) | 1 (Ref. cat.) |
| 2 doses | 0.03 (0.02-0.03) * | 0.01 (0.01-0.02) * |
| 3 doses | 0.18 (0.15-0.23) * | 0.15 (0.10-0.24) * |
| >6 months of follow-up | | |
| Unvaccinated | 1 (Ref. cat.) | 1 (Ref. cat.) |
| 2 doses | 0.31 (0.26-0.37) * | 0.25 (0.17-0.35) * |

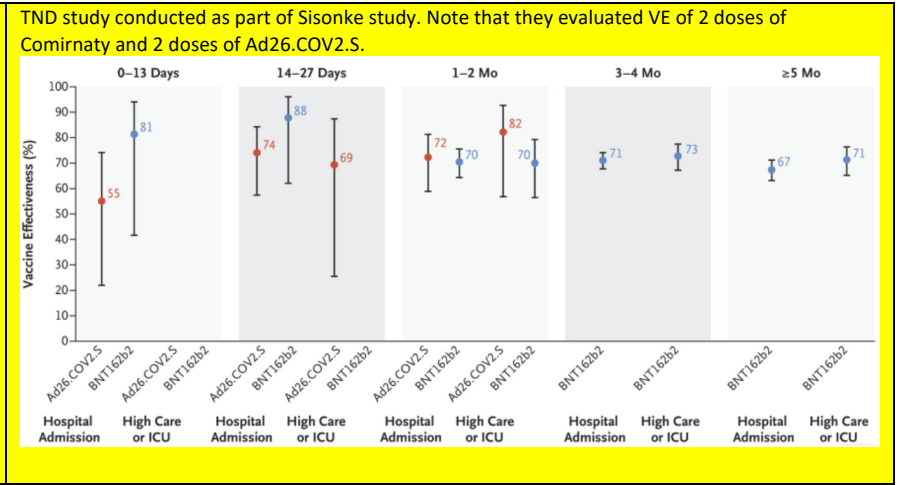
| | | | | | | |
|-----|---|-------|---------------|------------------------------|--|--------------------------------------|
| 166 | Fano et al (May 18, 2022) | Italy | 12+ year olds | Alpha, Delta, Omicron | ChAdOx1 Comirnaty mRNA-1273 Ad26.COV2.S | January 1, 2021- January 10, 2022 |
|-----|---|-------|---------------|------------------------------|--|--------------------------------------|



| 165 | Tenforde et al (May 17, 2022) | USA | General population | Pre-Omicron | Comirnaty mRNA-1273 | March 11-December 15, 2021 | <p>TND study evaluating 2-dose VE against hospitalization.</p> <table border="1"> <caption>Adjusted Vaccine Effectiveness (%) Data</caption> <thead> <tr> <th>Characteristic</th> <th>160 Days or More (%)</th> <th>Fewer Than 160 Days (%)</th> </tr> </thead> <tbody> <tr> <td>Overall (Immunocompetent)</td> <td>85</td> <td>90</td> </tr> <tr> <td>No Underlying Conditions</td> <td>89</td> <td>97</td> </tr> <tr> <td>≥ 1 Underlying Conditions</td> <td>80</td> <td>85</td> </tr> <tr> <td>Pfizer-BioNTech Vaccine</td> <td>78</td> <td>85</td> </tr> <tr> <td>Moderna Vaccine</td> <td>87</td> <td>91</td> </tr> <tr> <td>18-64 Years</td> <td>87</td> <td>87</td> </tr> <tr> <td>≥ 65 Years</td> <td>78</td> <td>82</td> </tr> <tr> <td>Immunocompromised</td> <td>53</td> <td>65</td> </tr> <tr> <td>Delta Period</td> <td>83</td> <td>87</td> </tr> </tbody> </table> | Characteristic | 160 Days or More (%) | Fewer Than 160 Days (%) | Overall (Immunocompetent) | 85 | 90 | No Underlying Conditions | 89 | 97 | ≥ 1 Underlying Conditions | 80 | 85 | Pfizer-BioNTech Vaccine | 78 | 85 | Moderna Vaccine | 87 | 91 | 18-64 Years | 87 | 87 | ≥ 65 Years | 78 | 82 | Immunocompromised | 53 | 65 | Delta Period | 83 | 87 |
|---------------------------|---|-------------------------|--------------------|-----------------------|---|--|--|----------------|----------------------|-------------------------|---------------------------|----|----|--------------------------|----|----|---------------------------|----|----|-------------------------|----|----|-----------------|----|----|-------------|----|----|------------|----|----|-------------------|----|----|--------------|----|----|
| Characteristic | 160 Days or More (%) | Fewer Than 160 Days (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Overall (Immunocompetent) | 85 | 90 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No Underlying Conditions | 89 | 97 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 1 Underlying Conditions | 80 | 85 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pfizer-BioNTech Vaccine | 78 | 85 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moderna Vaccine | 87 | 91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18-64 Years | 87 | 87 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 65 Years | 78 | 82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Immunocompromised | 53 | 65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta Period | 83 | 87 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 164 | Braeue et al (May 11, 2022) | Belgium | 18+ year olds | Delta, Omicron | ChAdOx1 Comirnaty mRNA-1273 Ad26.COV2.S | Delta: July 15, 2021-December 6, 2021 Omicron: January 3, 2022-April 14, 2022 | <p>TND study by linking administrative databases looking at VE against symptomatic diseases and COVID-19 hospitalization.</p> <p>Figure 1: Vaccine Effectiveness against symptomatic infection (Sym Inf) and hospitalization (Hosp), adults, both sexes, (left) primary-vaccination, (right) booster-vaccination, 15/07/2022 – 06/12/2021 (period proxy for the Delta-VOC), Belgium.</p> <p>Figure 2: Vaccine Effectiveness against symptomatic infection (Sym Inf) and hospitalization (Hosp), adults, both sexes, (left) primary-vaccination, (right) booster-vaccination, 03/01/2022 – 14/04/2022 (period proxy for the Omicron-VOC), Belgium.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 163 | Butt et al (May 3, 2022) | USA | Veterans | Omicron | Comirnaty mRNA-1273 | January 1-February 20, 2022 | Cohort study among veterans. Relative vaccine effectiveness was highest for patients receiving their booster vaccine within 28 days of the start of the period of omicron predominance (RVE=40% [35-44%] for BNT-162b2; RVE=30% [23-36%] for mRNA-1273), and protection against infection was negligible for both vaccines for patients with 4 or more months since receiving the booster vaccination. Relative vaccine effectiveness for hospitalizations remained above 44% for all groups. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|---|--------|---------------|----------------|------------------------|--|---|--|--|----|-----|-----|----------|-----------|-----|--|--|----------|-----------|-----|-----|-----|------------|-----|-----|-----|------------|-----|-----|-----|------------|-----|-----|-----|------------|-----|-----|-----|------------|-----|-----|-----|------------|-----|-----|-----|----------|------------|-----|-----|-----|
| 162 | Amir et al (May 5, 2022) | Israel | 60+ year olds | Omicron | Comirnaty | January 16, 2022, to March 12, 2022 | <p>Cohort study by linking administrative databases evaluating relative VE against severe disease.</p> <table border="1"> <thead> <tr> <th></th> <th></th> <th>VE</th> <th>LCI</th> <th>UCI</th> </tr> </thead> <tbody> <tr> <td>2nd dose</td> <td>4+ months</td> <td colspan="3">ref</td> </tr> <tr> <td rowspan="6">3rd dose</td> <td>0-1 month</td> <td>57%</td> <td>38%</td> <td>71%</td> </tr> <tr> <td>1-2 months</td> <td>66%</td> <td>44%</td> <td>79%</td> </tr> <tr> <td>2-3 months</td> <td>68%</td> <td>55%</td> <td>78%</td> </tr> <tr> <td>3-4 months</td> <td>67%</td> <td>58%</td> <td>73%</td> </tr> <tr> <td>4-5 months</td> <td>64%</td> <td>60%</td> <td>70%</td> </tr> <tr> <td>5-6 months</td> <td>64%</td> <td>60%</td> <td>69%</td> </tr> <tr> <td>6-7 months</td> <td>68%</td> <td>58%</td> <td>76%</td> </tr> <tr> <td>4th dose</td> <td>0-2 months</td> <td>89%</td> <td>87%</td> <td>91%</td> </tr> </tbody> </table> | | | VE | LCI | UCI | 2nd dose | 4+ months | ref | | | 3rd dose | 0-1 month | 57% | 38% | 71% | 1-2 months | 66% | 44% | 79% | 2-3 months | 68% | 55% | 78% | 3-4 months | 67% | 58% | 73% | 4-5 months | 64% | 60% | 70% | 5-6 months | 64% | 60% | 69% | 6-7 months | 68% | 58% | 76% | 4th dose | 0-2 months | 89% | 87% | 91% |
| | | VE | LCI | UCI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2nd dose | 4+ months | ref | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3rd dose | 0-1 month | 57% | 38% | 71% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1-2 months | 66% | 44% | 79% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2-3 months | 68% | 55% | 78% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3-4 months | 67% | 58% | 73% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-5 months | 64% | 60% | 70% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5-6 months | 64% | 60% | 69% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6-7 months | 68% | 58% | 76% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4th dose | 0-2 months | 89% | 87% | 91% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | |
|-----|--------------------------|--------------|-----|---------|-----------------------|-------------------------------------|
| 161 | Gray et al (May 4, 2022) | South Africa | HCW | Omicron | Comirnaty Ad26.COVS.2 | November 15, 2021- January 14, 2022 |
|-----|--------------------------|--------------|-----|---------|-----------------------|-------------------------------------|



| | | | | | | |
|-----|---------------------------------|--------|---------------|----------------|---------------------|--------------------------------------|
| 160 | Castillo et al (April 21, 2022) | France | 18+ year olds | Delta, Omicron | Comirnaty mRNA-1273 | December 13, 2021 – January 31, 2021 |
|-----|---------------------------------|--------|---------------|----------------|---------------------|--------------------------------------|

TND study linking administrative databases to assess VE against symptomatic disease, with a cohort study done among covid hospitalized cases.

| Immune status: time since named vaccine dose ^a | Omicron ^a | | | Delta ^a | | |
|--|-------------------------------------|--|----------------------|-------------------------------------|--|---------------------|
| | Risk reduction ^b against | | Protection | Risk reduction ^b against | | Protection |
| | Symptomatic Infection | Hospital admission among symptomatic cases | 1-OR+HR | Symptomatic Infection | Hospital admission among symptomatic cases | 1-OR+HR |
| | OR ^c (95%CI) | HR ^c (95%CI) | Protection (95%CI) | OR ^c (95%CI) | HR ^c (95%CI) | Protection (95%CI) |
| Vaccinated (ref.: unvaccinated without prior infection evidence) | | | | | | |
| D1: 0 day-28 days | 0.88 (0.86 to 0.91) | 0.99 (0.75 to 1.23) | 0.12 (-0.09 to 0.34) | 0.62 (0.59 to 0.66) | 0.66 (0.50 to 0.81) | 0.59 (0.49 to 0.69) |
| D2: 0 days-30 days | 0.57 (0.55 to 0.59) | 0.72 (0.50 to 0.95) | 0.59 (0.46 to 0.72) | 0.22 (0.20 to 0.23) | 0.40 (0.23 to 0.57) | 0.91 (0.87 to 0.95) |
| D2: 1 month-2 months | 0.68 (0.66 to 0.70) | 0.40 (0.27 to 0.53) | 0.73 (0.64 to 0.82) | 0.30 (0.28 to 0.31) | 0.41 (0.25 to 0.57) | 0.88 (0.83 to 0.93) |
| D2: 2 months-3 months | 0.73 (0.71 to 0.74) | 0.56 (0.41 to 0.71) | 0.59 (0.49 to 0.70) | 0.32 (0.31 to 0.33) | 0.29 (0.25 to 0.47) | 0.88 (0.85 to 0.92) |
| D2: 3 months-4 months | 0.74 (0.73 to 0.76) | 0.58 (0.48 to 0.68) | 0.57 (0.49 to 0.65) | 0.32 (0.32 to 0.33) | 0.29 (0.23 to 0.35) | 0.91 (0.89 to 0.92) |
| D2: 4 months-5 months | 0.84 (0.83 to 0.85) | 0.43 (0.36 to 0.49) | 0.64 (0.59 to 0.70) | 0.35 (0.34 to 0.36) | 0.21 (0.17 to 0.24) | 0.93 (0.91 to 0.94) |
| D2: 5 months-6 months | 0.97 (0.96 to 0.98) | 0.30 (0.24 to 0.35) | 0.71 (0.66 to 0.76) | 0.40 (0.39 to 0.41) | 0.14 (0.12 to 0.16) | 0.94 (0.94 to 0.95) |
| D2: >6 months | 0.89 (0.87 to 0.90) | 0.50 (0.43 to 0.56) | 0.56 (0.51 to 0.62) | 0.37 (0.36 to 0.38) | 0.26 (0.23 to 0.29) | 0.90 (0.89 to 0.91) |
| DB: 1 day-7 days | 0.65 (0.64 to 0.66) | 0.35 (0.27 to 0.43) | 0.77 (0.72 to 0.83) | 0.29 (0.28 to 0.30) | 0.14 (0.10 to 0.17) | 0.96 (0.95 to 0.97) |
| DB: 8 days-14 days | 0.36 (0.36 to 0.37) | 0.28 (0.21 to 0.36) | 0.90 (0.87 to 0.92) | 0.09 (0.09 to 0.10) | 0.16 (0.12 to 0.21) | 0.98 (0.98 to 0.99) |
| DB: 15 days-30 days | 0.33 (0.32 to 0.33) | 0.18 (0.14 to 0.22) | 0.94 (0.93 to 0.95) | 0.04 (0.04 to 0.05) | 0.16 (0.11 to 0.21) | 0.99 (0.99 to 1.00) |
| DB: 1 month-2 months | 0.41 (0.40 to 0.41) | 0.16 (0.13 to 0.18) | 0.94 (0.93 to 0.95) | 0.05 (0.05 to 0.06) | 0.14 (0.10 to 0.17) | 0.99 (0.99 to 0.99) |
| DB: 2 months-3 months | 0.42 (0.41 to 0.43) | 0.18 (0.15 to 0.21) | 0.92 (0.91 to 0.94) | 0.06 (0.05 to 0.07) | 0.10 (0.06 to 0.14) | 0.99 (0.99 to 1.00) |
| DB: 3 months | 0.50 (0.49 to 0.52) | 0.14 (0.11 to 0.16) | 0.93 (0.92 to 0.94) | 0.06 (0.05 to 0.07) | 0.10 (0.06 to 0.15) | 0.99 (0.99 to 1.00) |
| Naturally-acquired and hybrid immunity (ref.: unvaccinated without prior infection evidence) | | | | | | |
| Unvaccinated: NA | 0.49 (0.48 to 0.50) | 0.45 (0.30 to 0.60) | 0.78 (0.70 to 0.85) | 0.11 (0.11 to 0.12) | 0.43 (0.22 to 0.64) | 0.95 (0.93 to 0.98) |
| D1 or D2: NA | 0.33 (0.32 to 0.34) | 0.51 (0.36 to 0.66) | 0.83 (0.78 to 0.88) | 0.08 (0.08 to 0.09) | 0.56 (0.34 to 0.77) | 0.95 (0.94 to 0.97) |
| DB: NA | 0.19 (0.19 to 0.20) | 0.29 (0.22 to 0.36) | 0.94 (0.93 to 0.96) | 0.02 (0.02 to 0.02) | 0.29 (0.13 to 0.44) | 0.99 (0.99 to 1.00) |

CI: confidence interval; COVID-19: coronavirus disease; D1: first vaccine dose; D2: second vaccine dose; DB: booster dose; HR: hazard ratio; NA: not applicable; OR: odds ratio; ref.: reference; RT-PCR: reverse-transcription PCR; SARS-CoV-2: severe acute respiratory coronavirus 2.

^a Delta (respective Omicron): laboratory-confirmed (RT-PCR) SARS-CoV-2 infection with mutation screening indicative of Delta (respective Omicron) variant [14].

^b Duration since receiving the COVID-19 vaccine dose in question, at presentation to the screening centre.

^c Risk reductions are relative to symptoms attributable respectively to the Delta or the Omicron variant.

^d Odds ratios of symptomatic infections, according to the time elapsed since each COVID-19 vaccine dose reception or according to evidence of prior infection.

^e Hazard ratios of hospitalisations after symptomatic infections, according to the time elapsed since each COVID-19 vaccine dose reception or according to evidence of prior infection.

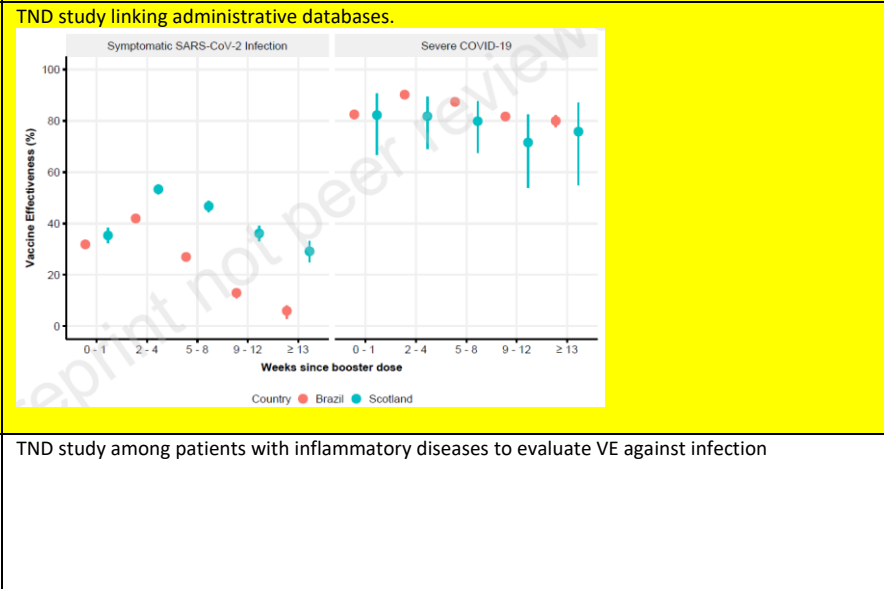
^f Naturally-acquired immunity: Individuals with evidence of prior SARS-CoV-2 infection; the causative variant for prior infection is unknown.

| Immune status: time since named vaccine dose ^a | Omicron ^a | | | Delta ^a | | | |
|--|---|-------------------------|-------------------------|-------------------------|--|--|---|
| | Hospital admission | ICU admission | Death | Hospital admission | ICU admission | Death | |
| | HR ^c (95%CI) | HR ^c (95%CI) | HR ^c (95%CI) | HR ^c (95%CI) | HR ^c (95%CI) | HR ^c (95%CI) | |
| Vaccinated (ref.: unvaccinated without prior infection evidence) | | | | | | | |
| D1: 0–28 days | 0.99 (0.75 to 1.23) | 1.09 (0.49 to 1.69) | 1.09 (0.53 to 1.65) | 0.66 (0.50 to 0.81) | 0.43 (0.21 to 0.65) | 0.93 (0.48 to 1.37) | |
| D2: 0–30 days | 0.72 (0.50 to 0.95) | 0.54 (0.06 to 1.02) | 0.71 (0.14 to 1.29) | 0.40 (0.23 to 0.57) | 0.32 (0.04 to 0.60) | 0.44 (0.01 to 0.87) | |
| D2: 1–2 months | 0.40 (0.27 to 0.53) | 0.32 (0.06 to 0.59) | 0.38 (0.10 to 0.67) | 0.41 (0.25 to 0.57) | 0.52 (0.21 to 0.84) | 0.14 (–0.13 to 0.42) | |
| D2: 2–3 months | 0.56 (0.41 to 0.71) | 0.22 (0.00 to 0.43) | 0.12 (–0.05 to 0.29) | 0.36 (0.25 to 0.47) | 0.35 (0.16 to 0.54) | 0.11 (–0.04 to 0.26) | |
| D2: 3–4 months | 0.58 (0.48 to 0.68) | 0.25 (0.09 to 0.42) | 0.43 (0.22 to 0.65) | 0.29 (0.23 to 0.35) | 0.18 (0.10 to 0.26) | 0.31 (0.12 to 0.49) | |
| D2: 4–5 months | 0.43 (0.36 to 0.49) | 0.15 (0.07 to 0.24) | 0.30 (0.14 to 0.45) | 0.21 (0.17 to 0.24) | 0.17 (0.12 to 0.23) | 0.37 (0.20 to 0.53) | |
| D2: 5–6 months | 0.30 (0.24 to 0.35) | 0.19 (0.11 to 0.28) | 0.32 (0.15 to 0.48) | 0.14 (0.12 to 0.16) | 0.10 (0.07 to 0.13) | 0.20 (0.11 to 0.28) | |
| D2: > 6 months | 0.50 (0.43 to 0.56) | 0.32 (0.21 to 0.42) | 0.51 (0.36 to 0.65) | 0.26 (0.23 to 0.29) | 0.14 (0.11 to 0.18) | 0.35 (0.25 to 0.44) | |
| DB: 1–7 days | 0.35 (0.27 to 0.43) | 0.12 (0.02 to 0.22) | 0.29 (0.07 to 0.50) | 0.14 (0.10 to 0.17) | 0.06 (0.03 to 0.10) | 0.29 (0.15 to 0.43) | |
| DB: 8–14 days | 0.28 (0.21 to 0.36) | 0.12 (0.02 to 0.21) | 0.14 (0.00 to 0.28) | 0.16 (0.12 to 0.21) | 0.07 (0.02 to 0.12) | 0.24 (0.09 to 0.39) | |
| DB: 15–30 days | 0.18 (0.14 to 0.22) | 0.13 (0.07 to 0.20) | 0.18 (0.08 to 0.28) | 0.16 (0.11 to 0.21) | 0.15 (0.07 to 0.23) | 0.15 (0.02 to 0.29) | |
| DB: 1–2 months | 0.16 (0.13 to 0.18) | 0.06 (0.03 to 0.08) | 0.15 (0.10 to 0.21) | 0.14 (0.10 to 0.17) | 0.13 (0.07 to 0.19) | 0.16 (0.06 to 0.25) | |
| DB: 2–3 months | 0.18 (0.15 to 0.21) | 0.08 (0.04 to 0.13) | 0.14 (0.08 to 0.20) | 0.10 (0.06 to 0.14) | 0.08 (0.00 to 0.15) | 0.09 (0.01 to 0.16) | |
| DB: > 3 months | 0.14 (0.11 to 0.16) | 0.05 (0.01 to 0.09) | 0.13 (0.08 to 0.17) | 0.10 (0.06 to 0.15) | 0.03 (–0.03 to 0.09) | 0.10 (0.01 to 0.19) | |
| Naturally-acquired or hybrid immunity ^a (ref.: unvaccinated without prior infection evidence) | | | | | | | |
| Unvaccinated: NA | 0.45 (0.30 to 0.60) | 0.14 (–0.05 to 0.33) | 0.24 (–0.09 to 0.58) | 0.43 (0.22 to 0.64) | 0.54 (0.10 to 0.97) | 1.06 (0.02 to 2.10) | |
| D1 or D2: NA | 0.51 (0.36 to 0.66) | 0.42 (0.12 to 0.72) | 0.34 (0.07 to 0.61) | 0.56 (0.34 to 0.77) | 0.39 (0.08 to 0.71) | 0.90 (0.17 to 1.62) | |
| DB: NA | 0.29 (0.22 to 0.36) | 0.16 (0.05 to 0.28) | 0.19 (0.06 to 0.32) | 0.29 (0.13 to 0.44) | 0.13 (–0.05 to 0.30) | 0.11 (–0.11 to 0.33) | |
| 159 | Kirsebom et al (April 28, 2022) | England | General population | Omicron Delta | ChAdOx1 Comirnaty mRNA-1273 followed by ChAdOx1 booster | September 13, 2021- February 17, 2022 | TND study linking administrative databases to assess VE against symptomatic disease |

| Study ID | Reference | Country | Population | Variant | Vaccine | Date | Study Data | | | | | | | | |
|----------|-------------------------------|----------|--------------------|---------|-----------------------------|------------------------------|-------------|--------------|----------------------|-----------------|----------|---------|------------------|------------------------|---------------------|
| | | | | | | | Age (years) | Dose | Booster Manufacturer | Interval (days) | Controls | Cases | OR* | VE (95% CI) | |
| 158 | Sheikh et al (April 22, 2022) | Scotland | General population | Omicron | ChAdOx1 Comirnaty mRNA-1273 | November 1-December 19, 2021 | 40-64 | Unvaccinated | | | | 27,361 | 51,265 | Baseline | Baseline |
| | | | | | | | | Dose 2** | n/a | 175+ | 85,175 | 89,230 | 0.92 (0.9-0.94) | 8 (6 to 9.9) | |
| | | | | | | | | Booster | Any*** | 0-1 | 11,879 | 77,165 | 0.8 (0.77-0.83) | 20.3 (17.2 to 23.3) | |
| | | | | | | | | | Any*** | 2-6 | 27,430 | 214,222 | 0.74 (0.72-0.76) | 25.8 (23.7 to 27.8) | |
| | | | | | | | | | BNT162b2 | 7-13 | 28,809 | 176,580 | 0.42 (0.41-0.43) | 58.2 (57.0 to 59.4) | |
| | | | | | | | | | BNT162b2 | 14-34 | 86,719 | 66,406 | 0.36 (0.35-0.37) | 63.8 (63.0 to 64.5) | |
| | | | | | | | | | BNT162b2 | 35-69 | 87,592 | 90,787 | 0.43 (0.42-0.44) | 57.3 (56.4 to 58.2) | |
| | | | | | | | | | BNT162b2 | 70-104 | 22,504 | 29,379 | 0.54 (0.52-0.55) | 46.4 (45.0 to 47.8) | |
| | | | | | | | | | BNT162b2 | 105+ | 2,758 | 4,278 | 0.69 (0.66-0.73) | 30.6 (26.8 to 34.3) | |
| | | | | | | | | | ChAdOx1-S | 7-13 | 70 | 40 | 0.39 (0.25-0.59) | 61.2 (40.9 to 74.6) | |
| | | | | | | | | | ChAdOx1-S | 14-34 | 193 | 159 | 0.48 (0.38-0.61) | 51.7 (38.9 to 61.8) | |
| | | | | | | | | | ChAdOx1-S | 35-69 | 216 | 215 | 0.47 (0.38-0.57) | 53.0 (42.8 to 61.6) | |
| | | | | | | | | | ChAdOx1-S | 70-104 | 69 | 97 | 0.59 (0.43-0.81) | 40.8 (18.6 to 58.9) | |
| | | | | | | | | | ChAdOx1-S | 105+ | 10 | 14 | 0.63 (0.27-1.44) | 37.2 (-44.1 to 72.6) | |
| | | | | | | | | | Unvaccinated | | | 1,701 | 2,361 | Baseline | Baseline |
| | | | | | | | | | Dose 2** | n/a | 175+ | 4,466 | 3,053 | 0.81 (0.73-0.88) | 19.5 (11.7 to 26.6) |
| | | | | | | | | Booster | Any*** | 0-1 | 428 | 110 | 0.85 (0.5-0.95) | 34.6 (14.8 to 49.8) | |
| | | | | | | | | | Any*** | 2-6 | 1,140 | 370 | 0.71 (0.61-0.84) | 28.6 (16.0 to 39.3) | |
| | | | | | | | | | BNT162b2 | 7-13 | 1,883 | 433 | 0.42 (0.36-0.48) | 58.1 (51.6 to 63.8) | |
| | | | | | | | | | BNT162b2 | 14-34 | 14,311 | 3,010 | 0.31 (0.29-0.34) | 68.5 (65.7 to 71.2) | |
| | | | | | | | | | BNT162b2 | 35-69 | 36,300 | 25,240 | 0.46 (0.42-0.49) | 54.1 (50.5 to 57.5) | |
| | | | | | | | | | BNT162b2 | 70-104 | 14,210 | 18,317 | 0.6 (0.55-0.65) | 40.1 (35.2 to 44.5) | |
| | | | | | | | | | BNT162b2 | 105+ | 1,970 | 2,789 | 0.77 (0.7-0.85) | 23.1 (15.1 to 30.5) | |
| | | | | | | | | | ChAdOx1-S | 7-13 | 23 | 8 | 0.34 (0.14-0.83) | 66.1 (16.6 to 86.3) | |
| | | | | | | | | | ChAdOx1-S | 14-34 | 53 | 32 | 0.48 (0.3-0.79) | 51.6 (20.8 to 70.4) | |
| | | | | | | | | | ChAdOx1-S | 35-69 | 88 | 81 | 0.56 (0.4-0.78) | 44.5 (22.4 to 60.2) | |
| | | | | | | | | | ChAdOx1-S | 70-104 | 16 | 40 | 1.27 (0.7-2.32) | -27.2 (-131.6 to 30.1) | |
| | | | | | | | | | ChAdOx1-S | 105+ | 3 | 5 | 0.98 (0.23-4.28) | N too low | |

| | S-gene-negative infections | | | S-gene-positive infections | | |
|--------------------|----------------------------|-------------|--|----------------------------|-------------|--|
| | Tested, n | Positive, n | Relative vaccine effectiveness, % (95% CI) | Tested, n | Positive, n | Relative vaccine effectiveness, % (95% CI) |
| 16-49 years | | | | | | |
| Unvaccinated | 10 302 | 1003 | 22% (14 to 29) | 14 583 | 5284 | -98% (-109 to -87) |
| First dose | | | | | | |
| 0-27 days | 550 | 36 | 47% (24 to 63) | 676 | 162 | -24% (-50 to -3) |
| ≥28 days | 6570 | 581 | 30% (21 to 38) | 8339 | 2350 | -39% (-49 to -30) |
| Second dose | | | | | | |
| 0-13 days | 732 | 46 | 58% (42 to 70) | 805 | 119 | 31% (16 to 44) |
| 14-69 days | 4248 | 256 | 53% (46 to 60) | 4258 | 266 | 73% (69 to 76) |
| 70-104 days | 12 581 | 814 | 33% (26 to 40) | 13 559 | 1792 | 50% (46 to 53) |
| 105-139 days | 29 209 | 3503 | 15% (9 to 21) | 31 963 | 6257 | 32% (29 to 36) |
| 140-174 days | 14 986 | 1824 | 3% (-5 to 11) | 17 991 | 4829 | 9% (4 to 13) |
| ≥175 days | 13 183 | 1435 | Reference | 15 462 | 3714 | Reference |
| Third dose | | | | | | |
| 0-6 days | 3773 | 515 | 26% (16 to 34) | 4003 | 745 | 33% (27 to 39) |
| 7-13 days | 2185 | 143 | 62% (54 to 68) | 2155 | 113 | 84% (80 to 87) |
| ≥14 days | 12 887 | 783 | 56% (51 to 60) | 12 798 | 694 | 83% (81 to 84) |
| ≥50 years | | | | | | |
| Unvaccinated | 716 | 48 | 33% (7 to 52) | 1158 | 490 | -45% (-65 to -28) |
| First dose | | | | | | |
| 0-27 days | 27 | 4 | 0 (-230 to 70) | 36 | 13 | -16% (-134 to 42) |
| ≥28 days | 256 | 13 | 48% (7 to 72) | 343 | 100 | 10% (-15 to 30) |
| Second dose | | | | | | |
| 0-13 days | 23 | 1 | 62% (-207 to 95) | 23 | 1 | 90% (27 to 99) |
| 14-69 days | 120 | 9 | 5% (-98 to 54) | 131 | 20 | 62% (38 to 77) |
| 70-104 days | 118 | 12 | 8% (-76 to 57) | 149 | 33 | 40% (10 to 60) |
| 105-139 days | 463 | 17 | 35% (-10 to 62) | 634 | 188 | 20% (4 to 33) |
| 140-174 days | 5513 | 265 | 4% (-13 to 19) | 8205 | 2957 | 4% (-3 to 10) |
| ≥175 days | 8007 | 799 | Reference | 10 856 | 3648 | Reference |
| Third dose | | | | | | |
| 0-6 days | 3522 | 420 | 0 (-15 to 13) | 4352 | 1250 | 20% (13 to 26) |
| 7-13 days | 3006 | 180 | 54% (46 to 62) | 3146 | 320 | 77% (74 to 80) |
| ≥14 days | 17 572 | 1045 | 57% (52 to 62) | 17 504 | 977 | 88% (86 to 89) |

| | | | | | | |
|-----|---|------------------|---|--------------|-----------------------------|---------------------------|
| 157 | Cerqueria-Silva et al (April 14, 2022) | Brazil, Scotland | 18+ year olds | Omicron | ChAdOx1 Comirnaty mRNA-1273 | January 1-March 7, 2022 |
| 156 | Widdifield et al (April 14, 2022) | Canada | Patients with rheumatoid arthritis, ankylosing spondylitis, psoriasis, and inflammatory bowel disease | Alpha, Delta | Comirnaty mRNA-1273 | March 1-November 21, 2021 |



| 155 | Lind et al (April 20,2022) | USA | 5+ years | Omicron specifically ^ | Comirnaty mRNA-1273 | November 1, 2021-January 31, 2022 | <p>This TND study assessed the benefit of primary series an booster doses in the context of Omicron VOC circulation among people with and without a prior documented infection. Primary vaccination had significant but low levels of protection in people with and without prior infection which was increased by booster doses; however, the study did not find a significant increase in people with prior infection.</p> <table border="1"> <thead> <tr> <th>SARS-CoV-2 infection history and vaccination status</th> <th>Cases</th> <th>Controls</th> <th>Vaccine effectiveness (95% CI)</th> </tr> </thead> <tbody> <tr> <td colspan="4">Vaccine effectiveness among people without a prior infection</td> </tr> <tr> <td>Unvaccinated</td> <td>5162</td> <td>53974</td> <td></td> </tr> <tr> <td colspan="4">Vaccinated</td> </tr> <tr> <td>Primary vaccination: <14 days after 2nd dose</td> <td>626</td> <td>7680</td> <td>23.1% (15.2, 30.2%)</td> </tr> <tr> <td>Primary vaccination: 14-149 days after 2nd dose</td> <td>454</td> <td>3531</td> <td>28.5% (20.0, 36.2%)</td> </tr> <tr> <td>Primary vaccination: ≥150 days after 2nd dose (pre-booster)</td> <td>3216</td> <td>35112</td> <td>15.3% (10.4, 20.0%)</td> </tr> <tr> <td>Booster vaccination: <14 days after booster (3rd) dose</td> <td>67</td> <td>1286</td> <td>38.1% (18.6, 52.9%)</td> </tr> <tr> <td>Booster vaccination: ≥14 days after booster (3rd) dose</td> <td>605</td> <td>8482</td> <td>56.9% (52.1, 61.2%)</td> </tr> <tr> <td colspan="4">Vaccine effectiveness among people with a prior infection</td> </tr> <tr> <td>Unvaccinated</td> <td>322</td> <td>4507</td> <td></td> </tr> <tr> <td colspan="4">Vaccinated</td> </tr> <tr> <td>Primary vaccination: <14 days after 2nd dose</td> <td>42</td> <td>693</td> <td>33.2% (3.7, 53.6%)</td> </tr> <tr> <td>Primary vaccination: 14-149 days after 2nd dose</td> <td>41</td> <td>541</td> <td>36.1% (7.1, 56.1%)</td> </tr> <tr> <td>Primary vaccination: ≥150 days after 2nd dose (pre-booster)</td> <td>199</td> <td>2982</td> <td>34.0% (18.5, 46.5%)</td> </tr> <tr> <td>Booster vaccination: <14 days after booster (3rd) dose</td> <td>5</td> <td>97</td> <td>36.3% (-71.8, 76.4%)</td> </tr> <tr> <td>Booster vaccination: ≥14 days after booster (3rd) dose</td> <td>37</td> <td>512</td> <td>45.8% (20.0, 63.2%)</td> </tr> </tbody> </table> | SARS-CoV-2 infection history and vaccination status | Cases | Controls | Vaccine effectiveness (95% CI) | Vaccine effectiveness among people without a prior infection | | | | Unvaccinated | 5162 | 53974 | | Vaccinated | | | | Primary vaccination: <14 days after 2nd dose | 626 | 7680 | 23.1% (15.2, 30.2%) | Primary vaccination: 14-149 days after 2nd dose | 454 | 3531 | 28.5% (20.0, 36.2%) | Primary vaccination: ≥150 days after 2nd dose (pre-booster) | 3216 | 35112 | 15.3% (10.4, 20.0%) | Booster vaccination: <14 days after booster (3rd) dose | 67 | 1286 | 38.1% (18.6, 52.9%) | Booster vaccination: ≥14 days after booster (3rd) dose | 605 | 8482 | 56.9% (52.1, 61.2%) | Vaccine effectiveness among people with a prior infection | | | | Unvaccinated | 322 | 4507 | | Vaccinated | | | | Primary vaccination: <14 days after 2nd dose | 42 | 693 | 33.2% (3.7, 53.6%) | Primary vaccination: 14-149 days after 2nd dose | 41 | 541 | 36.1% (7.1, 56.1%) | Primary vaccination: ≥150 days after 2nd dose (pre-booster) | 199 | 2982 | 34.0% (18.5, 46.5%) | Booster vaccination: <14 days after booster (3rd) dose | 5 | 97 | 36.3% (-71.8, 76.4%) | Booster vaccination: ≥14 days after booster (3rd) dose | 37 | 512 | 45.8% (20.0, 63.2%) |
|---|--|----------|--------------------------------|---------------------------|---------------------|-----------------------------------|--|---|-------|----------|--------------------------------|---|--|--|--|--------------|------|-------|--|-------------------|--|--|--|--|-----|------|---------------------|---|-----|------|---------------------|---|------|-------|---------------------|--|----|------|---------------------|--|-----|------|---------------------|--|--|--|--|--------------|-----|------|--|-------------------|--|--|--|--|----|-----|--------------------|---|----|-----|--------------------|---|-----|------|---------------------|--|---|----|----------------------|--|----|-----|---------------------|
| SARS-CoV-2 infection history and vaccination status | Cases | Controls | Vaccine effectiveness (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccine effectiveness among people without a prior infection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 5162 | 53974 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccinated | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Primary vaccination: <14 days after 2nd dose | 626 | 7680 | 23.1% (15.2, 30.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Primary vaccination: 14-149 days after 2nd dose | 454 | 3531 | 28.5% (20.0, 36.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Primary vaccination: ≥150 days after 2nd dose (pre-booster) | 3216 | 35112 | 15.3% (10.4, 20.0%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Booster vaccination: <14 days after booster (3rd) dose | 67 | 1286 | 38.1% (18.6, 52.9%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Booster vaccination: ≥14 days after booster (3rd) dose | 605 | 8482 | 56.9% (52.1, 61.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccine effectiveness among people with a prior infection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 322 | 4507 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccinated | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Primary vaccination: <14 days after 2nd dose | 42 | 693 | 33.2% (3.7, 53.6%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Primary vaccination: 14-149 days after 2nd dose | 41 | 541 | 36.1% (7.1, 56.1%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Primary vaccination: ≥150 days after 2nd dose (pre-booster) | 199 | 2982 | 34.0% (18.5, 46.5%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Booster vaccination: <14 days after booster (3rd) dose | 5 | 97 | 36.3% (-71.8, 76.4%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Booster vaccination: ≥14 days after booster (3rd) dose | 37 | 512 | 45.8% (20.0, 63.2%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 154 | Gram et al (April 20,2022) | Denmark | 12+ years | Alpha, Delta and Omicron^ | Comirnaty mRNA-1273 | December 27,2020-January 31,2022 | <p>This study evaluated the VE of mRNA vaccines in Denmark against infection and hospitalisation. The study reported that vaccination with mRNA vaccines was associated with protection against infection and hospitalization by Alpha, Delta and Omicron VOCs.</p> <p>VE of 2 doses mRNA agains infection: VE 2 doses mRNA against hospitalizatoin:</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

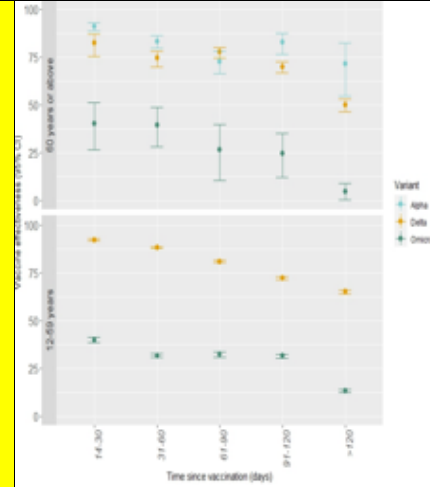


Figure 4

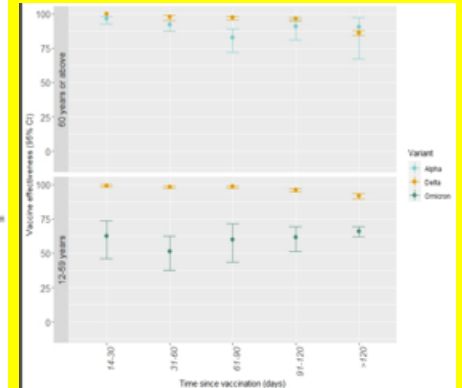


Figure 6

VE of 3 doses mRNA against infection:

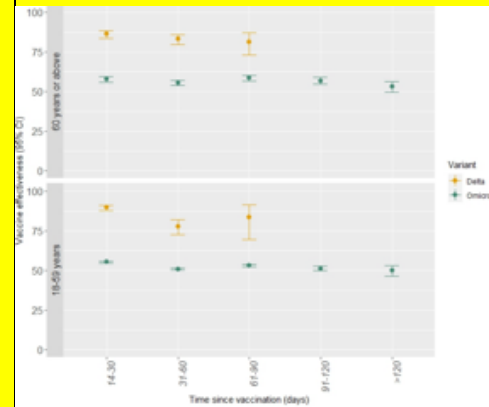


Figure 5

VE 2 doses mRNA against hospitalization:

