

**Supplementary Table 1.** Definition of history of chronic diseases included in the analysis

| Disease                     | ICD codes*  | Other elements of the definition  |
|-----------------------------|---|---|
| Acute myocardial infarction | I2100, I2110, I2120, I2130, I2140, I2190, I2191, I2200, I2210, I2280, I2290, I2300, I2310, I2320, I2330, I2340, I2350, I2360, I2380, I2400, I2490 |   |
| Angina                      | I20   |   |
| Chronic heart failure       | I50, I42, I110, J81   |   |
| Peripheral arterial disease | I70   |   |
| Stroke                      | I61, I6290, I63, I64, I74   |   |
| Asthma bronchiale           | J40-44, J47   | the time lag between the first and second occurrences 30-365 days   |
| COPD                        | J45, 46   | the time lag between the first and second occurrences 30-365 days   |
| Diabetes mellitus           | a) E10-14 or<br>b) not required<br>and<br>polycystic ovary syndrome (E282) or gestational diabetes (O24)  | at least 1 prescription of antidiabetic treatment (ATC A10)<br>at least 2 prescriptions of antidiabetic treatment (ATC A10)       |
| Type 1                      |   | only insulin or maximum 3 oral antidiabetic prescriptions together with insulin prescriptions in the first half year of treatment |
| Type 2                      |   | not Type 1 diabetes   |
| Chronic kidney disease      | N02, N03, N04, N05, N06, N07, N08, N11, N12, N14, N15, N16, N18, N19, N26, N27, N28, N29  |   |
| Neoplasms                   | All ICD codes starting with C   |   |
| Transplantation             | All patients from registry of transplantation   |   |
| Immunosuppression           | D5900, D5910, D6920, D8690, E05, E0630, G61, G70, I73, K50, K51, K52, K7430, K90, L10, L40, L9590, M0690, M30, M31, M32, M33, M35, M36            |   |

COPD: chronic obstructive pulmonary disease; ICD: International Classification of Diseases; ATC: Anatomical Therapeutic Chemical

\* Two occurrences of ICD-10 codes in outpatient or inpatient claims data since 1 January 2013

**Supplementary Table 2.** Incidence, crude and adjusted effectiveness of vaccine combinations against registered SARS-CoV-2 **infection** during the Delta wave in the *18-64 years old* Hungarian population

| Vaccination                   | Number of cases | Average population size<br>(1000 persons) | Incidence rate<br>(per 100 000 person-days)<br>(95% CI) | Crude vaccine efficacy<br>(%)<br>(95% CI) | Adjusted vaccine efficacy<br>(%)<br>(95% CI) |
|-------------------------------|-----------------|---|---|---|--|
| <b>Unvaccinated</b>           | 148 198         | 1 992.85                                  | 67.60 (67.26; 67.95)                                    | reference                                 | reference                                    |
| <b>Pfizer-BionTech</b>        |                 |   |   |   |  |
| primary 14-120 days           | 3 664           | 289.27                                    | 11.51 (11.14; 11.89)                                    | 83.0 (82.4; 83.5)                         | 70.3 (69.2; 71.3)                            |
| primary 121-180 days          | 24 917          | 549.89                                    | 41.19 (40.68; 41.71)                                    | 39.1 (38.2; 39.9)                         | 48.8 (47.8; 49.7)                            |
| primary 181-240 days          | 20 629          | 240.00                                    | 78.14 (77.08; 79.21)                                    | -15.6 (-17.3; -13.9)                      | 22.5 (20.9; 24.0)                            |
| primary >240 days             | 6 722           | 63.85                                     | 95.70 (93.43; 98.02)                                    | -41.6 (-45.1; -38.1)                      | 0.6 (-2.3; 3.4)                              |
| Pfizer booster 14-120 days    | 3 240           | 191.11                                    | 15.41 (14.89; 15.95)                                    | 77.2 (76.4; 78.0)                         | 82.2 (81.5; 82.8)                            |
| Moderna booster 14-120 days   | 91              | 6.65                                      | 12.45 (10.02; 15.28)                                    | 81.6 (77.4; 85.2)                         | 85.8 (82.6; 88.4)                            |
| Sinopharm booster 14-120 days | 307             | 4.56                                      | 61.19 (54.54; 68.43)                                    | 9.5 (-1.2; 19.3)                          | 24.5 (15.4; 32.5)                            |
| Janssen booster 14-120 days   | 118             | 7.08                                      | 15.16 (12.55; 18.16)                                    | 77.6 (73.1; 81.4)                         | 82.4 (78.9; 85.3)                            |
| <b>Moderna</b>                |                 |   |   |   |  |
| primary 14-120 days           | 191             | 33.48                                     | 5.19 (4.48; 5.98)                                       | 92.3 (91.2; 93.4)                         | 76.9 (73.3; 80.0)                            |
| primary 121-180 days          | 2 899           | 97.15                                     | 27.13 (26.15; 28.13)                                    | 59.9 (58.4; 61.3)                         | 63.6 (62.2; 65.1)                            |
| primary 181-240 days          | 2 820           | 46.40                                     | 55.26 (53.24; 57.33)                                    | 18.3 (15.2; 21.3)                         | 49.4 (47.3; 51.4)                            |
| primary >240 days             | 104             | 1.33                                      | 71.30 (58.26; 86.39)                                    | -5.5 (-27.8; 13.8)                        | 22.6 (6.1; 36.2)                             |
| Pfizer booster 14-120 days    | 102             | 8.62                                      | 10.76 (8.77; 13.06)                                     | 84.1 (80.7; 87.0)                         | 87.7 (85.1; 88.4)                            |
| Moderna booster 14-120 days   | 145             | 14.15                                     | 9.31 (7.86; 10.96)                                      | 86.2 (83.8; 88.4)                         | 88.9 (86.9; 90.6)                            |
| Sinopharm booster 14-120 days | 19              | 0.69                                      | 25.15 (15.14; 39.27)                                    | 62.8 (41.9; 77.6)                         | 69.5 (52.1; 80.5)                            |
| Janssen booster 14-120 days   | 23              | 1.35                                      | 14.06 (8.91; 21.10)                                     | 77.1 (65.7; 85.5)                         | 82.1 (73.0; 88.1)                            |
| <b>Sputnik</b>                |                 |   |   |   |  |
| primary 14-120 days           | 386             | 26.38                                     | 13.30 (12.01; 14.70)                                    | 80.3 (78.3; 82.2)                         | 38.3 (31.8; 44.3)                            |
| primary 121-180 days          | 8 642           | 275.34                                    | 28.53 (27.94; 29.14)                                    | 57.8 (56.9; 58.7)                         | 23.3 (21.3; 25.3)                            |
| primary 181-240 days          | 25 412          | 229.77                                    | 100.54 (99.31; 101.79)                                  | -48.7 (-50.7; -46.8)                      | 10.6 (8.8; 12.4)                             |
| primary >240 days             | 796             | 11.13                                     | 65.03 (60.59; 69.71)                                    | 3.8 (-3.1; 10.4)                          | -4.6 (-12.5; 2.9)                            |
| Pfizer booster 14-120 days    | 1 826           | 122.90                                    | 13.51 (12.89; 14.14)                                    | 80.0 (79.1; 80.9)                         | 83.6 (82.8; 84.4)                            |
| Moderna booster 14-120 days   | 184             | 12.42                                     | 13.46 (11.59; 15.55)                                    | 80.1 (77.0; 82.9)                         | 84.0 (81.5; 86.2)                            |
| Sinopharm booster 14-120 days | 66              | 1.31                                      | 45.95 (35.54; 58.46)                                    | 32.0 (13.5; 47.4)                         | 38.9 (22.2; 52.0)                            |

