SUPPLEMENTARY TABLE. Average weekly incidence* (October 3, 2021-December 24, 2022), mortality ${ }^{\dagger}$ (October 3, 2021-December 3, 2022), and rate ratios for unvaccinated compared with persons vaccinated with a booster dose by age, variant period, ${ }^{5}$ and time since receipt of last booster dose ${ }^{\text {¹ }}$ - 23 jurisdictions,** October 2021-December 2022

| Age group/ vaccine type/ interval since last booster dose | October 3-December 18, 2021(Delta) |  |  | December 19, 2021-March 19, 2022 (Omicron BA.1) |  |  | March 20-June 25, 2022 (Omicron BA.2) |  |  | June 26-September 17, 2022 (early Omicron BA.4/BA.5) |  |  | September 18-December 24, 2022 (late Omicron BA.4/BA.5) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | No. | Incidence | Rate Ratio $(95 \% \mathrm{Cl})^{++}$ | No. | Incidence | Rate Ratio $(95 \% \mathrm{Cl})^{+\dagger}$ | No. | Incidence | Rate Ratio $(95 \% \mathrm{CI})^{++}$ | No. | Incidence | $\begin{aligned} & \text { Rate Ratio } \\ & (95 \% \mathrm{CI})^{++} \end{aligned}$ | No. | Incidenc e | Rate Ratio $(95 \% \mathrm{Cl})^{+\dagger}$ |
| Cases |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| All ages $\geq 12$ years (age-standardized) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 105,069 | 75.6 | $\begin{gathered} 2.8 \\ (2.5-3.1) \\ \hline \end{gathered}$ |
| BV 3 mos | - | - | - | - | - | - | - | - | - | - | - | - | 5,717 | 121.8 | $\begin{gathered} 1.7 \\ (1.2-2.4) \end{gathered}$ |
| MV 2 wks-2 mos | 45,969 | 60.7 | $\begin{gathered} \hline 7.0 \\ (4.0-12.6) \\ \hline \end{gathered}$ | 1,013,495 | 349.1 | $\begin{gathered} 3.4 \\ (2.2-5.2) \end{gathered}$ | 112,316 | 94.8 | $\begin{gathered} 2.4 \\ (2.3-2.5) \\ \hline \end{gathered}$ | 112,215 | 150.0 | $\begin{gathered} 2.8 \\ (2.6-2.9) \\ \hline \end{gathered}$ | 15,616 | 75.6 | $\begin{gathered} 2.8 \\ (2.5-3.1) \end{gathered}$ |
| MV 3-5 mos | 3,391 | 106.5 | $\begin{gathered} 4.9 \\ (2.4-10.0) \\ \hline \end{gathered}$ | 339,278 | 239.3 | $\begin{gathered} 5.0 \\ (3.3-7.5) \\ \hline \end{gathered}$ | 532,048 | 173.6 | $\begin{gathered} 1.3 \\ (1.2-1.4) \\ \hline \end{gathered}$ | 181,552 | 181.6 | $\begin{gathered} 2.3 \\ (2.2-2.4) \\ \hline \end{gathered}$ | 94,737 | 103.2 | $\begin{gathered} 2.0 \\ (1.9-2.2) \end{gathered}$ |
| MV 6-8 mos | - | - | - | 2,458 | 62.0 | $\begin{gathered} 2.4 \\ (1.8-3.3) \\ \hline \end{gathered}$ | 392,970 | 272.5 | $\begin{gathered} 0.8 \\ (0.8-0.9) \\ \hline \end{gathered}$ | 583,512 | 212.7 | $\begin{gathered} 1.9 \\ (1.8-2.1) \\ \hline \end{gathered}$ | 105,553 | 108.1 | $\begin{gathered} 1.9 \\ (1.8-2.1) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 8,300 | 241.0 | $\begin{gathered} 1.4 \\ (1.3-1.6) \\ \hline \end{gathered}$ | 211,593 | 181.5 | $\begin{gathered} 2.3 \\ (2.1-2.5) \\ \hline \end{gathered}$ | 329,018 | 111.0 | $\begin{gathered} 1.9 \\ (1.8-2.0) \\ \hline \end{gathered}$ |
| MV $\geq 12$ months | - | - | - | - | - | - | - | - | - | 2,261 | 126.7 | $\begin{gathered} 2.5 \\ (2.2-2.9) \\ \hline \end{gathered}$ | 121,730 | 122.1 | $\begin{gathered} 1.7 \\ (1.6-1.8) \end{gathered}$ |