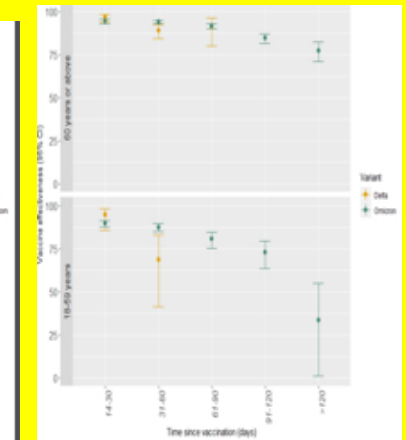
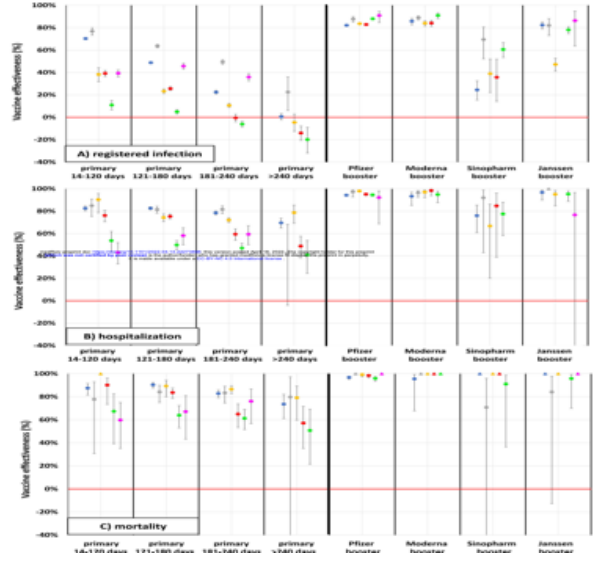
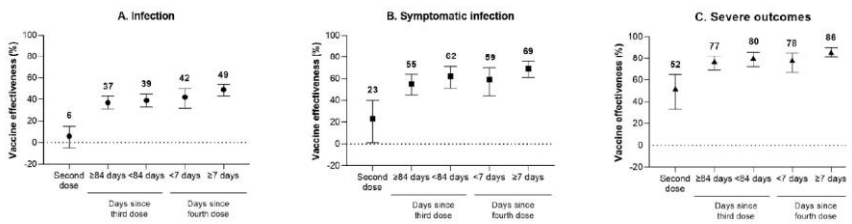
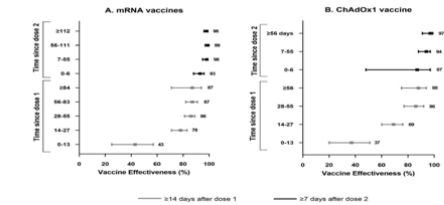
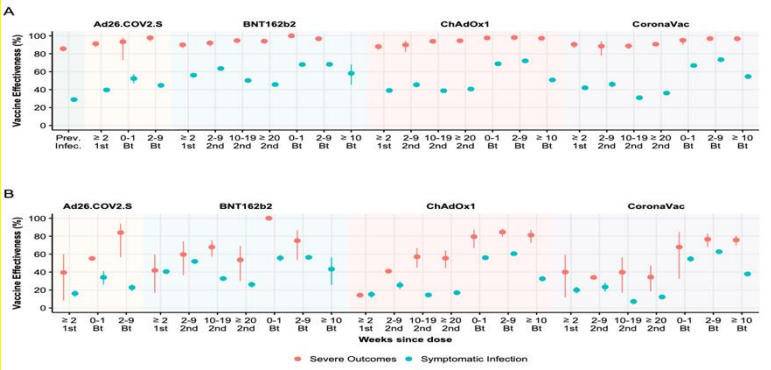


Figure 7

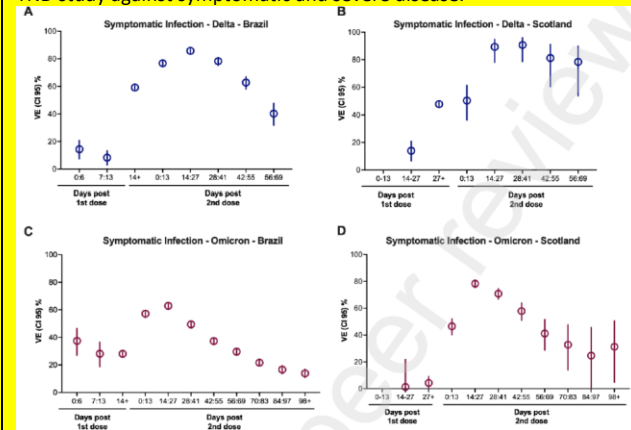
| | | | | | | | |
|-----|--|---------|------------------------------|-----------------------|--|-----------------------------------|---|
| 153 | Voko et al (April 18, 2022) | Hungary | 18-100 years | Delta^ | Comirnaty, mRNA-1273, ChAdOx1, Ad26.COV2.S, Sputnik, Sinopharm | March 4, 2020- December 31, 2021 | <p>This study assessed the effectiveness and duration of protection of six different types of vaccines with combinations as primary or booster vaccines against COVID-19 infection, hospitalization and death during a period of Delta variant predominance.</p>  |
| 152 | Grewal et al (April 18, 2022) (updated June 1, 2022) | Canada | LTC residents aged ≥60 years | Omicron specifically^ | Comirnaty, mRNA-1273 | December 30, 2021- April 27, 2022 | <p>This test-negative case control study estimated the marginal effectiveness of a fourth dose of COVID-19 vaccines relative to individuals with a third dose and/or unvaccinated.</p>  <p>Figure 2: Vaccine effectiveness of 2, 3, and 4 doses of mRNA COVID-19 vaccine against Omicron outcomes among long-term care residents in Ontario, Canada, compared to unvaccinated residents</p> |

| 151 | Richardson et al (April 17,2022) (updated June 20, 2022) | Mexico | Childcare workers aged ≥18 years | Non-VOC, Alpha, Gamma and Delta [^] | CanSino | March 30, 2021- December 31, 2021 | Prospective cohort study evaluating the VE of Cansino against laboratory-confirmed illness, hospitalisation and death associated with COVID-19. Vaccination with Cansino provided moderate protection against infection, and robust protection against hospitalization and death up to 4 months, with declines in VE seen after 120 days. <table border="1"> <thead> <tr> <th rowspan="2">Vaccination status</th> <th rowspan="2">Contributing participants</th> <th colspan="2">Person-days</th> <th rowspan="2">Laboratory-confirmed COVID-19^a</th> <th colspan="2">VE estimate (95% CI)</th> <th rowspan="2">Hospitalizations</th> <th colspan="2">VE estimate (95% CI)</th> <th rowspan="2">Deaths</th> <th colspan="2">VE estimate (95% CI)</th> </tr> <tr> <th>total no.</th> <th>median (IQR)</th> <th>Unadjusted^b</th> <th>Adjusted^c</th> <th>Unadjusted^b</th> <th>Adjusted^c</th> <th>Unadjusted^b</th> <th>Adjusted^c</th> </tr> </thead> <tbody> <tr> <td colspan="13">Full cohort period</td> </tr> <tr> <td>Unvaccinated</td> <td>43886</td> <td>3,164,516</td> <td>43 (33-52)</td> <td>395</td> <td>Ref</td> <td>Ref</td> <td>11</td> <td>Ref</td> <td>Ref</td> <td>4</td> <td>Ref</td> <td>Ref</td> </tr> <tr> <td>Fully vaccinated^d</td> <td>37646</td> <td>8,188,809</td> <td>223 (213-233)</td> <td>1853</td> <td>14% (3-23%)</td> <td>20% (10-29%)</td> <td>14</td> <td>73% (36-88%)</td> <td>70% (42-90%)</td> <td>2</td> <td>92% (55-99%)</td> <td>94% (66-99%)</td> </tr> <tr> <td>14-60 days after vaccination</td> <td>37646</td> <td>1,767,060</td> <td>47 (47-47)</td> <td>105</td> <td>44% (28-56%)</td> <td>48% (32-61%)</td> <td>1</td> <td>88% (12-99%)</td> <td>92% (23-99%)</td> <td>0</td> <td>—</td> <td>—</td> </tr> <tr> <td>61-120 days after vaccination</td> <td>37481</td> <td>2,217,743</td> <td>60 (60-60)</td> <td>1109</td> <td>17% (6-28%)</td> <td>20% (9-31%)</td> <td>6</td> <td>84% (54-95%)</td> <td>88% (65-96%)</td> <td>1</td> <td>95% (53-99%)</td> <td>95% (53-100%)</td> </tr> <tr> <td>>120 days after vaccination</td> <td>36365</td> <td>4,204,006</td> <td>317 (1079-826)</td> <td>583</td> <td>23% (10-30%)</td> <td>3% (26-16%)</td> <td>7</td> <td>23% (265-84%)</td> <td>24% (263-84%)</td> <td>1</td> <td>87% (1-53-99%)</td> <td>93% (22-99%)</td> </tr> <tr> <td colspan="13">Pre-Delta predominance^e</td> </tr> <tr> <td>Unvaccinated</td> <td>43886</td> <td>2,044,499</td> <td>43 (33-52)</td> <td>62</td> <td>Ref</td> <td>Ref</td> <td>3</td> <td>Ref</td> <td>Ref</td> <td>0</td> <td>Ref</td> <td>Ref</td> </tr> <tr> <td>Fully vaccinated^d</td> <td>37612</td> <td>8,928,471</td> <td>38 (27-46)</td> <td>61</td> <td>45% (13-66%)</td> <td>53% (23-71%)</td> <td>0</td> <td>—</td> <td>—</td> <td>0</td> <td>—</td> <td>—</td> </tr> <tr> <td colspan="13">Delta predominance^f</td> </tr> <tr> <td>Unvaccinated</td> <td>6227</td> <td>1,049,291</td> <td>175 (175-175)</td> <td>315</td> <td>Ref</td> <td>Ref</td> <td>8</td> <td>Ref</td> <td>Ref</td> <td>4</td> <td>Ref</td> <td>Ref</td> </tr> <tr> <td>Fully vaccinated^d</td> <td>32585</td> <td>6,379,959</td> <td>175 (175-175)</td> <td>1679</td> <td>12% (1-22%)</td> <td>18% (8-28%)</td> <td>14</td> <td>71% (31-88%)</td> <td>74% (38-89%)</td> <td>2</td> <td>92% (55-99%)</td> <td>94% (67-99%)</td> </tr> </tbody> </table> | Vaccination status | Contributing participants | Person-days | | Laboratory-confirmed COVID-19 ^a | VE estimate (95% CI) | | Hospitalizations | VE estimate (95% CI) | | Deaths | VE estimate (95% CI) | | total no. | median (IQR) | Unadjusted ^b | Adjusted ^c | Unadjusted ^b | Adjusted ^c | Unadjusted ^b | Adjusted ^c | Full cohort period | | | | | | | | | | | | | Unvaccinated | 43886 | 3,164,516 | 43 (33-52) | 395 | Ref | Ref | 11 | Ref | Ref | 4 | Ref | Ref | Fully vaccinated ^d | 37646 | 8,188,809 | 223 (213-233) | 1853 | 14% (3-23%) | 20% (10-29%) | 14 | 73% (36-88%) | 70% (42-90%) | 2 | 92% (55-99%) | 94% (66-99%) | 14-60 days after vaccination | 37646 | 1,767,060 | 47 (47-47) | 105 | 44% (28-56%) | 48% (32-61%) | 1 | 88% (12-99%) | 92% (23-99%) | 0 | — | — | 61-120 days after vaccination | 37481 | 2,217,743 | 60 (60-60) | 1109 | 17% (6-28%) | 20% (9-31%) | 6 | 84% (54-95%) | 88% (65-96%) | 1 | 95% (53-99%) | 95% (53-100%) | >120 days after vaccination | 36365 | 4,204,006 | 317 (1079-826) | 583 | 23% (10-30%) | 3% (26-16%) | 7 | 23% (265-84%) | 24% (263-84%) | 1 | 87% (1-53-99%) | 93% (22-99%) | Pre-Delta predominance^e | | | | | | | | | | | | | Unvaccinated | 43886 | 2,044,499 | 43 (33-52) | 62 | Ref | Ref | 3 | Ref | Ref | 0 | Ref | Ref | Fully vaccinated ^d | 37612 | 8,928,471 | 38 (27-46) | 61 | 45% (13-66%) | 53% (23-71%) | 0 | — | — | 0 | — | — | Delta predominance^f | | | | | | | | | | | | | Unvaccinated | 6227 | 1,049,291 | 175 (175-175) | 315 | Ref | Ref | 8 | Ref | Ref | 4 | Ref | Ref | Fully vaccinated ^d | 32585 | 6,379,959 | 175 (175-175) | 1679 | 12% (1-22%) | 18% (8-28%) | 14 | 71% (31-88%) | 74% (38-89%) | 2 | 92% (55-99%) | 94% (67-99%) |
|---|---|-------------|----------------------------------|---|-----------------------------|---------------------------------------|--|-------------------------|---------------------------|-------------------------|-----------------------|--|----------------------|----------------------|------------------|----------------------|--|--------|----------------------|--|-----------|--------------|-------------------------|-----------------------|-------------------------|-----------------------|-------------------------|-----------------------|---------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--------------|-------|-----------|------------|-----|-----|-----|----|-----|-----|---|-----|-----|-------------------------------|-------|-----------|---------------|------|-------------|--------------|----|--------------|--------------|---|--------------|--------------|------------------------------|-------|-----------|------------|-----|--------------|--------------|---|--------------|--------------|---|---|---|-------------------------------|-------|-----------|------------|------|-------------|-------------|---|--------------|--------------|---|--------------|---------------|-----------------------------|-------|-----------|----------------|-----|--------------|-------------|---|---------------|---------------|---|----------------|--------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--------------|-------|-----------|------------|----|-----|-----|---|-----|-----|---|-----|-----|-------------------------------|-------|-----------|------------|----|--------------|--------------|---|---|---|---|---|---|---------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--------------|------|-----------|---------------|-----|-----|-----|---|-----|-----|---|-----|-----|-------------------------------|-------|-----------|---------------|------|-------------|-------------|----|--------------|--------------|---|--------------|--------------|
| Vaccination status | Contributing participants | Person-days | | Laboratory-confirmed COVID-19 ^a | VE estimate (95% CI) | | Hospitalizations | | | VE estimate (95% CI) | | | Deaths | VE estimate (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | total no. | median (IQR) | | Unadjusted ^b | Adjusted ^c | | Unadjusted ^b | Adjusted ^c | Unadjusted ^b | Adjusted ^c | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Full cohort period | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 43886 | 3,164,516 | 43 (33-52) | 395 | Ref | Ref | 11 | Ref | Ref | 4 | Ref | Ref | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fully vaccinated ^d | 37646 | 8,188,809 | 223 (213-233) | 1853 | 14% (3-23%) | 20% (10-29%) | 14 | 73% (36-88%) | 70% (42-90%) | 2 | 92% (55-99%) | 94% (66-99%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-60 days after vaccination | 37646 | 1,767,060 | 47 (47-47) | 105 | 44% (28-56%) | 48% (32-61%) | 1 | 88% (12-99%) | 92% (23-99%) | 0 | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 61-120 days after vaccination | 37481 | 2,217,743 | 60 (60-60) | 1109 | 17% (6-28%) | 20% (9-31%) | 6 | 84% (54-95%) | 88% (65-96%) | 1 | 95% (53-99%) | 95% (53-100%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >120 days after vaccination | 36365 | 4,204,006 | 317 (1079-826) | 583 | 23% (10-30%) | 3% (26-16%) | 7 | 23% (265-84%) | 24% (263-84%) | 1 | 87% (1-53-99%) | 93% (22-99%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pre-Delta predominance^e | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 43886 | 2,044,499 | 43 (33-52) | 62 | Ref | Ref | 3 | Ref | Ref | 0 | Ref | Ref | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fully vaccinated ^d | 37612 | 8,928,471 | 38 (27-46) | 61 | 45% (13-66%) | 53% (23-71%) | 0 | — | — | 0 | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta predominance^f | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 6227 | 1,049,291 | 175 (175-175) | 315 | Ref | Ref | 8 | Ref | Ref | 4 | Ref | Ref | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fully vaccinated ^d | 32585 | 6,379,959 | 175 (175-175) | 1679 | 12% (1-22%) | 18% (8-28%) | 14 | 71% (31-88%) | 74% (38-89%) | 2 | 92% (55-99%) | 94% (67-99%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 150 | Nasreen et al (April 13,2022) | Canada | 18+ year olds | Non-VOC, Alpha, Beta, Gamma, Delta [^] | Comirnaty mRNA-1273 ChAdOx1 | December 14, 2020- September 30, 2021 | Test-negative case control study conducted across 4 canadian provinces to evaluate the effectiveness of heterologous and homologous regimen of COVID-19 vaccines in preventing hospitalization or death. <p>Figure 2: Pooled adjusted vaccine effectiveness against severe outcomes of hospitalization or death for mRNA (panel A) and ChAdOx1 (panel B) vaccines in Ontario, Quebec, British Columbia, and Manitoba.</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 149 | Cerqueira-Silva (April 13, 2022) | Brazil | 18+ year olds | Omicron ^A | BNT162b2, ChAdOx1, Ad26.COVS.2.S and CoronaVac | January 01,2022- March 22,2022 | <p>TND and matched case-control study evaluating the impact of hybrid immunity in preventing symptomatic infection and severe disease during Omicron circulation. Prior infection with vaccination provided robust protection against severe outcomes.</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|---|--------|---------------|----------------------|---|---------------------------------------|--|--------------------|--|--|--|--|--|--|--|--------|---------|------|---------|------|----|------------|---------------|-------------|--------|-----|---------|------|----|------------|---------------|-----------|---------|------|---------|------|----|------------|---------------|--------|--|--|--|--|--|--|--|--|--------|-----|---------|------|----|------------|---------------|----------------------|--|--|--|--|--|--|--|--------|---------|------|---------|------|---|-------------|---------------|-------------|--------|------|--------|------|----|-------------|---------------|-----------|---------|------|---------|------|----|-------------|----------------|--------|--|--|--|--|--|--|--|--|---------|------|---------|------|----|------------|---------------|
| 148 | Plumb et al (April 15, 2022) | USA | 18+ year olds | Delta → Omicron | Comirnaty and mRNA-1273 | June 20, 2021- February 24,2022 | <p>Test-negative case control study assessed effectiveness of mRNA primary series and booster vaccines in hospitalised patients with prior infection.</p> <p><small>** Among persons with a previous infection, adjusted VE <90 days after dose 1 was 42.0% (95% CI = 16.8%–59.5%) and ≥90 days after dose 1 was 42.2% (95% CI = 26.0%–54.8%); adjusted VE <90 days after dose 2 was 44.6% (95% CI = 28.6%–56.9%) and ≥90 days after dose 2 was 39.3% (95% CI = 32.4%–45.4%); and adjusted VE <90 days after dose 3 was 67.9% (95% CI = 60.3%–74.0%) and ≥90 days after dose 3 was 62.4% (95% CI = 48.6%–72.5%).</small></p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 147 | Kim et al (April 10, 2022) | USA | 18+ year olds | Delta → Omicron | Comirnaty and mRNA-1273 | October 1, 2021- February 12, 2022 | <p>Test-negative case control study evaluating VE of 2nd and 3rd doses of mRNA vaccines against symptomatic infection over time across outpatient centers in 7 US states. Paper contains data stratified by prior infection, chronic conditions, and high-risk exposure.</p> <table border="1"> <thead> <tr> <th colspan="8">Delta^b</th> </tr> </thead> <tbody> <tr> <td>2-Dose</td> <td>327/552</td> <td>(59)</td> <td>763/942</td> <td>(81)</td> <td>66</td> <td>(57 to 73)</td> <td>63 (51 to 72)</td> </tr> <tr> <td>14-149 Days</td> <td>14/239</td> <td>(6)</td> <td>106/285</td> <td>(37)</td> <td>89</td> <td>(81 to 94)</td> <td>89 (78 to 94)</td> </tr> <tr> <td>≥150 Days</td> <td>313/538</td> <td>(58)</td> <td>657/836</td> <td>(79)</td> <td>62</td> <td>(52 to 70)</td> <td>58 (44 to 68)</td> </tr> <tr> <th colspan="8">3-Dose</th> </tr> <tr> <td></td> <td>22/247</td> <td>(9)</td> <td>259/438</td> <td>(59)</td> <td>93</td> <td>(89 to 96)</td> <td>96 (93 to 98)</td> </tr> <tr> <th colspan="8">Omicron^b</th> </tr> <tr> <td>2-Dose</td> <td>464/684</td> <td>(68)</td> <td>257/380</td> <td>(68)</td> <td>0</td> <td>(-32 to 23)</td> <td>21 (-6 to 41)</td> </tr> <tr> <td>14-149 Days</td> <td>69/289</td> <td>(24)</td> <td>53/176</td> <td>(30)</td> <td>27</td> <td>(-11 to 52)</td> <td>45 (14 to 66)</td> </tr> <tr> <td>≥150 Days</td> <td>395/615</td> <td>(64)</td> <td>204/327</td> <td>(62)</td> <td>-8</td> <td>(-43 to 18)</td> <td>11 (-21 to 35)</td> </tr> <tr> <th colspan="8">3-Dose</th> </tr> <tr> <td></td> <td>322/542</td> <td>(59)</td> <td>408/531</td> <td>(77)</td> <td>56</td> <td>(43 to 66)</td> <td>62 (48 to 72)</td> </tr> </tbody> </table> | Delta ^b | | | | | | | | 2-Dose | 327/552 | (59) | 763/942 | (81) | 66 | (57 to 73) | 63 (51 to 72) | 14-149 Days | 14/239 | (6) | 106/285 | (37) | 89 | (81 to 94) | 89 (78 to 94) | ≥150 Days | 313/538 | (58) | 657/836 | (79) | 62 | (52 to 70) | 58 (44 to 68) | 3-Dose | | | | | | | | | 22/247 | (9) | 259/438 | (59) | 93 | (89 to 96) | 96 (93 to 98) | Omicron ^b | | | | | | | | 2-Dose | 464/684 | (68) | 257/380 | (68) | 0 | (-32 to 23) | 21 (-6 to 41) | 14-149 Days | 69/289 | (24) | 53/176 | (30) | 27 | (-11 to 52) | 45 (14 to 66) | ≥150 Days | 395/615 | (64) | 204/327 | (62) | -8 | (-43 to 18) | 11 (-21 to 35) | 3-Dose | | | | | | | | | 322/542 | (59) | 408/531 | (77) | 56 | (43 to 66) | 62 (48 to 72) |
| Delta ^b | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-Dose | 327/552 | (59) | 763/942 | (81) | 66 | (57 to 73) | 63 (51 to 72) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-149 Days | 14/239 | (6) | 106/285 | (37) | 89 | (81 to 94) | 89 (78 to 94) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥150 Days | 313/538 | (58) | 657/836 | (79) | 62 | (52 to 70) | 58 (44 to 68) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-Dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 22/247 | (9) | 259/438 | (59) | 93 | (89 to 96) | 96 (93 to 98) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omicron ^b | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-Dose | 464/684 | (68) | 257/380 | (68) | 0 | (-32 to 23) | 21 (-6 to 41) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-149 Days | 69/289 | (24) | 53/176 | (30) | 27 | (-11 to 52) | 45 (14 to 66) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥150 Days | 395/615 | (64) | 204/327 | (62) | -8 | (-43 to 18) | 11 (-21 to 35) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-Dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 322/542 | (59) | 408/531 | (77) | 56 | (43 to 66) | 62 (48 to 72) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | |
|-----|--|--------|---|------------------------|-----------------------------|------------------------------------|---|
| 146 | Menni et al* (April 08, 2022) | UK | General population | Delta^ | Comirnaty mRNA-1273 ChAdOx1 | May 23, 2021- November 23, 2021 | <p>Prospective cohort study analysed self-reported lateral flow or PCR test positivity data from an app in the UK among adults, 5-8 months after receiving primary dose and an mRNA booster. VE showed a gradual decline after the second dose.</p> |
| 145 | Glatman-Freedman et al (March 31, 2022) | Israel | 16+ year olds | Delta → Omicron | Comirnaty | September 6, 2021- January 1, 2022 | <p>Cohort study by linking administrative databases evaluate VE of 3rd dose versus 0 doses against infection over time. A=16-59 year olds; B=60+ year olds.</p> |
| 144 | Buchan et al (April 7, 2022) | Canada | 12-17 year olds | Delta → Omicron | Comirnaty | November 22, 2021- March 6, 2022 | <p>TND conducted by linking administrative databases evaluating VE against symptomatic infection and severe disease.</p> |
| 143 | Fabiani et al (April 6, 2022) | Italy | 60+ and other priority groups (e.g. hcws) | Delta | Comirnaty mRNA-1273 ChAdOx1 | July 19, 2021- December 12, 2021 | <p>Cohort study among vaccine recipients comparing time intervals to day 4-10 post dose 1. Paper contains data stratified by priority groups.</p> |

| | | | | | Ad26.COV2.S | | Any SARS-CoV-2 Infection ^a | | | Severe COVID-19 ^b | | | |
|-----|--|------------------|--------------------|--|--|---|--|--------------------------|---------------------------------------|------------------------------|--------------------------|---------------------------------------|------------|
| | | | | | | | No. Cases | Incidence per 100,000 PD | Adjusted VE ^c (%) (95% CI) | No. Cases | Incidence per 100,000 PD | Adjusted VE ^c (%) (95% CI) | |
| | | | | | | | Total | | | | | | |
| | | | | | | | 4-10 days since 1st dose (reference) | 608 | 11.2 | ref. | 115 | 2.2 | ref. |
| | | | | | | | >2 wks. after 1st dose to ≤2 wks. after 2nd | 7,451 | 6.7 | 29.3 (16.3 | 767 | 0.7 | 59.5 (49.4 |
| | | | | | | | 3-13 wks. after completion of primary series | 24,09 | 3.3 | 67.2 (62.5 | 1,406 | 0.2 | 89.5 (86.1 |
| | | | | | | | 14-18 wks. after completion of primary series | 25,56 | 4.9 | 51.4 (43.6 | 2,041 | 0.4 | 82.7 (76.5 |
| | | | | | | | 19-26 wks. after completion of primary series | 63,90 | 8.6 | 29.4 (15.5 | 4,366 | 0.7 | 75.9 (66.3 |
| | | | | | | | >26 wks. after completion of primary series | 56,69 | 12.5 | 12.2 (-4.7 | 3,912 | 1.1 | 65.3 (50.3 |
| | | | | | | | 3-10(8) ^d wks. after booster dose | 4,319 | 4.3 | 76.1 (70.4 | 171 | 0.4 | 93.0 (90.2 |
| 142 | Bansal et al (April 6, 2022) | Qatar | General population | Alpha, Beta, Delta, Omicron (but no omicron specific estimate) | Comirnaty mRNA-1273 ChAdOx1 (1.6% of all vaccinated) | January 1, 2021-February 20, 2022 | Matched case-control among all cases in Qatar, looking at progression to ICU. VE 89% (95% CI, 85 to 92) between 0-4 months post the second dose. VE 91%; 95% CI 84 to 95) between 4 -6 months after the second dose; VE 90%; 95% CI 84 to 94)) at 6 to 9 months after the second dose. | | | | | | |
| 141 | Florentino et al (April 5, 2022) | Brazil, Scotland | 12-17 year olds | Delta → Omicron | Comirnaty | Brazil: September 8, 2021-March 8, 2022 Scotland: August 6, 2021-March 1, 2022 | TND study against symptomatic and severe disease. | | | | | | |



| | | | | | | | |
|-----|---|---------|---------------|-----------------------|---------------------|------------------------------------|--|
| | | | | | | | |
| 140 | Bar-On et al (April 5, 2022) | Israel | 60+ year olds | Omicron | Comirnaty | January 10-March 2, 2022 | <p>Relative VE comparing 4th to 3rd dose.</p> |
| 139 | Perumal et al (April 1, 2022) | Germany | 12+ year olds | Delta, Omicron | Comirnaty mRNA-1273 | November 8, 2021-February 13, 2022 | <p>Analysis of surveillance data with comparison to aggregate vaccination data to calculate the VE against symptomatic disease, hospitalization, and severe disease. (Note unable to adjust for many confounders).</p> |

Table 3: Effectiveness of booster vaccination against symptomatic SARS-CoV-2 infection and COVID-19-associated hospitalizations and severe illness during dominant circulation of the Omicron variant in Germany, CW52/2021-06/2022, by age group and time interval.

| | 12-17 years | | | | ≥18 years | | | |
|------------------------------|-------------|------------------|-------------|------------------|-----------|------------------|-------------|------------------|
| | N | | VE (95% CI) | | N | | VE (95% CI) | |
| | (Cases) | | (Cases) | | (Cases) | | (Cases) | |
| Symptomatic infection | | | | | | | | |
| Unvaccinated | 46,544 | Ref. | 166,565 | Ref. | 147,877 | Ref. | 18,688 | Ref. |
| Boosted* | 2,565 | 88.3 (86.2-90.2) | 156,215 | 69.7 (65.2-73.6) | 131,523 | 67.4 (62.3-71.8) | 26,959 | 81.6 (77.2-85.2) |
| Boosted, by time interval | | | | | | | | |
| <4 weeks | 1,694 | 89.7 (88.1-91.1) | 42,311 | 78.7 (75.8-81.3) | 37,326 | 77.4 (74.6-79.9) | 4,985 | 87.8 (86.0-89.4) |
| 4 to <8 weeks | 871 | 84.4 (81.1-87.3) | 76,028 | 65.9 (62.1-69.4) | 64,484 | 62.9 (59.2-66.3) | 11,544 | 81.3 (79.3-83.2) |
| 8 to <12 weeks | -- | NC | 37,876 | 56.7 (50.0-62.5) | 29,713 | 51.1 (44.3-57.2) | 8,163 | 76.4 (73.4-79.0) |
| 12 to <16 weeks | -- | NC | -- | NC | -- | NC | 2,267 | 75.0 (69.7-79.5) |
| Hospitalization | | | | | | | | |
| Unvaccinated | 222 | Ref. | 5,325 | Ref. | 2,404 | Ref. | 2,921 | Ref. |
| Boosted* | 9 | 90.5 (86.4-93.6) | 1,340 | 94.4 (92.6-95.8) | 617 | 89.9 (86.9-92.3) | 905 | 95.9 (94.6-97.0) |
| Boosted, by time interval | | | | | | | | |
| <4 weeks | 6 | 91.4 (85.2-95.6) | 351 | 96.4 (94.9-97.6) | 180 | 93.7 (92.3-95.0) | 171 | 97.7 (97.0-98.3) |
| 4 to <8 weeks | 3 | 83.9 (66.2-93.9) | 580 | 94.8 (93.0-96.1) | 279 | 88.6 (86.5-90.5) | 301 | 96.7 (95.9-97.4) |
| 8 to <12 weeks | -- | NC | 409 | 91.4 (88.0-94.1) | 158 | 77.1 (71.4-82.0) | 251 | 94.3 (92.8-95.5) |
| 12 to <16 weeks | -- | NC | -- | NC | -- | NC | 182 | 85.6 (81.3-89.1) |
| Severe illness | | | | | | | | |
| Unvaccinated | 5 | Ref. | 1,535 | Ref. | 289 | Ref. | 1,246 | Ref. |
| Boosted* | 0 | NC | 244 | 97.5 (96.8-98.2) | 24 | 96.2 (92.2-98.4) | 220 | 97.7 (97.0-98.2) |
| Boosted, by time interval | | | | | | | | |
| <4 weeks | -- | NC | -- | NC | -- | NC | 39 | 98.8 (98.2-99.2) |
| 4 to <8 weeks | -- | NC | -- | NC | -- | NC | 73 | 98.1 (97.4-98.6) |
| 8 to <12 weeks | -- | NC | -- | NC | -- | NC | 46 | 97.3 (96.0-98.2) |
| 12 to <16 weeks | -- | NC | -- | NC | -- | NC | 62 | 87.9 (83.1-91.6) |

| | | | | | | | |
|-----|---|--------|---------------|-----------------------|------------------------|--------------------------------------|--|
| 138 | Ranzani et al (April 1, 2022) | Brazil | 18+ year olds | Delta, Omicron | Coronavac Comirnaty | September 6, 2021- March 10, 2022 | TND study linking administrative databases. Note booster dose VE is a relative VE (compared to primary series recipients) while primary series VE is compared to unvaccinated. |
|-----|---|--------|---------------|-----------------------|------------------------|--------------------------------------|--|



| | | | | | | |
|-----|--|--------|---------------|-------|-----------------------------|---------------------------|
| 137 | Starrfelt et al (March 30, 2022) | Norway | 18+ year olds | Delta | Comirnaty mRNA-1273 ChAdOx1 | July 15-November 30, 2021 |
|-----|--|--------|---------------|-------|-----------------------------|---------------------------|

Cohort study conducted by linking administrative databases.

Vaccine effectiveness

Legend: Infection (red), Hospitalization (green), ICU (orange), Death (yellow)

| Time Interval | Booster Type | Effectiveness (%) - Infection | Effectiveness (%) - Hospitalization | Effectiveness (%) - ICU | Effectiveness (%) - Death |
|--------------------------|--------------|-------------------------------|-------------------------------------|-------------------------|---------------------------|
| >3 weeks after dose 1 | Pfizer | ~20% | ~70% | ~80% | ~85% |
| 2-8 weeks after dose 2 | Pfizer | ~75% | ~95% | ~95% | ~95% |
| 10-17 weeks after dose 2 | Pfizer | ~65% | ~90% | ~90% | ~90% |
| 18-25 weeks after dose 2 | Pfizer | ~45% | ~85% | ~85% | ~85% |
| 26-33 weeks after dose 2 | Pfizer | ~35% | ~80% | ~80% | ~80% |
| >33 weeks after dose 2 | Pfizer | ~10% | ~70% | ~70% | ~70% |
| >1 week after dose 3 | Moderna | ~75% | ~90% | ~90% | ~90% |
| Reinfection | Moderna | ~90% | ~95% | ~95% | ~95% |

| | | | | | | |
|-----|---|---------|---------------|---------|---------------------|-------------------------------------|
| 136 | Hansen et al (March 30, 2022) | Denmark | 12+ year olds | Omicron | Comirnaty mRNA-1273 | December 28, 2021-February 15, 2022 |
|-----|---|---------|---------------|---------|---------------------|-------------------------------------|

Cohort study by linking administrative databases. (first column Pfizer, second Moderna)