|                               |        |        |                         |                         |                     |
|-------------------------------|--------|--------|-------------------------|-------------------------|---------------------|
| Janssen booster 14-120 days   | 337    | 6.58   | 46.57 (41.73; 51.82)    | 31.1 (23.3; 38.3)       | 47.2 (41.2; 52.6)   |
| <b>Astra-Zeneca</b>           |        |        |                         |                         |                     |
| primary 14-120 days           | 2 205  | 120.53 | 16.63 (15.94; 17.34)    | 75.4 (74.3; 76.4)       | 39.2 (36.4; 41.9)   |
| primary 121-180 days          | 13 200 | 167.84 | 71.50 (70.28; 72.73)    | -5.8 (-7.7; -3.9)       | 25.6 (23.9; 27.3)   |
| primary 181-240 days          | 3 995  | 50.16  | 72.40 (70.17; 74.68)    | -7.1 (-10.5; -3.8)      | -0.5 (-4.0; 2.8)    |
| primary >240 days             | 1 374  | 8.12   | 153.79 (145.76; 162.14) | -127.5 (-139.9; -115.6) | -14.0 (-20.5; -7.9) |
| Pfizer booster 14-120 days    | 1 372  | 82.96  | 15.03 (14.25; 15.85)    | 77.8 (76.5; 78.9)       | 82.9 (81.9; 83.8)   |
| Moderna booster 14-120 days   | 141    | 9.11   | 14.08 (11.85; 16.60)    | 79.2 (75.4; 82.5)       | 84.1 (81.2; 86.5)   |
| Sinopharm booster 14-120 days | 46     | 0.76   | 55.21 (40.42; 73.64)    | 18.3 (-8.9; 40.2)       | 35.8 (14.2; 51.9)   |
| <b>Sinopharm</b>              |        |        |                         |                         |                     |
| primary 14-120 days           | 1 991  | 77.95  | 23.22 (22.21; 24.26)    | 65.7 (64.1; 67.2)       | 10.9 (6.7; 15.0)    |
| primary 121-180 days          | 17 492 | 220.47 | 72.13 (71.06; 73.20)    | -6.7 (-8.4; -5.0)       | 4.9 (2.8; 7.0)      |
| primary 181-240 days          | 10 819 | 101.82 | 96.60 (94.79; 98.44)    | -42.9 (-45.7; -40.1)    | -6.1 (-8.7; -3.4)   |
| primary >240 days             | 448    | 4.24   | 96.03 (87.34; 105.35)   | -42.0 (-55.9; -29.2)    | -19.9 (-31.9; -9.0) |
| Pfizer booster 14-120 days    | 1 007  | 98.82  | 9.26 (8.70; 9.85)       | 86.3 (85.4; 87.1)       | 88.0 (87.2; 88.7)   |
| Moderna booster 14-120 days   | 54     | 6.69   | 7.33 (5.51; 9.57)       | 89.2 (85.8; 91.9)       | 91.0 (88.2; 93.1)   |
| Sinopharm booster 14-120 days | 138    | 3.90   | 32.16 (27.01; 37.99)    | 52.4 (43.8; 60.0)       | 60.6 (53.4; 66.7)   |
| Janssen booster 14-120 days   | 187    | 9.22   | 18.43 (15.88; 21.27)    | 72.7 (68.5; 76.5)       | 78.1 (74.7; 81.0)   |
| <b>Janssen</b>                |        |        |                         |                         |                     |
| primary 14-120 days           | 1 571  | 37.27  | 38.32 (36.45; 40.26)    | 43.3 (40.4; 46.1)       | 39.3 (36.1; 42.4)   |
| primary 121-180 days          | 1 866  | 42.90  | 39.55 (37.77; 41.38)    | 41.5 (38.8; 44.1)       | 45.7 (43.0; 48.2)   |
| primary 181-240 days          | 1 547  | 21.65  | 64.97 (61.77; 68.29)    | 3.9 (-1.0; 8.6)         | 35.9 (32.5; 39.2)   |
| Pfizer booster 14-120 days    | 14     | 1.81   | 7.02 (3.84; 11.78)      | 89.6 (82.6; 94.3)       | 90.9 (84.6; 94.6)   |
| Janssen booster 14-120 days   | 4      | 0.38   | 9.58 (2.61; 24.54)      | 85.8 (63.7; 96.1)       | 86.3 (63.5; 94.9)   |

CI: confidence interval

Vaccine combinations with less than 3,000 persons on 31 December 2021 and less than 300 registered cases since the start of the epidemic were not analyzed.

**Supplementary Table 3.** Incidence, crude and adjusted effectiveness of vaccine combinations against registered SARS-CoV-2 **infection** during the Delta wave in the *65-100 years old* Hungarian population

| Vaccination                   | Number of cases | Average population size<br>(1000 persons) | Incidence rate<br>(per 100 000 person-days)<br>(95% CI) | Crude vaccine efficacy<br>(%)<br>(95% CI) | Adjusted vaccine efficacy<br>(%)<br>(95% CI) |
|-------------------------------|-----------------|---|---|---|--|
| <b>Unvaccinated</b>           | 15 011          | 249.19                                    | 54.76 (53.89; 55.65)                                    | reference                                 | reference                                    |
| <b>Pfizer-BionTech</b>        |                 |   |   |   |  |
| primary 14-120 days           | 518             | 34.54                                     | 13.63 (12.49; 14.86)                                    | 75.1 (72.8; 77.2)                         | 67.0 (63.9; 69.8)                            |
| primary 121-180 days          | 2 268           | 158.13                                    | 13.04 (12.51; 13.59)                                    | 76.2 (75.1; 77.2)                         | 58.8 (56.8; 60.7)                            |
| primary 181-240 days          | 6 377           | 144.51                                    | 40.12 (39.14; 41.11)                                    | 26.7 (24.6; 28.9)                         | 46.8 (45.0; 48.5)                            |
| primary >240 days             | 1 687           | 23.59                                     | 65.02 (61.96; 68.20)                                    | -18.7 (-24.9; -12.8)                      | 31.6 (27.9; 35.1)                            |
| Pfizer booster 14-120 days    | 2 267           | 220.59                                    | 9.34 (8.96; 9.74)                                       | 82.9 (82.2; 83.7)                         | 88.1 (87.6; 88.7)                            |
| Moderna booster 14-120 days   | 39              | 5.71                                      | 6.21 (4.42; 8.49)                                       | 88.7 (84.5; 91.9)                         | 92.2 (89.4; 94.3)                            |
| Sinopharm booster 14-120 days | 342             | 5.88                                      | 52.90 (47.44; 58.82)                                    | 3.4 (-7.5; 13.5)                          | 26.5 (18.1; 34.0)                            |
| Janssen booster 14-120 days   | 110             | 7.26                                      | 13.78 (11.32; 16.61)                                    | 74.8 (69.7; 79.3)                         | 81.3 (77.4; 84.5)                            |
| <b>Moderna</b>                |                 |   |   |   |  |
| primary 14-120 days           | 25              | 5.38                                      | 4.22 (2.73; 6.23)                                       | 92.3 (88.6; 95.0)                         | 79.1 (69.0; 85.9)                            |
| primary 121-180 days          | 332             | 23.16                                     | 13.03 (11.67; 14.51)                                    | 76.2 (73.5; 78.7)                         | 67.4 (63.6; 70.8)                            |
| primary 181-240 days          | 604             | 22.40                                     | 24.52 (22.60; 26.55)                                    | 55.2 (51.4; 58.8)                         | 66.0 (63.1; 68.7)                            |
| primary >240 days             | 175             | 3.14                                      | 50.62 (43.40; 58.71)                                    | 7.6 (-7.3; 20.8)                          | 47.3 (38.8; 54.7)                            |
| Pfizer booster 14-120 days    | 87              | 12.63                                     | 6.26 (5.02; 7.72)                                       | 88.6 (85.9; 90.8)                         | 92.2 (90.4; 93.7)                            |
| Moderna booster 14-120 days   | 76              | 12.88                                     | 5.36 (4.23; 6.71)                                       | 90.2 (87.7; 92.3)                         | 93.3 (91.5; 94.6)                            |
| Sinopharm booster 14-120 days | 33              | 1.24                                      | 24.25 (16.69; 34.05)                                    | 55.7 (37.8; 69.5)                         | 68.2 (55.2; 77.4)                            |
| Janssen booster 14-120 days   | 23              | 1.97                                      | 9.63 (6.10; 14.45)                                      | 80.7 (71.0; 87.7)                         | 86.1 (79.0; 90.8)                            |
| <b>Sputnik</b>                |                 |   |   |   |  |
| primary 14-120 days           | 13              | 0.67                                      | 17.65 (9.40; 30.18)                                     | 67.8 (44.9; 82.8)                         | 32.8 (-15.8; 61.0)                           |
| primary 121-180 days          | 193             | 28.27                                     | 6.21 (5.36; 7.15)                                       | 88.7 (86.9; 90.2)                         | 50.1 (42.3; 56.8)                            |
| primary 181-240 days          | 1 817           | 38.08                                     | 43.37 (41.40; 45.42)                                    | 20.8 (16.8; 24.6)                         | 41.1 (37.9; 44.2)                            |
| primary >240 days             | 194             | 4.35                                      | 40.56 (35.06; 46.69)                                    | 25.9 (14.7; 36.0)                         | 40.2 (30.9; 48.2)                            |
| Pfizer booster 14-120 days    | 273             | 47.44                                     | 5.23 (4.63; 5.89)                                       | 90.4 (89.2; 91.6)                         | 92.5 (91.6; 93.4)                            |
| Moderna booster 14-120 days   | 17              | 3.43                                      | 4.51 (2.63; 7.22)                                       | 91.8 (86.8; 95.2)                         | 93.5 (89.6; 96.0)                            |
| Sinopharm booster 14-120 days | 8               | 0.44                                      | 16.58 (7.16; 32.67)                                     | 69.7 (40.3; 86.9)                         | 75.3 (50.6; 87.7)                            |