| 12-17 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks -2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 893 | 24.9 | $\begin{gathered} 2.9 \\ (1.9-4.4) \end{gathered}$ |
| BV 3 mos | - | - | - | - | - | - | - | - | - | - | - | - | 49 | 46.6 | $\begin{gathered} 1.5 \\ (0.8-3.0) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | - | - | - | 7,821 | 94.6 | $\begin{gathered} 5.0 \\ (2.6-9.6) \end{gathered}$ | 4,593 | 61.7 | $\begin{gathered} 1.5 \\ (1.2-1.9) \\ \hline \end{gathered}$ | 1,938 | 67.3 | $\begin{gathered} 2.9 \\ (1.5-5.7) \end{gathered}$ | 449 | 36.8 | $\begin{gathered} 2.0 \\ (1.3-2.9) \\ \hline \end{gathered}$ |
| MV 3-5 mos | - | - | - | 302 | 145.1 | $\begin{gathered} 3.3 \\ (1.7-6.1) \\ \hline \end{gathered}$ | 20,224 | 159.7 | $\begin{gathered} 0.6 \\ (0.5-0.8) \\ \hline \end{gathered}$ | 6,543 | 103.5 | $\begin{gathered} 1.9 \\ (1.0-3.5) \\ \hline \end{gathered}$ | 1,651 | 45.3 | $\begin{gathered} 1.6 \\ (1.0-2.5) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 11 | 41.0 | $\begin{gathered} 1.8 \\ (0.5-6.2) \\ \hline \end{gathered}$ | 600 | 141.0 | $\begin{gathered} 0.7 \\ (0.5-0.8) \\ \hline \end{gathered}$ | 13,201 | 115.5 | $\begin{gathered} 1.7 \\ (0.9-3.2) \\ \hline \end{gathered}$ | 4,150 | 57.2 | $\begin{gathered} 1.3 \\ (0.8-2.0) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 36 | 104.7 | $\begin{gathered} 1.2 \\ (0.5-2.8) \\ \hline \end{gathered}$ | 184 | 69.9 | $\begin{gathered} 2.8 \\ (1.1-7.0) \end{gathered}$ | 5,578 | 49.8 | $\begin{gathered} 1.4 \\ (1.0-2.0) \\ \hline \end{gathered}$ |
| 18-49 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 25,419 | 78.9 | $\begin{gathered} 1.9 \\ (1.7-2.1) \end{gathered}$ |
| BV 3 mos | - | - | - | - | - | - | - | - | - | - | - | - | 1,667 | 133.0 | $\begin{gathered} 1.1 \\ (0.7-1.9) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 20,271 | 87.6 | $\begin{gathered} 5.0 \\ (2.4-10.2) \\ \hline \end{gathered}$ | 516,412 | 438.1 | $\begin{gathered} 2.8 \\ (1.5-5.2) \\ \hline \end{gathered}$ | 28,370 | 89.4 | $\begin{gathered} 2.2 \\ (2.0-2.4) \\ \hline \end{gathered}$ | 15,023 | 155.1 | $\begin{gathered} 2.3 \\ (2.1-2.4) \\ \hline \end{gathered}$ | 2,526 | 73.1 | $\begin{gathered} 2.0 \\ (1.7-2.4) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 1,096 | 142.4 | $\begin{gathered} 3.7 \\ (1.4-9.6) \\ \hline \end{gathered}$ | 111,434 | 287.0 | $\begin{gathered} 4.2 \\ (2.2-8.0) \\ \hline \end{gathered}$ | 288,804 | 208.7 | $\begin{gathered} 0.9 \\ (0.9-1.0) \\ \hline \end{gathered}$ | 53,465 | 202.4 | $\begin{gathered} 1.7 \\ (1.6-1.9) \end{gathered}$ | 11,526 | 97.5 | $\begin{gathered} 1.5 \\ (1.4-1.7) \end{gathered}$ |
| MV 6-8 mos | - | - | - | 500 | 66.2 | $\begin{gathered} 1.8 \\ (1.1-2.9) \\ \hline \end{gathered}$ | 160,673 | 329.4 | $\begin{gathered} 0.6 \\ (0.5-0.7) \\ \hline \end{gathered}$ | 275,107 | 226.1 | $\begin{gathered} \hline 1.5 \\ (1.4-1.7) \\ \hline \end{gathered}$ | 33,098 | 105.1 | $\begin{gathered} 1.4 \\ (1.3-1.6) \\ \hline \end{gathered}$ |