| | | | | | | | <table border="1"> <thead> <tr> <th rowspan="2">Outcome</th> <th rowspan="2">Days since vaccination</th> <th colspan="2">a)</th> <th colspan="2">b)</th> </tr> <tr> <th>Adjusted VE [95% CI]</th> <th>(ref)</th> <th>Adjusted VE [95% CI]</th> <th>(ref)</th> </tr> </thead> <tbody> <tr> <td rowspan="5">Protection against infection after 2 doses</td> <td>Not vaccinated</td> <td></td> <td>(ref)</td> <td></td> <td>(ref)</td> </tr> <tr> <td>14-30</td> <td>37.9 (34.4; 41.2)</td> <td></td> <td>37.0 (35.6; 38.3)</td> <td></td> </tr> <tr> <td>31-60</td> <td>27.1 (24.5; 29.6)</td> <td></td> <td>27.4 (26.3; 28.4)</td> <td></td> </tr> <tr> <td>61-90</td> <td>26.8 (23.8; 29.6)</td> <td></td> <td>26.6 (25.3; 27.9)</td> <td></td> </tr> <tr> <td>91-120</td> <td>23.3 (21.1; 25.5)</td> <td></td> <td>27.4 (26.2; 28.5)</td> <td></td> </tr> <tr> <td>121+</td> <td>13.2 (12.3; 14.2)</td> <td></td> <td>9.8 (9.2; 10.4)</td> <td></td> </tr> <tr> <td rowspan="5">Protection against hospitalisation after 2 doses</td> <td>Not vaccinated</td> <td></td> <td>(ref)</td> <td></td> <td>(ref)</td> </tr> <tr> <td>14-30</td> <td>50.5 (47.9; 53.1)</td> <td></td> <td>50.5 (33.9; 63.0)</td> <td></td> </tr> <tr> <td>31-60</td> <td>48.5 (46.6; 50.3)</td> <td></td> <td>48.5 (36.6; 58.2)</td> <td></td> </tr> <tr> <td>61-90</td> <td>42.6 (36.9; 54.9)</td> <td></td> <td>42.6 (26.9; 54.9)</td> <td></td> </tr> <tr> <td>91-120</td> <td>47.2 (33.7; 57.9)</td> <td></td> <td>47.2 (33.7; 57.9)</td> <td></td> </tr> <tr> <td>121+</td> <td>51.6 (47.2; 55.6)</td> <td></td> <td>51.6 (47.2; 55.6)</td> <td></td> </tr> <tr> <td rowspan="5">Protection against infection after 3 doses</td> <td>Not vaccinated</td> <td></td> <td>(ref)</td> <td></td> <td>(ref)</td> </tr> <tr> <td>14-30</td> <td>47.7 (47.0; 48.3)</td> <td></td> <td>47.9 (47.4; 48.3)</td> <td></td> </tr> <tr> <td>31-60</td> <td>45.5 (44.9; 46.2)</td> <td></td> <td>43.0 (40.9; 45.1)</td> <td></td> </tr> <tr> <td>61-90</td> <td>43.5 (42.2; 44.7)</td> <td></td> <td>41.0 (40.3; 41.7)</td> <td></td> </tr> <tr> <td>91-120</td> <td>36.9 (34.8; 38.9)</td> <td></td> <td>38.6 (37.7; 39.5)</td> <td></td> </tr> <tr> <td>121+</td> <td>37.9 (33.4; 42.0)</td> <td></td> <td>40.5 (38.9; 42.3)</td> <td></td> </tr> <tr> <td rowspan="5">Protection against hospitalisation after 3 doses</td> <td>Not vaccinated</td> <td></td> <td>(ref)</td> <td></td> <td>(ref)</td> </tr> <tr> <td>14-30</td> <td>90.2 (87.3; 92.5)</td> <td></td> <td>88.8 (87.3; 90.1)</td> <td></td> </tr> <tr> <td>31-60</td> <td>87.7 (85.3; 89.7)</td> <td></td> <td>88.5 (87.4; 89.6)</td> <td></td> </tr> <tr> <td>61-90</td> <td>87.8 (84.5; 90.4)</td> <td></td> <td>84.9 (83.1; 86.5)</td> <td></td> </tr> <tr> <td>91-120</td> <td>83.6 (77.7; 88.0)</td> <td></td> <td>79.0 (76.5; 81.3)</td> <td></td> </tr> <tr> <td>121+</td> <td>77.3 (63.1; 86.1)</td> <td></td> <td>66.2 (61.1; 70.7)</td> <td></td> </tr> </tbody> </table> | Outcome | Days since vaccination | a) | | b) | | Adjusted VE [95% CI] | (ref) | Adjusted VE [95% CI] | (ref) | Protection against infection after 2 doses | Not vaccinated | | (ref) | | (ref) | 14-30 | 37.9 (34.4; 41.2) | | 37.0 (35.6; 38.3) | | 31-60 | 27.1 (24.5; 29.6) | | 27.4 (26.3; 28.4) | | 61-90 | 26.8 (23.8; 29.6) | | 26.6 (25.3; 27.9) | | 91-120 | 23.3 (21.1; 25.5) | | 27.4 (26.2; 28.5) | | 121+ | 13.2 (12.3; 14.2) | | 9.8 (9.2; 10.4) | | Protection against hospitalisation after 2 doses | Not vaccinated | | (ref) | | (ref) | 14-30 | 50.5 (47.9; 53.1) | | 50.5 (33.9; 63.0) | | 31-60 | 48.5 (46.6; 50.3) | | 48.5 (36.6; 58.2) | | 61-90 | 42.6 (36.9; 54.9) | | 42.6 (26.9; 54.9) | | 91-120 | 47.2 (33.7; 57.9) | | 47.2 (33.7; 57.9) | | 121+ | 51.6 (47.2; 55.6) | | 51.6 (47.2; 55.6) | | Protection against infection after 3 doses | Not vaccinated | | (ref) | | (ref) | 14-30 | 47.7 (47.0; 48.3) | | 47.9 (47.4; 48.3) | | 31-60 | 45.5 (44.9; 46.2) | | 43.0 (40.9; 45.1) | | 61-90 | 43.5 (42.2; 44.7) | | 41.0 (40.3; 41.7) | | 91-120 | 36.9 (34.8; 38.9) | | 38.6 (37.7; 39.5) | | 121+ | 37.9 (33.4; 42.0) | | 40.5 (38.9; 42.3) | | Protection against hospitalisation after 3 doses | Not vaccinated | | (ref) | | (ref) | 14-30 | 90.2 (87.3; 92.5) | | 88.8 (87.3; 90.1) | | 31-60 | 87.7 (85.3; 89.7) | | 88.5 (87.4; 89.6) | | 61-90 | 87.8 (84.5; 90.4) | | 84.9 (83.1; 86.5) | | 91-120 | 83.6 (77.7; 88.0) | | 79.0 (76.5; 81.3) | | 121+ | 77.3 (63.1; 86.1) | | 66.2 (61.1; 70.7) | |
|--|---|--|------------------------------------|---------------------------|---------------------|----------------------------------|---|----------|---|--|------------------------------------|-----------------------------|--|----------------------|-------|----------------------|-------|--|----------------|----------|-------------|--------------|---------------|----------|-------------------|--------------|-------------------|--------------------------|------------|-------------------|---------------|---------------------------|------------|---------------|-------------------|----------------------------|-------------------|------------|---------------|----------------------------|-------------|-------------------|--------------|---------------------------|-------------------|-------------|------------------|----------------------------|--|----------------|---------------|-------------------------|--|-------|-------|----------------------------|------------|-------------------|---------------|-------|-------------------|--|-------------------|--|-------|-------------------|--|-------------------|--|--------|-------------------|--|-------------------|--|------|-------------------|--|-------------------|--|--|----------------|--|-------|--|-------|-------|-------------------|--|-------------------|--|-------|-------------------|--|-------------------|--|-------|-------------------|--|-------------------|--|--------|-------------------|--|-------------------|--|------|-------------------|--|-------------------|--|--|----------------|--|-------|--|-------|-------|-------------------|--|-------------------|--|-------|-------------------|--|-------------------|--|-------|-------------------|--|-------------------|--|--------|-------------------|--|-------------------|--|------|-------------------|--|-------------------|--|
| Outcome | Days since vaccination | a) | | b) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Adjusted VE [95% CI] | (ref) | Adjusted VE [95% CI] | (ref) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Protection against infection after 2 doses | Not vaccinated | | (ref) | | (ref) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 14-30 | 37.9 (34.4; 41.2) | | 37.0 (35.6; 38.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 31-60 | 27.1 (24.5; 29.6) | | 27.4 (26.3; 28.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 61-90 | 26.8 (23.8; 29.6) | | 26.6 (25.3; 27.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 91-120 | 23.3 (21.1; 25.5) | | 27.4 (26.2; 28.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 121+ | 13.2 (12.3; 14.2) | | 9.8 (9.2; 10.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Protection against hospitalisation after 2 doses | Not vaccinated | | (ref) | | (ref) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 14-30 | 50.5 (47.9; 53.1) | | 50.5 (33.9; 63.0) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 31-60 | 48.5 (46.6; 50.3) | | 48.5 (36.6; 58.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 61-90 | 42.6 (36.9; 54.9) | | 42.6 (26.9; 54.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 91-120 | 47.2 (33.7; 57.9) | | 47.2 (33.7; 57.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 121+ | 51.6 (47.2; 55.6) | | 51.6 (47.2; 55.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Protection against infection after 3 doses | Not vaccinated | | (ref) | | (ref) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 14-30 | 47.7 (47.0; 48.3) | | 47.9 (47.4; 48.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 31-60 | 45.5 (44.9; 46.2) | | 43.0 (40.9; 45.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 61-90 | 43.5 (42.2; 44.7) | | 41.0 (40.3; 41.7) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 91-120 | 36.9 (34.8; 38.9) | | 38.6 (37.7; 39.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 121+ | 37.9 (33.4; 42.0) | | 40.5 (38.9; 42.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Protection against hospitalisation after 3 doses | Not vaccinated | | (ref) | | (ref) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 14-30 | 90.2 (87.3; 92.5) | | 88.8 (87.3; 90.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 31-60 | 87.7 (85.3; 89.7) | | 88.5 (87.4; 89.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 61-90 | 87.8 (84.5; 90.4) | | 84.9 (83.1; 86.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 91-120 | 83.6 (77.7; 88.0) | | 79.0 (76.5; 81.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 121+ | 77.3 (63.1; 86.1) | | 66.2 (61.1; 70.7) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 135 | Price et al (March 30, 2022) | USA | 5-18 year olds | Delta → Omicron | Comirnaty | July 1, 2021-February 17, 2022 | <p>TND study at 31 hospitals.</p> <table border="1"> <thead> <tr> <th>Subgroup</th> <th>Vaccinated Patients (no. of patients/total no. (%))</th> <th>Control Patients (no. of patients/total no. (%))</th> <th>Vaccine Effectiveness [95% CI] (%)</th> </tr> </thead> <tbody> <tr> <td>Adolescents 12-18 yr of age</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Age group</td> <td></td> <td></td> <td></td> </tr> <tr> <td>12-15 yr</td> <td>63/543 (12)</td> <td>313/828 (38)</td> <td>83 (77 to 88)</td> </tr> <tr> <td>16-18 yr</td> <td>59/375 (16)</td> <td>229/529 (43)</td> <td>82 (74 to 88)</td> </tr> <tr> <td>Delta-predominant period</td> <td>33/684 (5)</td> <td>442/1161 (38)</td> <td>92 (89 to 95)</td> </tr> <tr> <td>2-22 wk since vaccination</td> <td>25/676 (4)</td> <td>372/1091 (34)</td> <td>93 (89 to 95)</td> </tr> <tr> <td>23-44 wk since vaccination</td> <td>6/657 (1)</td> <td>60/779 (8)</td> <td>92 (80 to 97)</td> </tr> <tr> <td>Omicron-predominant period</td> <td>89/234 (38)</td> <td>100/196 (51)</td> <td>40 (9 to 60)</td> </tr> <tr> <td>2-22 wk since vaccination</td> <td>35/180 (19)</td> <td>39/135 (29)</td> <td>43 (-1 to 68)</td> </tr> <tr> <td>23-44 wk since vaccination</td> <td>52/197 (26)</td> <td>59/155 (38)</td> <td>38 (-3 to 62)</td> </tr> <tr> <td>Children 5-11 yr of age</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Omicron-predominant period</td> <td>20/267 (7)</td> <td>50/270 (19)</td> <td>68 (42 to 82)</td> </tr> </tbody> </table> | Subgroup | Vaccinated Patients (no. of patients/total no. (%)) | Control Patients (no. of patients/total no. (%)) | Vaccine Effectiveness [95% CI] (%) | Adolescents 12-18 yr of age | | | | Age group | | | | 12-15 yr | 63/543 (12) | 313/828 (38) | 83 (77 to 88) | 16-18 yr | 59/375 (16) | 229/529 (43) | 82 (74 to 88) | Delta-predominant period | 33/684 (5) | 442/1161 (38) | 92 (89 to 95) | 2-22 wk since vaccination | 25/676 (4) | 372/1091 (34) | 93 (89 to 95) | 23-44 wk since vaccination | 6/657 (1) | 60/779 (8) | 92 (80 to 97) | Omicron-predominant period | 89/234 (38) | 100/196 (51) | 40 (9 to 60) | 2-22 wk since vaccination | 35/180 (19) | 39/135 (29) | 43 (-1 to 68) | 23-44 wk since vaccination | 52/197 (26) | 59/155 (38) | 38 (-3 to 62) | Children 5-11 yr of age | | | | Omicron-predominant period | 20/267 (7) | 50/270 (19) | 68 (42 to 82) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Subgroup | Vaccinated Patients (no. of patients/total no. (%)) | Control Patients (no. of patients/total no. (%)) | Vaccine Effectiveness [95% CI] (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adolescents 12-18 yr of age | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Age group | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12-15 yr | 63/543 (12) | 313/828 (38) | 83 (77 to 88) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16-18 yr | 59/375 (16) | 229/529 (43) | 82 (74 to 88) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta-predominant period | 33/684 (5) | 442/1161 (38) | 92 (89 to 95) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-22 wk since vaccination | 25/676 (4) | 372/1091 (34) | 93 (89 to 95) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23-44 wk since vaccination | 6/657 (1) | 60/779 (8) | 92 (80 to 97) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omicron-predominant period | 89/234 (38) | 100/196 (51) | 40 (9 to 60) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-22 wk since vaccination | 35/180 (19) | 39/135 (29) | 43 (-1 to 68) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23-44 wk since vaccination | 52/197 (26) | 59/155 (38) | 38 (-3 to 62) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Children 5-11 yr of age | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omicron-predominant period | 20/267 (7) | 50/270 (19) | 68 (42 to 82) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 134 | Veneti et al (March 25, 2022) | Norway | 12-17 year olds | Delta → Omicron | Comirnaty | August 24, 2021-January 16, 2022 | <p>Cohort study of 12-17 year olds evaluating VE against infection based on linking administrative databases.</p> <p>b) Delta infections, 25 August 2021 to 16 January 2022</p> <p>c) Omicron infections, 26 November 2021 to 16 January 2022</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 133 | Wang et al (March 25, 2022) | USA | General population | Delta → Omicron | Comirnaty mRNA-1273 | October 1, 2021-January 31, 2022 | <p>TND study at Cleveland Clinic evaluating risk against infection (top table, note this can be converted to VE by subtracting the OR from 1) and death (bottom table, not this is among cases only and thus is VE against progression of infection to death).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | <table border="1"> <thead> <tr> <th></th> <th>Patients</th> <th>Positive</th> <th>Odds Ratio (95% CI)</th> </tr> </thead> <tbody> <tr> <td colspan="4">Delta Period</td> </tr> <tr> <td>Unvaccinated</td> <td>61,198</td> <td>16,185 (26%)</td> <td></td> </tr> <tr> <td colspan="4">Dose 2</td> </tr> <tr> <td>≥ 180 days</td> <td>35,931</td> <td>6,737 (19%)</td> <td>0.47 (0.45 to 0.48)</td> </tr> <tr> <td>< 180 days</td> <td>15,028</td> <td>1,654 (11%)</td> <td>0.30 (0.28 to 0.32)</td> </tr> <tr> <td colspan="4">Dose 3</td> </tr> <tr> <td>≥ 180 days</td> <td>2,390</td> <td>294 (12%)</td> <td>0.29 (0.26 to 0.33)</td> </tr> <tr> <td>< 180 days</td> <td>11,170</td> <td>521 (5%)</td> <td>0.09 (0.08 to 0.10)</td> </tr> <tr> <td>Other vaccination</td> <td>8,049</td> <td>1,610 (20%)</td> <td>0.52 (0.55 to 0.59)</td> </tr> <tr> <td>Prior infection</td> <td>8,386</td> <td>555 (14%)</td> <td>0.23 (0.21 to 0.25)</td> </tr> <tr> <td colspan="4">Omicron Period</td> </tr> <tr> <td>Unvaccinated</td> <td>38,858</td> <td>17,614 (45%)</td> <td></td> </tr> <tr> <td colspan="4">Dose 2</td> </tr> <tr> <td>≥ 180 days</td> <td>27,318</td> <td>13,306 (49%)</td> <td>0.93 (0.90 to 0.96)</td> </tr> <tr> <td>< 180 days</td> <td>7,857</td> <td>3,179 (40%)</td> <td>0.74 (0.70 to 0.78)</td> </tr> <tr> <td colspan="4">Dose 3</td> </tr> <tr> <td>≥ 180 days</td> <td>2,450</td> <td>711 (29%)</td> <td>0.50 (0.45 to 0.55)</td> </tr> <tr> <td>< 180 days</td> <td>31,467</td> <td>7,482 (24%)</td> <td>0.35 (0.34 to 0.37)</td> </tr> <tr> <td>Other vaccination</td> <td>7,354</td> <td>2,931 (40%)</td> <td>0.71 (0.67 to 0.75)</td> </tr> <tr> <td>Prior infection</td> <td>9,618</td> <td>3,117 (82%)</td> <td>0.61 (0.58 to 0.64)</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Variable</th> <th>Delta Variant Hazard Ratio (95 CI)</th> <th>Omicron Variant Hazard Ratio (95 CI)</th> </tr> </thead> <tbody> <tr> <td>Vaccination status</td> <td></td> <td></td> </tr> <tr> <td>Unvaccinated</td> <td>Reference</td> <td>Reference</td> </tr> <tr> <td>Dose 2 ≥ 180 days</td> <td>0.43 (0.29 to 0.64)</td> <td>0.43 (0.25 to 0.74)</td> </tr> <tr> <td>Dose 2 < 180 days</td> <td>0.42 (0.34 to 0.51)</td> <td>0.40 (0.32 to 0.51)</td> </tr> <tr> <td>Dose 3 ≥ 180 days</td> <td>0.77 (0.53 to 1.13)</td> <td>0.23 (0.17 to 0.31)</td> </tr> <tr> <td>Dose 3 < 180 days</td> <td>0.24 (0.11 to 0.54)</td> <td>0.15 (0.06 to 0.40)</td> </tr> <tr> <td>Other vaccination</td> <td>0.87 (0.64 to 1.19)</td> <td>0.74 (0.53 to 1.04)</td> </tr> </tbody> </table> | | Patients | Positive | Odds Ratio (95% CI) | Delta Period | | | | Unvaccinated | 61,198 | 16,185 (26%) | | Dose 2 | | | | ≥ 180 days | 35,931 | 6,737 (19%) | 0.47 (0.45 to 0.48) | < 180 days | 15,028 | 1,654 (11%) | 0.30 (0.28 to 0.32) | Dose 3 | | | | ≥ 180 days | 2,390 | 294 (12%) | 0.29 (0.26 to 0.33) | < 180 days | 11,170 | 521 (5%) | 0.09 (0.08 to 0.10) | Other vaccination | 8,049 | 1,610 (20%) | 0.52 (0.55 to 0.59) | Prior infection | 8,386 | 555 (14%) | 0.23 (0.21 to 0.25) | Omicron Period | | | | Unvaccinated | 38,858 | 17,614 (45%) | | Dose 2 | | | | ≥ 180 days | 27,318 | 13,306 (49%) | 0.93 (0.90 to 0.96) | < 180 days | 7,857 | 3,179 (40%) | 0.74 (0.70 to 0.78) | Dose 3 | | | | ≥ 180 days | 2,450 | 711 (29%) | 0.50 (0.45 to 0.55) | < 180 days | 31,467 | 7,482 (24%) | 0.35 (0.34 to 0.37) | Other vaccination | 7,354 | 2,931 (40%) | 0.71 (0.67 to 0.75) | Prior infection | 9,618 | 3,117 (82%) | 0.61 (0.58 to 0.64) | Variable | Delta Variant Hazard Ratio (95 CI) | Omicron Variant Hazard Ratio (95 CI) | Vaccination status | | | Unvaccinated | Reference | Reference | Dose 2 ≥ 180 days | 0.43 (0.29 to 0.64) | 0.43 (0.25 to 0.74) | Dose 2 < 180 days | 0.42 (0.34 to 0.51) | 0.40 (0.32 to 0.51) | Dose 3 ≥ 180 days | 0.77 (0.53 to 1.13) | 0.23 (0.17 to 0.31) | Dose 3 < 180 days | 0.24 (0.11 to 0.54) | 0.15 (0.06 to 0.40) | Other vaccination | 0.87 (0.64 to 1.19) | 0.74 (0.53 to 1.04) |
|-----------------------|---|--------------------------------------|---------------------|-------------------------------|--------------------------------|------------------------------|--|--|----------|----------|---------------------|---------------------|--|--|--|--------------|--------|--------------|--|---------------|--|--|--|------------|--------|-------------|---------------------|------------|--------|-------------|---------------------|---------------|--|--|--|------------|-------|-----------|---------------------|------------|--------|----------|---------------------|-------------------|-------|-------------|---------------------|-----------------|-------|-----------|---------------------|-----------------------|--|--|--|--------------|--------|--------------|--|---------------|--|--|--|------------|--------|--------------|---------------------|------------|-------|-------------|---------------------|---------------|--|--|--|------------|-------|-----------|---------------------|------------|--------|-------------|---------------------|-------------------|-------|-------------|---------------------|-----------------|-------|-------------|---------------------|----------|------------------------------------|--------------------------------------|--------------------|--|--|--------------|-----------|-----------|-------------------|---------------------|---------------------|-------------------|---------------------|---------------------|-------------------|---------------------|---------------------|-------------------|---------------------|---------------------|-------------------|---------------------|---------------------|
| | Patients | Positive | Odds Ratio (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta Period | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 61,198 | 16,185 (26%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 180 days | 35,931 | 6,737 (19%) | 0.47 (0.45 to 0.48) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| < 180 days | 15,028 | 1,654 (11%) | 0.30 (0.28 to 0.32) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 180 days | 2,390 | 294 (12%) | 0.29 (0.26 to 0.33) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| < 180 days | 11,170 | 521 (5%) | 0.09 (0.08 to 0.10) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other vaccination | 8,049 | 1,610 (20%) | 0.52 (0.55 to 0.59) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prior infection | 8,386 | 555 (14%) | 0.23 (0.21 to 0.25) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omicron Period | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | 38,858 | 17,614 (45%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 180 days | 27,318 | 13,306 (49%) | 0.93 (0.90 to 0.96) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| < 180 days | 7,857 | 3,179 (40%) | 0.74 (0.70 to 0.78) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 180 days | 2,450 | 711 (29%) | 0.50 (0.45 to 0.55) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| < 180 days | 31,467 | 7,482 (24%) | 0.35 (0.34 to 0.37) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other vaccination | 7,354 | 2,931 (40%) | 0.71 (0.67 to 0.75) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prior infection | 9,618 | 3,117 (82%) | 0.61 (0.58 to 0.64) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Variable | Delta Variant Hazard Ratio (95 CI) | Omicron Variant Hazard Ratio (95 CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccination status | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated | Reference | Reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 2 ≥ 180 days | 0.43 (0.29 to 0.64) | 0.43 (0.25 to 0.74) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 2 < 180 days | 0.42 (0.34 to 0.51) | 0.40 (0.32 to 0.51) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 3 ≥ 180 days | 0.77 (0.53 to 1.13) | 0.23 (0.17 to 0.31) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dose 3 < 180 days | 0.24 (0.11 to 0.54) | 0.15 (0.06 to 0.40) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other vaccination | 0.87 (0.64 to 1.19) | 0.74 (0.53 to 1.04) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 132 | Ng et al (March 24, 2022) | Singapore | Contacts of cases | Delta | Comirnaty mRNA-1273 | March 1-August 31, 2021 | <p>Cohort study looking at transmission in households of cases.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 131 | Kirsebom et al (March 24, 2022) (updated to final publication May 24, 2022) | England | General population | Omicron (BA.1 vs BA.2) | Comirnaty mRNA-1273 ChAdOx1 | January 17-February 17, 2022 | TND study comparing VE against symptomatic disease with BA.1 vs BA.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

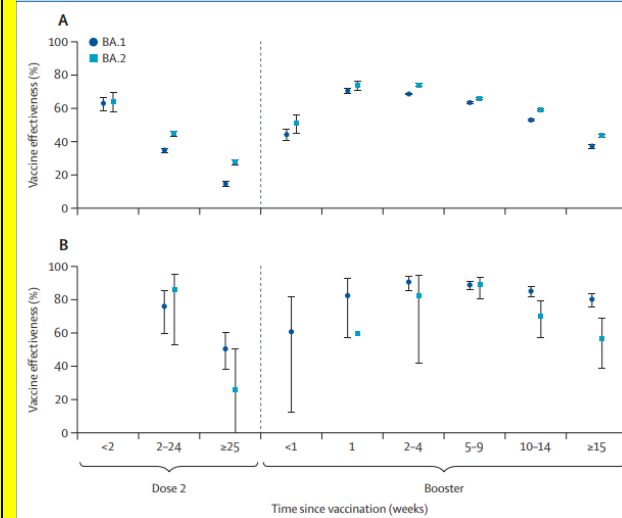


Figure 3. Vaccine effectiveness against symptomatic disease (A) and hospitalisation (B) following infection with the omicron sub-lineages BA.1 and BA.2 in adults aged 18 years and older in England

| | | | | | | | |
|-----|--|---------|--------------------|-------------------------|-----------------------------|----------------------------|---|
| | | | | | | | <p>TND study evaluating impact of different case definitions on VE against severe disease/hospitalization.</p> <p>Figure 3. Vaccine effectiveness against hospitalisations ≥2 days and on oxygen/ventilation ICU using SUS by age group and manufacturer (all symptomatic controls, Omicron only)</p> |
| 129 | Stowe et al (March 24, 2022) | England | General population | Delta Omicron | Comirnaty mRNA-1273 ChAdOx1 | April 26-February 23, 2022 | <p>TND study evaluating the relative VE of the 4th dose to the 3rd dose against infection (top) and hospitalization/death (bottom).</p> |
| 129 | Gazit et al (March 24, 2022) | Israel | ≥60 years | Omicron | Comirnaty | January 10-March 23, 2022 | <p>TND study evaluating the relative VE of the 4th dose to the 3rd dose against infection (top) and hospitalization/death (bottom).</p> |

| | | | | | | | |
|-----|--|----|--------------------------|--------------|-----------------------------------|---|---|
| | (updated to final publication on May 24, 2022) | | | | | | |
| 128 | Horne et al (March 23, 2022) | UK | General population | Alpha, Delta | Comirnaty ChAdOx1 | February 24, 2021- December 15, 2021 | <p>Cohort study based on linking of administrative databases.</p> <p>Figure 2. Adjusted hazard ratios comparing BNT162b2 and ChAdOx1 with unvaccinated individuals in each comparison period. Estimates for BNT162b2 in the 40-64 age group are omitted for all outcomes except positive SARS-CoV-2 test due to low event counts. The slopes of the dashed lines are the ratios of hazard ratios across comparison periods, fitted using meta-regression.</p> <p>*And not clinically vulnerable. **All follow-up dates are in 2021.</p> |
| 127 | Shrothi et al (March 12, 2022) | UK | LTCF residents and staff | Alpha, Delta | Comirnaty mRNA-1273 ChAdOx1 | December 8, 2020- December 11, 2021 | <p>Cohort study of LTCF residents and staff. VE declined from 50.7% (15.5, 71.3) to 17.2% (-23.9, 44.6) against infection; from 85.4% (60.7, 94.6) to 54.3% (26.2, 71.7) against hospitalisation; and from 94.4% (76.4, 98.7) to 62.8% (32.9, 79.4) against death, when comparing 2-12 weeks and ≥12 weeks after two doses. For 19,515 staff, VE against infection declined slightly from 50.3% (32.7, 63.3) to 42.1% (29.5, 52.4).</p> |

| | | | | | | | |
|-----|--|---------|---|--------------------------------|-----------------------------|-------------------------------------|---|
| 126 | Chemaitelly et al (March 13, 2022) | Qatar | General population (including children) | Omicron (BA.1 and BA.2) | Comirnaty mRNA-1273 | December 23, 2021-February 28, 2022 | <p>TND against symptomatic and severe disease.</p> <p>Figure 3. Effectiveness of the BNT162b2 and mRNA-1273 vaccines against symptomatic SARS-CoV-2 BA.1 Omicron infection (panels A and B, respectively) and symptomatic SARS-CoV-2 BA.2 Omicron infection (panels C and D, respectively). Data are presented as effectiveness point estimates. Error bars indicate the corresponding 95% confidence intervals.</p> |
| 125 | Baum et al (March 13, 2022) | Finland | 70+ | Pre Omicron/ Omicron | Comirnaty mRNA-1273 ChAdOx1 | December 27, 2020-February 19, 2022 | <p>Cohort study evaluating VE against hospitalization/ICU admission.</p> |

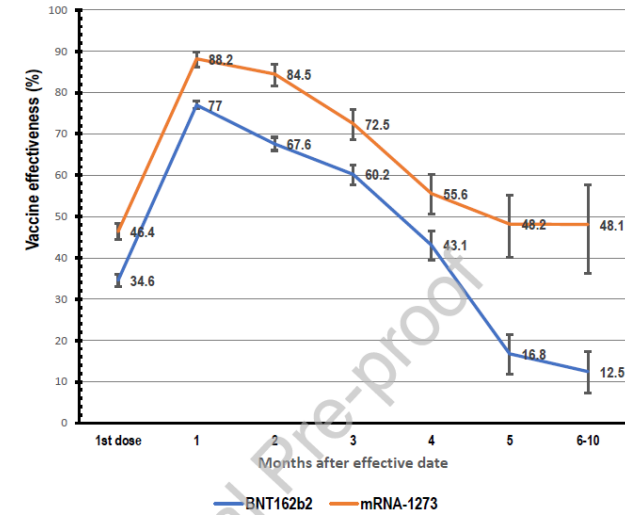
Supplementary Table 11: VE against Covid-19-related hospital admission in 2022 Q1, i.e., between January 01 and February 19. Vaccine effectiveness (in %) quantified as 1 minus the hazard ratio adjusted for age, sex, region of residence, residence in a long-term care facility, influenza vaccination in 2019-2020, number of nights hospitalized between 2015 and 2019 and presence of predisposing comorbidities.

| | Cases | P-years | MLE | LCI | UCI | p-value ¹ |
|---|-------|---------|-----|------|-----|----------------------|
| Not vaccinated | 145 | 5121 | . | . | . | . |
| Comirnaty 0-20 | <5 | 100 | 67 | -134 | 95 | . |
| Comirnaty 21-83 | 6 | 330 | 36 | -44 | 72 | . |
| Comirnaty 84+ | 6 | 606 | 62 | 13 | 83 | . |
| Comirnaty + Comirnaty 0-13 | <5 | 164 | 79 | -49 | 97 | . |
| Comirnaty + Comirnaty 14-90 | 6 | 2148 | 91 | 79 | 96 | . |
| Comirnaty + Comirnaty 91-180 | 12 | 1894 | 76 | 56 | 86 | . |
| Comirnaty + Comirnaty 181+ | 75 | 6450 | 61 | 48 | 71 | . |
| Comirnaty + Comirnaty + Comirnaty 0-13 | 15 | 4227 | 87 | 77 | 92 | . |
| Comirnaty + Comirnaty + Comirnaty 14-60 | 63 | 45889 | 95 | 94 | 97 | . |
| Comirnaty + Comirnaty + Comirnaty 61+ | 64 | 20872 | 90 | 87 | 93 | . |
| Comirnaty + Comirnaty + Spikevax 0-13 | 9 | 1934 | 85 | 70 | 92 | . |
| Comirnaty + Comirnaty + Spikevax 14-60 | 11 | 6190 | 94 | 89 | 97 | . |
| Comirnaty + Comirnaty + Spikevax 61+ | 7 | 416 | 48 | -13 | 76 | . |
| Spikevax 0-20 | <5 | 40 | 36 | -355 | 91 | . |
| Spikevax 21-83 | <5 | 75 | 64 | -156 | 95 | . |
| Spikevax 84+ | <5 | 122 | 14 | -132 | 68 | . |
| Spikevax + Spikevax 0-13 | 0 | 32 | 100 | . | . | 0.117 |
| Spikevax + Spikevax 14-90 | <5 | 341 | 92 | 43 | 99 | . |
| Spikevax + Spikevax 91-180 | <5 | 362 | 90 | 28 | 99 | . |
| Spikevax + Spikevax 181+ | 8 | 860 | 72 | 43 | 86 | . |
| Spikevax + Spikevax + Comirnaty 0-13 | 0 | 168 | 100 | . | . | 0.002 |
| Spikevax + Spikevax + Comirnaty 14-60 | <5 | 1466 | 96 | 82 | 99 | . |
| Spikevax + Spikevax + Comirnaty 61+ | 0 | 529 | 100 | . | . | <0.001 |
| Spikevax + Spikevax + Spikevax 0-13 | <5 | 697 | 86 | 56 | 96 | . |
| Spikevax + Spikevax + Spikevax 14-60 | 5 | 4529 | 97 | 92 | 99 | . |
| Spikevax + Spikevax + Spikevax 61+ | <5 | 1350 | 92 | 79 | 97 | . |
| Vaxzevria 21-83 | 0 | <5 | 100 | . | . | 0.894 |
| Vaxzevria 84+ | <5 | 37 | 8 | -558 | 87 | . |
| Vaxzevria + Vaxzevria 14-90 | 0 | <5 | 100 | . | . | 0.865 |
| Vaxzevria + Vaxzevria 91-180 | <5 | 140 | 41 | -140 | 86 | . |
| Vaxzevria + Vaxzevria 181+ | 10 | 652 | 43 | -10 | 70 | . |
| Vaxzevria + Vaxzevria + Comirnaty 0-13 | <5 | 383 | 80 | 19 | 95 | . |
| Vaxzevria + Vaxzevria + Comirnaty 14-60 | <5 | 2252 | 98 | 89 | 100 | . |
| Vaxzevria + Vaxzevria + Comirnaty 61+ | <5 | 365 | 90 | 27 | 99 | . |
| Vaxzevria + Vaxzevria + Spikevax 0-13 | <5 | 313 | 89 | 21 | 98 | . |
| Vaxzevria + Vaxzevria + Spikevax 14-60 | 0 | 1075 | 100 | . | . | <0.001 |
| Vaxzevria + Vaxzevria + Spikevax 61+ | <5 | 60 | 40 | -336 | 92 | . |

MLE, maximum likelihood estimate;
LCI/UCI, lower/upper limit of the 95% Wald confidence interval
¹ Likelihood-ratio test

(2022 Q1 only covers the period from January 01 to February 19—and was mostly Omicron)

| | | | | | | | |
|-----|---|-------|----------------|--------------------------------|------------------------|--|--|
| | | | | | | | Supplementary Table 11: VE against Covid-19-related hospital admission in 2022 Q1, i.e., between January 01 and February 19. Vaccine effectiveness (in %) quantified as 1 minus the hazard ratio adjusted for age, sex, region of residence, residence in a long-term care facility, influenza vaccination in 2019-2020, number of nights hospitalized between 2015 and 2019 and presence of predisposing comorbidities. |
| 124 | Fowlkes et al (March 11, 2022) | USA | 5-15 year olds | Delta, Omicron | Comirnaty | July 25, 2021– February 12, 2022 | Cohort study finding the adjusted VE at 14–149 days after receipt of dose 2 was 87% (95% CI = 49%–97%) against Delta infection and 59% (95% CI = 22%–79%) against Omicron infection. Adjusted VE ≥150 days after dose 2 was 60% against Delta infection and 62% against Omicron, with wide CIs that included zero. |
| 123 | Syed et al (March 2, 2022) | Qatar | 12+ | Alpha, Beta/Gamma, Delta | Comirnaty mRNA-1273 | December 16, 2020– October 31, 2021 | Cohort study linking administrative databases. VEs are unadjusted |



122 [Suarez-Castillo et al](#) (March 3, 2022) (updated June 6, 2022)

France

50+ year olds

Alpha, Beta/Gamma, Delta

Comirnaty mRNA-1273 Ad26.COV2.S ChAdOx1

January 1-December 12, 2021

TND study/survival analysis by linking administrative databases.

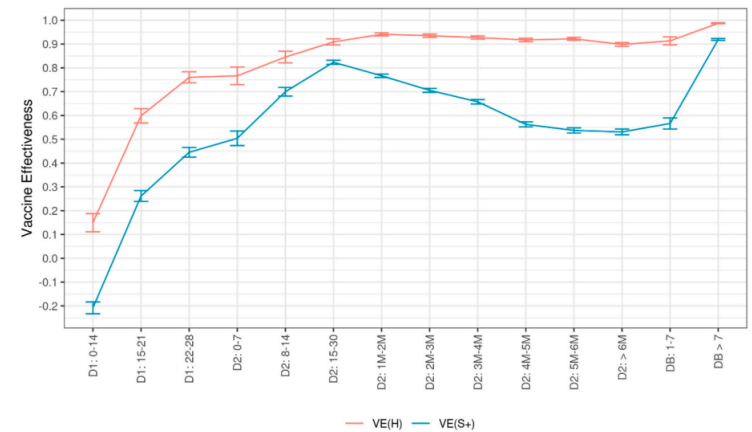


Fig. 2. Covid-19 vaccine effectiveness against symptomatic infections and hospitalizations among persons aged 50 years or over, according to the time elapsed since the receipt of each vaccine dose, data collected from January 1st to December 12, 2021
Abbreviations: D1: First vaccine dose. D2: Second vaccine dose. DB: Booster dose. M: Month. S+: Symptomatic infection. H: Hospitalization. VE: Vaccine effectiveness. The numbers in the x-axis indicate the time (in days or months) elapsed since the receipt of the dose of interest. Precisely, thresholds used to define month intervals are 31-62, 63-90, 91-120, 121-150, 151-182, >182 in days

| | | | | | | | |
|-----|--|-----|----------------|-------------------------|-----------|-------------------------|---|
| 121 | Klein et al (March 1, 2022) | USA | 5-17 year olds | Omicron Delta | Comirnaty | April 2021-January 2022 | TND study evaluating VE against emergency department/urgent care visits and hospitalizations. |
|-----|--|-----|----------------|-------------------------|-----------|-------------------------|---|

| Encounter type/Vaccination status | Total | SARS-CoV-2 test-positive, no. (%) | VE %* (95% CI) |
|---|--------|-----------------------------------|----------------|
| ED or UC encounters during Delta or Omicron predominance, by age group | | | |
| 5-11 yrs | | | |
| Unvaccinated (Ref) | 8,599 | 2,652 (30.8) | — |
| 2 doses (14-67 days earlier) | 582 | 124 (21.3) | 46 (24-61) |
| 12-15 yrs | | | |
| Unvaccinated (Ref) | 12,064 | 3,238 (26.8) | — |
| 2 doses (14-149 days earlier) | 4,547 | 254 (5.6) | 83 (80-85) |
| 2 doses (≥150 days earlier) | 1,517 | 378 (24.9) | 38 (28-48) |
| 3 doses (≥7 days earlier) | 10 | 3 (30) | NC |
| 16-17 yrs | | | |
| Unvaccinated (Ref) | 7,421 | 2,068 (27.9) | — |
| 2 doses (14-149 days earlier) | 2,692 | 193 (7.2) | 76 (71-80) |
| 2 doses (≥150 days earlier) | 1,721 | 329 (19.1) | 46 (36-54) |
| 3 doses (≥7 days earlier) | 64 | 13 (20.3) | 86 (73-93) |
| ED or UC encounters, by age group and predominant variant | | | |
| 5-11 yrs** | | | |
| Omicron predominant^{††} | | | |
| Unvaccinated (Ref) | 5,938 | 2,409 (40.6) | — |
| 2 doses (14-67 days earlier) | 486 | 118 (24.3) | 51 (30-65) |
| 12-15 yrs | | | |
| Delta predominant^{††} | | | |
| Unvaccinated (Ref) | 9,633 | 1,978 (20.5) | — |
| 2 doses (14-149 days earlier) | 4,060 | 80 (2.0) | 92 (89-94) |
| 2 doses (≥150 days earlier) | 798 | 32 (4.0) | 79 (68-86) |
| Omicron predominant^{††} | | | |
| Unvaccinated (Ref) | 2,336 | 1,254 (53.7) | — |
| 2 doses (14-149 days earlier) | 472 | 174 (36.9) | 45 (30-57) |
| 2 doses (≥150 days earlier) | 719 | 346 (48.1) | -2 (-25-17) |
| 3 doses (≥7 days earlier) | 10 | 3 (30.0) | NC |
| 16-17 yrs | | | |
| Delta predominant^{††} | | | |
| Unvaccinated (Ref) | 5,302 | 1,191 (22.5) | — |
| 2 doses (14-149 days earlier) | 2,340 | 78 (3.3) | 85 (81-89) |
| 2 doses (≥150 days earlier) | 1,156 | 47 (4.1) | 77 (67-84) |
| 3 doses (≥7 days earlier) | 2 | 0 (—) | NC |
| Omicron predominant^{††} | | | |
| Unvaccinated (Ref) | 1,363 | 771 (56.6) | — |
| 2 doses (14-149 days earlier) | 263 | 114 (43.4) | 34 (8-53) |
| 2 doses (≥150 days earlier) | 565 | 282 (49.9) | -3 (-30-18) |
| 3 doses (≥7 days earlier) | 62 | 13 (21.0) | 81 (59-91) |
| Hospitalizations during Delta or Omicron predominance, by age group | | | |
| 5-11 yrs | | | |
| Unvaccinated (Ref) | 262 | 59 (22.5) | — |
| 2 doses (14-67 days earlier) | 23 | 2 (8.7) | 74 (-35-95) |
| 12-15 yrs | | | |
| Unvaccinated (Ref) | 496 | 149 (30) | — |
| 2 doses (14-149 days earlier) | 182 | 7 (3.8) | 92 (79-97) |
| 2 doses (≥150 days earlier) | 63 | 13 (20.6) | 73 (43-88) |
| 16-17 yrs | | | |
| Unvaccinated (Ref) | 437 | 136 (31.1) | — |
| 2 doses (14-149 days earlier) | 150 | 7 (4.7) | 94 (87-97) |
| 2 doses (≥150 days earlier) | 82 | 14 (17.1) | 88 (72-95) |
| 3 doses (≥7 days earlier) | 4 | 1 (25.0) | NC |

| | | | | | | |
|-----|---|----------------|-------------------------------|-------------------------|---|--|
| 120 | <p>Smid et al (February 25, 2022)</p> <p>(updated April 28, 2022)</p> | Czech Republic | General population of country | Omicron Delta | Comirnaty mRNA-1273 Ad26.COVS.S ChAdOx1 | December 7, 2021- February 13, 2022 |
|-----|---|----------------|-------------------------------|-------------------------|---|--|

Cohort study created by linking administrative databases. (<2 months and >=2 months prior to onset)

| Category | Delta Effectiveness | Omicron Effectiveness |
|-----------|---------------------|-----------------------|
| Inf6- | ~0.95 | ~0.70 |
| Inf6+ | ~0.85 | ~0.15 |
| Full2- | ~0.75 | ~0.45 |
| Full2+ | ~0.60 | ~0.15 |
| Booster2- | ~0.90 | ~0.55 |
| Booster2+ | ~0.85 | ~0.20 |

Fig. 2. Protection provided by vaccination or previous infection against infection by the Omicron and Delta variants of the SARS-CoV-2 virus. Inf6-, previous infection <6 months ago; Inf6+, previous infection >6 months ago; Full2-, complete vaccination <2 months ago; Full2+, complete vaccination >2 months ago; Booster2-, booster dose <2 months ago; Booster2+, booster dose >2 months ago. Shown are point estimates of protection with 95% CI.

Table 3. Vaccine effectiveness and protection provided by post-infection immunity against hospitalization, for the Omicron and Delta variants of the SARS-CoV-2 virus, 95% confidence intervals (CI) in parentheses.

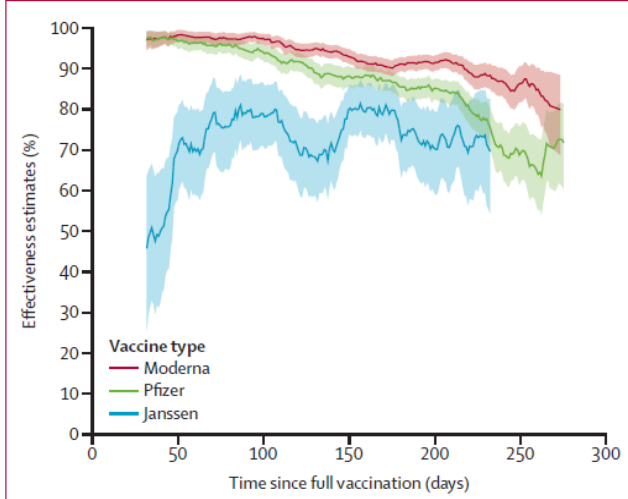
| Effect ag. Hosp. | Omicron | Delta |
|------------------|--------------|--------------|
| Full 2- | 45% (29-57%) | 75% (68-80%) |
| Full 2+ | 29% (21-37%) | 79% (78-81%) |
| Booster 2- | 87% (84-88%) | 98% (97-98%) |
| Booster 2+ | 79% (75-83%) | 97% (95-98%) |

Table 6. Vaccine effectiveness and protection provided by post-infection immunity against hospitalization with a need for oxygen therapy, for the Omicron and Delta variants of the SARS-CoV-2 virus, 95% confidence intervals (CI) in parentheses.

| Effect ag. O ₂ | Omicron | Delta |
|---------------------------|--------------|--------------|
| Full 2- | 57% (32-72%) | 82% (76-87%) |
| Full 2+ | 32% (20-43%) | 82% (80-83%) |
| Booster 2- | 90% (87-92%) | 98% (98-98%) |
| Booster 2+ | 85% (80-88%) | 97% (95-98%) |

Table 7. Vaccine effectiveness and protection provided by post-infection immunity against hospitalization with a need for *intensive care*, for the Omicron and Delta variants of the SARS-CoV-2 virus, 95% confidence intervals (CI) in parentheses.

| Effect ag. ICU | Omicron | Delta |
|----------------|--------------|--------------|
| Full 2- | 58% (3-82%) | 84% (72-91%) |
| Full 2+ | 37% (12-55%) | 86% (83-88%) |
| Booster 2- | 83% (75-89%) | 98% (97-99%) |
| Booster 2+ | 60% (37-74%) | 97% (92-99%) |

| | | | | | | | |
|-----|--|--------|------------------------------|------------------|---------------------------------------|----------------------------|---|
| | | | | | | | |
| 119 | Patalon et al (February 26, 2022) (updated June 9, 2022) | Israel | 16+ Maccabi insured patients | Omicron | Comirnaty | January 1-January 21, 2022 | Matched TND study to evaluate relative VE against infection and hospitalization/death. All persons had received the primary series by August 1, 2021. Marginal effectiveness against infection of a booster dose given a month before the outcome period was at its peak at 59.4% (95% CI, 54.9%-63.5%). Effectiveness declined gradually with time from inoculation, reaching 16% (95% CI, 12.3%-19.5%) in those vaccinated 5 months prior to the outcome period compared to those not receiving the booster dose. As for the marginal effectiveness against severe disease, it seems that waning exists though to a much lesser degree, as effectiveness declines from 72.2% (95% CI, 37.8%-87.6%) 3 months after inoculation to 54.5% (95% CI, 13.4-76.1) five months after vaccination. However, numbers are small as also reflected by the confidence intervals. |
| 118 | Wright et al (February 25, 2022) | USA | 18+ hospitalized | Pre Delta; Delta | Comirnaty mRNA-1273 Ad26.COV2.S | April 1-October 26, 2021 | Case-control study of patients hospitalized in one large US network of hospitals.  <p>Figure 3: Vaccine effectiveness against severe COVID-19 by time since vaccination and vaccine type</p> |

| 117 | Liu et al (February 18, 2022) | Australia | Persons exposed in two outbreaks (1 at a night club, 1 at a medical school graduation event) | Omicron | Comirnaty mRNA-1273 ChAdOx1 | December 8, 2021- December 22, 2021 | Unadjusted VE in two outbreaks by time since 2 nd dose (combined for all vaccines) <table border="1"> <thead> <tr> <th>Timing</th> <th>Night club outbreak</th> <th>Graduation event outbreak</th> </tr> </thead> <tbody> <tr> <td><1 month</td> <td>-33.3 (-141.4-26.3)</td> <td>No cases</td> </tr> <tr> <td>1-2 months</td> <td>-18.1 (-85.7-24.8)</td> <td>87.5 (64-95.7)</td> </tr> <tr> <td>2-3 months</td> <td>-5.9 (-67.5-33.1)</td> <td>60 (38-74.2)</td> </tr> <tr> <td>3+ months</td> <td>-36.2 (-114.3-13.4)</td> <td>32 (22-40.6)</td> </tr> </tbody> </table> | Timing | Night club outbreak | Graduation event outbreak | <1 month | -33.3 (-141.4-26.3) | No cases | 1-2 months | -18.1 (-85.7-24.8) | 87.5 (64-95.7) | 2-3 months | -5.9 (-67.5-33.1) | 60 (38-74.2) | 3+ months | -36.2 (-114.3-13.4) | 32 (22-40.6) |
|------------|---|---------------------------|--|--------------------------|------------------------------------|--|--|--------|---------------------|---------------------------|----------|---------------------|----------|------------|--------------------|----------------|------------|-------------------|--------------|-----------|---------------------|--------------|
| Timing | Night club outbreak | Graduation event outbreak | | | | | | | | | | | | | | | | | | | | |
| <1 month | -33.3 (-141.4-26.3) | No cases | | | | | | | | | | | | | | | | | | | | |
| 1-2 months | -18.1 (-85.7-24.8) | 87.5 (64-95.7) | | | | | | | | | | | | | | | | | | | | |
| 2-3 months | -5.9 (-67.5-33.1) | 60 (38-74.2) | | | | | | | | | | | | | | | | | | | | |
| 3+ months | -36.2 (-114.3-13.4) | 32 (22-40.6) | | | | | | | | | | | | | | | | | | | | |
| 116 | Wu et al (February 2022) | China | 18+ year old contacts of cases | Delta | Coronavac BBIBP-CorV | July 31, 2021-? (prior to November 17, 2021) | Study done in the context of an outbreak. The adjusted VE of full vaccination against symptomatic COVID-19 was 52.32% (25.73-69.39) for ≤3-month intervals and 49.95% (1.2-74.64) for 4–6-month intervals; against COVID-19 pneumonia, VEs were 60.31 (31.31-77.07) for ≤3-month and 67.08% (9.33-88.05) for 4–6-month intervals. | | | | | | | | | | | | | | | |
| 115 | Britton et al (February 14, 2022) | USA | 12+ year olds | Pre-Delta and Delta | Comirnaty mRNA-1273 Ad26.COV2.S | March 13, April 15, or June 15 (based on age-based vaccine-eligibility October 17, 2021) | TND study to evaluate VE against symptomatic disease based on data collected from pharmacies (note vaccination data based on recall and some portion of 2 dose recipients received 3 doses). In the paper, there is a stratification by age group. <p>A BNT162b2 vaccination among those aged ≥20 y B mRNA-1273 vaccination among those aged ≥20 y C Ad26.COV2.S vaccination among those aged ≥20 y</p> <p>Panels display odds ratios (ORs), plotted on a logarithmic scale, for prior COVID-19 vaccination (by vaccine product) and SARS-CoV-2 test positivity by day since vaccination (starting at day 14 since second mRNA dose or Ad26.COV2.S dose) in the pre-Delta (March 13-May 29, 2021; shown in blue) and Delta (July 18-October 17; shown in orange) periods with 95% CIs (shaded areas). ORs were adjusted for age group, race, ethnicity, sex, testing site state, testing site census tract social vulnerability index, and calendar date as a continuous variable. Tests with missing social vulnerability index were excluded from adjusted analyses. The presented (fitted) curves were truncated on the day after which 10 or fewer cases remained for each product- and period-specific model, beyond which CIs widened. ORs (95% CI) for day 14, mean of the daily OR estimates from days 14 to 60 (usual OR), and end day for each period are shown in eTable 13 in the Supplement.</p> | | | | | | | | | | | | | | | |
| 114 | Ferdinands et al (February 11, 2022) | USA | 18+ years | Delta, Omicron | Comirnaty mRNA-1273 | August 26, 2021- January 22, 2022 | TND study at 8 VISION network sites evaluating VE against emergency room/urgent care visits and hospitalizations. | | | | | | | | | | | | | | | |