|                               |       |        |                        |                       |                      |
|-------------------------------|-------|--------|------------------------|-----------------------|----------------------|
| Janssen booster 14-120 days   | 12    | 0.58   | 18.83 (9.73; 32.89)    | 65.6 (39.9; 82.2)     | 72.9 (52.3; 84.6)    |
| <b>Astra-Zeneca</b>           |       |        |                        |                       |                      |
| primary 14-120 days           | 114   | 23.69  | 4.37 (3.61; 5.26)      | 92.0 (90.4; 93.4)     | 63.1 (55.6; 69.4)    |
| primary 121-180 days          | 1 811 | 48.49  | 33.95 (32.40; 35.55)   | 38.0 (34.9; 41.0)     | 49.7 (47.0; 52.2)    |
| primary 181-240 days          | 485   | 8.51   | 51.79 (47.28; 56.61)   | 5.4 (-3.5; 13.8)      | 38.9 (33.0; 44.3)    |
| primary >240 days             | 7     | 0.04   | 148.46 (59.69; 305.89) | -171.1 (-458.7; -9.0) | -61.5 (-238.9; 23.0) |
| Pfizer booster 14-120 days    | 194   | 26.85  | 6.57 (5.68; 7.56)      | 88.0 (86.2; 89.6)     | 92.0 (90.8; 93.1)    |
| Moderna booster 14-120 days   | 9     | 2.24   | 3.65 (1.67; 6.92)      | 93.3 (87.4; 97.0)     | 95.6 (91.4; 97.7)    |
| Sinopharm booster 14-120 days | 7     | 0.20   | 31.38 (12.62; 64.65)   | 42.7 (-18.1; 77.0)    | 60.8 (17.7; 81.3)    |
| <b>Sinopharm</b>              |       |        |                        |                       |                      |
| primary 14-120 days           | 109   | 6.11   | 16.22 (13.32; 19.57)   | 70.4 (64.2; 75.7)     | 29.8 (15.2; 41.9)    |
| primary 121-180 days          | 884   | 49.32  | 16.29 (15.24; 17.40)   | 70.2 (68.2; 72.2)     | 25.4 (19.9; 30.5)    |
| primary 181-240 days          | 3 703 | 65.18  | 51.65 (50.00; 53.34)   | 5.7 (2.2; 9.0)        | 15.5 (12.0; 18.8)    |
| primary >240 days             | 920   | 11.21  | 74.62 (69.87; 79.60)   | -36.3 (-45.6; -27.3)  | 12.5 (6.1; 18.4)     |
| Pfizer booster 14-120 days    | 2 037 | 231.33 | 8.01 (7.66; 8.36)      | 85.4 (84.7; 86.0)     | 88.2 (87.6; 88.7)    |
| Moderna booster 14-120 days   | 75    | 10.78  | 6.33 (4.98; 7.93)      | 88.4 (85.5; 90.9)     | 90.9 (88.6; 92.8)    |
| Sinopharm booster 14-120 days | 80    | 2.58   | 28.23 (22.38; 35.13)   | 48.5 (35.8; 59.2)     | 60.2 (50.4; 68.0)    |
| Janssen booster 14-120 days   | 79    | 6.08   | 11.81 (9.35; 14.72)    | 78.4 (73.1; 82.9)     | 82.4 (78.0; 85.9)    |
| <b>Janssen</b>                |       |        |                        |                       |                      |
| primary 14-120 days           | 150   | 3.17   | 43.08 (36.46; 50.55)   | 21.3 (7.6; 33.5)      | 17.8 (3.4; 30.1)     |
| primary 121-180 days          | 112   | 3.86   | 26.36 (21.71; 31.72)   | 51.9 (42.0; 60.4)     | 49.1 (38.6; 57.7)    |
| primary 181-240 days          | 107   | 1.92   | 50.55 (41.42; 61.08)   | 7.7 (-11.6; 24.4)     | 42.1 (29.9; 52.2)    |
| Pfizer booster 14-120 days    | 4     | 0.44   | 8.31 (2.26; 21.28)     | 84.8 (61.1; 95.9)     | 88.8 (70.0; 95.8)    |
| Janssen booster 14-120 days   | 0     | 0.06   | 0.00 (0.00; 55.01)     | 100.0 (-0.5; 100.0)   | 100.0 (NA)           |

CI: confidence interval

Vaccine combinations with less than 3,000 persons on 31 December 2021 and less than 300 registered cases since the start of the epidemic were not analyzed.