| MV 9-11 mos | - | - | - | - | - | - | 2,573 | 272.1 | $\begin{gathered} \hline 1.1 \\ (0.9-1.3) \\ \hline \end{gathered}$ | 75,266 | 194.4 | $\begin{gathered} \hline 1.8 \\ (1.6-2.0) \\ \hline \end{gathered}$ | 142,773 | 109.8 | $\begin{gathered} \hline 1.4 \\ (1.2-1.5) \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 569 | 119.3 | $\begin{gathered} \hline 2.2 \\ (1.8-2.6) \\ \hline \end{gathered}$ | 38,255 | 122.5 | $\begin{gathered} \hline 1.2 \\ (1.1-1.4) \\ \hline \end{gathered}$ |
| 50-64 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 24,647 | 82.1 | $\begin{gathered} \hline 2.7 \\ (2.5-3.0) \\ \hline \end{gathered}$ |
| BV 3 mos | - | - | - | - | - | - | - | - | - | - | - | - | 1,216 | 121.3 | $\begin{gathered} \hline 1.8 \\ (1.2-2.8) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 10,476 | 41.3 | $\begin{gathered} 11.2 \\ (7.2-17.5) \\ \hline \end{gathered}$ | 280,390 | 314.7 | $\begin{gathered} 3.9 \\ (2.0-7.5) \\ \hline \end{gathered}$ | 30,792 | 112.3 | $\begin{gathered} 2.2 \\ (2.0-2.4) \\ \hline \end{gathered}$ | 36,506 | 169.5 | $\begin{gathered} \hline 2.5 \\ (2.3-2.7) \\ \hline \end{gathered}$ | 4,907 | 84.2 | $\begin{gathered} 2.6 \\ (2.4-2.9) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 931 | 94.3 | $\begin{gathered} 6.1 \\ (3.8-9.7) \\ \hline \end{gathered}$ | 81,814 | 201.1 | $\begin{gathered} 6.1 \\ (3.3-11.6) \\ \hline \end{gathered}$ | 137,083 | 139.9 | $\begin{gathered} 1.7 \\ (1.6-9) \\ \hline \end{gathered}$ | 46,104 | 173.9 | $\begin{gathered} 2.4 \\ (2.3-2.6) \\ \hline \end{gathered}$ | 27,630 | 117.6 | $\begin{gathered} 1.9 \\ (1.7-2.1) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 579 | 60.3 | $\begin{gathered} 2.7 \\ (1.3-5.3) \\ \hline \end{gathered}$ | 99,111 | 242.0 | $\begin{gathered} \hline 1.0 \\ (0.9-1.1) \\ \hline \end{gathered}$ | 161,628 | 218.3 | $\begin{gathered} \hline 1.9 \\ (1.8-2.1) \\ \hline \end{gathered}$ | 26,612 | 114.4 | $\begin{gathered} \hline 2.0 \\ (1.8-2.1) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 1,982 | 224.1 | $\begin{gathered} \hline 1.6 \\ (1.4-1.9) \\ \hline \end{gathered}$ | 50,497 | 188.7 | $\begin{gathered} 2.3 \\ (2.1-2.4) \end{gathered}$ | 93,495 | 123.4 | $\begin{gathered} \hline 1.8 \\ (1.7-1.9) \\ \hline \end{gathered}$ |
| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 579 | 141.6 | $\begin{gathered} \hline 2.2 \\ (1.6-3.1) \\ \hline \end{gathered}$ | 30,969 | 142.8 | $\begin{gathered} \hline 1.6 \\ (1.4-1.7) \\ \hline \end{gathered}$ |
| 65-79 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 36,801 | 83.0 | $\begin{gathered} \hline 6.1 \\ (5.4-6.9) \\ \hline \end{gathered}$ |
| BV 3 mos | - | - | - | - | - | - | - | - | - | - | - | - | 2,068 | 120.2 | $\begin{gathered} \hline 4.2 \\ (2.8-6.4) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 11,455 | 25.0 | $\begin{gathered} 28.9 \\ (20.9-39.9) \\ \hline \end{gathered}$ | 161,805 | 234.5 | $\begin{gathered} \hline 7.3 \\ (3.9-13.4) \\ \hline \end{gathered}$ | 36,809 | 114.2 | $\begin{gathered} \hline 3.8 \\ (3.5-4.2) \\ \hline \end{gathered}$ | 41,913 | 154.0 | $\begin{gathered} \hline 5.3 \\ (4.9-5.8) \\ \hline \end{gathered}$ | 5,267 | 87.8 | $\begin{gathered} \hline 5.8 \\ (5.1-6.5) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 1,110 | 64.3 | $\begin{gathered} 13.6 \\ (8.9-20.8) \\ \hline \end{gathered}$ | 111,798 | 172.7 | $\begin{gathered} 9.9 \\ (5.9-16.4) \\ \hline \end{gathered}$ | 64,409 | 90.0 | $\begin{gathered} \hline 4.8 \\ (4.4-5.3) \\ \hline \end{gathered}$ | 54,454 | 155.5 | $\begin{gathered} \hline 5.3 \\ (5.0-5.6) \\ \hline \end{gathered}$ | 34,780 | 123.4 | $\begin{gathered} \hline 4.1 \\ (3.7-4.6) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 1,036 | 61.3 | $\begin{gathered} \hline 5.4 \\ (3.4-8.5) \\ \hline \end{gathered}$ | 97,275 | 179.5 | $\begin{gathered} \hline 2.4 \\ (2.2-2.6) \\ \hline \end{gathered}$ | 100,057 | 211.5 | $\begin{gathered} \hline 3.9 \\ (3.7-4.1) \\ \hline \end{gathered}$ | 27,406 | 124.1 | $\begin{gathered} \hline 4.1 \\ (3.7-4.5) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 2,810 | 232.5 | $\begin{gathered} \hline 2.8 \\ (2.5-3.1) \\ \hline \end{gathered}$ | 61,401 | 187.9 | $\begin{gathered} \hline 4.4 \\ (4.1-4.6) \\ \hline \end{gathered}$ | 61,596 | 126.8 | $\begin{gathered} \hline 4.0 \\ (3.6-4.4) \\ \hline \end{gathered}$ |
| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 827 | 159.6 | $\begin{gathered} \hline 4.0 \\ (3.7-4.3) \\ \hline \end{gathered}$ | 35,196 | 143.0 | $\begin{gathered} \hline 3.5 \\ (3.2-3.9) \\ \hline \end{gathered}$ |
| $\geq 80$ years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 17,309 | 130.6 | $\begin{gathered} 4.1 \\ (3.5-4.8) \\ \hline \end{gathered}$ |
| BV 3 mos | - | - | - | - | - | - | - | - | - | - | - | - | 717 | 164.7 | $\begin{gathered} 3.3 \\ (2.0-5.3) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 3,767 | 27.3 | $\begin{gathered} 16.6 \\ (13.2-20.9) \\ \hline \end{gathered}$ | 47,067 | 235.6 | $\begin{gathered} 5.0 \\ (2.9-8.6) \\ \hline \end{gathered}$ | 11,752 | 123.2 | $\begin{gathered} 2.9 \\ (2.6-3.3) \\ \hline \end{gathered}$ | 16,835 | 193.3 | $\begin{gathered} 3.5 \\ (3.3-3.8) \\ \hline \end{gathered}$ | 2,467 | 136.3 | $\begin{gathered} 3.9 \\ (3.3-4.7) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 254 | 52.3 | $\begin{gathered} 10.7 \\ (8.4-13.7) \\ \hline \end{gathered}$ | 33,930 | 173.4 | $\begin{gathered} 6.7 \\ (4.4-10.3) \\ \hline \end{gathered}$ | 21,528 | 104.9 | $\begin{gathered} 3.4 \\ (3.0-3.9) \\ \hline \end{gathered}$ | 20,986 | 199.4 | $\begin{gathered} 3.4 \\ (3.2-3.6) \\ \hline \end{gathered}$ | 19,150 | 210.6 | $\begin{gathered} 2.5 \\ (2.2-3.0) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 332 | 67.9 | $\begin{gathered} 4.1 \\ (2.5-6.7) \\ \hline \end{gathered}$ | 35,311 | 213.0 | $\begin{gathered} 1.7 \\ (1.5-1.9) \\ \hline \end{gathered}$ | 33,519 | 254.6 | $\begin{gathered} 2.7 \\ (2.5-2.8) \\ \hline \end{gathered}$ | 14,287 | 209.4 | $\begin{gathered} 2.6 \\ (2.2-2.9) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 899 | 257.4 | $\begin{gathered} 2.0 \\ (1.8-2.4) \\ \hline \end{gathered}$ | 24,245 | 240.0 | $\begin{gathered} 2.8 \\ (2.6-3.0) \\ \hline \end{gathered}$ | 25,576 | 185.6 | $\begin{gathered} 2.9 \\ (2.5-3.3) \\ \hline \end{gathered}$ |


| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 270 | 181.0 | $\begin{gathered} 3.0 \\ (2.5-3.7) \\ \hline \end{gathered}$ | 17,234 | 214.3 | $\begin{gathered} 2.5 \\ (2.2-2.9) \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Deaths by age group and time since vaccination |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| All ages $\mathbf{\geq 1 2}$ years (age-standardized) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 220 | 0.1 | $\begin{gathered} \hline 15.2 \\ (11.3-20.3) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 580 | 0.2 | $\begin{gathered} 50.7 \\ (32.8-78.3) \\ \hline \end{gathered}$ | 3,136 | 0.7 | $\begin{array}{\|c\|} \hline 21.4 \\ (16.8-27.3) \\ \hline \end{array}$ | 361 | 0.2 | $\begin{gathered} \hline 7.9 \\ (5.5-11.4) \\ \hline \end{gathered}$ | 655 | 0.4 | $\begin{gathered} \hline 7.4 \\ (5.2-10.7) \\ \hline \end{gathered}$ | 109 | 0.3 | $\begin{gathered} 6.5 \\ (4.2-10.1) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 61 | 0.7 | $\begin{gathered} 20.1 \\ (12.0-33.6) \end{gathered}$ | 2,609 | 0.7 | $\begin{gathered} 22.1 \\ (17.4-28.1) \\ \hline \end{gathered}$ | 886 | 0.2 | $\begin{gathered} 7.5 \\ (5.8-9.8) \end{gathered}$ | 797 | 0.4 | $\begin{gathered} 7.2 \\ (5.6-9.3) \end{gathered}$ | 555 | 0.4 | $\begin{gathered} 5.0 \\ (3.5-7.0) \end{gathered}$ |
| MV 6-8 mos | - | - | - | 54 | 0.6 | $\begin{gathered} 9.1 \\ (4.7-17.7) \\ \hline \end{gathered}$ | 1,380 | 0.4 | $\begin{gathered} 3.6 \\ (2.9-4.4) \end{gathered}$ | 1,803 | 0.6 | $\begin{gathered} 4.6 \\ (3.9-5.5) \\ \hline \end{gathered}$ | 360 | 0.3 | $\begin{gathered} 5.4 \\ (4.5-6.5) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 48 | 0.7 | $\begin{gathered} 2.7 \\ (1.7-4.2) \end{gathered}$ | 1,323 | 0.6 | $\begin{gathered} 4.5 \\ (3.7-5.5) \\ \hline \end{gathered}$ | 981 | 0.4 | $\begin{gathered} 5.1 \\ (4.4-6.0) \end{gathered}$ |
| $\mathrm{MV} \geq 12$ months | - | - | - | - | - | - | - | - | - | 32 | 1.0 | $\begin{gathered} 2.5 \\ (0.9-6.7) \\ \hline \end{gathered}$ | 387 | 0.4 | $\begin{gathered} 4.7 \\ (3.3-6.8) \end{gathered}$ |
| 12-17 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 0 | 0 | - |
| MV 2 wks-2 mos | - | - | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| MV 3-5 mos | - | - | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| MV 6-8 mos | - | - | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| MV 9-11 mos | - | - | - | - | - | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| 18-49 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0.01 | $\begin{gathered} \hline 14.6 \\ (9.1-23.4) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 9 | 0.05 | $\begin{gathered} 29.8 \\ (2.5-355.6) \\ \hline \end{gathered}$ | 58 | 0.1 | $\begin{array}{\|c\|} \hline 16.8 \\ (11.1-25.4) \\ \hline \end{array}$ | 4 | 0.02 | $\begin{gathered} \hline 6.1 \\ (0.6-61.5) \\ \hline \end{gathered}$ | 5 | 0.1 | $\begin{gathered} 2.6 \\ (0.1-54.3) \end{gathered}$ | 0 | 0 | - |