TABLE 2. mRNA COVID-19 vaccine effectiveness* against laboratory-confirmed COVID-19-associated† emergency department and urgent care encounters and hospitalizations among adults aged ≥18 years, by number and timing of vaccine doses‡ — VISION Network, 10 states, August 2021–January 2022**

| Characteristic | Total | SARS-CoV-2 positive test result no. (%) | VE fully adjusted % (95% CI)* | Waning trend p value†† |
|-----------------------------------|---------|---|-------------------------------|------------------------|
| ED/UC encounters | | | | |
| Overall | | | | |
| Unvaccinated (Ref) | 110,873 | 43,054 (39) | — | — |
| Any mRNA vaccine, 2 doses | 105,193 | 16,487 (16) | 72 (72–73) | <0.001 |
| <2 mos | 4,808 | 301 (6) | 88 (87–90) | |
| 2–3 mos | 10,644 | 1,312 (12) | 80 (76–81) | |
| 4 mos | 10,175 | 1,230 (12) | 79 (77–80) | |
| ≥5 mos | 79,566 | 13,644 (17) | 69 (68–70) | |
| Any mRNA vaccine, 3 doses | 25,138 | 2,285 (9) | 89 (89–90) | <0.001 |
| <2 mos | 15,614 | 920 (6) | 92 (91–93) | |
| 2–3 mos | 8,759 | 1,120 (13) | 86 (85–87) | |
| 4 mos | 736 | 227 (31) | 75 (70–79) | |
| ≥5 mos | 29 | 18 (62) | 50 (<–77) | |
| Delta-predominant period | | | | |
| Unvaccinated (Ref) | 86,074 | 29,063 (34) | — | — |
| Any mRNA vaccine, 2 doses | 85,371 | 8,136 (10) | 80 (79–81) | <0.001 |
| <2 mos | 4,253 | 144 (3) | 92 (91–94) | |
| 2–3 mos | 8,662 | 527 (6) | 88 (86–89) | |
| 4 mos | 8,941 | 721 (8) | 85 (83–86) | |
| ≥5 mos | 65,515 | 6,744 (11) | 77 (76–78) | |
| Any mRNA vaccine, 3 doses | 14,207 | 347 (2) | 96 (95–96) | <0.001 |
| <2 mos | 10,621 | 210 (2) | 97 (96–97) | |
| 2–3 mos | 3,542 | 134 (4) | 93 (92–94) | |
| ≥5 mos | 44 | 3 (7) | 89 (64–97) | |
| Omicron-predominant period | | | | |
| Unvaccinated (Ref) | 24,799 | 13,991 (56) | — | — |
| Any mRNA vaccine, 2 doses | 19,822 | 8,351 (42) | 41 (38–43) | <0.001 |
| <2 mos | 555 | 157 (28) | 69 (62–75) | |
| 2–3 mos | 1,982 | 785 (40) | 50 (45–55) | |
| 4 mos | 1,234 | 509 (41) | 48 (41–54) | |
| ≥5 mos | 16,051 | 6,900 (43) | 37 (34–40) | |
| Any mRNA vaccine, 3 doses | 10,931 | 1,938 (18) | 83 (82–84) | <0.001 |
| <2 mos | 4,993 | 710 (14) | 87 (85–88) | |
| 2–3 mos | 5,217 | 986 (19) | 81 (79–82) | |
| 4 mos | 692 | 224 (32) | 66 (59–71) | |
| ≥5 mos | 29 | 18 (62) | 31 (<–50–68) | |
| Hospitalizations | | | | |
| Overall | | | | |
| Unvaccinated (Ref) | 40,125 | 16,335 (41) | — | — |
| Any mRNA vaccine, 2 doses | 42,326 | 4,294 (10) | 82 (81–83) | <0.001 |
| <2 mos | 1,662 | 71 (4) | 93 (91–94) | |
| 2–3 mos | 3,084 | 223 (7) | 88 (86–90) | |
| 4 mos | 3,229 | 224 (7) | 89 (87–90) | |
| ≥5 mos | 34,301 | 3,766 (11) | 80 (79–81) | |
| Any mRNA vaccine, 3 doses | 10,957 | 471 (4) | 93 (92–94) | <0.001 |
| <2 mos | 7,332 | 221 (3) | 95 (94–95) | |
| 2–3 mos | 3,413 | 211 (6) | 91 (89–92) | |
| ≥4 mos | 212 | 39 (18) | 81 (72–87) | |
| Delta-predominant period | | | | |
| Unvaccinated (Ref) | 36,214 | 14,445 (40) | — | — |
| Any mRNA vaccine, 2 doses | 38,707 | 3,315 (9) | 85 (84–85) | <0.001 |
| <2 mos | 1,574 | 49 (3) | 94 (92–96) | |
| 2–3 mos | 2,790 | 154 (6) | 91 (89–92) | |
| 4 mos | 3,129 | 192 (6) | 90 (89–92) | |
| ≥5 mos | 31,214 | 2,920 (9) | 82 (82–83) | |
| Any mRNA vaccine, 3 doses | 8,124 | 195 (2) | 95 (95–96) | <0.001 |
| <2 mos | 6,071 | 118 (2) | 96 (95–97) | |
| 2–3 mos | 2,030 | 74 (4) | 93 (91–95) | |
| ≥4 mos | 23 | 3 (13) | 76 (14–93) | |
| Omicron-predominant period | | | | |
| Unvaccinated (Ref) | 3,911 | 1,890 (48) | — | — |
| Any mRNA vaccine, 2 doses | 3,619 | 979 (27) | 55 (50–60) | 0.01 |
| <2 mos | 88 | 22 (25) | 71 (51–83) | |
| 2–3 mos | 294 | 69 (23) | 65 (53–74) | |
| 4 mos | 150 | 42 (28) | 58 (38–71) | |
| ≥5 mos | 3,087 | 846 (27) | 54 (48–59) | |
| Any mRNA vaccine, 3 doses | 2,833 | 276 (10) | 88 (86–90) | <0.001 |
| <2 mos | 1,261 | 103 (8) | 91 (88–93) | |
| 2–3 mos | 1,383 | 137 (10) | 88 (85–90) | |
| ≥4 mos | 189 | 36 (19) | 78 (67–85) | |

| | | | | | | | |
|-----|---|-------|-----------|--------------|---------------------|------------------------------------|---|
| 113 | Fabiani et al (February 10, 2022) | Italy | 16+ years | Alpha, Delta | Comirnaty mRNA-1273 | December 27, 2020–November 7, 2021 | Cohort study of people who received at least one dose of vaccine at some point before Sept 27. Used of day 0–<14 days post dose 1 as proxy for unvaccinated group. Provide stratification by age and risk group in paper. |
|-----|---|-------|-----------|--------------|---------------------|------------------------------------|---|

| 112 | Butt et al (February 9, 2022) | USA | Veterans on chronic hemodialysis | Pre-Delta→Delta | Comirnaty mRNA-1273 | January 26-August 31, 2021 | <p>TND study linking administrative databases. (Month=month since complete vaccination). VE against infection.</p> <table border="1"> <thead> <tr> <th rowspan="2">Month</th> <th colspan="2">Test positive</th> <th colspan="2">Test negative</th> <th rowspan="2">VE (95% CI)</th> </tr> <tr> <th>Vaccinated (N)</th> <th>Unvaccinated (N)</th> <th>Vaccinated (N)</th> <th>Unvaccinated (N)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>247</td> <td>822</td> <td>112</td> <td>573</td> <td>49.1 (38.2, 58.1)</td> </tr> <tr> <td>2</td> <td>245</td> <td>822</td> <td>107</td> <td>573</td> <td>40.4 (27.8, 50.9)</td> </tr> <tr> <td>3</td> <td>246</td> <td>822</td> <td>85</td> <td>573</td> <td>23.2 (7.3, 36.4)</td> </tr> <tr> <td>4</td> <td>246</td> <td>822</td> <td>70</td> <td>573</td> <td>45.3 (33.2, 55.2)</td> </tr> <tr> <td>5</td> <td>242</td> <td>822</td> <td>74</td> <td>573</td> <td>36.8 (23.0, 48.2)</td> </tr> <tr> <td>6</td> <td>216</td> <td>822</td> <td>69</td> <td>573</td> <td>34.1 (19.0, 46.4)</td> </tr> <tr> <td>7</td> <td>246</td> <td>822</td> <td>54</td> <td>573</td> <td>42.9 (29.5, 53.8)</td> </tr> <tr> <td>8</td> <td>49</td> <td>822</td> <td>4</td> <td>573</td> <td>87.6 (76.0, 93.6)</td> </tr> </tbody> </table> | Month | Test positive | | Test negative | | VE (95% CI) | Vaccinated (N) | Unvaccinated (N) | Vaccinated (N) | Unvaccinated (N) | 1 | 247 | 822 | 112 | 573 | 49.1 (38.2, 58.1) | 2 | 245 | 822 | 107 | 573 | 40.4 (27.8, 50.9) | 3 | 246 | 822 | 85 | 573 | 23.2 (7.3, 36.4) | 4 | 246 | 822 | 70 | 573 | 45.3 (33.2, 55.2) | 5 | 242 | 822 | 74 | 573 | 36.8 (23.0, 48.2) | 6 | 216 | 822 | 69 | 573 | 34.1 (19.0, 46.4) | 7 | 246 | 822 | 54 | 573 | 42.9 (29.5, 53.8) | 8 | 49 | 822 | 4 | 573 | 87.6 (76.0, 93.6) |
|-------|---|------------------|----------------------------------|------------------|---------------------|----------------------------|---|-------|---------------|--|---------------|--|-------------|----------------|------------------|----------------|------------------|---|-----|-----|-----|-----|-------------------|---|-----|-----|-----|-----|-------------------|---|-----|-----|----|-----|------------------|---|-----|-----|----|-----|-------------------|---|-----|-----|----|-----|-------------------|---|-----|-----|----|-----|-------------------|---|-----|-----|----|-----|-------------------|---|----|-----|---|-----|-------------------|
| Month | Test positive | | Test negative | | VE (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Vaccinated (N) | Unvaccinated (N) | Vaccinated (N) | Unvaccinated (N) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 247 | 822 | 112 | 573 | 49.1 (38.2, 58.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 245 | 822 | 107 | 573 | 40.4 (27.8, 50.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 246 | 822 | 85 | 573 | 23.2 (7.3, 36.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 246 | 822 | 70 | 573 | 45.3 (33.2, 55.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 242 | 822 | 74 | 573 | 36.8 (23.0, 48.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 216 | 822 | 69 | 573 | 34.1 (19.0, 46.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 246 | 822 | 54 | 573 | 42.9 (29.5, 53.8) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 49 | 822 | 4 | 573 | 87.6 (76.0, 93.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 111 | Risk et al (February 7, 2022) | USA | 18+ | Pre-Delta→Delta | Comirnaty mRNA-1273 | April 1-October 20, 2021 | <p>Cohort study based on electronic medical records (note 33% of infections and 19% of hospitalizations not based on laboratory testing but based on diagnostic code, though reported sensitivity analysis showed no difference but did not provide the data).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

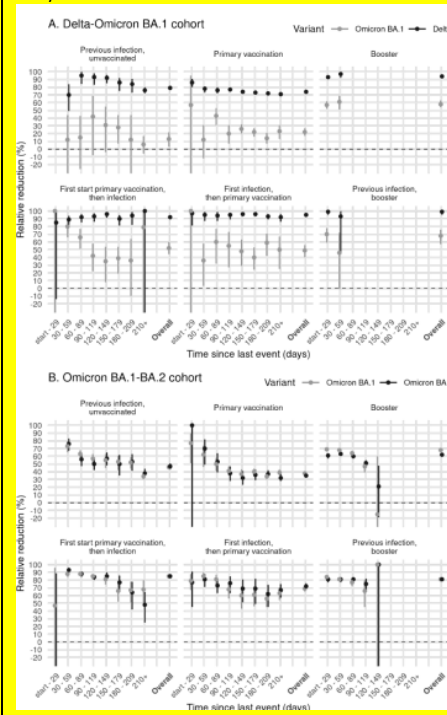
| | | | | | | <p>Vaccine Effectiveness HR (95% CI) p-value</p> <p>SARS-CoV-2 Infection</p> <p>BNT162b2</p> <p>pre-delta</p> <p>0-6 months • 0.13 (0.1-0.16) <0.001</p> <p>6+ months ■ 0.28 (0.21-0.38) <0.001</p> <p>post-delta</p> <p>0-6 months ■ 0.36 (0.32-0.42) <0.001</p> <p>6+ months ■ 0.78 (0.67-0.91) 0.002</p> <p>mRNA-1273</p> <p>pre-delta</p> <p>0-6 months ■ 0.09 (0.06-0.13) <0.001</p> <p>6+ months ■ 0.14 (0.08-0.24) <0.001</p> <p>post-delta</p> <p>0-6 months ■ 0.22 (0.17-0.33) <0.001</p> <p>6+ months ■ 0.45 (0.33-0.61) <0.001</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|---|-------------------|--------------------|--------------------|---|--|-----------------------------|---------|-------|-------|-----|--------------------|--|--|--|--|------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|--------|-------------------|-------------------|-------------------|-------------------|---------|-------------------|-------------------|-------------------|-------------------|---------|-------------------|-------------------|-------------------|------------------|------|-------------------|-------------------|-------------------|------------------|---------------------------|--|--|--|--|-----|-------------------|-------------------|-------------------|--------------------|------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|-----|-------------------|-------------------|-------------------|-------------------|-----------------------------|---------|-------|-------|-----|--------------------|--|--|--|--|------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|--------|-------------------|-------------------|-------------------|-------------------|---------|-------------------|-------------------|-------------------|-------------------|---------|-------------------|-------------------|-------------------|-------------------|------|-------------------|-------------------|-------------------|-------------------|---------------------------|--|--|--|--|-----|-------------------|-------------------|-------------------|-------------------|------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|-----|-------------------|----------|-------------------|-------------------|
| 110 | Cerqueria-Silva et al (February 9, 2022) | Brazil | General population | Gamma, Delta | Coronavac followed by Comirnaty booster | <p>January 18- November 11, 2021</p> <p>TND study linking administrative databases</p> <p>Table 3 Effectiveness of CoronaVac vaccine against confirmed SARS-CoV-2 infection, by length of time (in days) since two-dose vaccination or BNT162b2 booster dose, stratified by age group</p> <table border="1"> <thead> <tr> <th>Period after vaccine (days)</th> <th>Overall</th> <th>18-59</th> <th>60-79</th> <th>≥80</th> </tr> </thead> <tbody> <tr> <td>Second dose</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>0-13</td> <td>37.9% (36.9-38.8)</td> <td>43.5% (42.4-44.7)</td> <td>32.2% (30.1-34.2)</td> <td>28.3% (23.4-32.9)</td> </tr> <tr> <td>14-30</td> <td>55.0% (54.3-55.7)</td> <td>56.5% (55.6-57.5)</td> <td>55.1% (53.7-56.5)</td> <td>50.3% (46.8-53.6)</td> </tr> <tr> <td>31-60</td> <td>51.7% (51.1-52.4)</td> <td>52.9% (52.1-53.8)</td> <td>51.3% (49.7-52.4)</td> <td>47.0% (42.7-50.1)</td> </tr> <tr> <td>61-90</td> <td>47.6% (46.8-48.3)</td> <td>48.9% (47.9-49.9)</td> <td>45.2% (43.6-46.9)</td> <td>41.0% (37.3-44.4)</td> </tr> <tr> <td>91-120</td> <td>46.1% (45.3-46.9)</td> <td>52.3% (51.3-53.2)</td> <td>39.8% (37.8-41.8)</td> <td>31.8% (27.3-36.1)</td> </tr> <tr> <td>121-150</td> <td>41.8% (40.8-42.8)</td> <td>50.6% (49.3-51.9)</td> <td>36.3% (33.8-38.7)</td> <td>22.1% (16.5-27.3)</td> </tr> <tr> <td>151-180</td> <td>38.0% (36.7-39.3)</td> <td>44.0% (42.3-45.6)</td> <td>35.3% (32.2-38.2)</td> <td>15.1% (8.3-21.5)</td> </tr> <tr> <td>>180</td> <td>34.7% (33.1-36.3)</td> <td>34.1% (32.2-35.9)</td> <td>34.5% (29.9-38.7)</td> <td>10.1% (1.1-18.3)</td> </tr> <tr> <td>Booster (BNT162b2)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>0-6</td> <td>39.6% (33.8-44.8)</td> <td>40.3% (31.6-47.8)</td> <td>35.7% (25.2-44.8)</td> <td>11.5% (-12.4-30.3)</td> </tr> <tr> <td>7-13</td> <td>80.2% (77.0-82.9)</td> <td>84.6% (80.2-88.0)</td> <td>75.9% (69.6-80.8)</td> <td>59.6% (44.9-70.4)</td> </tr> <tr> <td>14-30</td> <td>92.7% (91.0-94.0)</td> <td>93.5% (90.7-95.5)</td> <td>93.4% (90.3-95.5)</td> <td>82.0% (75.0-87.0)</td> </tr> <tr> <td>>30</td> <td>82.6% (76.9-86.9)</td> <td>61.8% (27.2-79.9)</td> <td>81.2% (67.6-89.1)</td> <td>66.4% (49.6-77.5)</td> </tr> </tbody> </table> <p>Table 4 Effectiveness of CoronaVac vaccine against COVID-19 hospitalization or death, by length of time (in days) since two-dose vaccination or BNT162b2 booster dose, stratified by age group</p> <table border="1"> <thead> <tr> <th>Period after vaccine (days)</th> <th>Overall</th> <th>18-59</th> <th>60-79</th> <th>≥80</th> </tr> </thead> <tbody> <tr> <td>Second dose</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>0-13</td> <td>65.5% (64.2-66.6)</td> <td>79.6% (77.6-81.4)</td> <td>64.5% (62.8-66.1)</td> <td>51.4% (47.3-55.1)</td> </tr> <tr> <td>14-30</td> <td>82.1% (81.4-82.8)</td> <td>91.4% (90.3-92.4)</td> <td>81.6% (80.6-82.5)</td> <td>68.7% (65.9-71.2)</td> </tr> <tr> <td>31-60</td> <td>82.6% (82.1-83.2)</td> <td>89.9% (88.9-90.9)</td> <td>81.4% (80.6-82.2)</td> <td>66.5% (64.0-68.9)</td> </tr> <tr> <td>61-90</td> <td>80.5% (79.8-81.0)</td> <td>87.2% (86.0-88.3)</td> <td>77.6% (76.6-78.6)</td> <td>62.2% (60.4-65.8)</td> </tr> <tr> <td>91-120</td> <td>78.9% (78.3-79.6)</td> <td>89.0% (87.8-90.0)</td> <td>75.5% (74.3-76.7)</td> <td>58.0% (54.7-61.1)</td> </tr> <tr> <td>121-150</td> <td>77.0% (76.1-77.8)</td> <td>86.7% (85.2-88.0)</td> <td>74.9% (73.5-76.3)</td> <td>52.1% (48.0-55.8)</td> </tr> <tr> <td>151-180</td> <td>75.0% (73.9-76.0)</td> <td>81.9% (79.8-83.8)</td> <td>74.7% (72.9-76.4)</td> <td>47.9% (42.9-52.4)</td> </tr> <tr> <td>>180</td> <td>72.6% (71.0-74.2)</td> <td>74.8% (72.1-77.2)</td> <td>72.6% (69.5-75.3)</td> <td>41.4% (34.5-47.5)</td> </tr> <tr> <td>Booster (BNT162b2)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>0-6</td> <td>80.6% (76.4-84.0)</td> <td>89.1% (76.6-94.9)</td> <td>79.6% (73.5-84.2)</td> <td>48.8% (31.3-61.9)</td> </tr> <tr> <td>7-13</td> <td>91.4% (88.5-93.5)</td> <td>95.8% (82.9-99.0)</td> <td>88.3% (83.1-91.8)</td> <td>78.0% (67.1-85.3)</td> </tr> <tr> <td>14-30</td> <td>97.3% (96.1-98.1)</td> <td>97.9% (94.7-98.5)</td> <td>97.1% (94.7-98.5)</td> <td>89.5% (83.9-93.1)</td> </tr> <tr> <td>>30</td> <td>96.8% (94.1-98.3)</td> <td>100% (*)</td> <td>92.0% (79.6-96.9)</td> <td>89.3% (78.6-94.7)</td> </tr> </tbody> </table> <p>*The CI could not be estimated owing to zero/few events in the group.</p> | Period after vaccine (days) | Overall | 18-59 | 60-79 | ≥80 | Second dose | | | | | 0-13 | 37.9% (36.9-38.8) | 43.5% (42.4-44.7) | 32.2% (30.1-34.2) | 28.3% (23.4-32.9) | 14-30 | 55.0% (54.3-55.7) | 56.5% (55.6-57.5) | 55.1% (53.7-56.5) | 50.3% (46.8-53.6) | 31-60 | 51.7% (51.1-52.4) | 52.9% (52.1-53.8) | 51.3% (49.7-52.4) | 47.0% (42.7-50.1) | 61-90 | 47.6% (46.8-48.3) | 48.9% (47.9-49.9) | 45.2% (43.6-46.9) | 41.0% (37.3-44.4) | 91-120 | 46.1% (45.3-46.9) | 52.3% (51.3-53.2) | 39.8% (37.8-41.8) | 31.8% (27.3-36.1) | 121-150 | 41.8% (40.8-42.8) | 50.6% (49.3-51.9) | 36.3% (33.8-38.7) | 22.1% (16.5-27.3) | 151-180 | 38.0% (36.7-39.3) | 44.0% (42.3-45.6) | 35.3% (32.2-38.2) | 15.1% (8.3-21.5) | >180 | 34.7% (33.1-36.3) | 34.1% (32.2-35.9) | 34.5% (29.9-38.7) | 10.1% (1.1-18.3) | Booster (BNT162b2) | | | | | 0-6 | 39.6% (33.8-44.8) | 40.3% (31.6-47.8) | 35.7% (25.2-44.8) | 11.5% (-12.4-30.3) | 7-13 | 80.2% (77.0-82.9) | 84.6% (80.2-88.0) | 75.9% (69.6-80.8) | 59.6% (44.9-70.4) | 14-30 | 92.7% (91.0-94.0) | 93.5% (90.7-95.5) | 93.4% (90.3-95.5) | 82.0% (75.0-87.0) | >30 | 82.6% (76.9-86.9) | 61.8% (27.2-79.9) | 81.2% (67.6-89.1) | 66.4% (49.6-77.5) | Period after vaccine (days) | Overall | 18-59 | 60-79 | ≥80 | Second dose | | | | | 0-13 | 65.5% (64.2-66.6) | 79.6% (77.6-81.4) | 64.5% (62.8-66.1) | 51.4% (47.3-55.1) | 14-30 | 82.1% (81.4-82.8) | 91.4% (90.3-92.4) | 81.6% (80.6-82.5) | 68.7% (65.9-71.2) | 31-60 | 82.6% (82.1-83.2) | 89.9% (88.9-90.9) | 81.4% (80.6-82.2) | 66.5% (64.0-68.9) | 61-90 | 80.5% (79.8-81.0) | 87.2% (86.0-88.3) | 77.6% (76.6-78.6) | 62.2% (60.4-65.8) | 91-120 | 78.9% (78.3-79.6) | 89.0% (87.8-90.0) | 75.5% (74.3-76.7) | 58.0% (54.7-61.1) | 121-150 | 77.0% (76.1-77.8) | 86.7% (85.2-88.0) | 74.9% (73.5-76.3) | 52.1% (48.0-55.8) | 151-180 | 75.0% (73.9-76.0) | 81.9% (79.8-83.8) | 74.7% (72.9-76.4) | 47.9% (42.9-52.4) | >180 | 72.6% (71.0-74.2) | 74.8% (72.1-77.2) | 72.6% (69.5-75.3) | 41.4% (34.5-47.5) | Booster (BNT162b2) | | | | | 0-6 | 80.6% (76.4-84.0) | 89.1% (76.6-94.9) | 79.6% (73.5-84.2) | 48.8% (31.3-61.9) | 7-13 | 91.4% (88.5-93.5) | 95.8% (82.9-99.0) | 88.3% (83.1-91.8) | 78.0% (67.1-85.3) | 14-30 | 97.3% (96.1-98.1) | 97.9% (94.7-98.5) | 97.1% (94.7-98.5) | 89.5% (83.9-93.1) | >30 | 96.8% (94.1-98.3) | 100% (*) | 92.0% (79.6-96.9) | 89.3% (78.6-94.7) |
| Period after vaccine (days) | Overall | 18-59 | 60-79 | ≥80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Second dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-13 | 37.9% (36.9-38.8) | 43.5% (42.4-44.7) | 32.2% (30.1-34.2) | 28.3% (23.4-32.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-30 | 55.0% (54.3-55.7) | 56.5% (55.6-57.5) | 55.1% (53.7-56.5) | 50.3% (46.8-53.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31-60 | 51.7% (51.1-52.4) | 52.9% (52.1-53.8) | 51.3% (49.7-52.4) | 47.0% (42.7-50.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 61-90 | 47.6% (46.8-48.3) | 48.9% (47.9-49.9) | 45.2% (43.6-46.9) | 41.0% (37.3-44.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 91-120 | 46.1% (45.3-46.9) | 52.3% (51.3-53.2) | 39.8% (37.8-41.8) | 31.8% (27.3-36.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 121-150 | 41.8% (40.8-42.8) | 50.6% (49.3-51.9) | 36.3% (33.8-38.7) | 22.1% (16.5-27.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 151-180 | 38.0% (36.7-39.3) | 44.0% (42.3-45.6) | 35.3% (32.2-38.2) | 15.1% (8.3-21.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >180 | 34.7% (33.1-36.3) | 34.1% (32.2-35.9) | 34.5% (29.9-38.7) | 10.1% (1.1-18.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Booster (BNT162b2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-6 | 39.6% (33.8-44.8) | 40.3% (31.6-47.8) | 35.7% (25.2-44.8) | 11.5% (-12.4-30.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7-13 | 80.2% (77.0-82.9) | 84.6% (80.2-88.0) | 75.9% (69.6-80.8) | 59.6% (44.9-70.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-30 | 92.7% (91.0-94.0) | 93.5% (90.7-95.5) | 93.4% (90.3-95.5) | 82.0% (75.0-87.0) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >30 | 82.6% (76.9-86.9) | 61.8% (27.2-79.9) | 81.2% (67.6-89.1) | 66.4% (49.6-77.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Period after vaccine (days) | Overall | 18-59 | 60-79 | ≥80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Second dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-13 | 65.5% (64.2-66.6) | 79.6% (77.6-81.4) | 64.5% (62.8-66.1) | 51.4% (47.3-55.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-30 | 82.1% (81.4-82.8) | 91.4% (90.3-92.4) | 81.6% (80.6-82.5) | 68.7% (65.9-71.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31-60 | 82.6% (82.1-83.2) | 89.9% (88.9-90.9) | 81.4% (80.6-82.2) | 66.5% (64.0-68.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 61-90 | 80.5% (79.8-81.0) | 87.2% (86.0-88.3) | 77.6% (76.6-78.6) | 62.2% (60.4-65.8) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 91-120 | 78.9% (78.3-79.6) | 89.0% (87.8-90.0) | 75.5% (74.3-76.7) | 58.0% (54.7-61.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 121-150 | 77.0% (76.1-77.8) | 86.7% (85.2-88.0) | 74.9% (73.5-76.3) | 52.1% (48.0-55.8) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 151-180 | 75.0% (73.9-76.0) | 81.9% (79.8-83.8) | 74.7% (72.9-76.4) | 47.9% (42.9-52.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >180 | 72.6% (71.0-74.2) | 74.8% (72.1-77.2) | 72.6% (69.5-75.3) | 41.4% (34.5-47.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Booster (BNT162b2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-6 | 80.6% (76.4-84.0) | 89.1% (76.6-94.9) | 79.6% (73.5-84.2) | 48.8% (31.3-61.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7-13 | 91.4% (88.5-93.5) | 95.8% (82.9-99.0) | 88.3% (83.1-91.8) | 78.0% (67.1-85.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-30 | 97.3% (96.1-98.1) | 97.9% (94.7-98.5) | 97.1% (94.7-98.5) | 89.5% (83.9-93.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >30 | 96.8% (94.1-98.3) | 100% (*) | 92.0% (79.6-96.9) | 89.3% (78.6-94.7) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Extended Data Table 4 | Vaccine effectiveness against death due to COVID-19 using RT-PCR, by length of time (in days) since two-dose vaccination or BNT162b2 booster dose

| Period post vaccine (days) | Overall | 18-59 | 60-79 | ≥80 |
|----------------------------|-------------------|--------------------|-------------------|-------------------|
| Second dose | | | | |
| Second dose | | | | |
| 0-13 | 67.3% (65.6-68.9) | 86.4% (82.5-89.4) | 69.6% (67.6-71.6) | 56.0% (51.6-60.0) |
| 14-30 | 82.7% (81.7-83.6) | 91.4% (88.7-93.5) | 84.5% (83.3-85.6) | 72.7% (69.8-75.4) |
| 31-60 | 83.6% (82.8-84.3) | 91.9% (89.7-93.6) | 84.8% (83.8-85.7) | 70.0% (67.2-72.5) |
| 61-90 | 81.4% (80.5-82.2) | 92.2% (89.8-94.0) | 82.5% (81.3-83.7) | 67.2% (64.2-69.9) |
| 91-120 | 79.8% (78.7-80.8) | 95.0% (93.1-96.4) | 81.7% (80.3-83.0) | 63.5% (59.9-66.7) |
| 121-150 | 78.3% (77.0-79.6) | 93.7% (90.9-95.7) | 82.0% (80.3-83.5) | 58.7% (54.3-62.7) |
| 151-180 | 76.8% (75.1-78.4) | 92.1% (88.2-94.7) | 81.9% (79.7-83.8) | 53.9% (48.3-58.9) |
| >180 | 74.8% (72.2-77.2) | 90.3% (85.5-93.5) | 81.5% (77.6-84.7) | 45.5% (37.1-52.8) |
| Booster (BNT162b2) | | | | |
| 0-6 | 80.3% (73.1-85.6) | 100% (*) | 81.4% (71.3-87.9) | 59.9% (39.3-73.5) |
| 7-13 | 92.2% (87.4-95.2) | 100% (*) | 92.3% (83.8-96.3) | 80.7% (65.3-89.2) |
| 14-30 | 98.3% (96.3-99.2) | 81.9% (-31.6-97.5) | 99.1% (93.6-99.9) | 95.4% (88.7-98.1) |
| >30 | 97.1% (90.5-99.1) | 100% (*) | 94.3% (58.3-99.2) | 93.5% (73.2-98.4) |

109 [Andeweg et al \(February 8, 2022\) \(updated May 12, 2022\)](#) Netherlands General population **Omicron (BA.1 and BA.2)** Delta Comirnaty ChAdOx1 mRNA-1273 Ad26.COV2.S November 22, 2021-January 19, 2022

TND study linking administrative databases evaluating VE/risk reduction from prior infection and/or vaccination.



| | | | | | | |
|-----|--|-------|--------------------|-----------------------------------|---------------------|---|
| 108 | Chemaitelly et al (February 8, 2022) | Qatar | General population | Omicron | Comirnaty mRNA-1273 | December 23, 2021- February 2, 2022 |
| 107 | Lauring et al (February 7, 2022) | USA | ≥18 years | Delta (for the duration analysis) | Comirnaty mRNA-1273 | July 4-December 25, 2021 (for the Delta analysis) |

Matched TND study based on linking administrative databases.

Figure 1. Effectiveness of the BNT162b2 vaccine against A) symptomatic SARS-CoV-2 Omicron infection and B) severe, critical, or fatal COVID-19 due to Omicron infection. C) Effectiveness of the mRNA-1273 vaccine against symptomatic SARS-CoV-2 Omicron infection. Data are presented as effectiveness point estimates. Error bars indicate the corresponding 95% confidence intervals.

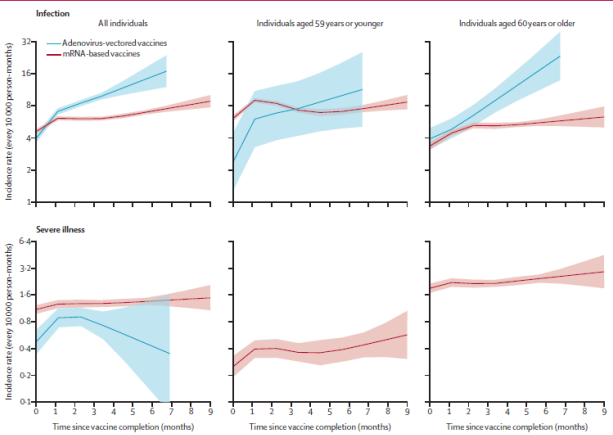
A Effectiveness of the BNT162b2 vaccine against symptomatic Omicron infection

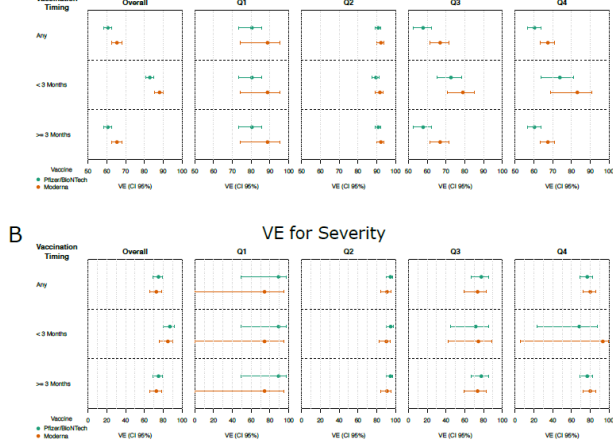
B Effectiveness of the BNT162b2 vaccine against any severe, critical, or fatal SARS-CoV-2 infections

C Effectiveness of the mRNA-1273 vaccine against symptomatic Omicron infection

The time-since-vaccination categories were chosen to maximize statistical precision in each analysis as the number of cases was small for some of the time-since-vaccination data. Therefore, the time-since-vaccination categories were different for the BNT162b2 and mRNA-1273 analyses and for the analysis against any severe, critical, or fatal COVID-19.

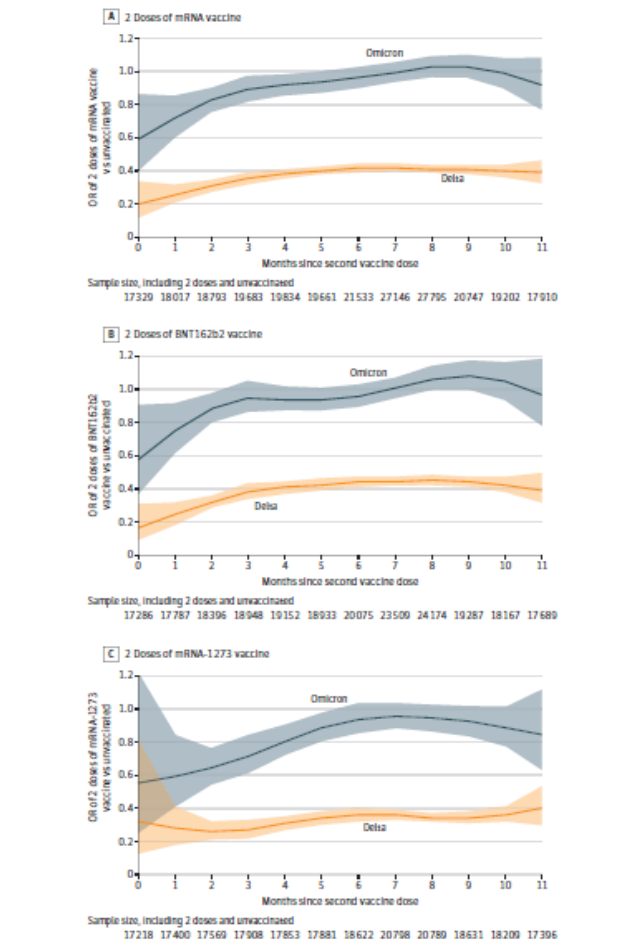
| Sub-studies ^a | mRNA-1273 | | | | Effectiveness in % (95% CI) ^b |
|---------------------------------------|--|-----|--------------------------------------|-----|--|
| | Cases ^c (Severe, critical, or fatal disease) ^d | | Controls ^e (PCR-negative) | | |
| | Vaccinated | | Vaccinated | | |
| | Yes | No | Yes | No | |
| Dose 1 | | | | | |
| Dose 1 and no Dose 2 | 0 | 103 | 2 | 280 | 100.0 (Omitted) ^f |
| Dose 2 | | | | | |
| 1-6 months after Dose 2 and no Dose 3 | 3 | 105 | 35 | 265 | 76.9 (19.2 to 93.4) |
| ≥7 months after Dose 2 and no Dose 3 | 23 | 117 | 139 | 257 | 64.0 (39.1 to 78.7) |
| Dose 3 (Booster dose) | | | | | |
| 1-6 weeks after Dose 3 | 1 | 103 | 19 | 270 | 80.8 (-51.9 to 97.6) |
| >7 weeks after Dose 3 | 0 | 102 | 5 | 278 | 100.0 (Omitted) ^f |

| | (updated March 9, 2022) | | | | | | | | | | | | | | |
|---|---|----------|-----------|------------------------|--|-----------------------------|---|--|---------------------|--|-----------------|---|------------------|--|-----------------|
| 106 | Kislava et al (January 31, 2022) | Portugal | ≥12 years | Delta → Omicron | Comirnaty ChAdOx1 mRNA-1273 Ad26.COV2.S | December 6-21, 2021 | <p>Compared the odds of vaccination in Delta versus Omicron cases. (higher odds = lower VE of Omicron).</p> <table border="1"> <thead> <tr> <th></th> <th>Omicron : Delta aOR</th> </tr> </thead> <tbody> <tr> <td>Complete primary vaccination <113 days</td> <td>2.3(1.9 to 2.8)</td> </tr> <tr> <td>Complete primary vaccination 113-168 days</td> <td>2.0 (1.7 to 2.4)</td> </tr> <tr> <td>Complete primary vaccination 169+ days</td> <td>1.9(1.6 to 2.3)</td> </tr> </tbody> </table> | | Omicron : Delta aOR | Complete primary vaccination <113 days | 2.3(1.9 to 2.8) | Complete primary vaccination 113-168 days | 2.0 (1.7 to 2.4) | Complete primary vaccination 169+ days | 1.9(1.6 to 2.3) |
| | Omicron : Delta aOR | | | | | | | | | | | | | | |
| Complete primary vaccination <113 days | 2.3(1.9 to 2.8) | | | | | | | | | | | | | | |
| Complete primary vaccination 113-168 days | 2.0 (1.7 to 2.4) | | | | | | | | | | | | | | |
| Complete primary vaccination 169+ days | 1.9(1.6 to 2.3) | | | | | | | | | | | | | | |
| 105 | Corrao et al (January 27, 2022) | Italy | ≥12 years | Alpha → Delta | Comirnaty ChAdOx1 mRNA-1273 Ad26.COV2.S | January 17-October 20, 2021 | <p>Cohort study</p>   <p>Figure 1: Influence of time since complete vaccination on rates of SARS-CoV-2 infection and severe COVID-19 illness. Estimates based on the cohort of 5 351 085 individuals who received complete vaccination from January to July, 2021. The figure reports the trends in age-period-cohort modelled incidence rates (and 95% CI bands) according to time since complete vaccination. Estimates are adjusted for the month of vaccine completion (cohort effect), and the month of outcome occurrence (period effect).</p> <p>Figure 2: Influence of time since complete vaccination on vaccine effectiveness against SARS-CoV-2 infection and severe COVID-19 illness. Estimates based on the cohort of 9 140 390 potential candidates who were to receive the vaccine as of Dec 27, 2020. Cox proportional hazard models were fitted for estimating hazard ratio and 95% CI. Vaccine effectiveness was directly calculated as 1 - hazard ratio.</p>  <p>Figure 3: Influence of time since complete vaccination on rates of SARS-CoV-2 infection (top boxes) and severe COVID-19 illness (bottom boxes) in the entire cohort and according to age and vaccine type. Estimates based on the cohort of 5 351 085 individuals who received complete vaccination from January to July, 2021. The figure reports the trends in age-period-cohort modelled incidence rates (and 95% CI bands) according to time since complete vaccination. Estimates are adjusted for the month of vaccine completion (cohort effect), and the month of outcome occurrence (period effect).</p> | | | | | | | | |

| | | | | | | | |
|-----|--|---------|---------------|---------------|---|-----------------------------|--|
| 104 | Roberts et al (January 31, 2022) | USA | Adults | Multiple | Comirnaty mRNA-1273 (for duration) | January 1-December 31, 2021 | <p>TND study evaluating VE against infection (top) and hospitalization/death (bottom). Note that this is a combination of primary and booster dose VE in quarter 4.</p>  <p>A</p> <p>B VE for Severity</p> |
| 103 | Belayachi et al (January 27, 2022) | Morocco | ≥18 year olds | Unknown→Delta | BBIBP-CorV | February 1-October 1, 2021 | <p>TND linking administrative databases to evaluate VE against severe disease. As a function of time after vaccination of second dose vaccination, vaccine effectiveness among persons who had received the second dose 1–30 days earlier was 88% (95% CI, 84-91), 87% (95% CI: 83-90) among those who had received it 31–90 days earlier, 75% (95% CI: 67-80) among those who had received it 91–120 days earlier, 61% (95% CI: 54-67) among those who had received it 121–150 days earlier, 64% (95% CI: 59-69) among those who had received it ≥150 days earlier.</p> <p>Note they attempted to stratify by age (>/< 60 years) showing a trend towards a lower VE against severe/critical disease in those over 60 but confidence intervals were overlapping.</p> |
| 102 | Lytras et al (January 29, 2022) (updated June 14, 2022) | Greece | ≥15 year olds | Alpha→Delta | Comirnaty ChAdOx1 mRNA-1273 Ad26.COVS.2 | January-December 2021 | <p>Cohort study linking administrative databases evaluating VE against intubation and death. VE provided for 6 months</p> |

| | | | | | | | <p>Vaccine Effectiveness (comparative)</p> <p>Vaccine</p> <p>VE (%)</p> <p>VE (%)</p> <p>VE (%) against Intubation</p> <p>VE (%) against death</p> |
|-----|--|-------|-----------------------------|---------------|---------------------|-------------------------------------|---|
| 101 | Goldhaber-Fiebert et al (January 23, 2022) | USA | Prison population and staff | Delta | Comirnaty mRNA-1273 | June 1-November 5, 2021 | Matched TND among cases evaluating duration of protection against infection of early vs late fully (primary series) vaccinated persons. Among staff, odds of infection increased 25% (Odds Ratio [OR], 1.25; 95% Confidence Interval [CI], 1.13 – 1.40) in each 28-day period post-vaccination; among residents, the odds increased by 21% (OR, 1.21; 95%CI 1.08 – 1.36) (Figure 1). Compared with individuals within 60 days of being fully vaccinated, odds of infection were over fourfold greater ≥181 days since full vaccination for staff (OR, 4.36; 95%CI 1.92 – 9.89) and nearly threefold greater for residents (OR, 2.89; 95%CI 1.40 – 5.98) |
| 100 | Bedston et al (January 20, 2022) | Wales | Healthcare Workers | Alpha→Delta | Comirnaty | December 7, 2020-September 30, 2021 | Cohort study. 2 weeks after dose 2, VE against infection was 67% (aHR 0.33, 95 %CI 0.24–0.44). This increased in weeks 2–5 to 86% (aHR 0.14, 95 %CI 0.09–0.21), and decreased to 77% over weeks 6–13. After this, vaccine effectiveness decreased from 60% to 53% between weeks 14–25, and from week 26 vaccine effective was 45% (aHR 0.55, 95 %CI 0.49–0.61). |
| 99 | Accorsi et al (January 21, 2022) | USA | ≥18 year olds | Delta→Omicron | Comirnaty mRNA-1273 | December 10-January 1, 2022 | TND study in ICATT (free testing sites throughout US) against symptomatic disease. Note OR can be converted to VE by the formulae VE=1-OR |