**Supplementary Table 4.** Incidence, crude and adjusted effectiveness of vaccine combinations against COVID-19 related **hospitalization** during the Delta wave in the 18-64 years old Hungarian population

| Vaccination                   | Number of cases | Average population size<br>(1000 persons) | Incidence rate<br>(per 100 000 person-days)<br>(95% CI) | Crude vaccine efficacy<br>(%)<br>(95% CI) | Adjusted vaccine efficacy<br>(%)<br>(95% CI) |
|-------------------------------|-----------------|---|---|---|--|
| <b>Unvaccinated</b>           | 12 738          | 2 213.67                                  | 5.23 (5.14; 5.32)                                       | reference                                 | reference                                    |
| <b>Pfizer-BionTech</b>        |                 |   |   |   |  |
| primary 14-120 days           | 236             | 360.42                                    | 0.60 (0.52; 0.68)                                       | 88.6 (87.1; 90.0)                         | 82.6 (80.1; 84.7)                            |
| primary 121-180 days          | 748             | 636.89                                    | 1.07 (0.99; 1.15)                                       | 79.6 (78.0; 81.1)                         | 82.6 (81.2; 83.9)                            |
| primary 181-240 days          | 671             | 281.14                                    | 2.17 (2.01; 2.34)                                       | 58.5 (55.2; 61.7)                         | 78.5 (76.7; 80.2)                            |
| primary >240 days             | 194             | 73.72                                     | 2.39 (2.07; 2.75)                                       | 54.3 (47.3; 60.5)                         | 69.6 (64.9; 73.6)                            |
| Pfizer booster 14-120 days    | 160             | 217.58                                    | 0.67 (0.57; 0.78)                                       | 87.2 (85.1; 89.1)                         | 94.3 (93.3; 95.1)                            |
| Moderna booster 14-120 days   | 6               | 7.57                                      | 0.72 (0.26; 1.57)                                       | 86.2 (70.0; 94.9)                         | 93.3 (85.2; 97.0)                            |
| Sinopharm booster 14-120 days | 16              | 5.36                                      | 2.71 (1.55; 4.41)                                       | 48.1 (15.7; 70.4)                         | 76.0 (60.9; 85.3)                            |
| Janssen booster 14-120 days   | 3               | 8.06                                      | 0.34 (0.07; 0.99)                                       | 93.5 (81.1; 98.7)                         | 96.8 (90.0; 99.0)                            |
| <b>Moderna</b>                |                 |   |   |   |  |
| primary 14-120 days           | 16              | 40.74                                     | 0.36 (0.20; 0.58)                                       | 93.2 (88.9; 96.1)                         | 84.9 (75.4; 90.8)                            |
| primary 121-180 days          | 147             | 110.34                                    | 1.21 (1.02; 1.42)                                       | 76.8 (72.8; 80.5)                         | 81.5 (78.2; 84.3)                            |
| primary 181-240 days          | 117             | 52.23                                     | 2.04 (1.68; 2.44)                                       | 61.1 (53.3; 67.8)                         | 81.6 (77.9; 84.7)                            |
| primary >240 days             | 11              | 1.65                                      | 6.07 (3.03; 10.86)                                      | -16.0 (-107.7; 42.1)                      | 42.5 (-4.0; 68.2)                            |
| Pfizer booster 14-120 days    | 4               | 9.63                                      | 0.38 (0.10; 0.97)                                       | 92.8 (81.5; 98)                           | 97.3 (92.7; 99)                              |
| Moderna booster 14-120 days   | 7               | 15.92                                     | 0.40 (0.16; 0.82)                                       | 92.4 (84.2; 96.9)                         | 96.5 (92.5; 98.3)                            |
| Sinopharm booster 14-120 days | 1               | 0.85                                      | 1.07 (0.03; 5.95)                                       | 79.6 (-13.7; 99.5)                        | 92.0 (43.0; 98.9)                            |
| Janssen booster 14-120 days   | 0               | 1.52                                      | 0.00 (0.00; 2.01)                                       | 100.0 (57.8; 100.0)                       | 100.0 (NA)                                   |
| <b>Sputnik</b>                |                 |   |   |   |  |
| primary 14-120 days           | 6               | 30.90                                     | 0.18 (0.06; 0.38)                                       | 96.6 (92.7; 98.8)                         | 90.4 (78.5; 95.7)                            |
| primary 121-180 days          | 241             | 295.38                                    | 0.74 (0.65; 0.84)                                       | 85.8 (83.9; 87.6)                         | 74.3 (70.7; 77.5)                            |
| primary 181-240 days          | 758             | 253.36                                    | 2.72 (2.53; 2.92)                                       | 48.0 (44.0; 51.7)                         | 72.1 (69.9; 74.2)                            |
| primary >240 days             | 28              | 13.30                                     | 1.91 (1.27; 2.77)                                       | 63.4 (47.1; 75.7)                         | 78.7 (69.1; 85.4)                            |
| Pfizer booster 14-120 days    | 30              | 130.59                                    | 0.21 (0.14; 0.30)                                       | 96.0 (94.3; 97.3)                         | 98.0 (97.1; 98.6)                            |
| Moderna booster 14-120 days   | 4               | 13.27                                     | 0.27 (0.07; 0.70)                                       | 94.8 (86.6; 98.6)                         | 97.0 (92.1; 98.9)                            |
| Sinopharm booster 14-120 days | 5               | 1.42                                      | 3.20 (1.04; 7.46)                                       | 38.9 (-42.6; 80.2)                        | 66.8 (20.1; 86.2)                            |

|                               |     |        |                     |                        |                    |
|-------------------------------|-----|--------|---------------------|------------------------|--------------------|
| Janssen booster 14-120 days   | 3   | 7.23   | 0.38 (0.08; 1.10)   | 92.8 (78.9; 98.5)      | 95.1 (84.8; 98.4)  |
| <b>Astra-Zeneca</b>           |     |        |                     |                        |                    |
| primary 14-120 days           | 89  | 128.46 | 0.63 (0.51; 0.78)   | 88.0 (85.2; 90.3)      | 76.2 (70.6; 80.7)  |
| primary 121-180 days          | 493 | 183.32 | 2.44 (2.23; 2.67)   | 53.3 (48.9; 57.4)      | 75.4 (73.0; 77.6)  |
| primary 181-240 days          | 255 | 55.78  | 4.16 (3.66; 4.70)   | 20.6 (10.1; 30.1)      | 59.5 (54.0; 64.2)  |
| primary >240 days             | 111 | 9.55   | 10.57 (8.69; 12.72) | -102.0 (-143.5; -66.0) | 48.8 (38.2; 57.6)  |
| Pfizer booster 14-120 days    | 68  | 88.58  | 0.70 (0.54; 0.88)   | 86.7 (83.1; 89.6)      | 95.1 (93.8; 96.2)  |
| Moderna booster 14-120 days   | 2   | 9.77   | 0.19 (0.02; 0.67)   | 96.4 (87.1; 99.6)      | 98.5 (93.9; 99.6)  |
| Sinopharm booster 14-120 days | 2   | 0.82   | 2.23 (0.27; 8.06)   | 57.4 (-54.1; 94.8)     | 84.7 (38.9; 96.2)  |
| <b>Sinopharm</b>              |     |        |                     |                        |                    |
| primary 14-120 days           | 106 | 87.74  | 1.10 (0.90; 1.33)   | 79.0 (74.6; 82.8)      | 53.8 (43.9; 61.9)  |
| primary 121-180 days          | 655 | 239.02 | 2.49 (2.30; 2.69)   | 52.4 (48.5; 56.0)      | 49.8 (45.6; 53.8)  |
| primary 181-240 days          | 584 | 114.32 | 4.64 (4.27; 5.04)   | 11.2 (3.5; 18.4)       | 47.0 (42.3; 51.4)  |
| primary >240 days             | 65  | 4.93   | 12.00 (9.26; 15.29) | -129.4 (-192.5; -76.9) | 40.9 (24.4; 53.8)  |
| Pfizer booster 14-120 days    | 89  | 105.07 | 0.77 (0.62; 0.95)   | 85.3 (81.9; 88.2)      | 94.6 (93.3; 95.6)  |
| Moderna booster 14-120 days   | 5   | 7.18   | 0.63 (0.21; 1.48)   | 87.9 (71.7; 96.1)      | 94.8 (87.6; 97.9)  |
| Sinopharm booster 14-120 days | 10  | 4.23   | 2.15 (1.03; 3.95)   | 58.9 (24.5; 80.3)      | 77.5 (58.2; 87.9)  |
| Janssen booster 14-120 days   | 5   | 10.01  | 0.45 (0.15; 1.06)   | 91.3 (79.7; 97.2)      | 95.3 (88.7; 98.0)  |
| <b>Janssen</b>                |     |        |                     |                        |                    |
| primary 14-120 days           | 140 | 44.57  | 2.86 (2.40; 3.37)   | 45.4 (35.5; 54.1)      | 43.2 (32.9; 52.0)  |
| primary 121-180 days          | 121 | 49.03  | 2.24 (1.86; 2.68)   | 57.1 (48.7; 64.4)      | 58.2 (49.9; 65.1)  |
| primary 181-240 days          | 91  | 24.97  | 3.31 (2.67; 4.07)   | 36.7 (22.2; 49.1)      | 59.4 (50.1; 67.0)  |
| Pfizer booster 14-120 days    | 2   | 2.46   | 0.74 (0.09; 2.67)   | 85.9 (49.0; 98.3)      | 92.2 (68.8; 98.0)  |
| Janssen booster 14-120 days   | 1   | 0.48   | 1.90 (0.05; 10.61)  | 63.6 (-102.9; 99.1)    | 76.7 (-65.7; 96.7) |