| MV 3-5 mos | 1 | 0.1 | $\begin{gathered} 10.0 \\ (0.3-353.9) \\ \hline \end{gathered}$ | 38 | 0.1 | $\begin{gathered} \hline 8.9 \\ (3.9-20.1) \\ \hline \end{gathered}$ | 16 | 0.01 | $\begin{gathered} \hline 6.8 \\ (1.7-26.9) \\ \hline \end{gathered}$ | 16 | 0.1 | $\begin{gathered} 2.1 \\ (0.4-10.1) \\ \hline \end{gathered}$ | 7 | 0.1 | $\begin{gathered} \hline 1.0 \\ (0.1-12.0) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 0 | 0 | - | 22 | 0.1 | $\begin{gathered} 1.8 \\ (0.4-9.4) \\ \hline \end{gathered}$ | 52 | 0.1 | $\begin{gathered} 3.0 \\ (1.4-6.4) \\ \hline \end{gathered}$ | 6 | 0.03 | $\begin{gathered} 3.0 \\ (0.4-20.9) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 2 | 0.2 | $\begin{gathered} 0.5 \\ (0.1-2.1) \\ \hline \end{gathered}$ | 19 | 0.1 | $\begin{gathered} \hline 2.7 \\ (0.6-11.8) \\ \hline \end{gathered}$ | 14 | 0.02 | $\begin{gathered} 5.2 \\ (1.3-20.3) \\ \hline \end{gathered}$ |
| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 1 | 0.2 | $\begin{gathered} \hline 0.6 \\ (0.003- \\ 139.8) \\ \hline \end{gathered}$ | 3 | 0.02 | $\begin{gathered} \hline 3.6 \\ (0.001- \\ 12,191.5) \\ \hline \end{gathered}$ |
| 50-64 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 9 | 0.1 | $\begin{gathered} 13.8 \\ (2.3-83.9) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 70 | 0.3 | $\begin{gathered} \hline 36.5 \\ (11.7-113.6) \\ \hline \end{gathered}$ | 338 | 0.5 | $\begin{gathered} \hline 24.3 \\ (15.2-38.7) \\ \hline \end{gathered}$ | 34 | 0.2 | $\begin{gathered} \hline 5.3 \\ (1.4-19.7) \\ \hline \end{gathered}$ | 32 | 0.2 | $\begin{gathered} 8.7 \\ (3.0-25.2) \\ \hline \end{gathered}$ | 12 | 0.2 | $\begin{gathered} \hline 3.2 \\ (0.7-15.1) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 13 | 1.5 | $\begin{gathered} 9.3 \\ (4.7-18.7) \\ \hline \end{gathered}$ | 247 | 0.7 | $\begin{gathered} 15.8 \\ (7.3-34.2) \\ \hline \end{gathered}$ | 97 | 0.1 | $\begin{gathered} 6.6 \\ (3.2-13.8) \\ \hline \end{gathered}$ | 50 | 0.2 | $\begin{gathered} 6.5 \\ (2.8-15.1) \\ \hline \end{gathered}$ | 34 | 0.2 | $\begin{gathered} 3.9 \\ (1.6-9.6) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 9 | 1.0 | $\begin{gathered} \hline 3.4 \\ (1.4-81) \\ \hline \end{gathered}$ | 90 | 0.3 | $\begin{gathered} \hline 3.1 \\ (1.6-6.0) \\ \hline \end{gathered}$ | 181 | 0.3 | $\begin{gathered} 4.9 \\ (2.8-8.6) \\ \hline \end{gathered}$ | 27 | 0.2 | $\begin{gathered} \hline 4.3 \\ (1.9-10.0) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - |  | - | - | 7 | 0.9 | $\begin{gathered} 1.1 \\ (0.6-2.1) \\ \hline \end{gathered}$ | 88 | 0.4 | $\begin{gathered} \hline 3.8 \\ (1.7-8.7) \\ \hline \end{gathered}$ | 95 | 0.2 | $\begin{gathered} \hline 4.2 \\ (2.0-8.7) \\ \hline \end{gathered}$ |


| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - |  | - | - | - | - | - | 2 | 0.5 | $\begin{gathered} 2.6 \\ (0.02- \\ 430.4) \end{gathered}$ | 20 | 0.2 | $\begin{gathered} \hline 3.6 \\ (0.5-23.5) \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 65-79 years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 71 | 0.3 | $\begin{gathered} 25.4 \\ (14.8-43.6) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 267 | 0.7 | $\begin{array}{c\|} \hline 81.5 \\ (53.2-124.8) \\ \hline \end{array}$ | 1,104 | 1.9 | $\begin{gathered} \hline 36.9 \\ (26.6-51.2) \\ \hline \end{gathered}$ | 116 | 0.4 | $\begin{gathered} 13.8 \\ (8.4-22.9) \\ \hline \end{gathered}$ | 186 | 0.8 | $\begin{gathered} 14.2 \\ (8.8-22.7) \\ \hline \end{gathered}$ | 36 | 0.7 | $\begin{gathered} 10.2 \\ (3.4-31.0) \\ \hline \end{gathered}$ |