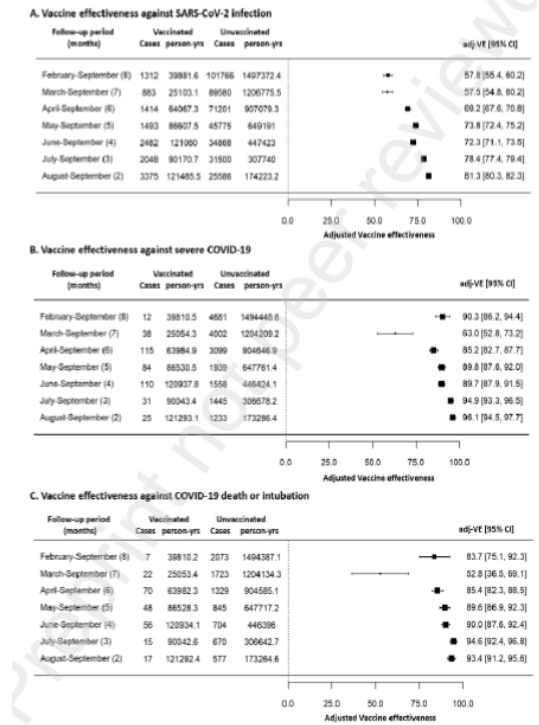
Figure 2. Odds Ratios for the Association of 2 Doses of mRNA Vaccine by Months Since Second Dose and Symptomatic SARS-CoV-2 Infection Caused by the Omicron or Delta Variants Among Adults 18 Years or Older Tested in the Increasing Community Access to Testing Platform, December 10, 2021, to January 1, 2022



| | | | | | | | |
|----|--|-----|---------------|---------------------------|------------------------|-------------------------------------|---|
| 98 | Thompson et al (January 21, 2022) | USA | ≥18 year olds | Delta → Omicron | Comirnaty mRNA-1273 | August 26, 2021- January 5, 2022 | TND study in VISION network calculating VE against emergency department/urgent care visits and hospitalization among persons with symptoms consistent with COVID-19 |
|----|--|-----|---------------|---------------------------|------------------------|-------------------------------------|---|

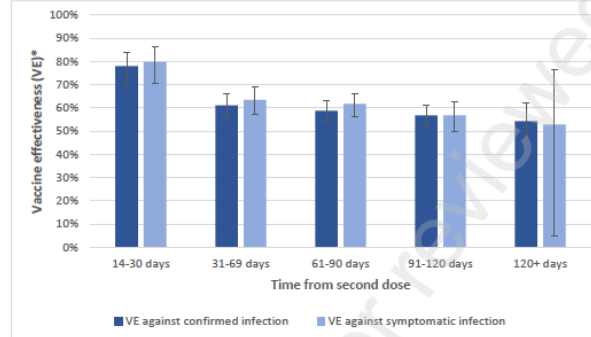
| | | | | | | | <p>TABLE 2. mRNA COVID-19 vaccine effectiveness* against laboratory-confirmed COVID-19-associated† emergency department and urgent care encounters and hospitalizations among adults aged ≥18 years, by number and timing of vaccine doses* and vaccine product received – VISION Network, 10 states, August 2021–January 2022[‡]</p> <table border="1"> <thead> <tr> <th>Encounter/Predominant variant period/Vaccination status</th> <th>Total</th> <th>SARS-CoV-2 positive test result, no. (%)</th> <th>VE, %* (95% CI)</th> </tr> </thead> <tbody> <tr> <td colspan="4">ED or UC encounters</td> </tr> <tr> <td colspan="4">Delta predominant</td> </tr> <tr> <td>Unvaccinated (Ref)</td> <td></td> <td></td> <td>—</td> </tr> <tr> <td>Any mRNA vaccine</td> <td>98,087</td> <td>36,542 (37.2)</td> <td>—</td> </tr> <tr> <td>2 doses (14–179 days earlier)</td> <td>39,629</td> <td>3,269 (8.2)</td> <td>86 (85–87)</td> </tr> <tr> <td>2 doses (≥180 days earlier)</td> <td>52,506</td> <td>6,893 (13.1)</td> <td>76 (75–77)</td> </tr> <tr> <td>3 doses</td> <td>14,523</td> <td>469 (3.2)</td> <td>94 (93–94)</td> </tr> <tr> <td colspan="4">Omicron predominant</td> </tr> <tr> <td>Unvaccinated (Ref)</td> <td></td> <td></td> <td>—</td> </tr> <tr> <td>Any mRNA vaccine</td> <td>6,996</td> <td>3,398 (48.6)</td> <td>—</td> </tr> <tr> <td>2 doses (14–179 days earlier)</td> <td>1,746</td> <td>591 (33.9)</td> <td>52 (46–58)</td> </tr> <tr> <td>2 doses (≥180 days earlier)</td> <td>5,409</td> <td>2,037 (37.7)</td> <td>38 (32–43)</td> </tr> <tr> <td>3 doses</td> <td>3,876</td> <td>520 (13.4)</td> <td>82 (79–84)</td> </tr> <tr> <td colspan="4">Hospitalizations</td> </tr> <tr> <td colspan="4">Delta predominant</td> </tr> <tr> <td>Unvaccinated (Ref)</td> <td></td> <td></td> <td>—</td> </tr> <tr> <td>Any mRNA vaccine</td> <td>37,400</td> <td>14,272 (38.2)</td> <td>—</td> </tr> <tr> <td>2 doses (14–179 days earlier)</td> <td>14,645</td> <td>895 (6.1)</td> <td>90 (89–90)</td> </tr> <tr> <td>2 doses (≥180 days earlier)</td> <td>26,190</td> <td>2,563 (9.8)</td> <td>81 (80–82)</td> </tr> <tr> <td>3 doses</td> <td>8,092</td> <td>209 (2.6)</td> <td>94 (93–95)</td> </tr> <tr> <td colspan="4">Omicron predominant</td> </tr> <tr> <td>Unvaccinated (Ref)</td> <td></td> <td></td> <td>—</td> </tr> <tr> <td>Any mRNA vaccine</td> <td>460</td> <td>174 (37.8)</td> <td>—</td> </tr> <tr> <td>2 doses (14–179 days earlier)</td> <td>115</td> <td>14 (12.2)</td> <td>81 (65–90)</td> </tr> <tr> <td>2 doses (≥180 days earlier)</td> <td>488</td> <td>86 (17.6)</td> <td>57 (39–70)</td> </tr> <tr> <td>3 doses</td> <td>514</td> <td>24 (4.7)</td> <td>90 (80–94)</td> </tr> </tbody> </table> | Encounter/Predominant variant period/Vaccination status | Total | SARS-CoV-2 positive test result, no. (%) | VE, %* (95% CI) | ED or UC encounters | | | | Delta predominant | | | | Unvaccinated (Ref) | | | — | Any mRNA vaccine | 98,087 | 36,542 (37.2) | — | 2 doses (14–179 days earlier) | 39,629 | 3,269 (8.2) | 86 (85–87) | 2 doses (≥180 days earlier) | 52,506 | 6,893 (13.1) | 76 (75–77) | 3 doses | 14,523 | 469 (3.2) | 94 (93–94) | Omicron predominant | | | | Unvaccinated (Ref) | | | — | Any mRNA vaccine | 6,996 | 3,398 (48.6) | — | 2 doses (14–179 days earlier) | 1,746 | 591 (33.9) | 52 (46–58) | 2 doses (≥180 days earlier) | 5,409 | 2,037 (37.7) | 38 (32–43) | 3 doses | 3,876 | 520 (13.4) | 82 (79–84) | Hospitalizations | | | | Delta predominant | | | | Unvaccinated (Ref) | | | — | Any mRNA vaccine | 37,400 | 14,272 (38.2) | — | 2 doses (14–179 days earlier) | 14,645 | 895 (6.1) | 90 (89–90) | 2 doses (≥180 days earlier) | 26,190 | 2,563 (9.8) | 81 (80–82) | 3 doses | 8,092 | 209 (2.6) | 94 (93–95) | Omicron predominant | | | | Unvaccinated (Ref) | | | — | Any mRNA vaccine | 460 | 174 (37.8) | — | 2 doses (14–179 days earlier) | 115 | 14 (12.2) | 81 (65–90) | 2 doses (≥180 days earlier) | 488 | 86 (17.6) | 57 (39–70) | 3 doses | 514 | 24 (4.7) | 90 (80–94) |
|---|--|--|--|-------------------------|------------------------|-----------------------------------|---|---|-------|--|-----------------|----------------------------|--|--|--|--------------------------|--|--|--|--------------------|--|--|---|------------------|--------|---------------|---|-------------------------------|--------|-------------|------------|-----------------------------|--------|--------------|------------|---------|--------|-----------|------------|----------------------------|--|--|--|--------------------|--|--|---|------------------|-------|--------------|---|-------------------------------|-------|------------|------------|-----------------------------|-------|--------------|------------|---------|-------|------------|------------|-------------------------|--|--|--|--------------------------|--|--|--|--------------------|--|--|---|------------------|--------|---------------|---|-------------------------------|--------|-----------|------------|-----------------------------|--------|-------------|------------|---------|-------|-----------|------------|----------------------------|--|--|--|--------------------|--|--|---|------------------|-----|------------|---|-------------------------------|-----|-----------|------------|-----------------------------|-----|-----------|------------|---------|-----|----------|------------|
| Encounter/Predominant variant period/Vaccination status | Total | SARS-CoV-2 positive test result, no. (%) | VE, %* (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ED or UC encounters | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta predominant | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated (Ref) | | | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Any mRNA vaccine | 98,087 | 36,542 (37.2) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (14–179 days earlier) | 39,629 | 3,269 (8.2) | 86 (85–87) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (≥180 days earlier) | 52,506 | 6,893 (13.1) | 76 (75–77) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 doses | 14,523 | 469 (3.2) | 94 (93–94) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omicron predominant | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated (Ref) | | | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Any mRNA vaccine | 6,996 | 3,398 (48.6) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (14–179 days earlier) | 1,746 | 591 (33.9) | 52 (46–58) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (≥180 days earlier) | 5,409 | 2,037 (37.7) | 38 (32–43) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 doses | 3,876 | 520 (13.4) | 82 (79–84) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hospitalizations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta predominant | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated (Ref) | | | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Any mRNA vaccine | 37,400 | 14,272 (38.2) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (14–179 days earlier) | 14,645 | 895 (6.1) | 90 (89–90) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (≥180 days earlier) | 26,190 | 2,563 (9.8) | 81 (80–82) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 doses | 8,092 | 209 (2.6) | 94 (93–95) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omicron predominant | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated (Ref) | | | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Any mRNA vaccine | 460 | 174 (37.8) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (14–179 days earlier) | 115 | 14 (12.2) | 81 (65–90) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 doses (≥180 days earlier) | 488 | 86 (17.6) | 57 (39–70) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 doses | 514 | 24 (4.7) | 90 (80–94) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 97 | <p>Tartof et al (January 19, 2022)</p> <p>(updated April 22, 2022)</p> | USA | ≥18 year olds enrolled in Kaiser insurance | Delta Omicron | Comirnaty | December 1, 2021-February 6, 2022 | <p>TND study of persons admitted to the emergency room or hospital with symptoms consistent with COVID-19.</p> <p>The figure consists of four dot plots arranged in a 2x2 grid. The top row shows 'Hospital admission due to delta (B.1.617.2) variant' and 'Hospital admission due to omicron (B.1.1.529) variant'. The bottom row shows 'ED admission due to delta (B.1.617.2) variant' and 'ED admission due to omicron (B.1.1.529) variant'. Each plot has 'Vaccine effectiveness (%)' on the y-axis (0 to 100) and 'Time since vaccination' on the x-axis, with markers for 'Second dose' and 'Third dose'. The plots show a general downward trend in effectiveness over time, with the third dose showing higher effectiveness than the second dose in most cases.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 96 | <p>Amodio et al (January 19, 2022)</p> | Italy | ≥18 year olds | Alpha→Delta | Comirnaty mRNA-1273 | January 1-September 30, 2021 | <p>Cohort study of 3.9 millions adults in Sicily conducted from administrative databases. Decreasing trends for vaccine effectiveness, measured as monthly percentage changes, were statistically significant for all the three evaluated outcomes (-4.76% per month, p<0.001 against SARS-CoV-2 infection; -2.27% per month, p=0.029 against severe COVID-19; 2.26% per month, p=0.028 against COVID-19 intubation/death, respectively).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 4: Vaccine effectiveness estimates after adjustment for age and sex according to the different assessed outcomes and follow-up periods.



| | | | | | | | |
|----|---|-----------|--------------------|-------|------------------------|--------------------------|---|
| 95 | Suah et al (January 16, 2022) (updated June 2022) | Malaysia | General population | Delta | Comirnaty CoronaVac | September 1-30, 2021 | Compared early (April-June) vs late (July-August) vaccinated persons (comparing to unvaccinated based on census data). For BNT162b2, crude vaccine effectiveness against COVID-19 infections declined from 90.8% (95% CI 89.4, 92.0) in the late group to 79.1% (95% CI 75.8, 81.9) in the late group. Vaccine effectiveness for BNT162b2 against ICU admission and deaths were comparable between the two different periods. For CoronaVac, crude vaccine effectiveness waned against COVID-19 infections from 74.4% in the late group (95% CI 209 70.4, 77.8) to 30.0% (95% CI 18.4, 39.9) in the early group. It also declined significantly against ICU admission, dropping from 56.1% (95% CI 51.4, 60.2) to 29.9% (95% CI 13.9, 43.0) (adjusted). For deaths, however, CoronaVac's effectiveness did not wane after three to five months of full vaccination. Waning more prominent in 60+. |
| 94 | Chiew et al (January 8, 2022) | Singapore | 12-18 year olds | Delta | Comirnaty | June 1-November 20, 2021 | Cohort study evaluating VE against infection and disease. |

Figure 1. Vaccine effectiveness over time from completion of second dose.



*Vaccine effectiveness is adjusted for age group, gender, ethnicity, housing type, time from second vaccination dose (in months) and date of notification using Poisson regression. Reference group is unvaccinated.

| | | | | | | |
|----|--|----|--|----------------|-----------------------------|--------------------------|
| 93 | <p>UKHSA (April 28, 2022) Update of #83/Dec 31st analysis</p> <p>(Note Andrews et al published March 2 with data through mid-January in case you're interested in the methods).</p> | UK | | Delta, Omicron | Comirnaty ChAdOx1 mRNA-1273 | November 27- April, 2021 |
|----|--|----|--|----------------|-----------------------------|--------------------------|

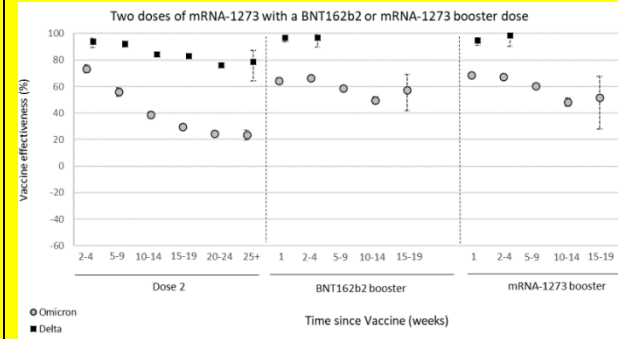
TND case control
VE against symptomatic disease

Two doses of ChAdOx1-S with a BNT162b2 or mRNA-1273 booster dose

| Booster Type | Time since Vaccine (weeks) | Omicron VE (%) | Delta VE (%) |
|-------------------|----------------------------|----------------|--------------|
| Dose 2 | 2-4 | ~50 | ~85 |
| | 5-9 | ~40 | ~80 |
| | 10-14 | ~35 | ~75 |
| | 15-19 | ~25 | ~65 |
| | 20-24 | ~15 | ~55 |
| | 25+ | ~10 | ~45 |
| BNT162b2 booster | 1 | ~60 | ~95 |
| | 2-4 | ~65 | ~95 |
| | 5-9 | ~55 | ~95 |
| | 10-14 | ~45 | ~95 |
| | 15-19 | ~30 | ~95 |
| | 20+ | ~15 | ~95 |
| mRNA-1273 booster | 1 | ~70 | ~95 |
| | 2-4 | ~70 | ~95 |
| | 5-9 | ~65 | ~95 |
| | 10-14 | ~55 | ~95 |
| | 15-19 | ~45 | ~95 |
| | 20+ | ~10 | ~95 |

Two doses of BNT162b2 with a BNT162b2 or mRNA-1273 booster dose

| Booster Type | Time since Vaccine (weeks) | Omicron VE (%) | Delta VE (%) |
|-------------------|----------------------------|----------------|--------------|
| Dose 2 | 2-4 | ~55 | ~90 |
| | 5-9 | ~45 | ~85 |
| | 10-14 | ~35 | ~80 |
| | 15-19 | ~25 | ~75 |
| | 20-24 | ~15 | ~70 |
| | 25+ | ~10 | ~65 |
| BNT162b2 booster | 1 | ~65 | ~95 |
| | 2-4 | ~65 | ~95 |
| | 5-9 | ~55 | ~95 |
| | 10-14 | ~45 | ~95 |
| | 15-19 | ~30 | ~95 |
| | 20+ | ~15 | ~95 |
| mRNA-1273 booster | 1 | ~75 | ~95 |
| | 2-4 | ~75 | ~95 |
| | 5-9 | ~65 | ~95 |
| | 10-14 | ~55 | ~95 |
| | 15-19 | ~45 | ~95 |
| | 20+ | ~10 | ~95 |



Combined for AZ, Pfizer, Moderna vaccines: VE against hospitalization (with different definitions)

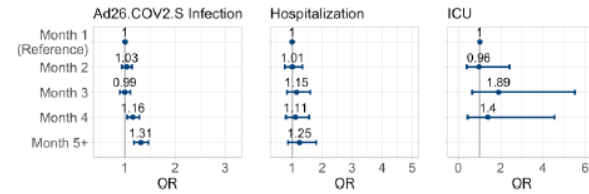
| | ECDS symptomatic with onset date | SUS at least 2 days with ARI code in primary field | SUS at least 2 days and either oxygen, ventilation or ICU with ARI code in primary field |
|-----------------|----------------------------------|--|--|
| 18 to 64 | | | |
| | Interval | VE | VE |
| Dose 1 | 0 to 27 | 48.5 (12.3 to 69.7) | 36.2 (-33.9 to 69.6) |
| | 28+ | 48.7 (32.8 to 60.8) | 44.1 (25.6 to 58) |
| Dose 2 | 0 to 13 | 39.6 (-31.5 to 72.2) | 88.9 (58.4 to 97) |
| | 14 to 174 | 54.7 (45.3 to 62.4) | 69 (58.1 to 77) |
| | 175+ | 34.6 (21.7 to 45.4) | 56.1 (46.4 to 64) |
| Booster | 0 to 6 | 63.9 (52.2 to 72.8) | 74.3 (55.9 to 85) |
| | 7 to 13 | 80.1 (73.5 to 85.1) | 90.9 (83.2 to 95.1) |
| | 14 to 34 | 82.4 (78.6 to 85.6) | 88.6 (84.9 to 91.5) |
| | 35 to 69 | 72.7 (67.2 to 77.2) | 85.8 (82.4 to 88.5) |
| | 70 to 104 | 66.9 (59.1 to 73.3) | 80.2 (74.9 to 84.4) |
| | 105+ | 53.6 (36.9 to 65.9) | 67.4 (53.1 to 77.4) |
| 65+ | | | |
| | Interval | VE | VE |
| Dose 1 | 0 to 27 | | 43.9 (-41 to 77.7) |
| | 28+ | | 53.4 (36.3 to 65.9) |
| Dose 2 | 0 to 13 | | |
| | 14 to 174 | 77.8 (45 to 91) | 82.3 (74.3 to 87.8) |
| | 175+ | 66.7 (43.4 to 80.4) | 57.7 (49.6 to 64.4) |
| Booster | 0 to 6 | 85.8 (61.5 to 94.7) | 77.9 (65.3 to 85.9) |
| | 7 to 13 | 92.3 (76.3 to 97.5) | 84.7 (76 to 90.2) |
| | 14 to 34 | 92.4 (86 to 95.8) | 91.3 (89.1 to 93.1) |
| | 35 to 69 | 87 (79.2 to 91.8) | 89.3 (87.3 to 90.9) |
| | 70 to 104 | 84 (74.6 to 89.9) | 88.1 (86.1 to 89.9) |
| | 105+ | 76.9 (60.6 to 86.4) | 85.3 (82.4 to 87.6) |

Combined for AZ, Pfizer, Moderna vaccines: VE against mortality

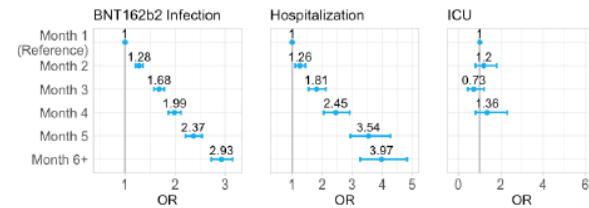
| | | | | | | | <table border="1"> <thead> <tr> <th>Dose</th> <th>Interval after dose</th> <th>Odds Ratio</th> <th>VE (95% CI)</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>25+ weeks</td> <td>0.52 (0.34-0.81)</td> <td>47.9 (19.3 to 66.4)</td> </tr> <tr> <td>3</td> <td>2-4 weeks</td> <td>0.06 (0.03-0.12)</td> <td>93.6 (88 to 96.6)</td> </tr> <tr> <td>3</td> <td>5-9 weeks</td> <td>0.11 (0.07-0.17)</td> <td>88.9 (83.4 to 92.6)</td> </tr> <tr> <td>3</td> <td>10+ weeks</td> <td>0.12 (0.09-0.18)</td> <td>87.6 (81.9 to 91.5)</td> </tr> </tbody> </table> | Dose | Interval after dose | Odds Ratio | VE (95% CI) | 2 | 25+ weeks | 0.52 (0.34-0.81) | 47.9 (19.3 to 66.4) | 3 | 2-4 weeks | 0.06 (0.03-0.12) | 93.6 (88 to 96.6) | 3 | 5-9 weeks | 0.11 (0.07-0.17) | 88.9 (83.4 to 92.6) | 3 | 10+ weeks | 0.12 (0.09-0.18) | 87.6 (81.9 to 91.5) | | | | | | | | | | | | | | | | | | | | | |
|--|---|---------------------|---|-----------------------|---------------------------------|-----------------------------|--|-------------------|-----------------------|---------------------|-----------------------------|--------|---------------------------------|------------------|---------------------|-----------|------------|------------------|-------------------|-------------|------------------|------------------|---------------------|------------------|----------------------------------|------------------|---------------------|-----------|---------------|----|-------|--|------------------|------------------|-------------------------------------|------------------|---------------------------------|---------------------------------|--|-------|--|------------------|------------------|-------------------------------------|----------------|------------------|----|-------|
| Dose | Interval after dose | Odds Ratio | VE (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 25+ weeks | 0.52 (0.34-0.81) | 47.9 (19.3 to 66.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 2-4 weeks | 0.06 (0.03-0.12) | 93.6 (88 to 96.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 5-9 weeks | 0.11 (0.07-0.17) | 88.9 (83.4 to 92.6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 10+ weeks | 0.12 (0.09-0.18) | 87.6 (81.9 to 91.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 92 | Tseng et al* (February 21, 2022) <i>[update from January 21 preprint]</i> | USA | 18+ year olds enrolled in Kaiser insurance | Delta, Omicron | mRNA-1273 | December 6-23, 2021 | <p>TND case control study done by linking administrative databases.</p> <table border="1"> <thead> <tr> <th></th> <th>Delta VE (95% CI)</th> <th>Omicron VE (95% CI)</th> </tr> </thead> <tbody> <tr> <td colspan="3">VE against Infection</td> </tr> <tr> <td>2 dose (14+)</td> <td>60.7 (56.5-64.5)</td> <td>0 (0-3.1)</td> </tr> <tr> <td>14-90 days</td> <td>82.8 (69.6-90.3)</td> <td>30.4 (5-49)</td> </tr> <tr> <td>91-180 days</td> <td>63.6 (51.8-72.5)</td> <td>15.2 (0-30.7)</td> </tr> <tr> <td>181-270 days</td> <td>61.4 (56.8-65.5)</td> <td>0 (0-1.2)</td> </tr> <tr> <td>>270 days</td> <td>52.9 (43.7-60.5)</td> <td>0 (0-1.7)</td> </tr> <tr> <td colspan="3">3 dose</td> </tr> <tr> <td>3rd dose on or after 10/21</td> <td>95.7 (94.2-96.9)</td> <td>63.6 (57.4-68.9)</td> </tr> <tr> <td>3rd dose prior to 10/21</td> <td>90.7 (81.4-95.3)</td> <td>39.1 (3.8-61.5)</td> </tr> <tr> <td colspan="3">3 dose (immunocompetent)</td> </tr> <tr> <td>3rd dose on or after 10/21</td> <td>95.9 (94.4-97.0)</td> <td>64.1 (57.9-69.4)</td> </tr> <tr> <td>3rd dose prior to 10/21</td> <td>93.1 (83.9-97)</td> <td>49.0 (12.6-70.2)</td> </tr> </tbody> </table> | | Delta VE (95% CI) | Omicron VE (95% CI) | VE against Infection | | | 2 dose (14+) | 60.7 (56.5-64.5) | 0 (0-3.1) | 14-90 days | 82.8 (69.6-90.3) | 30.4 (5-49) | 91-180 days | 63.6 (51.8-72.5) | 15.2 (0-30.7) | 181-270 days | 61.4 (56.8-65.5) | 0 (0-1.2) | >270 days | 52.9 (43.7-60.5) | 0 (0-1.7) | 3 dose | | | 3 rd dose on or after 10/21 | 95.7 (94.2-96.9) | 63.6 (57.4-68.9) | 3 rd dose prior to 10/21 | 90.7 (81.4-95.3) | 39.1 (3.8-61.5) | 3 dose (immunocompetent) | | | 3 rd dose on or after 10/21 | 95.9 (94.4-97.0) | 64.1 (57.9-69.4) | 3 rd dose prior to 10/21 | 93.1 (83.9-97) | 49.0 (12.6-70.2) | | |
| | Delta VE (95% CI) | Omicron VE (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VE against Infection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 dose (14+) | 60.7 (56.5-64.5) | 0 (0-3.1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-90 days | 82.8 (69.6-90.3) | 30.4 (5-49) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 91-180 days | 63.6 (51.8-72.5) | 15.2 (0-30.7) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 181-270 days | 61.4 (56.8-65.5) | 0 (0-1.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >270 days | 52.9 (43.7-60.5) | 0 (0-1.7) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 dose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 rd dose on or after 10/21 | 95.7 (94.2-96.9) | 63.6 (57.4-68.9) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 rd dose prior to 10/21 | 90.7 (81.4-95.3) | 39.1 (3.8-61.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 dose (immunocompetent) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 rd dose on or after 10/21 | 95.9 (94.4-97.0) | 64.1 (57.9-69.4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 rd dose prior to 10/21 | 93.1 (83.9-97) | 49.0 (12.6-70.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 91 | Grgič Vitek et al (January 6, 2022) | Slovenia | 18+ year olds | Delta | Comirnaty mRNA-1273 | October 2021 | <p>Cohort study using administrative databases specifically evaluated VE against SARI hospitalization. Note results are unadjusted.</p> <table border="1"> <thead> <tr> <th rowspan="2">Age group (years)</th> <th colspan="2">Vaccine effectiveness</th> </tr> <tr> <th>%</th> <th>95% CI</th> </tr> </thead> <tbody> <tr> <td colspan="3">Vaccinated ≤3 months ago</td> </tr> <tr> <td>18-49</td> <td>97</td> <td>90-99</td> </tr> <tr> <td>50-64</td> <td>94</td> <td>91-97</td> </tr> <tr> <td>≥ 65</td> <td>93</td> <td>88-96</td> </tr> <tr> <td colspan="3">Vaccinated 4-5 months ago</td> </tr> <tr> <td>18-49</td> <td>NA</td> <td>NA</td> </tr> <tr> <td>50-64</td> <td>90</td> <td>79-95</td> </tr> <tr> <td>≥ 65</td> <td>85</td> <td>81-88</td> </tr> <tr> <td colspan="3">Vaccinated ≥6 months ago</td> </tr> <tr> <td>18-49</td> <td>23</td> <td>0-69</td> </tr> <tr> <td>50-64</td> <td>89</td> <td>56-97</td> </tr> <tr> <td>≥ 65</td> <td>43</td> <td>30-54</td> </tr> </tbody> </table> | Age group (years) | Vaccine effectiveness | | % | 95% CI | Vaccinated ≤3 months ago | | | 18-49 | 97 | 90-99 | 50-64 | 94 | 91-97 | ≥ 65 | 93 | 88-96 | Vaccinated 4-5 months ago | | | 18-49 | NA | NA | 50-64 | 90 | 79-95 | ≥ 65 | 85 | 81-88 | Vaccinated ≥6 months ago | | | 18-49 | 23 | 0-69 | 50-64 | 89 | 56-97 | ≥ 65 | 43 | 30-54 |
| Age group (years) | Vaccine effectiveness | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | % | 95% CI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccinated ≤3 months ago | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18-49 | 97 | 90-99 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50-64 | 94 | 91-97 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 65 | 93 | 88-96 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccinated 4-5 months ago | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18-49 | NA | NA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50-64 | 90 | 79-95 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 65 | 85 | 81-88 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccinated ≥6 months ago | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18-49 | 23 | 0-69 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50-64 | 89 | 56-97 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 65 | 43 | 30-54 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90 | Zheutlin et al (January 6, 2022) | USA | 18+ year olds who had been fully vaccinated | Alpha, Delta, nonVOC | Comirnaty mRNA-1273 Ad26.COV2.S | January 1-September 7, 2021 | <p>Matched case control using an administrative dataset among vaccinated persons, comparing the odds of infection, hospitalization, and ICU admission at 28 day intervals post dose 2 relative to the 1st month after full vaccination. Note outcomes defined by COVID-19 ICD10 codes or SARS-CoV-2 PCR testing.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 2. Odds ratios (OR) and 95% CI assessing durability of baseline vaccine protection against COVID-19 breakthrough infections, hospitalizations, and ICU admissions.

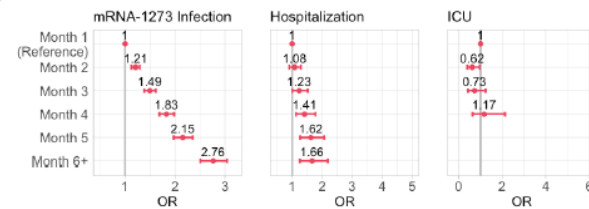
a) Ad26.COV2.S



b) BNT162b2



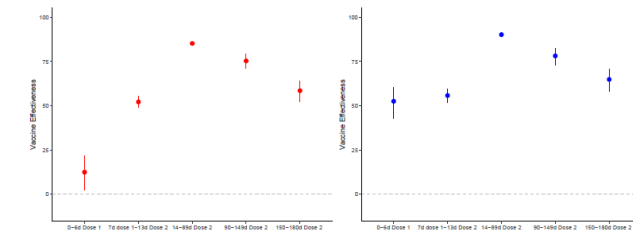
c) mRNA-1273

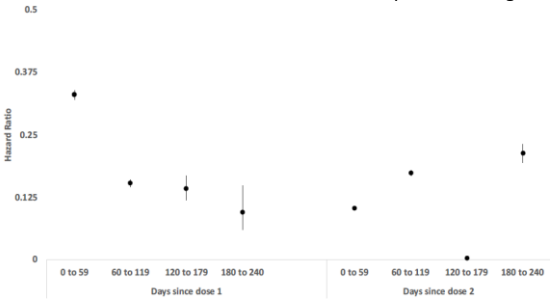
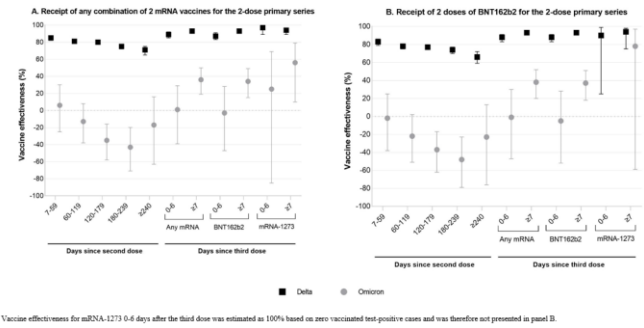


| | | | | | | |
|----|--|---------|---|-------|-----------------------------------|--------------------------|
| | | | | | | |
| 89 | Lyngse et al (January 6, 2022) | Denmark | General population | Delta | Comirnaty ChAdOx1 mRNA-1273 | June 21-October 26, 2021 |
| 88 | Prunas et al (January 5, 2022) | Israel | 12-16 year olds enrolled in Maccabi health services | Delta | Comirnaty | June 15-December 8, 2021 |

HH transmission study. The VE against susceptibility and VE against transmission decreased from 71% (95%CI: 69-72) and 57% (95%CI: 53-61), respectively, to 32% (95%CI: 16-45) and 29% (95%CI: 14-41), respectively, between time points corresponding to 0-1 months and 7-8 months after vaccination

Matched case control evaluating association between time since vaccination and infection (red) and disease (blue).



| | | | | | | | |
|----|---|--------|--|------------------------------------|---|--|--|
| 87 | Fisman et al (January 5, 2022) | Canada | 5+ year olds | Alpha, Beta, Gamma, Delta, nonVOCs | Comirnaty ChAdOx1 mRNA-1273 (homologous and heterologous) | December 2020- October 2021 | <p>Case-Cohort study looking at VE against infection combined across the different platforms over time since vaccination as well as evaluated impact of dosing intervals.</p>  |
| 86 | Buchan et al (January 28, 2022) [updated from January 1, 2022 version] | Canada | 18+ year olds | Delta, Omicron | Comirnaty ChAdOx1 mRNA-1273 (vaccinated persons had at least 1 dose of an mrna vaccine) | December 6- December 26, 2021 | <p>TND study linking administrative databases.</p> <p>Figure S1. Vaccine effectiveness against infection by Omicron or Delta among adults aged ≥18 years by vaccine schedule and time since latest dose</p>  <p>Vaccine effectiveness for mRNA-1273 0-6 days after the third dose was estimated as 100% based on zero vaccinated test-positive cases and was therefore not presented in panel B.</p> |
| 85 | Cerqueira-Silva et al (December 27, 2021) | Brazil | 18+ year olds with prior infection 90+ days prior to testing in study period | Gamma, Delta | Coronavac, Comirnaty ChAdOx1 Ad26.COVS.2 | January 18, 2021, - November 11, 2021. | <p>Matched TND study linking administrative databases. VE against symptomatic disease on top; severe disease on bottom.</p> |

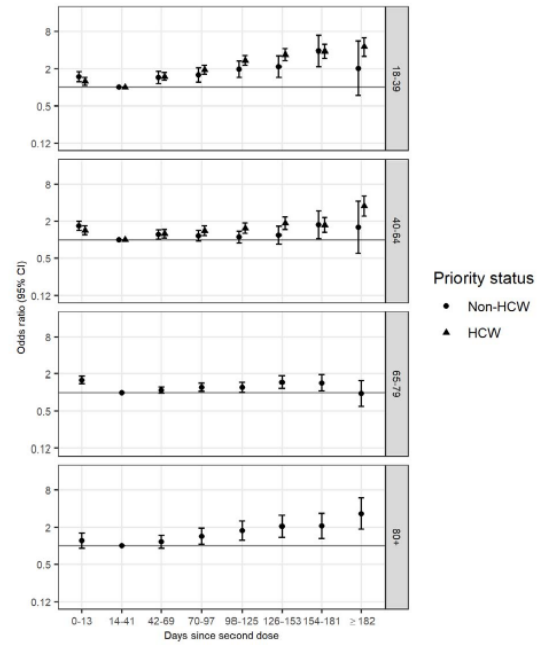
| | 14-90 days | >90 days | p-value |
|--------------------|----------------------|-----------------------|---------|
| BNT162b2 | 64.2% (54.2-72.0) | 100% (*) | 0.277 |
| ChAdOx1 | 55.5% (50.5-60.1) | 56.8% (46.6-65.1) | 0.544 |
| CoronaVac | 40.5% (36.4-44.3) | 38.0% (33.1-42.5) | 0.760 |
| Ad26.COV2.S | 46.1% (32.7-56.7) | 30.6% (-12.4-57.1) | 0.420 |

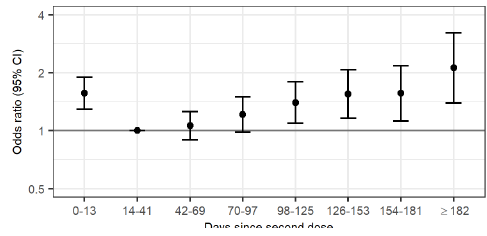
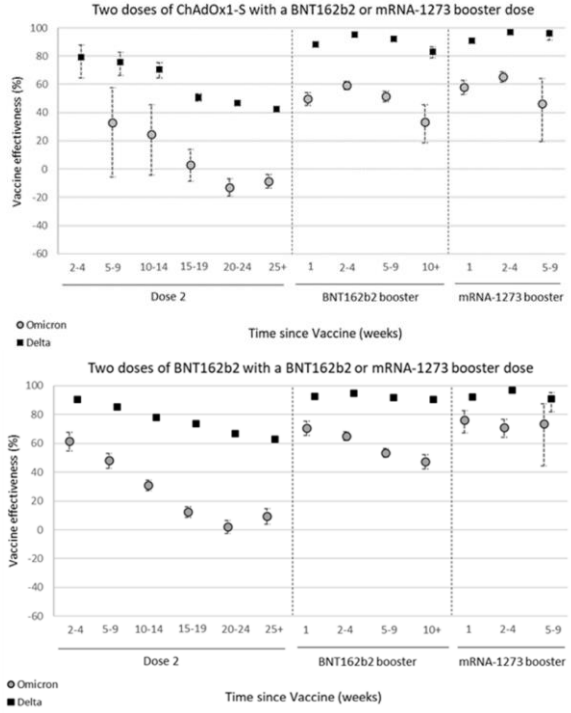
Table A4. Vaccine effectiveness ≥14 days after series comp

| | Vaccine waning (time after series completion) | | |
|--------------------|--|------------------------|---------|
| | 14-90 days | >90 days | p-value |
| BNT162b2 | 88.8% (50.0-97.5) | 100% (*) | 0.765 |
| ChAdOx1 | 86.6% (77.6-92.0) | 95.1% (84.8-98.4) | 0.007 |
| CoronaVac | 86.6% (79.8-90.3) | 74.4% (63.3-82.2) | 0.012 |
| Ad26.COV2.S | 60.2% (-10.8-85.7) | 41.0% (-240.9-89.9) | 0.978 |

84 [Hitchings et al \(December 24, 2021\)](#) Brazil 18+ year olds living in Sao Paulo Gamma, Delta Coronavac January 17-September 30, 2021

TND based on linking administrative databases among persons with 2 doses of coronavac (ref period day 14-41 post dose 2). OR for symptomatic disease.



| | | | | | | | |
|----|---|----|--------------------|-----------------------|-----------------------------------|--|--|
| | | | | | | <p>OR against hospitalization or death</p>  | |
| 83 | <p>UK HSA (December 24, 2021) (update of Andrews et al publication)</p> | UK | General population | Delta, Omicron | Comirnaty ChAdOx1 mRNA-1273 | November 27- December 17, 2021 | <p>Two doses of ChAdOx1-S with a BNT162b2 or mRNA-1273 booster dose</p>  |

| | | | | | | | |
|----|--|----------------------|---------------|----------------------|---|----------------------|---|
| | | | | | | | <p>Vaccine effectiveness (%)</p> <p>Time since Dose 2 (weeks)</p> <p>○ Omicron ■ Delta</p> <p>*Numbers were too low to estimate booster vaccine effectiveness amongst recipients of a primary course of the Moderna vaccine.</p> |
| 82 | Tabak et al (December 22, 2021) | USA | 18+ year olds | NonVOC, Alpha, Delta | Comirnaty mRNA-1273 Ad26.COV2.S | May 1-August 7, 2021 | <p>TND study on patients presenting to CVS with symptoms for testing. (final dose in primary series)</p> <p>Figure 2. Multivariable Adjusted Estimated Vaccine Effectiveness Against SARS-CoV-2 Infection and 95% CIs</p> <p>Estimated vaccine effectiveness, %</p> <p>Time since the final dose</p> <p>□ mRNA-1273 ▲ BNT162b2 ◆ JNJ-78436735</p> |
| 81 | Kissling et al (December 22, 2021) (updated May 26, 2022) | 8 European countries | 30+ years | Delta | Comirnaty mRNA-1273 ChAdOx1 Ad26.COV2.S | July-August 2021 | TND study in primary care sites evaluating VE against symptomatic disease |

| | | | | | | | |
|----|---|-----|--|------------------------|-----------|------------------------------------|---|
| | | | | | | | <p>A. 30-59 year-olds (n = 7,177)</p> <p>B. ≥60 year-olds (n = 3,172)^a</p> <p>○ Stratified estimates by time since vaccination, with 95% CI</p> <p>— VE — Lower CI — Upper CI</p> |
| 80 | Tartof et al (December 21, 2021) (updated February 14, 2022) | USA | 3 million Kaiser Permanente members, 18+ years | Non-VOC, Alpha, Delta, | Comirnaty | December 14, 2020-December 5, 2021 | Cohort study looking at booster dose VE and duration of protection of 2 doses. Manuscript has stratification by age group and immunocompromised status, with similar patterns as seen below though immunocompromised has a trend towards more waning against hospitalization but not significant. |

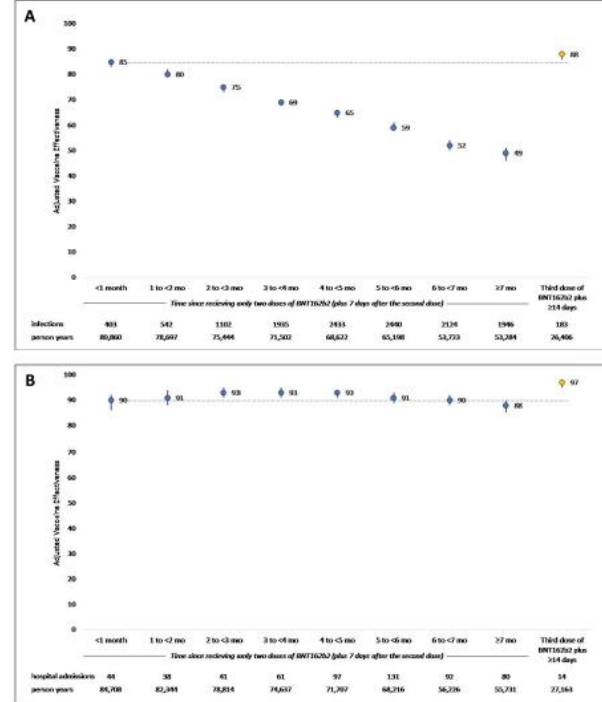


Figure 1. Vaccine effectiveness of 2- and 3-doses of BNT162b2 against (A) SARS-CoV-2 infections and (B) COVID-19 hospital admissions — December 14, 2020 to December 5, 2021.