CI: confidence interval

Vaccine combinations with less than 3,000 persons on 31 December 2021 and less than 300 registered cases since the start of the epidemic were not analyzed.

**Supplementary Table 5.** Incidence, crude and adjusted effectiveness of vaccine combinations against COVID-19 related **hospitalization** during the Delta wave in the 65-100 years old Hungarian population

| Vaccination                   | Number of cases | Average population size<br>(1000 persons) | Incidence rate<br>(per 100 000 person-days)<br>(95% CI) | Crude vaccine efficacy<br>(%)<br>(95% CI) | Adjusted vaccine efficacy<br>(%)<br>(95% CI) |
|-------------------------------|-----------------|---|---|---|--|
| Unvaccinated                  | 8 269           | 261.16                                    | 28.78 (28.17; 29.41)                                    | reference                                 | reference                                    |
| <b>Pfizer-BionTech</b>        |                 |   |   |   |  |
| primary 14-120 days           | 243             | 40.88                                     | 5.40 (4.75; 6.13)                                       | 81.2 (78.7; 83.5)                         | 76.6 (73.3; 79.4)                            |
| primary 121-180 days          | 949             | 167.53                                    | 5.15 (4.83; 5.49)                                       | 82.1 (80.9; 83.3)                         | 72.7 (70.7; 74.6)                            |
| primary 181-240 days          | 2 082           | 150.66                                    | 12.56 (12.03; 13.11)                                    | 56.4 (54.2; 58.4)                         | 67.8 (66.2; 69.4)                            |
| primary >240 days             | 639             | 25.26                                     | 23.00 (21.25; 24.86)                                    | 20.1 (13.4; 26.4)                         | 59.2 (55.6; 62.4)                            |
| Pfizer booster 14-120 days    | 794             | 232.40                                    | 3.11 (2.89; 3.33)                                       | 89.2 (88.4; 90.0)                         | 93.0 (92.5; 93.5)                            |
| Moderna booster 14-120 days   | 12              | 5.95                                      | 1.83 (0.95; 3.20)                                       | 93.6 (88.9; 96.7)                         | 95.8 (92.6; 97.6)                            |
| Sinopharm booster 14-120 days | 115             | 6.51                                      | 16.06 (13.26; 19.27)                                    | 44.2 (32.9; 54.0)                         | 62.6 (55.0; 68.9)                            |
| Janssen booster 14-120 days   | 29              | 7.66                                      | 3.44 (2.30; 4.94)                                       | 88.0 (82.8; 92.0)                         | 91.9 (88.3; 94.4)                            |
| <b>Moderna</b>                |                 |   |   |   |  |
| primary 14-120 days           | 16              | 6.66                                      | 2.18 (1.25; 3.55)                                       | 92.4 (87.7; 95.7)                         | 83.8 (73.5; 90.1)                            |
| primary 121-180 days          | 139             | 25.45                                     | 4.96 (4.17; 5.86)                                       | 82.8 (79.6; 85.5)                         | 78.6 (74.7; 82.0)                            |
| primary 181-240 days          | 229             | 23.33                                     | 8.92 (7.81; 10.16)                                      | 69.0 (64.6; 72.9)                         | 76.6 (73.3; 79.5)                            |
| primary >240 days             | 67              | 3.31                                      | 18.42 (14.28; 23.40)                                    | 36.0 (18.6; 50.4)                         | 69.3 (60.9; 75.9)                            |
| Pfizer booster 14-120 days    | 28              | 13.33                                     | 1.91 (1.27; 2.76)                                       | 93.4 (90.4; 95.6)                         | 96.0 (94.1; 97.2)                            |
| Moderna booster 14-120 days   | 29              | 13.69                                     | 1.93 (1.29; 2.77)                                       | 93.3 (90.4; 95.5)                         | 95.7 (93.8; 97)                              |
| Sinopharm booster 14-120 days | 17              | 1.39                                      | 11.15 (6.50; 17.86)                                     | 61.3 (37.9; 77.4)                         | 75.9 (61.2; 85.0)                            |
| Janssen booster 14-120 days   | 7               | 2.06                                      | 2.81 (1.13; 5.79)                                       | 89.3 (77.8; 95.7)                         | 93.0 (85.4; 96.7)                            |
| <b>Sputnik</b>                |                 |   |   |   |  |
| primary 14-120 days           | 3               | 0.89                                      | 3.06 (0.63; 8.93)                                       | 89.4 (69.0; 97.8)                         | 78.3 (32.7; 93.0)                            |
| primary 121-180 days          | 92              | 29.25                                     | 2.86 (2.30; 3.51)                                       | 90.1 (87.8; 92.0)                         | 66.0 (58.1; 72.4)                            |
| primary 181-240 days          | 402             | 39.25                                     | 9.31 (8.42; 10.27)                                      | 67.7 (64.2; 70.8)                         | 70.7 (67.5; 73.6)                            |
| primary >240 days             | 57              | 4.68                                      | 11.08 (8.39; 14.35)                                     | 61.5 (50.1; 70.9)                         | 61.6 (50.0; 70.5)                            |
| Pfizer booster 14-120 days    | 40              | 48.72                                     | 0.75 (0.53; 1.02)                                       | 97.4 (96.5; 98.1)                         | 97.6 (96.7; 98.2)                            |
| Moderna booster 14-120 days   | 2               | 3.52                                      | 0.52 (0.06; 1.86)                                       | 98.2 (93.5; 99.8)                         | 98.3 (93.1; 99.6)                            |
| Sinopharm booster 14-120 days | 2               | 0.46                                      | 3.95 (0.48; 14.25)                                      | 86.3 (50.5; 98.3)                         | 86.7 (46.9; 96.7)                            |