| MV 3-5 mos | 29 | 1.9 | $\begin{gathered} 35.9 \\ (23.1-55.7) \end{gathered}$ | 1,113 | 2.0 | $\begin{gathered} 35.5 \\ (25.0-50.4) \end{gathered}$ | 278 | 0.5 | $\begin{gathered} 12.7 \\ (8.3-19.4) \end{gathered}$ | 285 | 1.0 | $\begin{gathered} 11.5 \\ (7.4-17.9) \end{gathered}$ | 156 | 0.7 | $\begin{gathered} 10.0 \\ (6.6-15.2) \end{gathered}$ |
| MV 6-8 mos | - | - | - | 27 | 1.8 | $\begin{gathered} 12.9 \\ (4.1-40.1) \end{gathered}$ | 388 | 0.8 | $\begin{gathered} 7.1 \\ (5.2-9.7) \end{gathered}$ | 596 | 1.5 | $\begin{gathered} 7.3 \\ (5.3-10.2) \end{gathered}$ | 124 | 0.9 | $\begin{gathered} 8.3 \\ (5.7-11.9) \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 19 | 1.7 | $\begin{gathered} \hline 4.4 \\ (1.4-14.3) \end{gathered}$ | 508 | 1.8 | $\begin{gathered} 6.2 \\ (5.0-7.7) \end{gathered}$ | 320 | 0.9 | $\begin{gathered} \hline 8.0 \\ (5.7-11.3) \end{gathered}$ |
| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 14 | 3.0 | $\begin{gathered} 3.3 \\ (0.9-12.0) \\ \hline \end{gathered}$ | 132 | 1.0 | $\begin{gathered} 6.9 \\ (4.9-9.8) \\ \hline \end{gathered}$ |
| $\geq 80$ years |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BV 2 wks-2 mos | - | - | - | - | - | - | - | - | - | - | - | - | 139 | 1.9 | $\begin{gathered} \hline 11.2 \\ (8.0-15.5) \\ \hline \end{gathered}$ |
| MV 2 wks-2 mos | 234 | 2.0 | $\begin{gathered} 38.5 \\ (24.1-61.5) \end{gathered}$ | 1,636 | 10.0 | $\begin{gathered} 12.9 \\ (8.5-19.6) \end{gathered}$ | 207 | 2.6 | $\begin{gathered} 6.1 \\ (3.9-9.5) \end{gathered}$ | 432 | 5.8 | $\begin{gathered} 5.4 \\ (3.8-7.7) \end{gathered}$ | 61 | 4.0 | $\begin{gathered} 5.3 \\ (3.6-7.7) \end{gathered}$ |
| MV 3-5 mos | 18 | 4.3 | $\begin{gathered} 21.8 \\ (10.8-43.8) \\ \hline \end{gathered}$ | 1,211 | 7.3 | $\begin{gathered} 17.6 \\ (12.5-24.9) \\ \hline \end{gathered}$ | 495 | 2.9 | $\begin{gathered} 5.5 \\ (3.9-7.7) \\ \hline \end{gathered}$ | 446 | 5.1 | $\begin{gathered} 6.1 \\ (4.8-7.7) \\ \hline \end{gathered}$ | 358 | 5.1 | $\begin{gathered} 4.1 \\ (3.4-4.8) \\ \hline \end{gathered}$ |
| MV 6-8 mos | - | - | - | 18 | 4.2 | $\begin{gathered} \hline 10.2 \\ (2.5-41.9) \\ \hline \end{gathered}$ | 880 | 6.2 | $\begin{gathered} 2.6 \\ (2.1-3.1) \\ \hline \end{gathered}$ | 974 | 9.0 | $\begin{gathered} 3.5 \\ (2.7-4.4) \\ \hline \end{gathered}$ | 203 | 4.8 | $\begin{gathered} 4.4 \\ (3.6-5.3) \\ \hline \end{gathered}$ |
| MV 9-11 mos | - | - | - | - | - | - | 20 | 6.4 | $\begin{gathered} 3.5 \\ (2.1-5.7) \\ \hline \end{gathered}$ | 708 | 8.2 | $\begin{gathered} 3.9 \\ (2.9-5.1) \\ \hline \end{gathered}$ | 552 | 5.3 | $\begin{gathered} \hline 3.9 \\ (3.3-4.6) \\ \hline \end{gathered}$ |
| $\mathrm{MV} \geq 12 \mathrm{mos}$ | - | - | - | - | - | - | - | - | - | 15 | 11.3 | $\begin{gathered} 2.4 \\ (1.2-4.9) \\ \hline \end{gathered}$ | 232 | 5.5 | $\begin{gathered} 3.8 \\ (3.0-4.8) \\ \hline \end{gathered}$ |

Abbreviations: BV = Bivalent booster; MV = Monovalent booster; "-" = not applicable/calculated.