*Blue circles represent 2-dose VE estimates, and the yellow circles represent 3-dose VE estimates. The bars represent 95% confidence intervals. Estimates are adjusted for age, sex, race/ethnicity, body mass index, comorbidities, Charlson comorbidity index, previous SARS-CoV-2 PCR, previous positive SARS-CoV-2 serology, influenza vaccine in year prior, pneumococcal vaccine in prior 5 years, neighborhood deprivation index, prior healthcare utilization (Tables 1, Appendix 2).

| | | | | | | | |
|----|---|---------------------|---------------------------------|--------------------------------------|---------|--|---|
| | | | | | | | |
| 79 | Katikireddi et al (December 20, 2021) | Scotland and Brazil | ≥18 year old general population | Scotland: Delta; Brazil: Gamma/Delta | ChAdOx1 | Scotland: May 19-October 25, 2021 Brazil: January 18-October 25, 2021 | Scotland: administrative database linkage study Brazil: evaluated VE by comparing fully vaccinated persons at day 0-13 and persons 14+ days post dose 2. |

| | Scotland | | | Brazil | | |
|-------------------------------|--------------|------------------|---------------------------------|--------------|------------------|---------------------------------|
| | Person-years | Number of events | Vaccine effectiveness* (95% CI) | Person-years | Number of events | Vaccine effectiveness* (95% CI) |
| Unvaccinated | 336 942 | 2245 | 0% (ref) | – | – | – |
| 0–2 weeks after first dose | 6860 | 39 | –15.4% (–60.6 to 17.0) | 1 849 099 | 21736 | 0% (ref) |
| Partially vaccinated† | 94761 | 420 | 49.3% (43.3 to 54.6) | 11701 310 | 37 802 | 59.9% (56.9 to 58.9) |
| 0–1 week after second dose | 47252 | 78 | 77.7% (71.9 to 82.3) | 1 601 585 | 2688 | 73.2% (71.9 to 74.5) |
| 2–3 weeks after second dose | 55318 | 85 | 83.7% (79.7 to 87.0) | 1 492 259 | 1095 | 86.4% (85.4 to 87.3) |
| 4–5 weeks after second dose | 65 698 | 106 | 86.6% (83.6 to 89.0) | 1 338 063 | 1019 | 83.5% (82.3 to 84.7) |
| 6–7 weeks after second dose | 71120 | 134 | 86.8% (84.2 to 88.9) | 1 117 983 | 1019 | 77.9% (76.1 to 79.5) |
| 8–9 weeks after second dose | 73540 | 245 | 79.0% (75.9 to 81.7) | 862 976 | 863 | 75.6% (73.4 to 77.6) |
| 10–11 weeks after second dose | 73212 | 280 | 79.6% (76.8 to 82.1) | 651 213 | 751 | 69.3% (66.3 to 72.1) |
| 12–13 weeks after second dose | 71773 | 337 | 77.4% (74.6 to 80.0) | 445 924 | 646 | 60.8% (56.6 to 64.6) |
| 14–15 weeks after second dose | 68 114 | 356 | 75.9% (72.9 to 78.6) | 264 128 | 472 | 59.7% (54.6 to 64.2) |
| 16–17 weeks after second dose | 63 974 | 402 | 70.5% (67.0 to 73.7) | 169 692 | 397 | 50.5% (43.4 to 56.6) |
| 18–19 weeks after second dose | 58 608 | 508 | 63.7% (59.6 to 67.4) | 132 459 | 275 | 42.2% (32.4 to 50.6) |
| 20–21 weeks after second dose | 45716 | 598 | 53.6% (48.4 to 58.3) | – | – | – |

Scotland reference group: unvaccinated, Brazil reference group: 0–13 days after first dose vaccination. *In Scotland, vaccine effectiveness was adjusted for age, sex, deprivation, comorbidities, number of previous tests, interval between doses, and temporal trend; individuals positive for SARS-CoV-2 before Dec 8, 2020, were excluded from the analysis. In Brazil, vaccine effectiveness was adjusted for age, sex, deprivation, macroregion of residence, primary reason for vaccination, interval between doses, and temporal trend. †Partially vaccinated: ≥2 weeks after the first dose and before the second dose.

Table 2: Vaccine effectiveness estimates for ChAdOx1 nCoV-19 against COVID-19 hospital admissions or death by length of time since two-dose vaccination in Scotland and Brazil

| | Scotland | | | Brazil | | |
|-------------------------------|---------------|------------------|---------------------------------|---------------|------------------|---------------------------------|
| | Total samples | Positive samples | Vaccine effectiveness* (95% CI) | Total samples | Positive samples | Vaccine effectiveness* (95% CI) |
| Unvaccinated | 26 130 | 13 698 | 0% (ref) | 9 852 053 | 4 920 001 | 0% (ref) |
| 0–1 week after first dose | 911 | 374 | 20.9% (8.2 to 31.9) | 286 322 | 151 328 | –9.6% (–10.5 to –8.8) |
| Partially vaccinated† | 15 714 | 7176 | 37.6% (34.6 to 40.5) | 1 143 423 | 398 717 | 37.6% (37.3 to 37.9) |
| 0–1 week after second dose | 5027 | 2025 | 50.2% (46.7 to 53.5) | 112 391 | 30 550 | 51.3% (50.6 to 52.0) |
| 2–3 weeks after second dose | 7341 | 2429 | 67.9% (65.9 to 69.8) | 95 671 | 7963 | 69.8% (69.3 to 70.4) |
| 4–5 weeks after second dose | 8947 | 3387 | 67.3% (65.3 to 69.1) | 79 298 | 15 568 | 68.4% (67.8 to 68.9) |
| 6–7 weeks after second dose | 10 622 | 4346 | 63.8% (61.7 to 65.7) | 60 301 | 12 401 | 66.8% (66.1 to 67.5) |
| 8–9 weeks after second dose | 11 258 | 4633 | 63.3% (61.3 to 65.3) | 44 351 | 9424 | 65.4% (64.6 to 66.2) |
| 10–11 weeks after second dose | 14 043 | 6319 | 59.3% (57.2 to 61.4) | 32 832 | 7103 | 63.2% (62.2 to 64.2) |
| 12–13 weeks after second dose | 17 300 | 7966 | 55.3% (53.0 to 57.5) | 22 454 | 5177 | 58.8% (57.4 to 60.1) |
| 14–15 weeks after second dose | 17 421 | 7670 | 52.9% (50.4 to 55.2) | 15 305 | 3435 | 59.8% (58.2 to 61.4) |
| 16–17 weeks after second dose | 15 442 | 6554 | 48.7% (45.9 to 51.4) | 10 822 | 2529 | 58.7% (56.7 to 60.5) |
| 18–19 weeks after second dose | 14 403 | 6248 | 44.6% (41.5 to 47.6) | 7458 | 1852 | 57.7% (55.4 to 60.0) |
| 20–21 weeks after second dose | 10 596 | 4718 | 39.1% (35.4 to 42.6) | – | – | – |

*In Scotland, vaccine effectiveness was adjusted for age, sex, deprivation, comorbidities, number of at-risk groups, smoking status, blood pressure, body-mass index, health board, interval between doses, and temporal trend. In Brazil, vaccine effectiveness was adjusted for age, sex, deprivation, macroregion of residence, diabetes, obesity, immunosuppression, cardiac disease, pregnancy, puerperal period, chronic kidney disease, and temporal trend. Descriptive characteristics for the sample are available in appendix 2 (pp 11–15). †Partially vaccinated: ≥2 weeks after the first dose and before the second dose.

Table 3: Vaccine effectiveness estimates for ChAdOx1 nCoV-19 against confirmed SARS-CoV-2 symptomatic infection by length of time since two-dose vaccination in Scotland and Brazil using a test-negative design case-control study

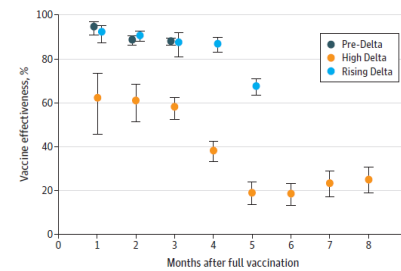
| | | | | | | | |
|----|---|-------|--------------------|----------------------|-----------|--------------------------------|---|
| 78 | Abu-Raddad et al (December 16, 2021) <i>Updated January 26, 2022</i> | Qatar | General population | Alpha→Beta →Delta | mRNA-1273 | January 1 and December 5, 2021 | TND study linking administrative databases. |
|----|---|-------|--------------------|----------------------|-----------|--------------------------------|---|

| | | | | | | | |
|----|--|-----|---|----------------------|---------------------|------------------------|----------------------------|
| | | | | | | | |
| 77 | Young-Xu et al (December 15, 2021) | USA | Male 65+ year old veterans in VA system | NonVOC, Alpha, Delta | Comirnaty mRNA-1273 | January-September 2021 | Matched case control study |

Table. Change in Estimated Messenger RNA Vaccine Effectiveness Against Laboratory-Confirmed SARS-CoV-2 Infections, January to September 2021

| Adjusted vaccine effectiveness by month from full vaccination, % (95% CI) ^a | | | |
|--|------------------------------|----------------------------|--------------------------------|
| Month | Pre-Delta (January to April) | Rising Delta (May to June) | High Delta (July to September) |
| 1 | 94.5 (90.7-96.7) | 92.1 (87.2-95.1) | 62.0 (45.6-73.5) |
| 2 | 88.5 (86.1-90.5) | 90.6 (87.8-92.7) | 60.9 (51.5-68.4) |
| 3 | 87.9 (85.9-89.5) | 87.3 (80.8-91.7) | 57.8 (52.5-62.5) |
| 4 | NA | 86.6 (83.0-89.5) | 38.3 (33.5-42.7) |
| 5 | NA | 67.3 (63.2-70.9) | 18.9 (13.7-23.8) |
| 6 | NA | NA | 18.4 (13.3-23.3) |
| 7 | NA | NA | 23.4 (17.3-29.0) |
| 8 | NA | NA | 24.8 (18.8-30.4) |

Figure. Estimated Messenger RNA Vaccine Effectiveness Against SARS-CoV-2 Infection by Delta Variant Period, January to September 2021

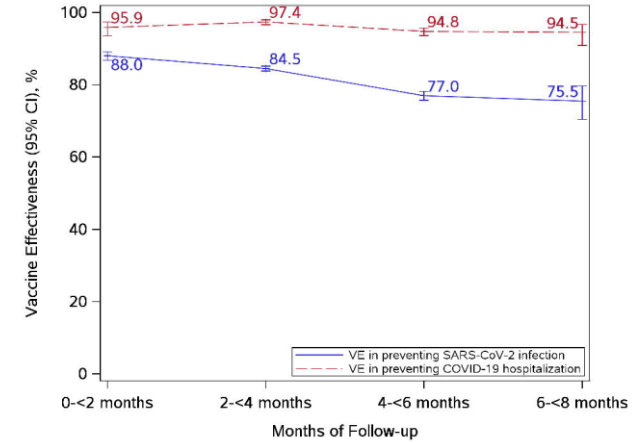


| | | | | | | |
|----|--|----------|--|----------------------|-----------------------------|--|
| 76 | Machado et al (December 14, 2021) | Portugal | Non-institutionalized 65-<110 year olds | Alpha, Delta | Comirnaty mRNA-1273 ChAdOx1 | February 2 (80+) or March 30 (65-79) - August 2021 |
| 75 | Florea et al (December 14, 2021) (updated April 28, 2022) | USA | ≥18 year olds Kaiser Permanente insured patients | NonVOC, Alpha, Delta | mRNA-1273 | December 18, 2020-September 30, 2021 |

Cohort study linking administrative databases.

| timing post dose 2 | disease | | hospitalization | | deaths | |
|--------------------|-------------------------------|---------------|-----------------|---------------|-------------|---------------|
| | 65-79 years | 80-<110 years | 65-79 years | 80-<110 years | 65-79 years | 80-<110 years |
| 14-41 days | 79 (76-83) | 72 (61-79) | 95 (90-97) | 83 (68-91) | 95 (88-98) | 87 (71-93) |
| 42-69 days | 68 (64-71) | 64 (53-72) | 97 (94-98) | 81 (66-90) | 97 (92-98) | 88 (78-94) |
| 70+ days | | | 93 (86-96) | | 93 (87-96) | |
| 70-97 days | 59 (53-64) | 53 (43-62) | | 74 (60-84) | | 86 (78-91) |
| 98+ days | 39 (29-48) | | | | | |
| 98-123 days | | 50 (40-59) | | 74 (58-83) | | 80 (71-86) |
| 124+days | | 34 (29-48) | | 63 (37-78) | | 75 (64-82) |
| timing post dose 2 | AZ disease in 65-79 year olds | | | | | |
| 14-41 days | 48 (42-54) | | | | | |
| 42-69 days | 33 (23-42) | | | | | |
| 70+ days | 34 (10-52) | | | | | |

Cohort study



73 [Berec et al \(December 12, 2021\)](#) Czech Republic General population Alpha, Delta Comirnaty mRNA-1273 ChAdOx1 Ad26.COV2.S December 27, 2020- November 21, 2021

Cohort study of population of Czech Republic using administrative databases, evaluating duration of protection of primary and VE of boosted mRNA.

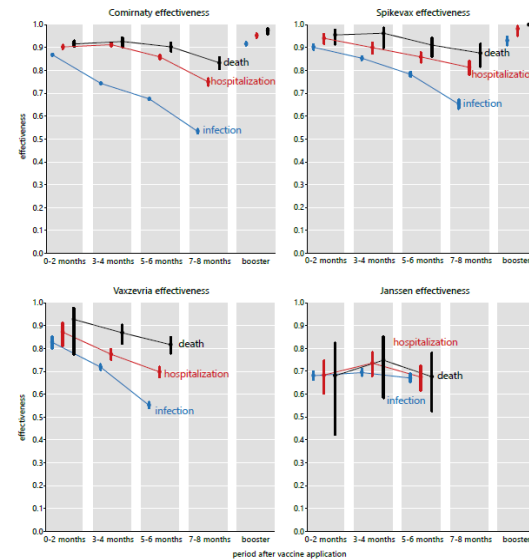


Fig. 2. Vaccine-acquired immunity against infection with respect to the delay from the full vaccine application, including the effect of a booster vaccine dose.

| | | | | | | | Table 1. Estimated increase of breakthrough infection hazard ratios (HRs) in times of the SARS-CoV-2 delta variant dominance for age groups having started vaccination in the same month. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------|--|------------|--|--------------------------|---------------------------------------|--|--|---------|--------------------|--|--------------------|--|------------------|--|----|--------|----|--------|----|--------|-----------|------|-----------|------|-----------|------|-----------|----------|------|-----------|------|-----------|------|-----------|-----------|------|-----------|------|-----------|------|-----------|---------|------|------------|------|-----------|------|-----------|
| | | | | | | | <table border="1"> <thead> <tr> <th rowspan="2">Vaccine</th> <th colspan="2">March (age 70-80y)</th> <th colspan="2">April (age 55-69y)</th> <th colspan="2">May (age 35-54y)</th> </tr> <tr> <th>HR</th> <th>95% CI</th> <th>HR</th> <th>95% CI</th> <th>HR</th> <th>95% CI</th> </tr> </thead> <tbody> <tr> <td>Comirnaty</td> <td>1.28</td> <td>1.09-1.52</td> <td>1.04</td> <td>0.95-1.14</td> <td>1.33</td> <td>1.27-1.40</td> </tr> <tr> <td>Spikevax</td> <td>0.82</td> <td>0.41-1.67</td> <td>1.56</td> <td>1.08-2.25</td> <td>1.59</td> <td>1.29-1.98</td> </tr> <tr> <td>Vaxzevria</td> <td>1.64</td> <td>1.05-2.57</td> <td>1.12</td> <td>0.74-1.70</td> <td>1.24</td> <td>0.82-1.86</td> </tr> <tr> <td>Janssen</td> <td>2.70</td> <td>0.37-19.63</td> <td>0.40</td> <td>0.20-0.78</td> <td>0.91</td> <td>0.34-2.43</td> </tr> </tbody> </table> | Vaccine | March (age 70-80y) | | April (age 55-69y) | | May (age 35-54y) | | HR | 95% CI | HR | 95% CI | HR | 95% CI | Comirnaty | 1.28 | 1.09-1.52 | 1.04 | 0.95-1.14 | 1.33 | 1.27-1.40 | Spikevax | 0.82 | 0.41-1.67 | 1.56 | 1.08-2.25 | 1.59 | 1.29-1.98 | Vaxzevria | 1.64 | 1.05-2.57 | 1.12 | 0.74-1.70 | 1.24 | 0.82-1.86 | Janssen | 2.70 | 0.37-19.63 | 0.40 | 0.20-0.78 | 0.91 | 0.34-2.43 |
| Vaccine | March (age 70-80y) | | April (age 55-69y) | | May (age 35-54y) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HR | 95% CI | HR | 95% CI | HR | 95% CI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Comirnaty | 1.28 | 1.09-1.52 | 1.04 | 0.95-1.14 | 1.33 | 1.27-1.40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spikevax | 0.82 | 0.41-1.67 | 1.56 | 1.08-2.25 | 1.59 | 1.29-1.98 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaxzevria | 1.64 | 1.05-2.57 | 1.12 | 0.74-1.70 | 1.24 | 0.82-1.86 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Janssen | 2.70 | 0.37-19.63 | 0.40 | 0.20-0.78 | 0.91 | 0.34-2.43 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 72 | Bjork et al (December 9, 2021) (Updated March 2, 2022) | Sweden | General population | Alpha, Delta | Comirnaty mRNA-1273 ChAdOx1 | March 8-November 7, 2021 | <p>Case-control study based on surveillance data, matching on age/sex and no adjustment for other confounders.</p> <p>Infection</p> <p>Vaccine type, at least two doses</p> <ul style="list-style-type: none"> Pfizer BioNTech: 74 (72 - 76) Moderna: 84 (81 - 86) AstraZeneca: 60 (52 - 67) Mixed: 68 (60 - 74) <p>Time since last dose</p> <ul style="list-style-type: none"> 0 - 3 months: 79 (77 - 80) 3 - 6 months: 65 (60 - 69) ≥ 6 months: 41 (31 - 50) <p>Hospitalization</p> <p>Vaccine type, at least two doses</p> <ul style="list-style-type: none"> Pfizer BioNTech: 90 (85 - 93) Moderna: 80 (63 - 89) AstraZeneca: 88 (75 - 94) <p>Time since last dose</p> <ul style="list-style-type: none"> 0 - 3 months: 91 (87 - 94) 3 - 6 months: 88 (78 - 93) ≥ 6 months: 52 (0 - 77) <p>Severe disease</p> <p>Vaccine type, at least two doses</p> <ul style="list-style-type: none"> Pfizer BioNTech: 90 (83 - 95) Moderna: 82 (53 - 93) AstraZeneca: 94 (80 - 98) <p>Time since last dose</p> <ul style="list-style-type: none"> 0 - 3 months: 92 (86 - 96) 3 - 6 months: 90 (75 - 96) ≥ 6 months: 69 (7 - 90) <p>Effectiveness (%)</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 71 | Kshirsagar et al (December 9, 2021) | USA | Fully vaccinated persons | NonVOCs, Alpha, Delta | Comirnaty mRNA-1273 Ad26.COV2.S | March 10-October 14, 2021 | Cohort study of fully vaccinated persons evaluating risk of reinfection by vaccination. There was an increase in the rate of hospitalization starting ~110-125 days after full vaccination for all three vaccines depending on age group, with a steeper increase for Janssen. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70 | Powell et al (February 18, 2022) (updated May 2022) | UK | General population with a focus on adolescents | Delta, Omicron | Comirnaty | Week 32 (~Aug 15) (16-17 yo) and Week 37 (12-15 yo) - January 12, 2022 | TND study among adolescents against symptomatic disease | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

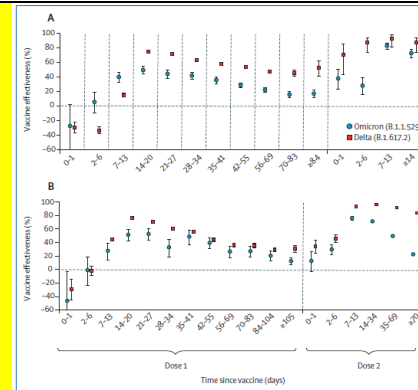


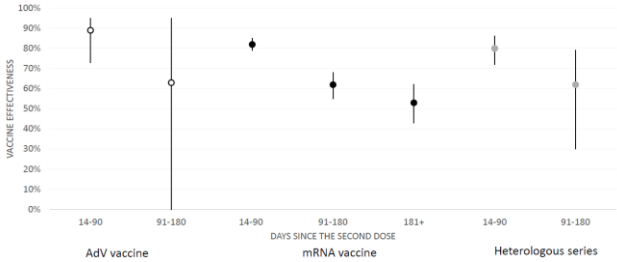
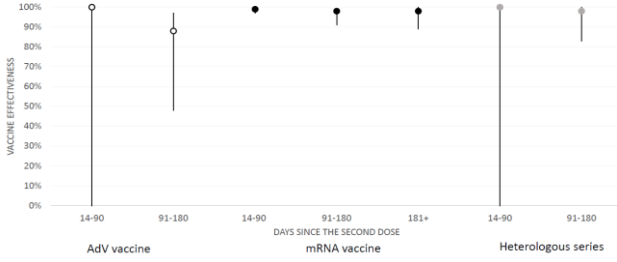
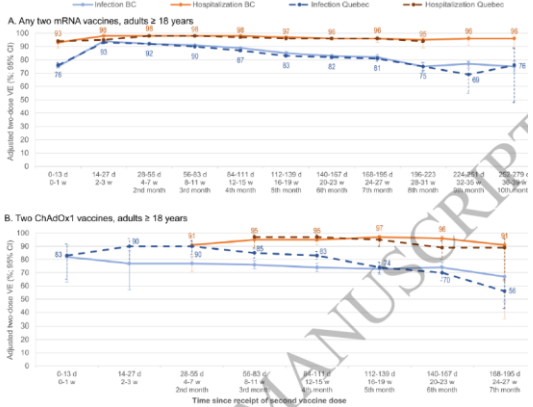
Figure: Vaccine effectiveness in 12-15-year-olds (A) and 16-17-year-olds (B) with symptomatic, PCR confirmed COVID-19

| | | | | | | | |
|----|---|--------|--------------------|-----------------------|---------------------|-------------------------------|---|
| | | | | | | | |
| 69 | Bajema et al (December 9, 2021) | USA | Veterans | nonVOCs, Alpha, Delta | Comirnaty mRNA-1273 | February 1–September 30, 2021 | TND among 1,896 U.S. veterans. Adjusted VE against hospitalization 14–119 days following 2 nd dose of Moderna vaccine dose was 89.6% (95% CI = 80.1%–94.5%) and after the 2nd Pfizer-BioNTech dose was 86.0% (95% CI = 77.6%–91.3%); at ≥120 days VE was 86.1% (95% CI = 77.7%–91.3%) for Moderna and 75.1% (95% CI = 64.6%–82.4%) for Pfizer-BioNTech. |
| 67 | Goldberg et al (December 5, 2021) (updated to final publication May 26, 2022) | Israel | General population | Delta | Comirnaty | August 1-September 31, 2021 | Analysis of surveillance data comparing the following groups: Recovered: Previously infected individuals 90 or more days after confirmed infection who had never been vaccinated; Recovered then Vaccinated: Previously infected individuals who later were 7 or more days after receiving a single vaccine dose; Vaccinated then Recovered: Individuals who had been vaccinated with one or two doses and were later infected; Vaccinated: Individuals seven days or more after receiving the second dose, and who had not been infected before the start of the study period; Booster: Individuals who received a third (booster) dose 12 or more days previously and had not been infected before the start of the study period. |

| | | | | | | | |
|----|---|----|---------------|-------------|----------------------|---|--|
| | | | | | | | <p>A Recovered, Unvaccinated Cohort</p> <p>B Two-Dose and Three-Dose Cohorts</p> <p>C Cohorts with Hybrid Immunity</p> |
| 64 | <p>Hall et al* (February 16, 2022)</p> <p>[Update to (December 1, 2021 preprint)]</p> | UK | 18+ year HCWs | Alpha→Delta | Comirnaty AZD2222 | December 7, 2020- September 21, 2021 | <p>Cohort study of HCWs looking a VE against infection over time in those with and without prior infection. Pfizer long interval is doses separated by ≥6 weeks; short interval by <6 weeks</p> |

| | | | | | | | <p>A BNT162b2 Vaccine, Long Interval between Doses</p> <table border="1"> <caption>Data for Figure A: BNT162b2 Vaccine, Long Interval between Doses</caption> <thead> <tr> <th>Vaccination Status</th> <th>Adjusted Vaccine Effectiveness (%)</th> </tr> </thead> <tbody> <tr> <td>14-73 Days after dose 2</td> <td>~85</td> </tr> <tr> <td>74-133 Days after dose 2</td> <td>~65</td> </tr> <tr> <td>134-193 Days after dose 2</td> <td>~65</td> </tr> <tr> <td>194-239 Days after dose 2</td> <td>~50</td> </tr> </tbody> </table> <p>B BNT162b2 Vaccine, Short Interval between Doses</p> <table border="1"> <caption>Data for Figure B: BNT162b2 Vaccine, Short Interval between Doses</caption> <thead> <tr> <th>Vaccination Status</th> <th>Adjusted Vaccine Effectiveness (%)</th> </tr> </thead> <tbody> <tr> <td>14-73 Days after dose 2</td> <td>~90</td> </tr> <tr> <td>74-133 Days after dose 2</td> <td>~60</td> </tr> <tr> <td>134-193 Days after dose 2</td> <td>~55</td> </tr> <tr> <td>194-265 Days after dose 2</td> <td>~55</td> </tr> </tbody> </table> <p>C ChAdOx1 nCoV-19 Vaccine</p> <table border="1"> <caption>Data for Figure C: ChAdOx1 nCoV-19 Vaccine</caption> <thead> <tr> <th>Vaccination Status</th> <th>Adjusted Vaccine Effectiveness (%)</th> </tr> </thead> <tbody> <tr> <td>14-73 Days after dose 2</td> <td>~55</td> </tr> <tr> <td>74-133 Days after dose 2</td> <td>~50</td> </tr> <tr> <td>134-220 Days after dose 2</td> <td>~70</td> </tr> </tbody> </table> | Vaccination Status | Adjusted Vaccine Effectiveness (%) | 14-73 Days after dose 2 | ~85 | 74-133 Days after dose 2 | ~65 | 134-193 Days after dose 2 | ~65 | 194-239 Days after dose 2 | ~50 | Vaccination Status | Adjusted Vaccine Effectiveness (%) | 14-73 Days after dose 2 | ~90 | 74-133 Days after dose 2 | ~60 | 134-193 Days after dose 2 | ~55 | 194-265 Days after dose 2 | ~55 | Vaccination Status | Adjusted Vaccine Effectiveness (%) | 14-73 Days after dose 2 | ~55 | 74-133 Days after dose 2 | ~50 | 134-220 Days after dose 2 | ~70 |
|---------------------------|---|--------|-----------|-------|-----------|---------------------------|--|--------------------|------------------------------------|-------------------------|-----|--------------------------|-----|---------------------------|-----|---------------------------|-----|--------------------|------------------------------------|-------------------------|-----|--------------------------|-----|---------------------------|-----|---------------------------|-----|--------------------|------------------------------------|-------------------------|-----|--------------------------|-----|---------------------------|-----|
| Vaccination Status | Adjusted Vaccine Effectiveness (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-73 Days after dose 2 | ~85 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 74-133 Days after dose 2 | ~65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 134-193 Days after dose 2 | ~65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 194-239 Days after dose 2 | ~50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccination Status | Adjusted Vaccine Effectiveness (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-73 Days after dose 2 | ~90 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 74-133 Days after dose 2 | ~60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 134-193 Days after dose 2 | ~55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 194-265 Days after dose 2 | ~55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vaccination Status | Adjusted Vaccine Effectiveness (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-73 Days after dose 2 | ~55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 74-133 Days after dose 2 | ~50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 134-220 Days after dose 2 | ~70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Israel et al (November 25, 2021) (updated with results from publication, see ref 2 below) | Israel | 18+ years | Delta | Comirnaty | May 15-September 17, 2021 | Test-negative design case control using administrative database of Leumit Health Services among 2-dose vaccine recipients. Compared with the initial 90 days after the vaccine, they found an increased risk of infection with time elapsed since vaccination. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | <p>Table 4 Adjusted odds ratios for risk of SARS-CoV-2 in matched cohort</p> <table border="1"> <thead> <tr> <th></th> <th>Adjusted odds ratio (95% CI)</th> <th>P value</th> </tr> </thead> <tbody> <tr> <td colspan="3">Time since second vaccine (days):</td> </tr> <tr> <td>21-89</td> <td>Reference</td> <td>—</td> </tr> <tr> <td>90-119</td> <td>2.37 (1.67 to 3.36)</td> <td><0.001</td> </tr> <tr> <td>120-149</td> <td>2.66 (1.94 to 3.66)</td> <td><0.001</td> </tr> <tr> <td>150-179</td> <td>2.82 (2.07 to 3.84)</td> <td><0.001</td> </tr> <tr> <td>≥180</td> <td>2.82 (2.07 to 3.85)</td> <td><0.001</td> </tr> <tr> <td>Age (continuous in years)</td> <td>1.01 (1.00 to 1.01)</td> <td>0.008</td> </tr> <tr> <td>Male sex</td> <td>1.05 (0.99 to 1.11)</td> <td>0.08</td> </tr> <tr> <td>Socioeconomic status (continuous 1-20)</td> <td>0.97 (0.96 to 0.98)</td> <td><0.001</td> </tr> </tbody> </table> <p>Based on a conditional regression model fitted in a cohort matched for week of testing, age category (<18-39, 40-59, ≥60 years), and demographic group.</p> | | Adjusted odds ratio (95% CI) | P value | Time since second vaccine (days): | | | 21-89 | Reference | — | 90-119 | 2.37 (1.67 to 3.36) | <0.001 | 120-149 | 2.66 (1.94 to 3.66) | <0.001 | 150-179 | 2.82 (2.07 to 3.84) | <0.001 | ≥180 | 2.82 (2.07 to 3.85) | <0.001 | Age (continuous in years) | 1.01 (1.00 to 1.01) | 0.008 | Male sex | 1.05 (0.99 to 1.11) | 0.08 | Socioeconomic status (continuous 1-20) | 0.97 (0.96 to 0.98) | <0.001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--|---------------------------------|-------------------------------|--|---|---|----------|--|--|-----------------------------------|-------------------------------|--|--|--|---|--------|---------------------|--------|---------|---------------------|-------------------------------|----------------|---------------------|------------------------|---------------------|---------------------|--------|-----------------------------|---------------------|------------------|------------------------|---------------------|------|--|---|--------|--|--|--|--|--|----------------------|----------------|-----------------|------------------------|---------------------|---|---|-------------------------------|----------------|-----------------|------------------------|---------------------|---|---|-----------------------------|-------------|------------------|------------------------|---------------------|---|---|----------------------------|----------------|-----------------|---------------------|---------------------|---|---|-------------------------------|----------------|-----------------|---------------------|---------------------|---|---|-----------------------------|----------------|------------------|------------------------|---------------------|---|---|-----------------------------------|--|--|--|--|--|--|-----------------|----------------|-----------------|------------------------|---------------------|---|---|---------------------------|----------------|-----------------|---------------------|---------------------|---|---|---|--|--|--|--|--|--|-------------------|--|--|--|--|--|--|-------------------------------|----------------|-----------------|------------------------|---------------------|---|---|-----------------------------|----------------|-----------------|------------------------|---------------------|---|---|-------------------------------|----------------|------------------|------------------------|---------------------|---|---|-----------------------|-----------------|-------------------|------------------------|---------------------|---|---|-------------------------------|-----------------|-----------------|------------------------|---------------------|---|---|-----------------------------|-----------------|------------------|------------------------|---------------------|---|---|
| | Adjusted odds ratio (95% CI) | P value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Time since second vaccine (days): | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21-89 | Reference | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90-119 | 2.37 (1.67 to 3.36) | <0.001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 120-149 | 2.66 (1.94 to 3.66) | <0.001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 150-179 | 2.82 (2.07 to 3.84) | <0.001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥180 | 2.82 (2.07 to 3.85) | <0.001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Age (continuous in years) | 1.01 (1.00 to 1.01) | 0.008 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Male sex | 1.05 (0.99 to 1.11) | 0.08 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Socioeconomic status (continuous 1-20) | 0.97 (0.96 to 0.98) | <0.001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 63 | Irizarry et al (November 19, 2021) | USA (Puerto Rico) | 12+ years | Predelta and delta | Comirnaty mRNA-1273 Ad26.COVS.2 | December 15, 2020- October 15, 2021 | <p>Analysis of surveillance data linked to immunization registry data. VE against B) Infection c) Hospitalizations D) death by time since 2 weeks post complete series completion. Shading represents 99% CI.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 61 | Andrews et al (November 15, 2021) | UK | 50+ | Delta | Comirnaty AZD2222 | September 13- November 1, 2021 | <p>TND booster dose study that also calculated the VE of a 2nd dose >140 days after receipt of the 2nd dose. VE against symptomatic diseases for two doses of ChAdOx1-S and BNT162b2 ≥20 weeks after being given were 44.1% (41.9 to 46.1) and 62.5% (61.0 to 63.9), respectively.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 59 | Tenforde et al (November 4, 2021) | USA | Hospitalized patients | Mix, alpha, and delta | Comirnaty mRNA-1273 | March 11-August 15, 2021 | <p>Case-control study among hospitalized patients. When the mRNA-1273 and BNT162b2 vaccines were compared, estimated vaccine effectiveness was similar within 120 days of vaccination. In contrast, beyond 120 days, the results corresponded to an estimated effectiveness of 85% for the mRNA-1273 and 64% for the BNT162b2 vaccine to prevent COVID-19 hospitalizations.</p> <table border="1"> <thead> <tr> <th>Subgroup</th> <th>Vaccinated case patients/total case patients (%)</th> <th>Vaccinated control patients/total control patients (%)</th> <th>Absolute difference (95% CI), %</th> <th>Adjusted odds ratio (95% CI)*</th> <th>Unvaccinated associated with hospitalization</th> <th>Vaccinated associated with hospitalization</th> </tr> </thead> <tbody> <tr> <td colspan="7">By time between vaccine dose 2 and illness onset</td> </tr> <tr> <td>14-120 Days since vaccination</td> <td>170/1848 (9.2)</td> <td>1136/2278 (49.8)</td> <td>-40.1 (-43.8 to -37.4)</td> <td>0.13 (0.10 to 0.15)</td> <td>●</td> <td>●</td> </tr> <tr> <td>>120 Days since vaccination</td> <td>130/1868 (7.0)</td> <td>2503/2961 (84.3)</td> <td>-78.6 (-81.9 to -75.3)</td> <td>0.07 (0.02 to 0.10)</td> <td>●</td> <td>●</td> </tr> <tr> <td colspan="7">By month of illness onset (overall and time between vaccine dose 2 and illness onset)</td> </tr> <tr> <td>March 2021 (overall)</td> <td>121/118 (10.3)</td> <td>961/2742 (35.1)</td> <td>-48.7 (-51.7 to -45.7)</td> <td>0.14 (0.11 to 0.16)</td> <td>●</td> <td>●</td> </tr> <tr> <td>14-120 Days since vaccination</td> <td>116/118 (10.3)</td> <td>849/2684 (31.6)</td> <td>-49.8 (-52.8 to -46.8)</td> <td>0.14 (0.11 to 0.16)</td> <td>●</td> <td>●</td> </tr> <tr> <td>>120 Days since vaccination</td> <td>6/118 (9.3)</td> <td>1112/2658 (41.8)</td> <td>-52.1 (-55.1 to -49.1)</td> <td>0.07 (0.02 to 0.10)</td> <td>●</td> <td>●</td> </tr> <tr> <td>July-August 2021 (overall)</td> <td>381/657 (57.8)</td> <td>488/2762 (17.7)</td> <td>39.5 (41.9 to 37.1)</td> <td>0.16 (0.13 to 0.21)</td> <td>●</td> <td>●</td> </tr> <tr> <td>14-120 Days since vaccination</td> <td>347/657 (52.8)</td> <td>296/2684 (10.9)</td> <td>40.1 (42.4 to 37.8)</td> <td>0.10 (0.07 to 0.14)</td> <td>●</td> <td>●</td> </tr> <tr> <td>>120 Days since vaccination</td> <td>127/657 (19.3)</td> <td>1920/2678 (71.7)</td> <td>-51.8 (-54.8 to -48.8)</td> <td>0.07 (0.02 to 0.10)</td> <td>●</td> <td>●</td> </tr> <tr> <td colspan="7">By SARS-CoV-2 lineage († overall)</td> </tr> <tr> <td>Delta (n=1,171)</td> <td>212/842 (24.1)</td> <td>961/2742 (35.1)</td> <td>-43.1 (-47.2 to -39.0)</td> <td>0.10 (0.06 to 0.14)</td> <td>●</td> <td>●</td> </tr> <tr> <td>Delta (n=1,417) (2 or 40)</td> <td>432/888 (31.9)</td> <td>488/2762 (17.7)</td> <td>49.8 (51.8 to 47.8)</td> <td>0.14 (0.10 to 0.21)</td> <td>●</td> <td>●</td> </tr> <tr> <td colspan="7">By vaccine product (overall and by time between vaccine dose 2 and illness onset)</td> </tr> <tr> <td colspan="7">mRNA-1273 overall</td> </tr> <tr> <td>14-120 Days since vaccination</td> <td>226/2400 (9.4)</td> <td>810/2894 (28.0)</td> <td>-39.5 (-42.7 to -36.3)</td> <td>0.10 (0.08 to 0.12)</td> <td>●</td> <td>●</td> </tr> <tr> <td>>120 Days since vaccination</td> <td>120/2400 (5.0)</td> <td>645/2894 (22.3)</td> <td>-38.8 (-41.9 to -35.7)</td> <td>0.09 (0.02 to 0.16)</td> <td>●</td> <td>●</td> </tr> <tr> <td>14-120 Days since vaccination</td> <td>106/2772 (3.8)</td> <td>1480/2311 (64.5)</td> <td>-57.7 (-60.8 to -54.6)</td> <td>0.06 (0.02 to 0.10)</td> <td>●</td> <td>●</td> </tr> <tr> <td>Overall (171) overall</td> <td>366/2772 (13.2)</td> <td>2766/2311 (119.3)</td> <td>-78.8 (-81.9 to -75.7)</td> <td>0.05 (0.00 to 0.10)</td> <td>●</td> <td>●</td> </tr> <tr> <td>14-120 Days since vaccination</td> <td>361/2772 (13.0)</td> <td>473/2311 (20.5)</td> <td>-39.1 (-42.4 to -35.8)</td> <td>0.09 (0.07 to 0.11)</td> <td>●</td> <td>●</td> </tr> <tr> <td>>120 Days since vaccination</td> <td>321/2772 (11.6)</td> <td>1993/2311 (86.3)</td> <td>-44.1 (-47.4 to -40.7)</td> <td>0.05 (0.00 to 0.10)</td> <td>●</td> <td>●</td> </tr> </tbody> </table> | Subgroup | Vaccinated case patients/total case patients (%) | Vaccinated control patients/total control patients (%) | Absolute difference (95% CI), % | Adjusted odds ratio (95% CI)* | Unvaccinated associated with hospitalization | Vaccinated associated with hospitalization | By time between vaccine dose 2 and illness onset | | | | | | | 14-120 Days since vaccination | 170/1848 (9.2) | 1136/2278 (49.8) | -40.1 (-43.8 to -37.4) | 0.13 (0.10 to 0.15) | ● | ● | >120 Days since vaccination | 130/1868 (7.0) | 2503/2961 (84.3) | -78.6 (-81.9 to -75.3) | 0.07 (0.02 to 0.10) | ● | ● | By month of illness onset (overall and time between vaccine dose 2 and illness onset) | | | | | | | March 2021 (overall) | 121/118 (10.3) | 961/2742 (35.1) | -48.7 (-51.7 to -45.7) | 0.14 (0.11 to 0.16) | ● | ● | 14-120 Days since vaccination | 116/118 (10.3) | 849/2684 (31.6) | -49.8 (-52.8 to -46.8) | 0.14 (0.11 to 0.16) | ● | ● | >120 Days since vaccination | 6/118 (9.3) | 1112/2658 (41.8) | -52.1 (-55.1 to -49.1) | 0.07 (0.02 to 0.10) | ● | ● | July-August 2021 (overall) | 381/657 (57.8) | 488/2762 (17.7) | 39.5 (41.9 to 37.1) | 0.16 (0.13 to 0.21) | ● | ● | 14-120 Days since vaccination | 347/657 (52.8) | 296/2684 (10.9) | 40.1 (42.4 to 37.8) | 0.10 (0.07 to 0.14) | ● | ● | >120 Days since vaccination | 127/657 (19.3) | 1920/2678 (71.7) | -51.8 (-54.8 to -48.8) | 0.07 (0.02 to 0.10) | ● | ● | By SARS-CoV-2 lineage († overall) | | | | | | | Delta (n=1,171) | 212/842 (24.1) | 961/2742 (35.1) | -43.1 (-47.2 to -39.0) | 0.10 (0.06 to 0.14) | ● | ● | Delta (n=1,417) (2 or 40) | 432/888 (31.9) | 488/2762 (17.7) | 49.8 (51.8 to 47.8) | 0.14 (0.10 to 0.21) | ● | ● | By vaccine product (overall and by time between vaccine dose 2 and illness onset) | | | | | | | mRNA-1273 overall | | | | | | | 14-120 Days since vaccination | 226/2400 (9.4) | 810/2894 (28.0) | -39.5 (-42.7 to -36.3) | 0.10 (0.08 to 0.12) | ● | ● | >120 Days since vaccination | 120/2400 (5.0) | 645/2894 (22.3) | -38.8 (-41.9 to -35.7) | 0.09 (0.02 to 0.16) | ● | ● | 14-120 Days since vaccination | 106/2772 (3.8) | 1480/2311 (64.5) | -57.7 (-60.8 to -54.6) | 0.06 (0.02 to 0.10) | ● | ● | Overall (171) overall | 366/2772 (13.2) | 2766/2311 (119.3) | -78.8 (-81.9 to -75.7) | 0.05 (0.00 to 0.10) | ● | ● | 14-120 Days since vaccination | 361/2772 (13.0) | 473/2311 (20.5) | -39.1 (-42.4 to -35.8) | 0.09 (0.07 to 0.11) | ● | ● | >120 Days since vaccination | 321/2772 (11.6) | 1993/2311 (86.3) | -44.1 (-47.4 to -40.7) | 0.05 (0.00 to 0.10) | ● | ● |
| Subgroup | Vaccinated case patients/total case patients (%) | Vaccinated control patients/total control patients (%) | Absolute difference (95% CI), % | Adjusted odds ratio (95% CI)* | Unvaccinated associated with hospitalization | Vaccinated associated with hospitalization | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| By time between vaccine dose 2 and illness onset | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-120 Days since vaccination | 170/1848 (9.2) | 1136/2278 (49.8) | -40.1 (-43.8 to -37.4) | 0.13 (0.10 to 0.15) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >120 Days since vaccination | 130/1868 (7.0) | 2503/2961 (84.3) | -78.6 (-81.9 to -75.3) | 0.07 (0.02 to 0.10) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| By month of illness onset (overall and time between vaccine dose 2 and illness onset) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| March 2021 (overall) | 121/118 (10.3) | 961/2742 (35.1) | -48.7 (-51.7 to -45.7) | 0.14 (0.11 to 0.16) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-120 Days since vaccination | 116/118 (10.3) | 849/2684 (31.6) | -49.8 (-52.8 to -46.8) | 0.14 (0.11 to 0.16) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >120 Days since vaccination | 6/118 (9.3) | 1112/2658 (41.8) | -52.1 (-55.1 to -49.1) | 0.07 (0.02 to 0.10) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| July-August 2021 (overall) | 381/657 (57.8) | 488/2762 (17.7) | 39.5 (41.9 to 37.1) | 0.16 (0.13 to 0.21) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-120 Days since vaccination | 347/657 (52.8) | 296/2684 (10.9) | 40.1 (42.4 to 37.8) | 0.10 (0.07 to 0.14) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >120 Days since vaccination | 127/657 (19.3) | 1920/2678 (71.7) | -51.8 (-54.8 to -48.8) | 0.07 (0.02 to 0.10) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| By SARS-CoV-2 lineage († overall) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta (n=1,171) | 212/842 (24.1) | 961/2742 (35.1) | -43.1 (-47.2 to -39.0) | 0.10 (0.06 to 0.14) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta (n=1,417) (2 or 40) | 432/888 (31.9) | 488/2762 (17.7) | 49.8 (51.8 to 47.8) | 0.14 (0.10 to 0.21) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| By vaccine product (overall and by time between vaccine dose 2 and illness onset) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| mRNA-1273 overall | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-120 Days since vaccination | 226/2400 (9.4) | 810/2894 (28.0) | -39.5 (-42.7 to -36.3) | 0.10 (0.08 to 0.12) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >120 Days since vaccination | 120/2400 (5.0) | 645/2894 (22.3) | -38.8 (-41.9 to -35.7) | 0.09 (0.02 to 0.16) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-120 Days since vaccination | 106/2772 (3.8) | 1480/2311 (64.5) | -57.7 (-60.8 to -54.6) | 0.06 (0.02 to 0.10) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Overall (171) overall | 366/2772 (13.2) | 2766/2311 (119.3) | -78.8 (-81.9 to -75.7) | 0.05 (0.00 to 0.10) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-120 Days since vaccination | 361/2772 (13.0) | 473/2311 (20.5) | -39.1 (-42.4 to -35.8) | 0.09 (0.07 to 0.11) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >120 Days since vaccination | 321/2772 (11.6) | 1993/2311 (86.3) | -44.1 (-47.4 to -40.7) | 0.05 (0.00 to 0.10) | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 58 | Poukka et al (November 4, 2021) | Finland | 16-69 year old HCWs | Mix and delta | Comirnaty mRNA-1273 AZD2222 heterologous | December 27, 2020- August 26 (infection) October 26 (hospitalization), 2021 | <p>HCW cohort study based on registries. No difference seen between delta and pre-delta periods. VE against infection</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | |
|----|--|--------|--------------------|---------------------|---|----------------------------------|---|
| | | | | | | |  <p>VACCINE EFFECTIVENESS</p> <p>100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%</p> <p>14-90 91-180 14-90 91-180 181+ 14-90 91-180</p> <p>AdV vaccine mRNA vaccine Heterologous series</p> <p>VE against hospitalization</p>  <p>VACCINE EFFECTIVENESS</p> <p>100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%</p> <p>14-90 91-180 14-90 91-180 181+ 14-90 91-180</p> <p>AdV vaccine mRNA vaccine Heterologous series</p> |
| 56 | <p>Skowronski et al (October 26, 2021)</p> <p>(updated April 19, 2022)</p> | Canada | General population | Alpha, Gamma, Delta | AZD1222 Comirnaty mRNA-1273 And heterologous schedules of the above | May 30, 2021 - November 27, 2021 | <p>TND study in BC and Quebec. In both provinces, all homologous or heterologous mRNA and/or ChAdOx1 two-dose 12 schedules were associated with $\geq 90\%$ reduction in SARS-CoV-2 hospitalization risk for at least 7 13 months. With slight decline from a peak of $>90\%$, VE against infection was $\geq 80\%$ for at least 6 14 months following homologous mRNA vaccination, lower by $\sim 10\%$ when both doses were 15 ChAdOx1 but comparably-high following heterologous ChAdOx1+mRNA receipt.</p>  <p>— Infection BC — Hospitalization BC — Infection Quebec — Hospitalization Quebec</p> <p>A. Any two mRNA vaccines, adults ≥ 18 years</p> <p>Adjusted vaccine effectiveness (VE) (%; 95% CI)</p> <p>0-13 d 14-27 d 28-55 d 56-83 d 84-111 d 112-139 d 140-167 d 168-195 d 196-223 d 224-251 d 252-279 d</p> <p>0-1 w 2-3 w 4-7 w 8-11 w 12-15 w 16-19 w 20-23 w 24-27 w 28-31 w 32-35 w 36-39 w</p> <p>2nd month 3rd month 4th month 5th month 6th month 7th month 8th month 9th month 10th month</p> <p>B. Two ChAdOx1 vaccines, adults ≥ 18 years</p> <p>Adjusted vaccine effectiveness (VE) (%; 95% CI)</p> <p>0-13 d 14-27 d 28-55 d 56-83 d 84-111 d 112-139 d 140-167 d 168-195 d 196-223 d 224-251 d 252-279 d</p> <p>0-1 w 2-3 w 4-7 w 8-11 w 12-15 w 16-19 w 20-23 w 24-27 w 28-31 w 32-35 w 36-39 w</p> <p>2nd month 3rd month 4th month 5th month 6th month 7th month</p> |

| | | | | | | | |
|----|--|-----|--------------------|----------|---------------------------------|--------------------------------|---|
| 55 | Lin et al (October 26, 2021) <i>[updated with final publication on January 12, 2022]</i> | USA | General population | multiple | Comirnaty mRNA-1273 Ad26.COV2.S | December 13, 2020-Sept 8, 2021 | Administrative database cohort study in North Carolina. For Pfizer two-dose, VE peaks at 94.5% (95% CI, 94.1 to 94.9) at 2 months (post the first dose). VE starts to decline after 2 months and drops to 66.6% (95% CI, 65.2 to 67.8) at 7 months. For Moderna two-dose, VE peaks at 95.9% (95% CI, 95.5 to 96.2) at 2 months. Effectiveness started to decline after 2 months and was maintained at 80.3% (95% CI, 79.3 to 81.2) at 7 months. For the Janssen one-dose regimen, vaccine effectiveness ramps to a peak level of 74.8% (95% CI, 72.5 to 76.9) at 1 month. Effectiveness started to decline after 1 month and decreased to 59.4% (95% CI, 57.2 to 61.5) at 5 months. |
|----|--|-----|--------------------|----------|---------------------------------|--------------------------------|---|