|                               |       |        |                      |                      |                     |
|-------------------------------|-------|--------|----------------------|----------------------|---------------------|
| Janssen booster 14-120 days   | 0     | 0.61   | 0.00 (0.00; 5.51)    | 100.0 (80.9; 100.0)  | 100.0 (NA)          |
| <b>Astra-Zeneca</b>           |       |        |                      |                      |                     |
| primary 14-120 days           | 63    | 24.54  | 2.33 (1.79; 2.99)    | 91.9 (89.6; 93.8)    | 73.8 (66.4; 79.7)   |
| primary 121-180 days          | 588   | 50.15  | 10.66 (9.81; 11.56)  | 63.0 (59.7; 66.0)    | 68.1 (65.2; 70.7)   |
| primary 181-240 days          | 152   | 9.02   | 15.32 (12.98; 17.96) | 46.8 (37.5; 55.0)    | 63.0 (56.5; 68.6)   |
| primary >240 days             | 2     | 0.05   | 39.67 (4.80; 143.32) | -37.8 (-398.1; 83.3) | 24.2 (-203.1; 81.1) |
| Pfizer booster 14-120 days    | 57    | 27.75  | 1.87 (1.41; 2.42)    | 93.5 (91.6; 95.1)    | 95.3 (93.9; 96.4)   |
| Moderna booster 14-120 days   | 3     | 2.31   | 1.18 (0.24; 3.45)    | 95.9 (88.0; 99.2)    | 97.0 (90.6; 99)     |
| Sinopharm booster 14-120 days | 4     | 0.21   | 17.18 (4.68; 43.99)  | 40.3 (-52.9; 83.7)   | 57.1 (-14.4; 83.9)  |
| <b>Sinopharm</b>              |       |        |                      |                      |                     |
| primary 14-120 days           | 60    | 7.14   | 7.64 (5.83; 9.84)    | 73.4 (65.8; 79.8)    | 45.7 (30.0; 57.9)   |
| primary 121-180 days          | 393   | 52.06  | 6.86 (6.20; 7.58)    | 76.2 (73.6; 78.5)    | 48.5 (42.8; 53.6)   |
| primary 181-240 days          | 1 358 | 67.36  | 18.33 (17.37; 19.33) | 36.3 (32.6; 39.9)    | 40.1 (36.4; 43.6)   |
| primary >240 days             | 341   | 12.07  | 25.69 (23.04; 28.57) | 10.7 (0.5; 20.1)     | 38.0 (30.6; 44.5)   |
| Pfizer booster 14-120 days    | 579   | 237.05 | 2.22 (2.04; 2.41)    | 92.3 (91.6; 92.9)    | 93.4 (92.8; 94.0)   |
| Moderna booster 14-120 days   | 22    | 11.07  | 1.81 (1.13; 2.74)    | 93.7 (90.5; 96.1)    | 94.8 (92.1; 96.6)   |
| Sinopharm booster 14-120 days | 26    | 2.68   | 8.83 (5.77; 12.94)   | 69.3 (55; 80.0)      | 74.6 (62.7; 82.7)   |
| Janssen booster 14-120 days   | 22    | 6.27   | 3.19 (2.00; 4.83)    | 88.9 (83.2; 93.1)    | 90.0 (84.8; 93.4)   |
| <b>Janssen</b>                |       |        |                      |                      |                     |
| primary 14-120 days           | 77    | 3.53   | 19.83 (15.65; 24.78) | 31.1 (13.8; 45.7)    | 26.4 (7.9; 41.3)    |
| primary 121-180 days          | 53    | 4.44   | 10.86 (8.14; 14.21)  | 62.3 (50.6; 71.8)    | 59.0 (46.2; 68.7)   |
| primary 181-240 days          | 52    | 2.17   | 21.81 (16.29; 28.6)  | 24.2 (0.5; 43.5)     | 46.7 (29.9; 59.5)   |
| Pfizer booster 14-120 days    | 2     | 0.62   | 2.92 (0.35; 10.56)   | 89.8 (63.3; 98.8)    | 92.1 (68.5; 98.0)   |
| Janssen booster 14-120 days   | 0     | 0.07   | 0 (0.00; 45.92)      | 100.0 (-59.6; 100.0) | 100.0 (NA)          |

CI: confidence interval

Vaccine combinations with less than 3,000 persons on 31 December 2021 and less than 300 registered cases since the start of the epidemic were not analyzed.

**Supplementary Table 6.** Incidence, crude and adjusted effectiveness of vaccine combinations against COVID-19 related **mortality** during the Delta wave in the 18-64 years old Hungarian population

| Vaccination                   | Number of cases | Average population size<br>(1000 persons) | Incidence rate<br>(per 100 000 person-days)<br>(95% CI) | Crude vaccine efficacy<br>(%)<br>(95% CI) | Adjusted vaccine efficacy<br>(%)<br>(95% CI) |
|-------------------------------|-----------------|---|---|---|--|
| Unvaccinated                  | 1 928           | 2 228.48                                  | 0.79 (0.75; 0.82)                                       | reference                                 | reference                                    |
| <b>Pfizer-BionTech</b>        |                 |   |   |   |  |
| primary 14-120 days           | 26              | 366.56                                    | 0.06 (0.04; 0.09)                                       | 91.8 (87.9; 94.7)                         | 87.4 (81.5; 91.5)                            |
| primary 121-180 days          | 59              | 640.70                                    | 0.08 (0.06; 0.11)                                       | 89.4 (86.2; 91.9)                         | 90.3 (87.4; 92.5)                            |
| primary 181-240 days          | 111             | 281.95                                    | 0.36 (0.29; 0.43)                                       | 54.5 (44.9; 62.8)                         | 82.8 (79.1; 85.8)                            |
| primary >240 days             | 26              | 73.90                                     | 0.32 (0.21; 0.47)                                       | 59.3 (40.2; 73.5)                         | 73.6 (61.1; 82.1)                            |
| Pfizer booster 14-120 days    | 23              | 218.63                                    | 0.10 (0.06; 0.14)                                       | 87.8 (81.7; 92.3)                         | 96.8 (95.2; 97.9)                            |
| Moderna booster 14-120 days   | 1               | 7.61                                      | 0.12 (0.00; 0.67)                                       | 84.8 (15.3; 99.6)                         | 95.5 (67.9; 99.4)                            |
| Sinopharm booster 14-120 days | 0               | 5.38                                      | 0.00 (0.00; 0.62)                                       | 100.0 (20.7; 100.0)                       | 100.0 (NA)                                   |
| Janssen booster 14-120 days   | 0               | 8.09                                      | 0.00 (0.00; 0.41)                                       | 100.0 (47.2; 100.0)                       | 100.0 (NA)                                   |
| <b>Moderna</b>                |                 |   |   |   |  |
| primary 14-120 days           | 3               | 41.33                                     | 0.07 (0.01; 0.19)                                       | 91.6 (75.4; 98.3)                         | 77.7 (30.7; 92.8)                            |
| primary 121-180 days          | 19              | 111.11                                    | 0.16 (0.09; 0.24)                                       | 80.2 (69.0; 88.1)                         | 84.1 (75.0; 89.9)                            |
| primary 181-240 days          | 22              | 52.40                                     | 0.38 (0.24; 0.58)                                       | 51.5 (26.3; 69.7)                         | 83.3 (74.6; 89.0)                            |
| primary >240 days             | 1               | 1.66                                      | 0.55 (0.01; 3.06)                                       | 30.2 (-289.4; 98.2)                       | 79.7 (-44.3; 97.1)                           |
| Pfizer booster 14-120 days    | 0               | 9.72                                      | 0.00 (0.00; 0.35)                                       | 100.0 (56.1; 100.0)                       | 100.0 (NA)                                   |
| Moderna booster 14-120 days   | 0               | 16.03                                     | 0.00 (0.00; 0.21)                                       | 100.0 (73.4; 100.0)                       | 100.0 (NA)                                   |
| Sinopharm booster 14-120 days | 1               | 0.86                                      | 1.05 (0.03; 5.86)                                       | -33.6 (-645.4; 96.6)                      | 70.7 (-107.9; 95.9)                          |
| Janssen booster 14-120 days   | 1               | 1.53                                      | 0.54 (0.01; 3.01)                                       | 24.5 (-321.4; 98.1)                       | 84.1 (-12.6; 97.8)                           |
| <b>Sputnik</b>                |                 |   |   |   |  |
| primary 14-120 days           | 0               | 31.19                                     | 0.00 (0.00; 0.11)                                       | 100.0 (86.3; 100.0)                       | 100.0 (NA)                                   |
| primary 121-180 days          | 10              | 295.81                                    | 0.03 (0.01; 0.06)                                       | 96.1 (92.8; 98.1)                         | 89.3 (79.9; 94.3)                            |
| primary 181-240 days          | 62              | 253.79                                    | 0.22 (0.17; 0.28)                                       | 71.8 (63.6; 78.4)                         | 86.5 (82.7; 89.6)                            |
| primary >240 days             | 9               | 13.37                                     | 0.61 (0.28; 1.16)                                       | 22.2 (-48.0; 64.5)                        | 79.1 (59.8; 89.2)                            |
| Pfizer booster 14-120 days    | 3               | 130.74                                    | 0.02 (0.00; 0.06)                                       | 97.3 (92.2; 99.5)                         | 99.2 (97.4; 99.7)                            |
| Moderna booster 14-120 days   | 0               | 13.28                                     | 0.00 (0.00; 0.25)                                       | 100.0 (67.9; 100.0)                       | 100.0 (NA)                                   |
| Sinopharm booster 14-120 days | 0               | 1.43                                      | 0.00 (0.00; 2.35)                                       | 100.0 (-199.1; 100.0)                     | 100.0 (NA)                                   |