* Cases per 100,000 persons aged $\geq 12$ years. COVID-19 cases among unvaccinated persons and persons vaccinated with a primary series with or without a monovalent or bivalent booster dose were defined as previously described ( https://www.cdc.gov/coronavirus/2019-ncov/php/hd-breakthrough.). Cases were excluded in persons who only completed a primary series or who received at least one FDA-authorized vaccine dose but did not complete a primary series $\geq 14$ days prior to the positive specimen collection date.
${ }^{\dagger}$ Deaths per 100,000 persons aged $\geq 12$ years. A COVID-19-associated death occurred in a person with a documented COVID-19 diagnosis who died, and whose report local health authorities reviewed (e.g., using vital records, public health investigation, or other data sources)-make that determination. Per national guidance, this group includes persons whose death certificate lists COVID-19 disease or SARS-CoV-2 as an underlying cause of death or as a significant condition contributing-death. COVID-19 mortality by vaccination status is reported based on COVID-19 test date, not the date the patient died.
${ }^{\S}$ Analysis periods were categorized based on variant predominance (defined as $>50 \%$ ): Delta, October 3-December 18, 2021; Omicron BA.1, December 19, 2021-March 19, 2022; Omicron BA.2, March 20-June 25, 2022; early Omicron BA.4/BA.5, June 26-September 17, 2022; late Omicron BA.4/BA. 5 (only period where BV boosters were recommended), September 18-December 24, 2022
${ }^{9}$ Time since last monovalent booster categories were restricted to outcomes occurring during eligible weeks based on the timing of the first booster recommendation for adults $\geq 65$ years and adults ages $\geq 18$ years in high-risk groups on September 24, 2021: 2 weeks -2 months (starting October 3, 2021); 3-5 months (starting November 13, 2021); 6-8 months (starting February 13, 2022); 9-11 months (starting May 15, 2022); $\geq 12$ months (starting August 14, 2022). For people ages 12-17 years, boosters were recommended for all on January 5, 2022; data are included the week starting January 16, 2022. Bivalent boosters were included for the period starting September 18, 2022, and for categories
of 2 weeks-2 months and 3-5 months after receipt of a booster for cases and 2 weeks-2 months after receipt of a booster for deaths. Unvaccinated persons are compared to vaccinated persons for the same time frame in each category. The median interval in the 2 weeks -2 months since vaccination period was longer for persons with monovalent boosters during early ( 60 days) and late ( 70 days) BA.4/BA. 5 periods than for those who received bivalent boosters ( 47 days). The median interval among persons who received a monovalent booster $3-5$ months earlier was 131 and 144 days, respectively, during early and late BA.4/BA. 5 periods; among those who received bivalent boosters $3-5$ months earlier, the median interval was 95 days.
** These 23 states represent $50 \%$ of the overall U.S. population and were included in this analysis: Alabama, Arkansas, Arizona, Colorado, District of Columbia, Georgia, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Nebraska, New Jersey, New Mexico, New York, North Carolina, Tennessee, Texas, Utah, Washington, West Virginia; New York did not provide mortality data.
${ }^{\dagger+} 95 \%$ Cls calculated after detrending underlying linear changes in weekly rates using piecewise linear regression. Each $95 \% \mathrm{Cl}$ represents the remaining variation in observed weekly rates and resulting rate ratios. The number of observations informing each $95 \% \mathrm{Cl}$ reflects the number of weeks per period: Delta (11), Omicron BA. 1 (13), Omicron BA. 2 (14), early Omicron BA.4/BA. 5 (12), and late Omicron BA.4/BA. 5 (14).