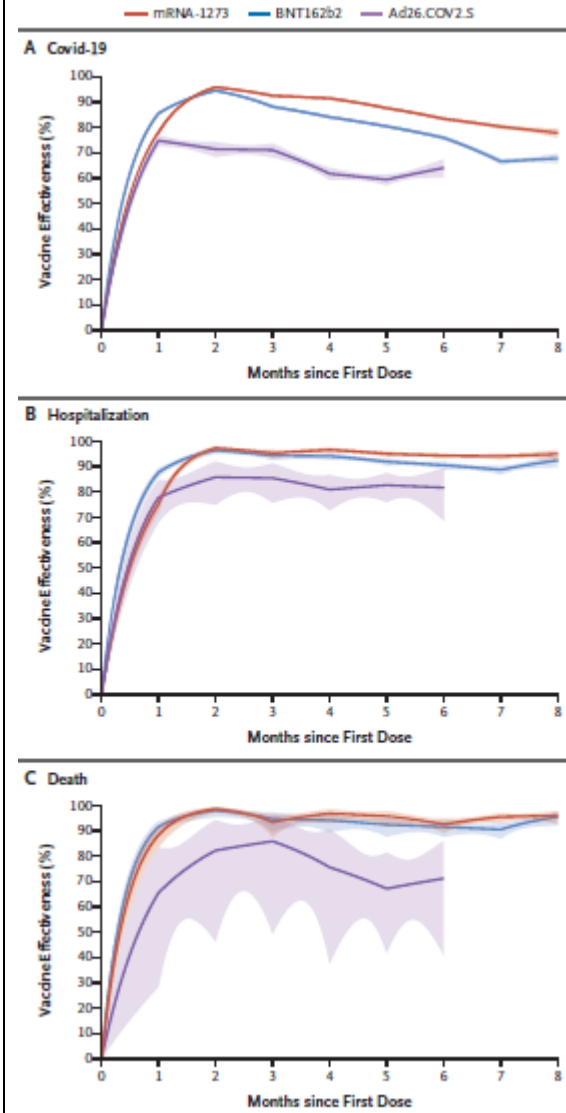
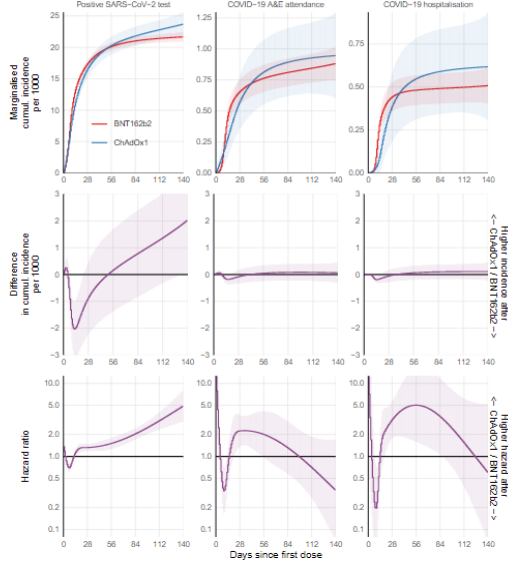


Figure 1. Effectiveness of the BNT162b2, mRNA-1273, and Ad26.COV2.S Vaccines against Covid-19, Hospitalization, and Death.

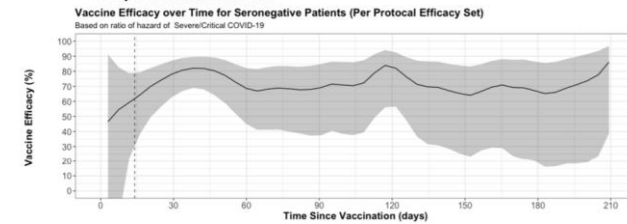
| | | | | | | | |
|----|---|-------------------|--------------------|--|---|-----------------------------------|---|
| 54 | <p>Nordstrom et al (October 25, 2021)</p> <p>[Updated February 4, 2022]</p> | Sweden | General population | Alpha, Delta, | <p>AZD1222 Comirnaty mRNA-1273 And AZD1222a mRNA-1273</p> | January 12-October 4, 2021 | <p>National cohort study based on database linkage. Vaccine effectiveness of BNT162b2 against infection waned progressively from 92% (95% CI, 92-93, P<0.001) at day 15-30 to 47% (95% CI, 39-55, P<0.001) at day 121-180, and from day 211 and onwards no effectiveness could be detected (23%; 95% CI, -2-41, P=0.07). The effectiveness waned slightly slower for mRNA-1273, being estimated to 59% (95% CI, 18-79) from day 181 and onwards. In contrast, effectiveness of ChAdOx1 nCoV-19 was generally lower and waned faster, with no effectiveness detected from day 121 and onwards (-19%, 95% CI, -97-28), whereas effectiveness from heterologous ChAdOx1 nCoV-19 / mRNA was maintained from 121 days and onwards (66%; 95% CI, 41-80). Overall, vaccine effectiveness was lower and waned faster among men and older individuals. For the outcome severe Covid-19, effectiveness waned from 89% (95% CI, 82-93, P<0.001) at day 15-30 to 42% (95% CI, -35-75, P=0.21) from day 181 and onwards, with sensitivity analyses showing notable waning among men, older frail individuals, and individuals with comorbidities.</p> |
| 52 | <p>Hulme et al (October 18, 2021)</p> | UK | HCW | Alpha, delta | <p>Comirnaty AZD1222</p> | January 4-June 13 | <p>Comparative VE Cohort study of HCWs based on linking databases who were vaccinated with AZD1222 or Comirnaty between January 4-February 28, 2021 who were followed for 20 weeks.</p> <p>Figure 2: Comparative effectiveness For each outcome based on the fully adjusted model, the marginal cumulative incidence for ChAdOx1 and BNT162b2, their difference, and the hazard ratio are shown. Models that assumed piecewise-constant hazards gave similar effect estimates (supplementary Figure S2). The models with less extensive confounder adjustment gave very similar estimates (supplementary Figure S1) suggesting that recipients of each vaccine were similar after accounting for differences in vaccine allocation over space and time (as did all models).</p>  |
| 51 | <p>Robles-Fontan et al (October 18, 2021)</p> | USA (Puerto Rico) | General population | Multiple, with delta time frame analysis | <p>Comirnaty mRNA-1273 Ad26.COV2.S</p> | December 15,2020-October 15, 2021 | Cohort study of Puerto Rican population. |

| | (updated March 2, 2022) | | | | | | <table border="1"> <thead> <tr> <th>Outcome</th> <th>Vaccine</th> <th>Effectiveness on first day as fully vaccinated (CI)</th> <th>Effectiveness after 144 days (CI)</th> </tr> </thead> <tbody> <tr> <td>Infection</td> <td>mRNA-1273</td> <td>90% (88–91%)</td> <td>72% (69–75%)</td> </tr> <tr> <td>Infection</td> <td>BNT162b2</td> <td>87% (85–88%)</td> <td>54% (51–57%)</td> </tr> <tr> <td>Infection</td> <td>Ad26.COV2.S</td> <td>64% (58–69%)</td> <td>36% (31–42%)</td> </tr> <tr> <td>Hospitalization</td> <td>mRNA-1273</td> <td>95% (89–97%)</td> <td>91% (84–95%)</td> </tr> <tr> <td>Hospitalization</td> <td>BNT162b2</td> <td>92% (86–95%)</td> <td>81% (74–86%)</td> </tr> <tr> <td>Hospitalization</td> <td>Ad26.COV2.S</td> <td>82% (61–91%)</td> <td>67% (54–77%)</td> </tr> <tr> <td>Death</td> <td>mRNA-1273</td> <td>99% (89–100%)</td> <td>93% (81–97%)</td> </tr> <tr> <td>Death</td> <td>BNT162b2</td> <td>97% (87–99%)</td> <td>86% (76–92%)</td> </tr> <tr> <td>Death</td> <td>Ad26.COV2.S</td> <td>78% (14–94%)</td> <td>73% (49–86%)</td> </tr> </tbody> </table> <p>Table 1: Waning effectiveness against infection with 99% point-wise confidence intervals.</p> | Outcome | Vaccine | Effectiveness on first day as fully vaccinated (CI) | Effectiveness after 144 days (CI) | Infection | mRNA-1273 | 90% (88–91%) | 72% (69–75%) | Infection | BNT162b2 | 87% (85–88%) | 54% (51–57%) | Infection | Ad26.COV2.S | 64% (58–69%) | 36% (31–42%) | Hospitalization | mRNA-1273 | 95% (89–97%) | 91% (84–95%) | Hospitalization | BNT162b2 | 92% (86–95%) | 81% (74–86%) | Hospitalization | Ad26.COV2.S | 82% (61–91%) | 67% (54–77%) | Death | mRNA-1273 | 99% (89–100%) | 93% (81–97%) | Death | BNT162b2 | 97% (87–99%) | 86% (76–92%) | Death | Ad26.COV2.S | 78% (14–94%) | 73% (49–86%) |
|-------------------------------------|---|---|--|--|---|---------------------------------|--|----------|---|---|--|--|---|---------------------------------|----------------|--------------|------------|--------------|--------------|-------------------------------------|----------------|--------------|--------------|-----------------|------------|--------------|--------------|-----------------|----------|--------------|--------------|-----------------|-------------|--------------|--------------|-------|-----------|---------------|--------------|-------|----------|--------------|--------------|-------|-------------|--------------|--------------|
| Outcome | Vaccine | Effectiveness on first day as fully vaccinated (CI) | Effectiveness after 144 days (CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infection | mRNA-1273 | 90% (88–91%) | 72% (69–75%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infection | BNT162b2 | 87% (85–88%) | 54% (51–57%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infection | Ad26.COV2.S | 64% (58–69%) | 36% (31–42%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hospitalization | mRNA-1273 | 95% (89–97%) | 91% (84–95%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hospitalization | BNT162b2 | 92% (86–95%) | 81% (74–86%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hospitalization | Ad26.COV2.S | 82% (61–91%) | 67% (54–77%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Death | mRNA-1273 | 99% (89–100%) | 93% (81–97%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Death | BNT162b2 | 97% (87–99%) | 86% (76–92%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Death | Ad26.COV2.S | 78% (14–94%) | 73% (49–86%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | De Gier et al (October 14, 2021) | Netherlands | General population | Delta | Comirnaty mRNA-1273 Ad26.COV2.S AZD1222 | August 9-September 24, 2021 | <p>Study of unvaccinated and vaccinated index cases and their contacts to evaluate transmission. They did not have sufficient sample size but evaluated if VE against transmission differed by time since vaccination of the index case</p> <p>Table S2. Secondary attack rate of SARS-CoV-2 and VET adjusted for time since full vaccination of the contact (< or >= 60 days, only in analysis of fully vaccinated contacts), age group of the index case and contact and week of notification date of the index case, stratified by time since full vaccination of the index case.</p> <table border="1"> <thead> <tr> <th>Analysis</th> <th>Unvaccinated index - infected contacts / all contacts (SAR)</th> <th>Index fully vaccinated < 60 days ago - infected contacts / all contacts (SAR)</th> <th>Index fully vaccinated < 60 days ago - adjusted VET (%) (95% CI)</th> <th>Index fully vaccinated >= 60 days ago - infected contacts / all contacts (SAR)</th> <th>Index fully vaccinated >= 60 days ago - adjusted VET (%) (95% CI)</th> </tr> </thead> <tbody> <tr> <td>Unvaccinated household contacts</td> <td>547/2517 (22%)</td> <td>24/209 (11%)</td> <td>67 (47;79)</td> <td>14/94 (15%)</td> <td>55 (19;76)</td> </tr> <tr> <td>Fully vaccinated household contacts</td> <td>164/1505 (11%)</td> <td>99/1278 (8%)</td> <td>57 (40;69)</td> <td>157/792 (20%)</td> <td>28 (-4;50)</td> </tr> </tbody> </table> | Analysis | Unvaccinated index - infected contacts / all contacts (SAR) | Index fully vaccinated < 60 days ago - infected contacts / all contacts (SAR) | Index fully vaccinated < 60 days ago - adjusted VET (%) (95% CI) | Index fully vaccinated >= 60 days ago - infected contacts / all contacts (SAR) | Index fully vaccinated >= 60 days ago - adjusted VET (%) (95% CI) | Unvaccinated household contacts | 547/2517 (22%) | 24/209 (11%) | 67 (47;79) | 14/94 (15%) | 55 (19;76) | Fully vaccinated household contacts | 164/1505 (11%) | 99/1278 (8%) | 57 (40;69) | 157/792 (20%) | 28 (-4;50) | | | | | | | | | | | | | | | | | | | | | | |
| Analysis | Unvaccinated index - infected contacts / all contacts (SAR) | Index fully vaccinated < 60 days ago - infected contacts / all contacts (SAR) | Index fully vaccinated < 60 days ago - adjusted VET (%) (95% CI) | Index fully vaccinated >= 60 days ago - infected contacts / all contacts (SAR) | Index fully vaccinated >= 60 days ago - adjusted VET (%) (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unvaccinated household contacts | 547/2517 (22%) | 24/209 (11%) | 67 (47;79) | 14/94 (15%) | 55 (19;76) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fully vaccinated household contacts | 164/1505 (11%) | 99/1278 (8%) | 57 (40;69) | 157/792 (20%) | 28 (-4;50) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 49 | Janssen Briefing document for US FDA (October 14, 2021) | multiple | General population | Multiple | Ad26.COV2.S | September 21, 2020-July 9, 2021 | <p>Final results from RCT</p> <p>Figure 2: Vaccine Efficacy Over Time of Molecularly Confirmed Moderate to Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination, PP Set (Seronegative; Study VAC31518COV3001) Final Analysis of Double-Blind Phase</p> <p>Vaccine Efficacy over Time for Seronegative Patients (Per Protocol Efficacy Set)</p> <p>Based on ratio of hazard of Moderate to Severe/Critical COVID-19</p> <p>95% pointwise CI; 95% of events prior to day 189. Last event: day 220. Hazard smoothed over 21 days. Based on the methods in Gilbert et al. (2022).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 3: Vaccine Efficacy of Molecularly Confirmed Moderate to Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination; Per Protocol Set Final Analysis of Double-Blind Phase Study (VAC31518COV3001)

| | Ad26 5e10 vp (19577) | | Placebo (19608) | | VE% (95% CI) |
|--|-------------------------|---------|--------------------|---------|----------------------|
| Analysis set: PP | | | | | |
| Moderate to severe/critical ^a | | | | | |
| Day 2 to Day 14 | 82 (19577) | 748.66 | 88 (19608) | 749.83 | 6.7% (-27.54; 31.77) |
| Day 15 to Day 28 | 51 (19400) | 1483.44 | 184 (19398) | 1480.09 | 72.3% (62.10; 80.13) |
| Day 29 to Day 56 | 119 (19113) | 2877.42 | 306 (18924) | 2837.44 | 61.7% (52.46; 69.23) |
| Day 57 to end DB Phase | 314 (17586) | 6460.98 | 573 (17090) | 6158.91 | 47.8% (39.95; 54.62) |
| Day 57 to Day 112 | 157 (17586) | 5040.02 | 308 (17090) | 4860.10 | 50.8% (40.24; 59.70) |
| Day 113 to end DB Phase | 157 (11379) | 4900.35 | 265 (10572) | 4529.34 | 45.2% (33.04; 55.34) |

Figure 4: Vaccine Efficacy Over Time of Molecularly Confirmed Severe/Critical COVID-19 with Onset at Least 1 Day After Vaccination, PP Set (Seronegative; Study VAC31518COV3001) Final Analysis of Double-Blind Phase



| | | | | | | |
|----|--|-----|--------------------------------------|--------------------------------|--------------------------------|-------------------------------|
| 48 | Rosenberg et al (October 9, 2021) <i>Updated with final publication on December 1, 2021</i> | USA | General adult population of New York | Delta for part of study period | Comirnaty mRNA-1273 Ad26.CO2.S | May 1-September 3, 2021 |
| 47 | Liu et al (October 7, 2021) | USA | General population of NYC | Alpha, Delta, others | Comirnaty mRNA-1273 | January 18-September 21, 2021 |

Cohort study based on administrative databases. Estimated VE for cases declined contemporaneously across age, products, and time-cohorts. VE for hospitalization for adults 18-64 years was >86% across cohorts, without time trend.

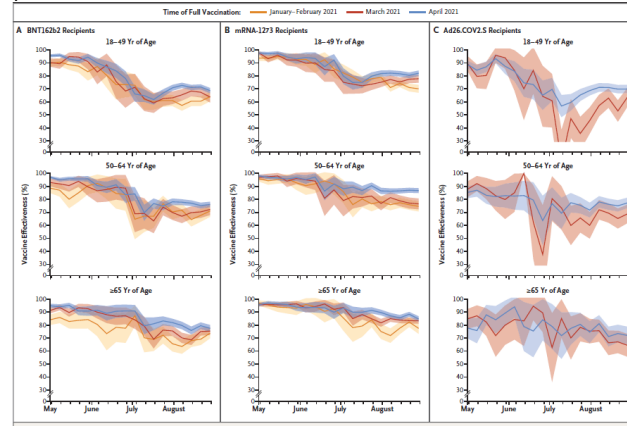
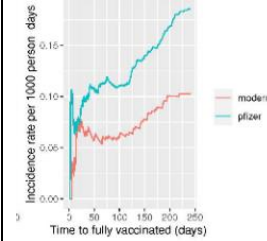


Figure 1. Estimated Vaccine Effectiveness against Laboratory-Confirmed Coronavirus Disease 2019 (Covid-19) According to Vaccine Product, Age of Recipient, and Time of Full Vaccination. The time of full vaccination was defined as at least 14 days after the final dose. Vaccine effectiveness was calculated as 1 minus the hazard ratio. The shaded areas indicate 95% confidence intervals.

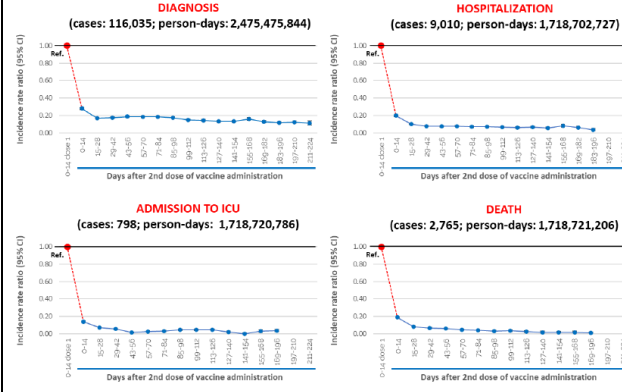
Hospital database cohort study. They found that there was an increased incidence rate with the increased time from vaccination, especially 120 days after vaccination.



| Time to fully vaccination | Pfizer/BNT162b2 | | | Moderna/mRNA-1273 | | |
|---------------------------|--|-----------|----------------------------------|---------------------------|-----------|----------------------------------|
| | Total person-days at risk ¹ | Incidence | Incident rate / 1000 person-days | Total person-days at risk | Incidence | Incident rate / 1000 person-days |
| 210-240 days | 3074 | 6 | 1.952 | 443 | 1 | 2.257 |
| 180-210 days | 16811 | 24 | 1.428 | 5543 | 5 | 0.902 |
| 150-180 days | 34847 | 16 | 0.459 | 16525 | 6 | 0.363 |
| 120-150 days | 66486 | 27 | 0.406 | 32243 | 7 | 0.217 |
| 90-120 days | 105697 | 15 | 0.142 | 52162 | 5 | 0.096 |
| 60-90 days | 150864 | 16 | 0.106 | 74806 | 5 | 0.067 |
| 30-60 days | 203392 | 26 | 0.128 | 100706 | 5 | 0.050 |
| 0-30 days | 259596 | 26 | 0.100 | 126977 | 8 | 0.063 |

46 [Italian Institutio Superiore di Sanita](#) (September 30, 2021) Italy ≥16 year old general population who received at least 1 dose of mRNA vaccine Alpha, Delta Comirnaty mRNA-1273 December 27, 2020-August 29, 2021

Compared different time points post vaccination dose 2 to day 0-14 post dose 1. They did not observe a reduction of the protective effect of vaccination, against symptomatic or asymptomatic COVID-19 diagnosis, after about seven months since the 2nd dose (VE 89%), nor against diagnosis with subsequent hospitalization (VE 96%), admission to ICU (VE 96%), or death (VE 99%) after about 6 months. Persons >80+, nursing home residents, nursing home residents with comorbidities or immunocompromised did see a decline in VE against infection though confidence intervals are wide for the latter.



45 [Martinez Bas et al](#) (September 30, 2021) Spain ≥18 year old general population Alpha, Delta Comirnaty mRNA-1273 AZD1222 April 1-August 31, 2021

Cohort study of contacts of cases.

| | | | | | Ad26.COV2.S | | Adjust VE (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|---|------------|--------------------|---------------------|--------------|---------------------------------|---|--------------------------|---------|------------|------------|-------------|--------------|--------------|-------|-----|-----|-----|-----|-----|-----------|-----|-----|-----|-----|-----|--------------|-----|-----|-----|-----|-----|
| | | | | | | | <90 days since last dose | ≥90 days since last dose | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | REF | REF | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 52 (44-59) | 28 (-8-53) | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 65 (56-73) | NA | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 85(80-88) | 67 (50-78) | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 57 (51-61) | NA | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 70 (67-73) | 63 (58-68) | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 40 (31-47) | 52 (37-64) | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 54 (47-60) | NA | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 85 (69-93) | NA | | | | | | | | | | | | | | | | | | | | | | | | |
| 44 | Bruxvoort et al (October 1, 2021) | USA | General population | Delta, Alpha+others | mRNA-1273 | March 1-July 27, 2021 | <p>TND study among persons insured by Kaiser Permanente Southern California.</p> <table border="1"> <caption>Vaccine Effectiveness (VE) % by Variant and Time since Vaccination</caption> <thead> <tr> <th>Variant</th> <th>14-60 days</th> <th>61-90 days</th> <th>91-120 days</th> <th>121-150 days</th> <th>151-180 days</th> </tr> </thead> <tbody> <tr> <td>Delta</td> <td>~90</td> <td>~85</td> <td>~80</td> <td>~75</td> <td>~75</td> </tr> <tr> <td>Non-Delta</td> <td>~95</td> <td>~90</td> <td>~85</td> <td>~80</td> <td>~80</td> </tr> <tr> <td>Unidentified</td> <td>~80</td> <td>~75</td> <td>~70</td> <td>~65</td> <td>~70</td> </tr> </tbody> </table> | | Variant | 14-60 days | 61-90 days | 91-120 days | 121-150 days | 151-180 days | Delta | ~90 | ~85 | ~80 | ~75 | ~75 | Non-Delta | ~95 | ~90 | ~85 | ~80 | ~80 | Unidentified | ~80 | ~75 | ~70 | ~65 | ~70 |
| Variant | 14-60 days | 61-90 days | 91-120 days | 121-150 days | 151-180 days | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Delta | ~90 | ~85 | ~80 | ~75 | ~75 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Non-Delta | ~95 | ~90 | ~85 | ~80 | ~80 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unidentified | ~80 | ~75 | ~70 | ~65 | ~70 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 43 | Payne et al (July 21, 2021) | UK | HCWs | Alpha | Comirnaty | December 7, 2020-March 12, 2021 | Cohort study of HCWs | | | | | | | | | | | | | | | | | | | | | | | | | |

| 41 | Eyre et al* (January 5, 2022) [Update to September 29, 2021 preprint] | UK | contacts of symptomatic and asymptomatic SARS-CoV-2-infected index cases | Alpha/Delta | Comirnaty AZD1222 | January 1-July 31, 2021 | <p>Transmission study. Independently of contact vaccination status, for each doubling of weeks since 14 days after second vaccination in index cases, the odds of a contact testing PCR-positive increased 1.13-fold (95%CI 1.09-1.17) for ChAdOx1 and 1.20-fold (1.10-1.31) for BNT162b2 with no evidence of a difference between vaccines (p=0.19). Higher probabilities of PCR-positive results in contacts 14 days after second vaccination for Delta vs. Alpha meant that by 12 weeks post second ChAdOx1 dose there was no evidence that onward Delta transmission rates differed between those not vaccinated and those having received two ChAdOx1 doses and the impact of BNT162b2 had also attenuated substantially</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------|---|------------|--|-------------|---------------------|----------------------------|--|---------------------------|--------------|------------|------|------------|--------|------------------------|--------|----|--------|------------------------|--|--|--|--|--|--|--|--|--|---------------|--------|----|------|------|-----------|------|-----------|----|-------|---------------|--------|----|------|------|-----------|------|-----------|----|-------|---------------|--------|----|------|------|-----------|------|-----------|----|-------|----------|--------|---|------|------|-----------|------|-----------|----|-------|--------------|--|--|--|--|--|--|--|--|--|------------|--------|---|------|------|-----------|------|-----------|----|-------|------------|--------|----|------|------|-----------|------|-----------|----|-------|------------|--------|----|------|------|-----------|------|-----------|----|-------|----------|--------|----|------|------|-----------|------|-----------|----|-------|
| 40 | Nunes et al (September 23, 2021) | Portugal | Cohort of 80-109 year olds | Multiple | Comirnaty mRNA-1273 | February 2-August 13, 2021 | <p>Cohort study done by linking administrative records. VE against hospitalization in persons ≥ 98 days post dose 2 was 89% (71–96) compared to 14-41 days post dose 2 was 81% (64–91). VE against COVID-19-related deaths in persons ≥ 98 days post dose 2 was 74% (60–83) compared to 14-41 days post dose 2 was 86% (68–93). Neither were statistically different.</p> <table border="1"> <thead> <tr> <th>Outcome by vaccine status</th> <th>Person-years</th> <th>Events (n)</th> <th>Rate</th> <th>Rate ratio</th> <th>95% CI</th> <th>Confounder-adjusted HR</th> <th>95% CI</th> <th>VE</th> <th>95% CI</th> </tr> </thead> <tbody> <tr> <td colspan="10">Hospitalisation</td> </tr> <tr> <td>14 to 41 days</td> <td>32,505</td> <td>10</td> <td>0.31</td> <td>0.03</td> <td>0.01–0.05</td> <td>0.18</td> <td>0.09–0.36</td> <td>82</td> <td>64–91</td> </tr> <tr> <td>42 to 69 days</td> <td>32,059</td> <td>11</td> <td>0.34</td> <td>0.03</td> <td>0.02–0.05</td> <td>0.19</td> <td>0.09–0.39</td> <td>81</td> <td>61–91</td> </tr> <tr> <td>70 to 97 days</td> <td>31,161</td> <td>16</td> <td>0.51</td> <td>0.04</td> <td>0.03–0.07</td> <td>0.22</td> <td>0.12–0.43</td> <td>78</td> <td>57–88</td> </tr> <tr> <td>≥98 days</td> <td>33,321</td> <td>6</td> <td>0.18</td> <td>0.02</td> <td>0.01–0.03</td> <td>0.11</td> <td>0.04–0.29</td> <td>89</td> <td>71–96</td> </tr> <tr> <td colspan="10">Death</td> </tr> <tr> <td>14–41 days</td> <td>32,506</td> <td>7</td> <td>0.22</td> <td>0.02</td> <td>0.01–0.05</td> <td>0.14</td> <td>0.07–0.32</td> <td>86</td> <td>68–93</td> </tr> <tr> <td>42–69 days</td> <td>32,062</td> <td>13</td> <td>0.41</td> <td>0.05</td> <td>0.03–0.08</td> <td>0.16</td> <td>0.09–0.30</td> <td>84</td> <td>70–91</td> </tr> <tr> <td>70–97 days</td> <td>31,164</td> <td>20</td> <td>0.64</td> <td>0.07</td> <td>0.05–0.11</td> <td>0.13</td> <td>0.08–0.23</td> <td>87</td> <td>77–92</td> </tr> <tr> <td>≥98 days</td> <td>33,326</td> <td>51</td> <td>1.53</td> <td>0.17</td> <td>0.13–0.22</td> <td>0.26</td> <td>0.17–0.40</td> <td>74</td> <td>60–83</td> </tr> </tbody> </table> | Outcome by vaccine status | Person-years | Events (n) | Rate | Rate ratio | 95% CI | Confounder-adjusted HR | 95% CI | VE | 95% CI | Hospitalisation | | | | | | | | | | 14 to 41 days | 32,505 | 10 | 0.31 | 0.03 | 0.01–0.05 | 0.18 | 0.09–0.36 | 82 | 64–91 | 42 to 69 days | 32,059 | 11 | 0.34 | 0.03 | 0.02–0.05 | 0.19 | 0.09–0.39 | 81 | 61–91 | 70 to 97 days | 31,161 | 16 | 0.51 | 0.04 | 0.03–0.07 | 0.22 | 0.12–0.43 | 78 | 57–88 | ≥98 days | 33,321 | 6 | 0.18 | 0.02 | 0.01–0.03 | 0.11 | 0.04–0.29 | 89 | 71–96 | Death | | | | | | | | | | 14–41 days | 32,506 | 7 | 0.22 | 0.02 | 0.01–0.05 | 0.14 | 0.07–0.32 | 86 | 68–93 | 42–69 days | 32,062 | 13 | 0.41 | 0.05 | 0.03–0.08 | 0.16 | 0.09–0.30 | 84 | 70–91 | 70–97 days | 31,164 | 20 | 0.64 | 0.07 | 0.05–0.11 | 0.13 | 0.08–0.23 | 87 | 77–92 | ≥98 days | 33,326 | 51 | 1.53 | 0.17 | 0.13–0.22 | 0.26 | 0.17–0.40 | 74 | 60–83 |
| Outcome by vaccine status | Person-years | Events (n) | Rate | Rate ratio | 95% CI | Confounder-adjusted HR | 95% CI | VE | 95% CI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hospitalisation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 to 41 days | 32,505 | 10 | 0.31 | 0.03 | 0.01–0.05 | 0.18 | 0.09–0.36 | 82 | 64–91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42 to 69 days | 32,059 | 11 | 0.34 | 0.03 | 0.02–0.05 | 0.19 | 0.09–0.39 | 81 | 61–91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70 to 97 days | 31,161 | 16 | 0.51 | 0.04 | 0.03–0.07 | 0.22 | 0.12–0.43 | 78 | 57–88 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥98 days | 33,321 | 6 | 0.18 | 0.02 | 0.01–0.03 | 0.11 | 0.04–0.29 | 89 | 71–96 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Death | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14–41 days | 32,506 | 7 | 0.22 | 0.02 | 0.01–0.05 | 0.14 | 0.07–0.32 | 86 | 68–93 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42–69 days | 32,062 | 13 | 0.41 | 0.05 | 0.03–0.08 | 0.16 | 0.09–0.30 | 84 | 70–91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70–97 days | 31,164 | 20 | 0.64 | 0.07 | 0.05–0.11 | 0.13 | 0.08–0.23 | 87 | 77–92 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥98 days | 33,326 | 51 | 1.53 | 0.17 | 0.13–0.22 | 0.26 | 0.17–0.40 | 74 | 60–83 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 37 | Pilishvili et al (September 22, 2021) | USA | HCW | Multiple | Comirnaty mRNA-1273 | December 28-May 19, 2021 | TND case control among HCWs evaluated VE every 2 weeks for 14 weeks. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | <table border="1"> <thead> <tr> <th>Weeks of Follow-up after Receipt of Second Dose</th> <th>No. of Cases</th> <th>No. of Controls</th> </tr> </thead> <tbody> <tr> <td>1-2</td> <td>40</td> <td>541</td> </tr> <tr> <td>3-4</td> <td>10</td> <td>213</td> </tr> <tr> <td>5-6</td> <td>16</td> <td>156</td> </tr> <tr> <td>7-8</td> <td>24</td> <td>137</td> </tr> <tr> <td>9-10</td> <td>23</td> <td>99</td> </tr> <tr> <td>11-12</td> <td>35</td> <td>139</td> </tr> <tr> <td>13-14</td> <td>24</td> <td>88</td> </tr> </tbody> </table> | Weeks of Follow-up after Receipt of Second Dose | No. of Cases | No. of Controls | 1-2 | 40 | 541 | 3-4 | 10 | 213 | 5-6 | 16 | 156 | 7-8 | 24 | 137 | 9-10 | 23 | 99 | 11-12 | 35 | 139 | 13-14 | 24 | 88 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|-----------------|-------------------------------|------------------------|---------------------------------|------------------------------|--|---|-----------------------|-----------------|-----|------------------------|-----|-----|---|---------|-----------|---------------------|---------|-----------|---------------------|-----------|------|------|------|-------|------|------|------------------|------------|-----|------|------|----|------|------|------------------|--------|----|-----|------|----|-----|------|-------------------|--------|----|------|-----|---|------|-----|-------------------|------------|---|------|-----|---|------|-----|---------------------|--------|---|-----|------|---|-----|-----|--------------------|
| Weeks of Follow-up after Receipt of Second Dose | No. of Cases | No. of Controls | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-2 | 40 | 541 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-4 | 10 | 213 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5-6 | 16 | 156 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7-8 | 24 | 137 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9-10 | 23 | 99 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11-12 | 35 | 139 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13-14 | 24 | 88 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 36 | El Sahly et al (September 22, 2021) | USA | RCT participants | Multiple | mRNA-1273 | July 27, 2020-March 26, 2021 | Findings from the double blinded placebo controlled RCT. VE against disease was similar at 2 weeks-<2 months (91.8%), 2 months-<4 months (94%), and ≥4 months (92.4%) post dose 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | Baden et al (September 22, 2021) | USA | ≥18-year-old RCT participants | Delta | mRNA-1273 | July 1-August 27, 2021 | <p>RCT participants were followed after unblinding. Initial vaccine recipients (mRNA-1273e) were vaccinated between 7/27/20-12/16/20 while those vaccinated after unblinding (mRNA-1273p) were vaccinated between 12/29/20-4/30/21. Median follow-up times from the first dose were 13 months in the mRNA-1273e (including double-blind and open-label phases) and 7.9 months in the mRNA-1273p (only open-label phase) groups. While there was a significant difference in disease incidence rates between the groups, there was no difference in severe disease incidence rates though numbers are small.</p> <table border="1"> <thead> <tr> <th rowspan="2">Covid-19 Cases†</th> <th colspan="3">mRNA-1273e N=14746</th> <th colspan="3">mRNA-1273p* N=11431</th> <th rowspan="2">Reduction of observed incidence rate % (95% CI)</th> </tr> <tr> <th>Cases n</th> <th>Person-yr</th> <th>Rate/1000 Person-yr</th> <th>Cases n</th> <th>Person-yr</th> <th>Rate/1000 Person-yr</th> </tr> </thead> <tbody> <tr> <td>All cases</td> <td>162</td> <td>2102</td> <td>77.1</td> <td>88</td> <td>1796</td> <td>49.0</td> <td>36.4 (17.1-51.5)</td> </tr> <tr> <td>≥18-<65 yr</td> <td>136</td> <td>1558</td> <td>87.3</td> <td>68</td> <td>1289</td> <td>52.8</td> <td>39.6 (18.6-55.5)</td> </tr> <tr> <td>≥65 yr</td> <td>26</td> <td>544</td> <td>47.8</td> <td>20</td> <td>507</td> <td>39.5</td> <td>17.4 (-53.9-56.3)</td> </tr> <tr> <td>Severe</td> <td>13</td> <td>2102</td> <td>6.2</td> <td>6</td> <td>1796</td> <td>3.3</td> <td>46.0 (-52.4-83.2)</td> </tr> <tr> <td>≥18-<65 yr</td> <td>7</td> <td>1558</td> <td>4.5</td> <td>4</td> <td>1289</td> <td>3.1</td> <td>30.9 (-171.7- 85.2)</td> </tr> <tr> <td>≥65 yr</td> <td>6</td> <td>544</td> <td>11.0</td> <td>2</td> <td>507</td> <td>3.9</td> <td>64.2 (-100.2-96.5)</td> </tr> </tbody> </table> | Covid-19 Cases† | mRNA-1273e N=14746 | | | mRNA-1273p* N=11431 | | | Reduction of observed incidence rate % (95% CI) | Cases n | Person-yr | Rate/1000 Person-yr | Cases n | Person-yr | Rate/1000 Person-yr | All cases | 162 | 2102 | 77.1 | 88 | 1796 | 49.0 | 36.4 (17.1-51.5) | ≥18-<65 yr | 136 | 1558 | 87.3 | 68 | 1289 | 52.8 | 39.6 (18.6-55.5) | ≥65 yr | 26 | 544 | 47.8 | 20 | 507 | 39.5 | 17.4 (-53.9-56.3) | Severe | 13 | 2102 | 6.2 | 6 | 1796 | 3.3 | 46.0 (-52.4-83.2) | ≥18-<65 yr | 7 | 1558 | 4.5 | 4 | 1289 | 3.1 | 30.9 (-171.7- 85.2) | ≥65 yr | 6 | 544 | 11.0 | 2 | 507 | 3.9 | 64.2 (-100.2-96.5) |
| Covid-19 Cases† | mRNA-1273e N=14746 | | | mRNA-1273p* N=11431 | | | Reduction of observed incidence rate % (95% CI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cases n | Person-yr | Rate/1000 Person-yr | Cases n | Person-yr | Rate/1000 Person-yr | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| All cases | 162 | 2102 | 77.1 | 88 | 1796 | 49.0 | 36.4 (17.1-51.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥18-<65 yr | 136 | 1558 | 87.3 | 68 | 1289 | 52.8 | 39.6 (18.6-55.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥65 yr | 26 | 544 | 47.8 | 20 | 507 | 39.5 | 17.4 (-53.9-56.3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Severe | 13 | 2102 | 6.2 | 6 | 1796 | 3.3 | 46.0 (-52.4-83.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥18-<65 yr | 7 | 1558 | 4.5 | 4 | 1289 | 3.1 | 30.9 (-171.7- 85.2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥65 yr | 6 | 544 | 11.0 | 2 | 507 | 3.9 | 64.2 (-100.2-96.5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | Hagan et al (September 21, 2021) | USA | Incarcerated persons | Delta | Comirnaty mRNA-1273 Ad26.COV2.S | July 11-August 14, 2021 | Outbreak investigation in a prison found that the attack rate among fully vaccinated persons was significantly higher in those vaccinated 4-6 months ago (89%) compared to those vaccinated 2 weeks-2 months ago (61%). This was combined for 3 vaccines used in the population. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 33 | Thomas et al (September 15, 2021) | Multiple | ≥12-year-old RCT participants | Multiple | Comirnaty | July 27, 2020-March 13, 2021 | Findings from the double blinded placebo controlled RCT. VE against disease was 96.2% (93.3-98.1) at 7 days-<2 months, 90.1% (86.6-92.9) at 2 months-<4 months, and 83.7% (74.7-89.9) at ≥4 months post dose 2. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | Efficacy End Point | | | | | |
|----|--|-------------|---|---|---|--|--|----------------|-----------------------|-------------------|------------------|----------------------|
| | | | | | | | BNT162b2 (N=23,040) | | Placebo (N=23,037) | | Vaccine Efficacy | |
| | | | | | | | | | | | | |
| | | | | | | No. of cases | Surveillance time | No. at risk | No. of cases | Surveillance time | No. at risk | % (95% CI) |
| | | | | | | 1000 person-yr | | 1000 person-yr | | | | |
| | | | | | | 131 | 8,412 | 22,505 | 1014 | 8,124 | 22,434 | 87.8 (85.3 to 89.9) |
| | | | | | | 46 | 1,339 | 22,505 | 110 | 1,331 | 22,434 | 58.4 (40.8 to 71.2) |
| | | | | | | 41 | 0,677 | 22,505 | 50 | 0,675 | 22,434 | 18.2 (-26.1 to 41.3) |
| | | | | | | 5 | 0,662 | 22,399 | 60 | 0,656 | 22,369 | 91.7 (79.6 to 97.4) |
| | | | | | | 3 | 0,424 | 22,163 | 35 | 0,422 | 22,057 | 91.5 (72.9 to 98.3) |
| | | | | | | 82 | 6,649 | 22,132 | 889 | 6,371 | 22,001 | 91.2 (88.9 to 93.0) |
| | | | | | | 12 | 2,923 | 22,132 | 312 | 2,884 | 22,001 | 96.2 (93.3 to 98.1) |
| | | | | | | 46 | 2,696 | 20,814 | 449 | 2,593 | 20,344 | 90.1 (86.6 to 92.9) |
| | | | | | | 24 | 1,030 | 12,670 | 128 | 0,895 | 11,802 | 83.7 (74.7 to 89.9) |
| 32 | Pfizer (September 17, 2021) | Multiple | ≥16-year-old RCT participants | Delta | Comirnaty | July 1-August 31, 2021 | RCT participants were evaluated for duration of protection against symptomatic disease, with the original placebo recipients receiving the vaccine after unblinding. The mean time from Dose 2 of Comirnaty to 01 July 2021 was approximately 5 months for the crossover group and 10 months for the original group. There was a 26.3% (7.4%- 41.4%) relative vaccine efficacy for the group vaccinated later (crossover group) compared to the group vaccinated earlier (original group), with a difference in incidence rates of -18.6 per 1000 person-years of follow-up. | | | | | |
| 31 | de Gier et al (September 17, 2021) | Netherlands | Hospitalized patients | Delta (just for duration of protection) | Comirnaty mRNA-1273 Ad26.COVS.S AZD1222 | July 4-August 29, 2021 (just for duration of protection) | Incidence rate ratios were calculated based on national coverage and vaccination status of hospitalized cases. All 4 vaccines were combined in calculating the VE by time since vaccination, and VE was only calculated during the delta dominant period when 99% of sequenced isolates were delta. No drop in VE against hospitalization nor in VE against ICU admission was seen between those vaccinated up to 20 weeks since full vaccination among 15-49, 50-69, ≥70 year olds. | | | | | |
| 30 | Self et al (September 17, 2021) | USA | ≥18 years who were hospitalized at 21 U.S. hospitals across 18 states | Alpha, Delta, Non-VOC | Comirnaty mRNA-1273 Ad26.COVS.S | March 11–August 15, 2021 | This case-control study found that the for mRNA-1273 vaccine, there was no difference in VE against hospitalization among those were 14-120 days post full vaccination and those who were >120 days post full vaccination. For Comirnaty, VE against hospitalization was 91% (88-93) for those 14-120 days post full vaccination while it was 77% (67-84) for those >120 das post full vaccination. Ad26.COVS.S did not have enough data to stratify by more than 28 days post full vaccination. | | | | | |
| 29 | Polinski et al (September 12, 2021) (updated March 17, 2022) | USA | ≥18 years of age | Alpha/Delta | Ad26.COVS.S | March 1, 2021- August 31, 2021 | Retrospective cohort study used insurance claims data linked to health data sources to evaluate VE of Ad26.COVS.S against COVID-19 diagnosis and hospitalization among vaccinated individuals and matched unvaccinated individuals (matched on age, sex, comorbid-risk, calendar date, location, and other risk factors for COVID-19 severity). VE was stable over time up to 152 days after vaccination. | | | | | |
| 28 | McKeigue et al (September 15, 2021) (updated February 25, 2022) | Scotland | Population of Scotland | Alpha/Delta | Comirnaty mRNA-1273 AZD1222 | December 1, 2020- September 8, 2021 | Matched case-control study (REACT-SCOT) assessed rate ratios over time comparing rate of severe COVID-19 and the rate of hospitalization or death among those full vaccinated with Comirnaty, mRNA-1273, and AZD1222 to unvaccinated persons. | | | | | |