|                               |    |        |                   |                         |                   |
|-------------------------------|----|--------|-------------------|-------------------------|-------------------|
| Janssen booster 14-120 days   | 0  | 7.24   | 0.00 (0.00; 0.46) | 100.0 (41.0; 100.0)     | 100.0 (NA)        |
| <b>Astra-Zeneca</b>           |    |        |                   |                         |                   |
| primary 14-120 days           | 4  | 128.71 | 0.03 (0.01; 0.07) | 96.4 (90.8; 99.0)       | 90.1 (73.5; 96.3) |
| primary 121-180 days          | 57 | 183.79 | 0.28 (0.21; 0.37) | 64.2 (53.4; 73.0)       | 83.6 (78.7; 87.4) |
| primary 181-240 days          | 48 | 56.01  | 0.78 (0.57; 1.03) | 0.9 (-31.9; 27.2)       | 65.0 (53.3; 73.7) |
| primary >240 days             | 23 | 9.64   | 2.17 (1.38; 3.26) | -175.9 (-315.2; -74.5)  | 57.1 (35.2; 71.6) |
| Pfizer booster 14-120 days    | 6  | 88.79  | 0.06 (0.02; 0.13) | 92.2 (83.0; 97.1)       | 98.4 (96.5; 99.3) |
| Moderna booster 14-120 days   | 0  | 9.79   | 0.00 (0.00; 0.34) | 100.0 (56.4; 100.0)     | 100.0 (NA)        |
| Sinopharm booster 14-120 days | 0  | 0.82   | 0.00 (0.00; 4.11) | 100.0 (-422.8; 100.0)   | 100.0 (NA)        |
| <b>Sinopharm</b>              |    |        |                   |                         |                   |
| primary 14-120 days           | 10 | 88.32  | 0.10 (0.05; 0.19) | 86.9 (75.9; 93.7)       | 67.4 (39.2; 82.5) |
| primary 121-180 days          | 57 | 239.80 | 0.22 (0.16; 0.28) | 72.5 (64.2; 79.3)       | 63.9 (53.0; 72.3) |
| primary 181-240 days          | 81 | 114.78 | 0.64 (0.51; 0.80) | 18.4 (-1.9; 35.5)       | 61.2 (51.6; 69.0) |
| primary >240 days             | 18 | 5.01   | 3.27 (1.94; 5.17) | -315.6 (-558.7; -145.8) | 50.7 (21.4; 69.1) |
| Pfizer booster 14-120 days    | 17 | 105.50 | 0.15 (0.09; 0.23) | 81.4 (70.1; 89.2)       | 95.9 (93.4; 97.5) |
| Moderna booster 14-120 days   | 0  | 7.21   | 0.00 (0.00; 0.46) | 100.0 (40.8; 100.0)     | 100.0 (NA)        |
| Sinopharm booster 14-120 days | 1  | 4.27   | 0.21 (0.01; 1.19) | 72.9 (-51.1; 99.3)      | 91.1 (36.4; 98.7) |
| Janssen booster 14-120 days   | 1  | 10.03  | 0.09 (0.00; 0.50) | 88.5 (35.7; 99.7)       | 95.8 (70.0; 99.4) |
| <b>Janssen</b>                |    |        |                   |                         |                   |
| primary 14-120 days           | 17 | 45.12  | 0.34 (0.20; 0.55) | 56.5 (30.1; 74.7)       | 59.8 (35.2; 75.1) |
| primary 121-180 days          | 13 | 49.41  | 0.24 (0.13; 0.41) | 69.6 (47.9; 83.8)       | 67.1 (43.2; 81.0) |
| primary 181-240 days          | 11 | 25.14  | 0.40 (0.20; 0.71) | 49.4 (9.3; 74.8)        | 76.1 (56.7; 86.8) |
| Pfizer booster 14-120 days    | 0  | 2.53   | 0.00 (0.00; 1.33) | 100.0 (-68.6; 100.0)    | 100.0 (NA)        |
| Janssen booster 14-120 days   | 0  | 0.48   | 0.00 (0.00; 6.93) | 100.0 (-782.6; 100.0)   | 100.0 (NA)        |

CI: confidence interval

Vaccine combinations with less than 3,000 persons on 31 December 2021 and less than 300 registered cases since the start of the epidemic were not analyzed.

**Supplementary Table 7.** Incidence, crude and adjusted effectiveness of vaccine combinations against COVID-19 related **mortality** during the Delta wave in the 65-100 years old Hungarian population

| Vaccination                   | Number of cases | Average population size<br>(1000 persons) | Incidence rate<br>(per 100 000 person-days)<br>(95% CI) | Crude vaccine efficacy<br>(%)<br>(95% CI) | Adjusted vaccine efficacy<br>(%)<br>(95% CI) |
|-------------------------------|-----------------|---|---|---|--|
| Unvaccinated                  | 3 366           | 266.84                                    | 11.47 (11.08; 11.86)                                    | reference                                 | reference                                    |
| <b>Pfizer-BionTech</b>        |                 |   |   |   |  |
| primary 14-120 days           | 77              | 43.96                                     | 1.59 (1.26; 1.99)                                       | 86.1 (82.6; 89.1)                         | 81.5 (76.8; 85.3)                            |
| primary 121-180 days          | 195             | 169.79                                    | 1.04 (0.90; 1.20)                                       | 90.9 (89.5; 92.2)                         | 79.9 (76.8; 82.7)                            |
| primary 181-240 days          | 625             | 151.89                                    | 3.74 (3.45; 4.05)                                       | 67.4 (64.5; 70.1)                         | 74.6 (72.3; 76.8)                            |
| primary >240 days             | 321             | 25.73                                     | 11.34 (10.13; 12.65)                                    | 1.1 (-10.9; 12.1)                         | 60.2 (55.2; 64.6)                            |
| Pfizer booster 14-120 days    | 226             | 234.09                                    | 0.88 (0.77; 1.00)                                       | 92.3 (91.2; 93.3)                         | 95.8 (95.2; 96.3)                            |
| Moderna booster 14-120 days   | 4               | 5.98                                      | 0.61 (0.17; 1.56)                                       | 94.7 (86.4; 98.6)                         | 97.0 (92.1; 98.9)                            |
| Sinopharm booster 14-120 days | 36              | 6.57                                      | 4.98 (3.49; 6.89)                                       | 56.6 (39.8; 69.6)                         | 73.9 (63.8; 81.2)                            |
| Janssen booster 14-120 days   | 6               | 7.71                                      | 0.71 (0.26; 1.54)                                       | 93.8 (86.6; 97.7)                         | 96.2 (91.6; 98.3)                            |
| <b>Moderna</b>                |                 |   |   |   |  |
| primary 14-120 days           | 2               | 7.15                                      | 0.25 (0.03; 0.92)                                       | 97.8 (92.0; 99.7)                         | 93.2 (72.6; 98.3)                            |
| primary 121-180 days          | 29              | 26.14                                     | 1.01 (0.68; 1.45)                                       | 91.2 (87.3; 94.1)                         | 86.4 (80.4; 90.6)                            |
| primary 181-240 days          | 68              | 23.54                                     | 2.63 (2.04; 3.33)                                       | 77.1 (70.9; 82.3)                         | 81.7 (76.7; 85.6)                            |
| primary >240 days             | 35              | 3.37                                      | 9.45 (6.58; 13.15)                                      | 17.6 (-14.9; 42.7)                        | 71.9 (60.7; 79.9)                            |
| Pfizer booster 14-120 days    | 13              | 13.49                                     | 0.88 (0.47; 1.50)                                       | 92.4 (86.9; 95.9)                         | 96.2 (93.5; 97.8)                            |
| Moderna booster 14-120 days   | 6               | 13.87                                     | 0.39 (0.14; 0.86)                                       | 96.6 (92.5; 98.7)                         | 98.2 (96.1; 99.2)                            |
| Sinopharm booster 14-120 days | 7               | 1.41                                      | 4.51 (1.81; 9.28)                                       | 60.7 (18.9; 84.2)                         | 79.3 (56.6; 90.1)                            |
| Janssen booster 14-120 days   | 1               | 2.08                                      | 0.40 (0.01; 2.22)                                       | 96.2 (78.7; 99.9)                         | 97.9 (84.9; 99.7)                            |
| <b>Sputnik</b>                |                 |   |   |   |  |
| primary 14-120 days           | 0               | 0.98                                      | 0.00 (0.00; 3.41)                                       | 100.0 (70.2; 100.0)                       | 100.0 (NA)                                   |
| primary 121-180 days          | 7               | 29.40                                     | 0.22 (0.09; 0.45)                                       | 98.1 (96.1; 99.2)                         | 86.4 (71.4; 93.6)                            |
| primary 181-240 days          | 86              | 39.43                                     | 1.98 (1.59; 2.45)                                       | 82.7 (78.6; 86.2)                         | 80.7 (76.0; 84.4)                            |
| primary >240 days             | 29              | 4.75                                      | 5.55 (3.72; 7.98)                                       | 51.6 (30.3; 67.6)                         | 63.0 (46.6; 74.4)                            |
| Pfizer booster 14-120 days    | 13              | 48.85                                     | 0.24 (0.13; 0.41)                                       | 97.9 (96.4; 98.9)                         | 98.1 (96.6; 98.9)                            |
| Moderna booster 14-120 days   | 1               | 3.54                                      | 0.26 (0.01; 1.43)                                       | 97.8 (87.5; 99.9)                         | 97.9 (85.1; 99.7)                            |
| Sinopharm booster 14-120 days | 1               | 0.46                                      | 1.97 (0.05; 10.96)                                      | 82.8 (4.3; 99.6)                          | 84.2 (-12.1; 97.8)                           |

|                               |     |        |                      |                       |                    |
|-------------------------------|-----|--------|----------------------|-----------------------|--------------------|
| Janssen booster 14-120 days   | 0   | 0.61   | 0.00 (0.00; 5.49)    | 100.0 (52.1; 100.0)   | 100.0 (NA)         |
| <b>Astra-Zeneca</b>           |     |        |                      |                       |                    |
| primary 14-120 days           | 7   | 24.70  | 0.26 (0.1; 0.53)     | 97.8 (95.4; 99.1)     | 84.8 (67.8; 92.8)  |
| primary 121-180 days          | 144 | 50.48  | 2.59 (2.19; 3.05)    | 77.4 (73.3; 81.0)     | 76.1 (71.7; 79.8)  |
| primary 181-240 days          | 71  | 9.17   | 7.04 (5.5; 8.88)     | 38.6 (22.3; 52.2)     | 66.7 (57.8; 73.7)  |
| primary >240 days             | 0   | 0.05   | 0.00 (0.00; 71.37)   | 100.0 (-522.7; 100.0) | 100.0 (NA)         |
| Pfizer booster 14-120 days    | 22  | 27.87  | 0.72 (0.45; 1.09)    | 93.7 (90.5; 96.1)     | 96.2 (94.2; 97.5)  |
| Moderna booster 14-120 days   | 1   | 2.31   | 0.39 (0.01; 2.19)    | 96.6 (80.9; 99.9)     | 97.9 (84.8; 99.7)  |
| Sinopharm booster 14-120 days | 2   | 0.21   | 8.50 (1.03; 30.70)   | 25.9 (-167.9; 91)     | 55.3 (-78.9; 88.8) |
| <b>Sinopharm</b>              |     |        |                      |                       |                    |
| primary 14-120 days           | 16  | 7.68   | 1.90 (1.08; 3.08)    | 83.5 (73.1; 90.6)     | 58.6 (32.3; 74.7)  |
| primary 121-180 days          | 74  | 52.92  | 1.27 (1.00; 1.6)     | 88.9 (86.0; 91.3)     | 65.2 (56.0; 72.4)  |
| primary 181-240 days          | 379 | 68.04  | 5.06 (4.57; 5.6)     | 55.8 (50.9; 60.4)     | 49.0 (43.2; 54.3)  |
| primary >240 days             | 187 | 12.40  | 13.71 (11.82; 15.83) | -19.6 (-38.6; -2.7)   | 36.4 (26.0; 45.3)  |
| Pfizer booster 14-120 days    | 158 | 238.30 | 0.60 (0.51; 0.70)    | 94.7 (93.8; 95.5)     | 95.4 (94.6; 96.1)  |
| Moderna booster 14-120 days   | 5   | 11.14  | 0.41 (0.13; 0.95)    | 96.4 (91.7; 98.8)     | 97.1 (93.1; 98.8)  |
| Sinopharm booster 14-120 days | 6   | 2.70   | 2.02 (0.74; 4.40)    | 82.4 (61.6; 93.5)     | 86.8 (70.6; 94.1)  |
| Janssen booster 14-120 days   | 5   | 6.30   | 0.72 (0.23; 1.68)    | 93.7 (85.3; 98.0)     | 94.2 (86.0; 97.6)  |
| <b>Janssen</b>                |     |        |                      |                       |                    |
| primary 14-120 days           | 21  | 3.73   | 5.12 (3.17; 7.83)    | 55.3 (31.6; 72.4)     | 53.3 (28.2; 69.6)  |
| primary 121-180 days          | 18  | 4.64   | 3.53 (2.09; 5.57)    | 69.2 (51.3; 81.8)     | 57.6 (32.5; 73.3)  |
| primary 181-240 days          | 30  | 2.25   | 12.13 (8.18; 17.31)  | -5.7 (-51.2; 28.8)    | 39.5 (13.3; 57.8)  |
| Pfizer booster 14-120 days    | 0   | 0.69   | 0.00 (0.00; 4.89)    | 100.0 (57.4; 100.0)   | 100.0 (NA)         |
| Janssen booster 14-120 days   | 0   | 0.08   | 0.00 (0.00; 42.2)    | 100.0 (-268.2; 100.0) | 100.0 (NA)         |

CI: confidence interval

Vaccine combinations with less than 3,000 persons on 31 December 2021 and less than 300 registered cases since the start of the epidemic were not analyzed.