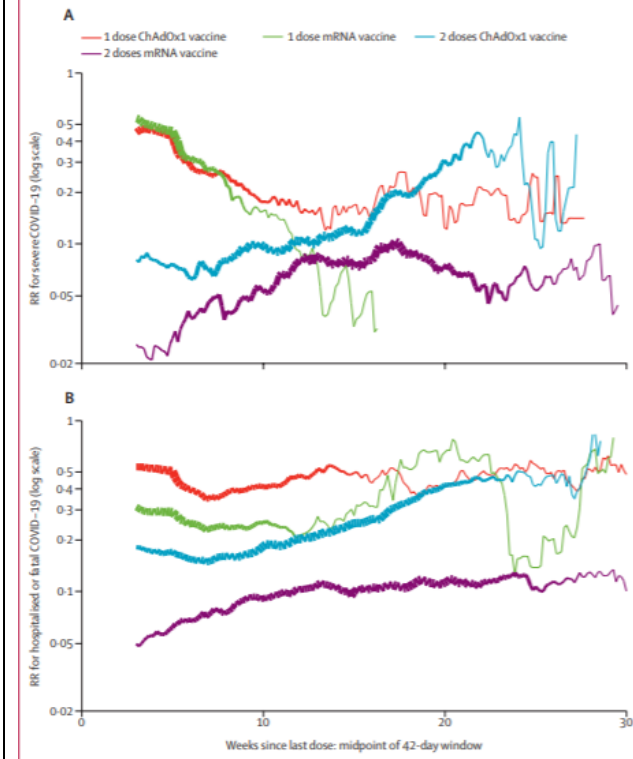
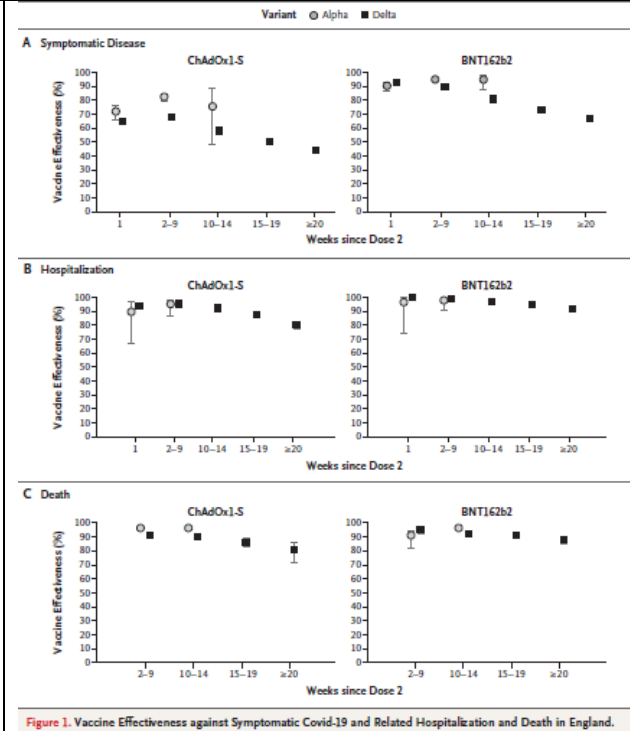


Figure 2: Association between vaccine efficacy and time since last vaccine dose
(A) Severe COVID-19. RRs in conditional logistic regression model, adjusted for covariates. (B) Hospitalised or fatal COVID-19 cases. RRs in the 42-day time window centred on 20 weeks from the most recent vaccine dose are presented. The efficacy of vaccination is 1 minus the RR. For each effect, line thickness is proportional to precision (inverse variance) of estimate, scaled to the same maximum thickness for each effect. RR=rate ratio.

| | | | | | | | |
|----|--|-----|---|-------------|-----------------------------|-------------------------------------|--|
| | | | | | | | |
| 27 | Bajema et al (September 10, 2021) | USA | Veterans ≥ 18 years | Alpha/Delta | BNT162b2 & mRNA-1273 | February 1, 2021- August 6, 2021 | Test-negative case-control study of adults hospitalized at 5 Veterans Affairs with COVID-like illness. No difference was found in VE against hospitalization <90 days vs. ≥ 90 days post second dose of BNT162b2 or mRNA-1273: 86.1% (76.5-91.8%) vs. 87.2 (78.2-92.5%). |
| 26 | Andrews et al With updated data through August 20 th here (September 14, 2021) | UK | Symptomatic cases and test-negative controls 16 years and older | Alpha/Delta | Comirnaty mRNA-1273 AZD1222 | December 8, 2020- September 3, 2021 | This test-negative case-control study assessed VE of 2 doses of Comirnaty, mRNA-1273, and AZD1222 against symptomatic disease, hospitalization, and death over time separately for Alpha and Delta variants. VE against symptomatic disease peaked in early weeks post 2nd dose and then declined for Comirnaty and mRNA-1273 for both Alpha and Delta. Waning was greater for Delta than Alpha. Only limited waning against hospitalization and death was observed. |

Updated with final
publication on
January 12, 2022



Waning was also greater for those 65+ years compared to 40-64 year-olds and in those in a clinical risk group and clinically extremely vulnerable group. Data for mRNA-1273 was only available through 10-14 weeks post 2nd dose for symptomatic disease and shows high VE (85.6%) at 10-14 weeks.

| | | | | | | | |
|----|--|--------|------------------|--------------------------------|---------------------------------|---------------------------------|--|
| 25 | Dagan et al (September 9, 2021) | Israel | Pregnant women | Alpha/Delta | Comirnaty | December 20, 2020- June 3, 2021 | Cohort study of pregnant women that showed no drop in VE through 56 days post dose 2 |
| 24 | Thompson et al (September 9, 2021) | USA | ≥50 years of age | Multiple including alpha/delta | Comirnaty mRNA-1273 Ad26.COV2.S | January 1-June 22, 2021 | Test negative case control study that found that VE against hospitalization remained >80% through at least 112 days post the dose 2 for Comirnaty and mRNA-1273. For Ad26.COV2.S, VE stayed high at time point ≥56 days after vaccination. VE against ER/urgent care visit is >80% through at least 112 days post dose 2 for Comirnaty and mRNA-1273. For Ad26.COV2.S, VE stayed high at time point ≥56 days after vaccination. VE against hospitalization (for all 3 vaccines combined) |

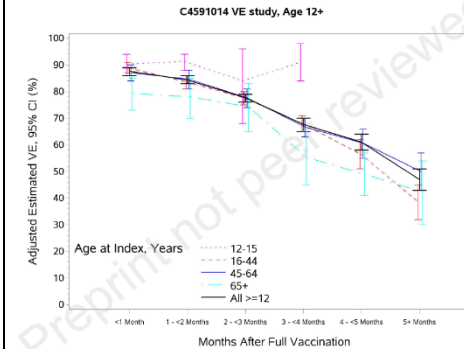
| | | | | | | | <p>Fully vaccinated — 2 doses</p> <table border="1"> <tr><td>14–27 Days after dose 2</td><td>2,754</td><td>48 (1.7)</td><td>88 (84 to 92)</td></tr> <tr><td>28–41 Days after dose 2</td><td>2,783</td><td>41 (1.5)</td><td>92 (88 to 94)</td></tr> <tr><td>42–55 Days after dose 2</td><td>2,603</td><td>41 (1.6)</td><td>90 (87 to 93)</td></tr> <tr><td>56–69 Days after dose 2</td><td>2,394</td><td>51 (2.1)</td><td>86 (82 to 90)</td></tr> <tr><td>70–83 Days after dose 2</td><td>2,048</td><td>24 (1.2)</td><td>93 (89 to 95)</td></tr> <tr><td>84–97 Days after dose 2</td><td>1,528</td><td>27 (1.8)</td><td>86 (79 to 91)</td></tr> <tr><td>98–111 Days after dose 2</td><td>971</td><td>23 (2.4)</td><td>82 (72 to 89)</td></tr> <tr><td>≥112 Days after dose 2</td><td>568</td><td>11 (1.9)</td><td>86 (74 to 93)</td></tr> </table> <p>VE against emergency department visits/urgent care visits (for all 3 vaccines combined)</p> <table border="1"> <tr><td>Fully vaccinated — 2 doses</td><td></td><td></td><td></td></tr> <tr><td>14–27 Days after dose 2</td><td>1,198</td><td>23 (1.9)</td><td>92 (88 to 95)</td></tr> <tr><td>28–41 Days after dose 2</td><td>1,170</td><td>20 (1.7)</td><td>95 (92 to 97)</td></tr> <tr><td>42–55 Days after dose 2</td><td>1,067</td><td>18 (1.7)</td><td>95 (91 to 97)</td></tr> <tr><td>56–69 Days after dose 2</td><td>924</td><td>28 (3.0)</td><td>88 (81 to 92)</td></tr> <tr><td>70–83 Days after dose 2</td><td>667</td><td>24 (3.6)</td><td>86 (78 to 91)</td></tr> <tr><td>84–97 Days after dose 2</td><td>487</td><td>13 (2.7)</td><td>92 (87 to 96)</td></tr> <tr><td>98–111 Days after dose 2</td><td>331</td><td>17 (5.1)</td><td>86 (77 to 92)</td></tr> <tr><td>≥112 Days after dose 2</td><td>221</td><td>11 (5.0)</td><td>86 (74 to 93)</td></tr> </table> | 14–27 Days after dose 2 | 2,754 | 48 (1.7) | 88 (84 to 92) | 28–41 Days after dose 2 | 2,783 | 41 (1.5) | 92 (88 to 94) | 42–55 Days after dose 2 | 2,603 | 41 (1.6) | 90 (87 to 93) | 56–69 Days after dose 2 | 2,394 | 51 (2.1) | 86 (82 to 90) | 70–83 Days after dose 2 | 2,048 | 24 (1.2) | 93 (89 to 95) | 84–97 Days after dose 2 | 1,528 | 27 (1.8) | 86 (79 to 91) | 98–111 Days after dose 2 | 971 | 23 (2.4) | 82 (72 to 89) | ≥112 Days after dose 2 | 568 | 11 (1.9) | 86 (74 to 93) | Fully vaccinated — 2 doses | | | | 14–27 Days after dose 2 | 1,198 | 23 (1.9) | 92 (88 to 95) | 28–41 Days after dose 2 | 1,170 | 20 (1.7) | 95 (92 to 97) | 42–55 Days after dose 2 | 1,067 | 18 (1.7) | 95 (91 to 97) | 56–69 Days after dose 2 | 924 | 28 (3.0) | 88 (81 to 92) | 70–83 Days after dose 2 | 667 | 24 (3.6) | 86 (78 to 91) | 84–97 Days after dose 2 | 487 | 13 (2.7) | 92 (87 to 96) | 98–111 Days after dose 2 | 331 | 17 (5.1) | 86 (77 to 92) | ≥112 Days after dose 2 | 221 | 11 (5.0) | 86 (74 to 93) |
|-----------------------------------|---|---|---|--------------------------------|--------------------|---------------------------|--|-------------------------|----------------|---|-----------------------------------|-------------------------|---------------|----------|-------------------|-------------------------|-------------------|----------|--------------------|-------------------------|--------------------|----------|---------------------|-------------------------|-------|----------|---------------|-------------------------|-------|----------|---------------|--------------------------|-----|----------|---------------|------------------------|-----|----------|---------------|----------------------------|--|--|--|-------------------------|-------|----------|---------------|-------------------------|-------|----------|---------------|-------------------------|-------|----------|---------------|-------------------------|-----|----------|---------------|-------------------------|-----|----------|---------------|-------------------------|-----|----------|---------------|--------------------------|-----|----------|---------------|------------------------|-----|----------|---------------|
| 14–27 Days after dose 2 | 2,754 | 48 (1.7) | 88 (84 to 92) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28–41 Days after dose 2 | 2,783 | 41 (1.5) | 92 (88 to 94) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42–55 Days after dose 2 | 2,603 | 41 (1.6) | 90 (87 to 93) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 56–69 Days after dose 2 | 2,394 | 51 (2.1) | 86 (82 to 90) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70–83 Days after dose 2 | 2,048 | 24 (1.2) | 93 (89 to 95) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 84–97 Days after dose 2 | 1,528 | 27 (1.8) | 86 (79 to 91) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 98–111 Days after dose 2 | 971 | 23 (2.4) | 82 (72 to 89) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥112 Days after dose 2 | 568 | 11 (1.9) | 86 (74 to 93) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fully vaccinated — 2 doses | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14–27 Days after dose 2 | 1,198 | 23 (1.9) | 92 (88 to 95) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28–41 Days after dose 2 | 1,170 | 20 (1.7) | 95 (92 to 97) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42–55 Days after dose 2 | 1,067 | 18 (1.7) | 95 (91 to 97) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 56–69 Days after dose 2 | 924 | 28 (3.0) | 88 (81 to 92) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70–83 Days after dose 2 | 667 | 24 (3.6) | 86 (78 to 91) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 84–97 Days after dose 2 | 487 | 13 (2.7) | 92 (87 to 96) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 98–111 Days after dose 2 | 331 | 17 (5.1) | 86 (77 to 92) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥112 Days after dose 2 | 221 | 11 (5.0) | 86 (74 to 93) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | Puranik et al (September 7, 2021) | USA | Persons ≥14 days post dose 2 (“full vaccination”) who received first dose after January 1 | Multiple including alpha/delta | Comirnaty | January 1-August 8, 2021 | <p>Test negative case control study to assess duration of protection against symptomatic disease. Adjusted OR start showing waning at day 60 after full vaccination.</p> <table border="1"> <thead> <tr> <th>Covariate</th> <th>Level/Category</th> <th>Symptomatic Infection [N = 974 positive events]</th> </tr> </thead> <tbody> <tr> <td rowspan="6">Time Relative to Full vaccination</td> <td>Day 0</td> <td>1 (Reference)</td> </tr> <tr> <td>Day 30</td> <td>2.19 (0.89, 5.36)</td> </tr> <tr> <td>Day 60</td> <td>3.65 (1.78, 7.46)</td> </tr> <tr> <td>Day 90</td> <td>5.58 (2.72, 11.46)</td> </tr> <tr> <td>Day 120</td> <td>7.25 (3.47, 15.18)</td> </tr> <tr> <td>Day 150</td> <td>10.33 (5.03, 21.24)</td> </tr> </tbody> </table> | Covariate | Level/Category | Symptomatic Infection [N = 974 positive events] | Time Relative to Full vaccination | Day 0 | 1 (Reference) | Day 30 | 2.19 (0.89, 5.36) | Day 60 | 3.65 (1.78, 7.46) | Day 90 | 5.58 (2.72, 11.46) | Day 120 | 7.25 (3.47, 15.18) | Day 150 | 10.33 (5.03, 21.24) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Covariate | Level/Category | Symptomatic Infection [N = 974 positive events] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Time Relative to Full vaccination | Day 0 | 1 (Reference) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Day 30 | 2.19 (0.89, 5.36) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Day 60 | 3.65 (1.78, 7.46) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Day 90 | 5.58 (2.72, 11.46) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Day 120 | 7.25 (3.47, 15.18) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Day 150 | 10.33 (5.03, 21.24) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | Kertes et al (September 7, 2021) | Israel | Fully vaccinated population | Delta | Comirnaty | June 9-July 18, 2021 | Study of Maccabi HMO clients who were 7 days post dose 2 by June 9 and had no history of prior infection. Found that those vaccinated in January-February had odds of infection of 1.61 (1.45-1.79) compared to those vaccinated in March-May of testing positive for SARS-CoV-2. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | Keehner et al (September 1, 2021) | USA | ~19,000 employees of University of California San Diego Health | Delta | BNT162b2 mRNA-1273 | July -August 26, 2021 | Cohort study of HCWs showed that among symptomatic cases occurring in July, HCW vaccinated in January or February had an attack rate of 6.7 per 1000 persons (95% CI, 5.9 to 7.8), whereas the attack rate was 3.7 per 1000 persons (95% CI, 2.5 to 5.7) among those who completed vaccination during the period from March through May. Among unvaccinated persons, the July attack rate was 16.4 per 1000 persons (95% CI, 11.8 to 22.9). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | Nunes et al (August 29, 2021) | Portugal | 1.5 million ≥65 year olds (duration of protection on only those 80+) | Alpha→Delta | BNT162b2 mRNA-1273 | ?February-August 13, 2021 | Cohort study using electronic databases. For those 80+, VE against hospitalization was 82 (64-91) at day 14-41 and 89% (71-96) at day 98+. For COVID related mortality, it was 86% (68-93) at day 14-41 and 74 (60-83) at day 98+. Noted limitations are that data delays could mean that outcomes such as hospitalization/mortality have not been recorded for more recent cases. Additionally, only 6% of the 80+ cohort remained unvaccinated during the study period, making these unvaccinated individuals probably quite different from the vaccinated. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | Cerqueira-Silva et al (August 27, 2021) | Brazil | 75.9 million vaccinated in Brazil | Gamma | CoronaVac AZD1222 | January 18-July 24, 2021 | This was a retrospective cohort study that calculated VE, as well as evaluated the daily hospitalization incidence per 100,000 vaccinees. For CoronaVac, there was low hospitalization incidence up to 84 days in vaccinees up to 79 years old. 80-89 and ≥90 age groups lowest incidence 28 days post dose 2 but then increased but were still lower than 1 dose recipients | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | |
|----|---|-------|---|----------------------------------|----------|----------------------------------|--|
| | | | | | | | |
| 16 | Chemaitelly et al* (October 6, 2021) <i>[Update to Aug 27 preprint]</i> | Qatar | | Alpha→Beta →Delta | BNT162b2 | January 1-August 15, 2021 | <p>Test-negative case-control study evaluating VE by time since vaccination stratified by age, VOC, and outcome. They see a drop in VE against infection over time since vaccination with no difference by those older/younger than 60. VE against severe disease is preserved (until sample size is insufficient).</p> |
| 13 | Tartof et al* (October 16, 2021) | USA | 3.4 million Kaiser Permanente Southern California members ≥12 years | Delta for latter months of study | BNT162b2 | December 14, 2020-August 8, 2021 | <p>Retrospective cohort study. VE against infection for the fully vaccinated decreased with increasing time since vaccination, declining from 88% (86–89) during the first month after full vaccination to 47% (43–51) after ≥5 months. Individuals ≥65 years of age had lower overall effectiveness against infections but declined at a similar rate (VE at <1 month after being fully vaccinated: 80% [73–85]; VE at ≥5 months: 43% [30–54]). Among fully vaccinated persons of all ages, protection against</p> |

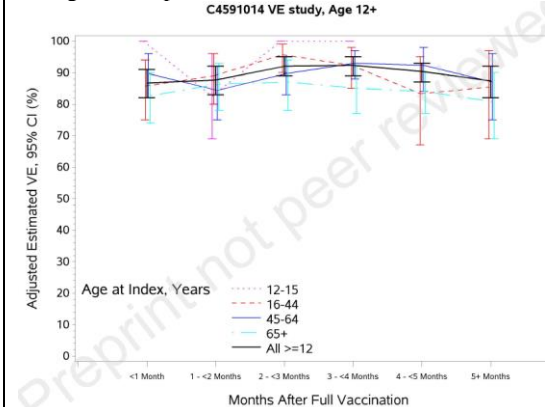
[Update to Aug 23
preprint]

COVID-19-related hospitalization did not wane over time, with overall adjusted VE estimates of 87% (82–91) at < 1 month after being fully vaccinated, and 88% (82–92) at ≥5 months after full vaccination. At <1 month, VE against Delta: 93% [85–97] and VE against other variants: 97% [95–99]). At ≥4 months, VE against Delta infections: 53% [39–65] and VE against other variants: 67% [45–80].

VE against infection:



VE against hospitalization:



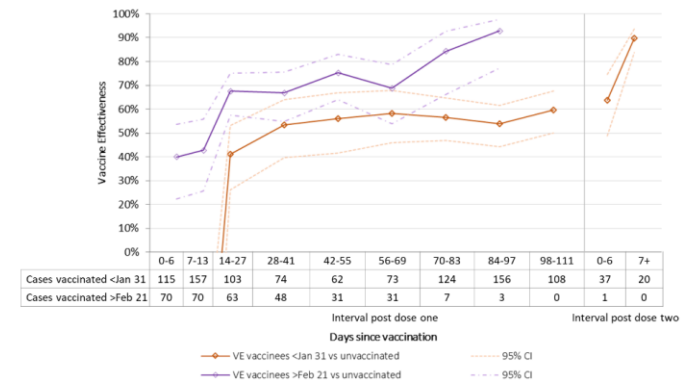
| | | | | | | |
|----|--|--------|---|-------|----------|----------------------|
| 12 | Goldberg et al (August 24, 2021) | Israel | 4.8 million fully vaccinated persons; >16 and ≥40 (depending on analysis) +unvaccinated in israel | Delta | BNT162b2 | July 11-July 31 2021 |
|----|--|--------|---|-------|----------|----------------------|

The study compared the rate of breakthrough infection in July, when Delta was the dominant strain, between individuals who received 2 doses of the vaccine earlier this year to individuals who received two doses of the vaccine more recently, while adjusting for confounders. Rates of infection decline the more recently one was vaccinated; with severe disease, this is seen in those ≥60 years. A second analysis was done among the general population cohort of vaccinated and

| | | | | | | | <p>unvaccinated to calculate VE by age group and month of vaccination.</p> <table border="1"> <thead> <tr> <th colspan="8">OUTCOME = Positive SARS-CoV-2 PCR test</th> </tr> <tr> <th>Age</th> <th>JanB</th> <th>FebA</th> <th>FebB</th> <th>MarA</th> <th>MarB</th> <th>Apr</th> <th>May</th> </tr> </thead> <tbody> <tr> <td>16-39</td> <td>50% [45, 55]</td> <td>47% [42, 52]</td> <td>58% [55, 62]</td> <td>62% [59, 64]</td> <td>68% [65, 70]</td> <td>74% [71, 77]</td> <td>73% [67, 78]</td> </tr> <tr> <td>40-59</td> <td>58% [54, 62]</td> <td>61% [58, 65]</td> <td>63% [59, 66]</td> <td>67% [63, 70]</td> <td>74% [70, 77]</td> <td>78% [73, 82]</td> <td>80% [71, 86]</td> </tr> <tr> <td>60+</td> <td>57% [52, 62]</td> <td>63% [57, 67]</td> <td>65% [57, 71]</td> <td>73% [66, 78]</td> <td>72% [64, 77]</td> <td>73% [63, 81]</td> <td>75% [58, 85]</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="4">OUTCOME = Severe COVID-19</th> </tr> <tr> <th>Age</th> <th>Jan</th> <th>Feb</th> <th>Mar</th> </tr> </thead> <tbody> <tr> <td>40-59</td> <td>94% [87, 97]</td> <td>98% [95, 99]</td> <td>98% [94, 99]</td> </tr> <tr> <td>60+</td> <td>86% [82, 90]</td> <td>88% [84, 91]</td> <td>91% [85, 95]</td> </tr> </tbody> </table> | OUTCOME = Positive SARS-CoV-2 PCR test | | | | | | | | Age | JanB | FebA | FebB | MarA | MarB | Apr | May | 16-39 | 50% [45, 55] | 47% [42, 52] | 58% [55, 62] | 62% [59, 64] | 68% [65, 70] | 74% [71, 77] | 73% [67, 78] | 40-59 | 58% [54, 62] | 61% [58, 65] | 63% [59, 66] | 67% [63, 70] | 74% [70, 77] | 78% [73, 82] | 80% [71, 86] | 60+ | 57% [52, 62] | 63% [57, 67] | 65% [57, 71] | 73% [66, 78] | 72% [64, 77] | 73% [63, 81] | 75% [58, 85] | OUTCOME = Severe COVID-19 | | | | Age | Jan | Feb | Mar | 40-59 | 94% [87, 97] | 98% [95, 99] | 98% [94, 99] | 60+ | 86% [82, 90] | 88% [84, 91] | 91% [85, 95] |
|--|---|--------------|--------------------------|--------------|-----------------------|-------------------------------------|---|--|--|--|--|--|--|--|--|-----|------|------|------|------|------|-----|-----|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------------------|--|--|--|-----|-----|-----|-----|-------|--------------|--------------|--------------|-----|--------------|--------------|--------------|
| OUTCOME = Positive SARS-CoV-2 PCR test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Age | JanB | FebA | FebB | MarA | MarB | Apr | May | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16-39 | 50% [45, 55] | 47% [42, 52] | 58% [55, 62] | 62% [59, 64] | 68% [65, 70] | 74% [71, 77] | 73% [67, 78] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40-59 | 58% [54, 62] | 61% [58, 65] | 63% [59, 66] | 67% [63, 70] | 74% [70, 77] | 78% [73, 82] | 80% [71, 86] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60+ | 57% [52, 62] | 63% [57, 67] | 65% [57, 71] | 73% [66, 78] | 72% [64, 77] | 73% [63, 81] | 75% [58, 85] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OUTCOME = Severe COVID-19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Age | Jan | Feb | Mar | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40-59 | 94% [87, 97] | 98% [95, 99] | 98% [94, 99] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60+ | 86% [82, 90] | 88% [84, 91] | 91% [85, 95] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | <p>Pouwels et al* (October 14, 2021)</p> <p>[Update to Aug 18 preprint]</p> | UK | General adult population | Alpha, Delta | BNT162b2 AZD1222 | December 1, 2020- August 1, 2020 | <p>COVID-19 infection survey is a household longitudinal survey with testing. During the delta dominant period, in those 18 to 64 years, VE of BNT162b2 against new PCR-positives reduced by 22% (95% CI 6% to 41%) for every 30 days from second vaccination. Reductions were numerically smaller for ChAdOx1 (change -7% per 30 days, 95% CI -18% to +2%) but there was no formal evidence of heterogeneity (p=0.14).</p> <p>Overall</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Tenforde et al (August 18, 2021) | USA | Hospitalized patients | Alpha→Delta | BNT162b2 mRNA-1273 | March 11-July 14, 2021 | <p>Test-negative design case control study of hospitalized patients. VE against COVID-19– associated hospitalization was 86% (95% CI = 82%–90%) 2–12 weeks and 84% (95% CI = 77%–90%) 13–24 weeks from receipt of the 2nd dose, with no significant change between these periods (p = 0.854). There was no difference in VE by timing since vaccine among those ≥/ < 65 years, immunocompromised versus not and among those with ≥/ < 3 chronic conditions.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | <p>FIGURE 2. Sustained vaccine effectiveness* against COVID-19 among hospitalized adults, by patient status^{1,2} and interval since vaccination — 21 medical centers in 18 states,³ March–July 2021</p> | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|--|--------|---|-------------|--------------------|--------------------------|---|------------------------|------------------------|-----|-----|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-----|-----|----|----|
| 8 | Yassi et al (July 16, 2021) | Canada | HCWs in Vancouver | Alpha/Gamma | BNT162b2 mRNA-1273 | December 15-May 13, 2021 | Retrospective cohort study of HCWs linking administrative databases. At 16 weeks (day 112) post dose 1 and 2 they don't see a decline in VE. Note that day 0-13 post dose 1 is included in the unvaccinated comparison group. | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Chemaitelly et al (August 9, 2021) | Qatar | Immunosuppressed kidney transplant patients | Alpha/Beta | BNT162b2 mRNA-1273 | February 1-July 21, 2021 | Retrospective cohort study finding VE against infection was 73.9% (95% CI: 33.0-89.9%) at day 56+ post dose 2; VE against severe/critical/fatal disease was 83.8% (95% CI: 31.3-96.2) at day 56+ post dose 2. | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Carazo et al (July 22, 2021) | Canada | HCWs in Quebec | Alpha | BNT162b2 mRNA-1273 | January 17-June 5, 2021 | <p>This is a test-negative case control linking surveillance and vaccination data from administrative databases for HCWs. Across 16 weeks, no decline in single-dose VE against infection was observed with appropriate stratification based upon prioritized vaccination determined by higher versus lower likelihood of direct patient contact.</p> <p>Figure 2. Vaccine effectiveness against COVID-19 by interval since vaccination</p> <table border="1"> <thead> <tr> <th>Interval post dose one</th> <th>Interval post dose two</th> </tr> </thead> <tbody> <tr> <td>0-6</td> <td>0-6</td> </tr> <tr> <td>7-13</td> <td>7-13</td> </tr> <tr> <td>14-27</td> <td>14-27</td> </tr> <tr> <td>28-41</td> <td>28-41</td> </tr> <tr> <td>42-55</td> <td>42-55</td> </tr> <tr> <td>56-69</td> <td>56-69</td> </tr> <tr> <td>70-83</td> <td>70-83</td> </tr> <tr> <td>84-97</td> <td>84-97</td> </tr> <tr> <td>98-111</td> <td>98-111</td> </tr> <tr> <td>0-6</td> <td>0-6</td> </tr> <tr> <td>7+</td> <td>7+</td> </tr> </tbody> </table> | Interval post dose one | Interval post dose two | 0-6 | 0-6 | 7-13 | 7-13 | 14-27 | 14-27 | 28-41 | 28-41 | 42-55 | 42-55 | 56-69 | 56-69 | 70-83 | 70-83 | 84-97 | 84-97 | 98-111 | 98-111 | 0-6 | 0-6 | 7+ | 7+ |
| Interval post dose one | Interval post dose two | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-6 | 0-6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7-13 | 7-13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-27 | 14-27 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28-41 | 28-41 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42-55 | 42-55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 56-69 | 56-69 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70-83 | 70-83 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 84-97 | 84-97 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 98-111 | 98-111 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-6 | 0-6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7+ | 7+ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

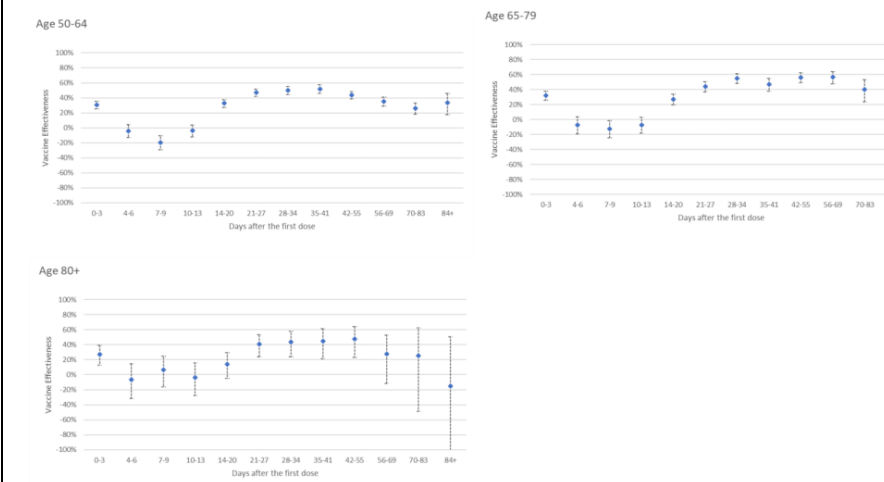
Figure 3. Vaccine effectiveness against COVID-19 in healthcare workers vaccinated before January 31st 2021 (highest contacts with patients) and those vaccinated after February 20th 2021 (fewer contacts with patients) by interval since vaccination



5 [Amirthalingam et al \(July 28, 2021\)](#) UK 50+ year old population Alpha/Delta BNT162b2 AZD1222 January 4-June 18, 2021

This is a test-negative case control study linking surveillance and vaccination data from administrative databases. In summary, VE against disease potentially declines post dose 1 at day 70+ for AZD1222 and at day 56+ for BNT162b2 but there are wide/overlapping confidence intervals making conclusions challenging. Higher two-dose VE was observed with > 6-week intervals between BNT162b2 doses compared to the authorized 3-week schedule, including ≥ 80-year-olds. (This paper also includes information on GMTs at different time points post vaccination.)

(a) AZ Vaccine



(b) Pfizer

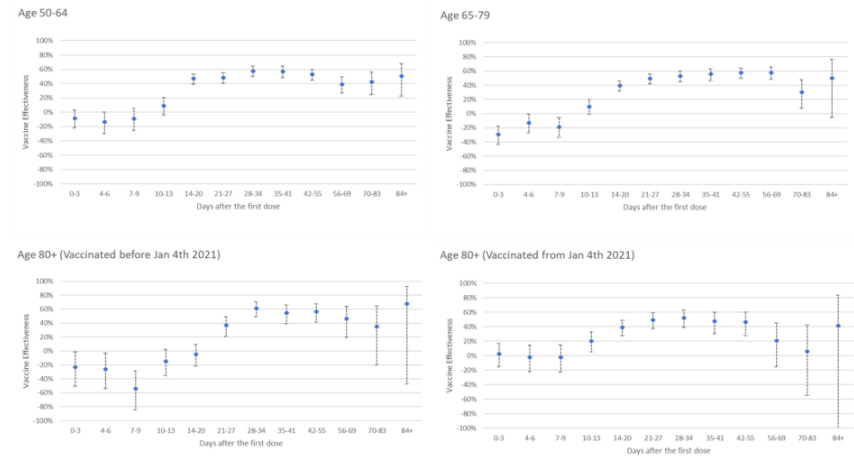
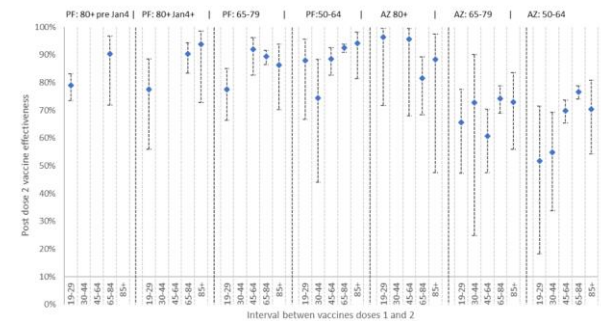
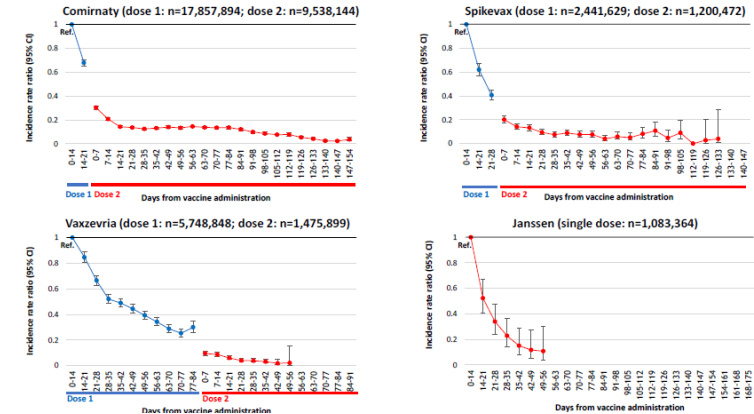


Figure 4: Two dose vaccine effectiveness by age group, vaccine type and interval between doses



| | | | | | | | |
|---|---|-------|--|-------|---|-------------------------------------|--|
| 3 | Italian Istituto Superiore di Sanita (July 30, 2021) | Italy | Italian general adult population with at least 1 dose of vaccine | Alpha | BNT162b2 AZD1222 mRNA-1273 Ad26.COV2.S | December 27, 2020- July 14, 2021 | <p>This study linked Italy’s national vaccination registry with their surveillance data. For each of the outcomes evaluated, a multivariable negative binomial model was used to estimate the incidence rate ratio at different time intervals post dose 1 and 2, compared to the time period of 0-14 days after the first dose. VE is preserved against infection post complete vaccination for BNT162b2 at day 147-154, for mRNA-1273 at day 126-133, for AZD1222 at day 49-56, and for Ad26.COV2.S at day 49-56. VE against hospitalization, ICU admission, and mortality also do not change significantly over time.</p> |
|---|---|-------|--|-------|---|-------------------------------------|--|

Figure 16. Adjusted estimates of the Incidence Rate Ratio of diagnosis at different time intervals from the administration of the first and second dose compared to the reference period (0-14 days from the first dose) by vaccine brand



| | | | | | | | |
|---|--|--------|---|-------|----------|----------------------|---|
| | | | | | | | |
| 2 | Israel et al (August 5, 2021) | Israel | All fully vaccinated persons enrolled in Leumit Health Services | Delta | BNT162b2 | May 15-July 26, 2021 | There was a significantly higher rate of positive results among patients who received their second vaccine dose at least 146 days before the RT-PCR test compared to patients who have received their vaccine less than 146 days before: adjusted odds ratio for infection was 2.76 (95% CI 1.62-3.08) for ≥ 60-year-old patients; 2.22 (95% CI 1.62-3.08) for patients 40-59-years; and 1.67 (95% CI 1.21-2.29) for 18-39-year-old patients. |
| 1 | Mizrahi et al (July 31, 2021) | Israel | 16+ year olds enrolled at Maccabi Health Services | Delta | BNT162b2 | June 1-July 27, 2021 | The study compared the rate of breakthrough infection during June and July, when Delta was the dominant strain, between individuals who received 2 doses of the vaccine earlier this year to individuals who received two doses of the vaccine more recently, while adjusting for confounders. The authors report that persons vaccinated between January and February 2021 had a 53% (95% CI: 40-68%) increased risk of breakthrough infection in June and July compared to individuals vaccinated between March and April 2021. There was no difference by age groups 16-39, 40-59, ≥60 years. No unvaccinated persons were included in the study; thus, vaccine effectiveness was not evaluated. |

Other data of interest:

- https://www.gov.il/BlobFolder/reports/vpb-12082021/he/files_publications_corona_vpb-12082021-01.pdf
- [Salo et al](#) HH transmission study in Finland, showing VE 10 weeks after 1 dose of an mRNA vaccine but is a mix of 1 and 2 dose recipients.
- Pfizer’s press announcement of 4 month efficacy in adolescents <https://www.pfizer.com/news/press-release/press-release-detail/follow-data-phase-3-trial-pfizer-biontech-covid-19-vaccine>

Note as of January 7, 2022 version, only true duration of protection analyses are included. Please look at the [update](#) from December 30, 2021 if you wish to see full list of previously included studies with other data such as Kaplan-Meier curves. Missing reference numbers in table above indicate studies that have been removed.