Supplementary Information

A population-based matched cohort study of early pregnancy outcomes following COVID-19 vaccination and SARS-CoV-2 infection
**Supplementary Table 1: Key characteristics of vaccinated and control groups included in the vaccination and miscarriage subgroup analyses**

| Key characteristics | BNT162b2 sub-group analysis | mRNA-1273 sub-group analysis | ChAdOx1-S/nCoV-19 subgroup analysis |
|---------------------|-----------------------------|-----------------------------|-----------------------------------|
|                     | Vaccinated cohort | Unvaccinated historical controls | Unvaccinated contemporary controls | Vaccinated cohort | Unvaccinated historical controls | Unvaccinated contemporary controls | Vaccinated cohort | Unvaccinated historical controls | Unvaccinated contemporary controls |
| Number of pregnancies | 13675           | 41025                        | 13675                          | 2260              | 6780                          | 2260                          | 2612              | 7836                          | 2612                          |
| Median age (min-max) | 31 (14-49)      | 31 (14-50)                   | 31 (14-52)                     | 31 (17-51)        | 31 (16-51)                    | 31 (14-46)                    | 32 (17-50)        | 32 (16-51)                    | 32 (14-54)                    |
| Deprivation (SIMD quintile) |                  |                              |                                |                   |                              |                               |                   |                               |                                |
| 1 (most deprived)   | 2361 (17.3%)    | 8986 (21.9%)                 | 3216 (23.5%)                  | 461 (20.4%)       | 1459 (21.5%)                 | 523 (23.1%)                  | 649 (24.8%)       | 1673 (21.4%)                 | 611 (23.4%)                  |
| 2                   | 2165 (18.4%)    | 8039 (19.6%)                 | 2821 (20.6%)                  | 412 (18.2%)       | 1325 (19.5%)                 | 444 (19.6%)                  | 539 (20.6%)       | 1544 (19.7%)                 | 498 (19.1%)                  |
| 3                   | 2667 (19.5%)    | 7325 (17.9%)                 | 2515 (18.4%)                  | 315 (13.9%)       | 1181 (17.4%)                 | 405 (17.9%)                  | 480 (18.4%)       | 1384 (17.7%)                 | 498 (19.1%)                  |
| 4                   | 3168 (23.2%)    | 8499 (20.7%)                 | 2717 (19.9%)                  | 459 (20.3%)       | 1436 (21.2%)                 | 471 (20.8%)                  | 487 (18.6%)       | 1585 (20.2%)                 | 499 (19.1%)                  |
| 5 (least deprived)  | 2850 (20.8%)    | 7782 (19.0%)                 | 2319 (17.0%)                  | 599 (26.5%)       | 1329 (19.6%)                 | 406 (18.0%)                  | 434 (16.6%)       | 1531 (19.5%)                 | 478 (18.3%)                  |
| Unknown             | 106 (0.8%)      | 394 (1.0%)                   | 87 (0.6%)                     | 14 (0.6%)         | 50 (0.7%)                    | 11 (0.5%)                    | 23 (0.9%)         | 119 (1.5%)                   | 28 (1.1%)                    |
| Ethnicity           |                |                              |                                |                   |                              |                               |                   |                               |                                |
| White               | 11639 (85.1%)   | 27297 (66.5%)                | 11455 (83.8%)                 | 1746 (77.3%)      | 4608 (68.0%)                  | 1891 (83.7%)                  | 2314 (88.6%)      | 4829 (61.6%)                  | 2131 (81.6%)                  |
| South Asian         | 496 (3.6%)      | 964 (2.3%)                   | 458 (3.3%)                    | 123 (5.4%)        | 140 (2.1%)                   | 82 (3.6%)                    | 76 (2.9%)         | 149 (1.9%)                    | 88 (3.4%)                    |
| Black/Caribbean/African | 133 (1.0%)   | 473 (1.2%)                   | 266 (1.9%)                    | 61 (2.7%)         | 81 (1.2%)                    | 46 (2.0%)                    | 40 (1.5%)         | 113 (1.4%)                    | 58 (2.2%)                    |
| Other/mixed ethnicity | 413 (3.0%)     | 1022 (2.5%)                  | 491 (3.6%)                    | 115 (5.1%)        | 168 (2.5%)                   | 88 (3.9%)                    | 59 (2.3%)         | 199 (2.5%)                    | 99 (3.8%)                    |
| Unknown             | 994 (7.3%)      | 11269 (27.5%)                | 1005 (7.3%)                   | 215 (9.5%)        | 1783 (26.3%)                  | 153 (6.8%)                    | 123 (4.7%)        | 2546 (32.5%)                  | 236 (9.0%)                    |
| Urban/rural status  |                |                              |                                |                   |                              |                               |                   |                               |                                |
| Large urban areas   | 4255 (31.1%)    | 15503 (37.8%)                | 5113 (37.4%)                  | 1504 (66.5%)      | 2493 (36.8%)                  | 843 (37.3%)                  | 904 (34.6%)       | 2985 (38.1%)                  | 962 (36.8%)                  |
| Other urban areas   | 4686 (34.3%)    | 14658 (35.7%)                | 4783 (35.0%)                  | 316 (14.0%)       | 2529 (37.3%)                  | 776 (34.3%)                  | 938 (35.9%)       | 2744 (35.0%)                  | 926 (35.5%)                  |
| Accessible small towns | 1103 (8.1%)   | 3310 (8.1%)                  | 1026 (7.5%)                   | 97 (4.3%)         | 528 (7.8%)                   | 157 (6.9%)                    | 229 (8.8%)        | 624 (8.0%)                    | 193 (7.4%)                    |
| Remote small towns  | 442 (3.2%)      | 1155 (2.8%)                  | 414 (3.0%)                    | 16 (0.7%)         | 184 (2.7%)                   | 72 (3.2%)                    | 89 (3.4%)         | 245 (3.1%)                    | 71 (2.7%)                    |
| Accessible rural areas | 1568 (11.5%)  | 4084 (10.0%)                 | 1479 (10.8%)                  | 131 (5.8%)        | 675 (10.0%)                   | 290 (12.8%)                  | 270 (10.3%)       | 772 (9.9%)                    | 286 (10.9%)                  |
| Remote rural areas  | 696 (5.1%)      | 1858 (4.5%)                  | 572 (4.2%)                    | 17 (0.8%)         | 310 (4.6%)                   | 84 (3.7%)                    | 116 (4.4%)        | 336 (4.3%)                    | 102 (3.9%)                    |
| Unknown             | 926 (6.8%)      | 457 (1.1%)                   | 288 (2.1%)                    | 179 (7.9%)        | 61 (0.9%)                    | 38 (1.7%)                    | 66 (2.5%)         | 130 (1.7%)                    | 72 (2.8%)                    |
| Clinical vulnerability | Extremely vulnerable | Vulnerable | Not vulnerable |
|------------------------|----------------------|------------|---------------|
|                        | 109 (0.8%)           | 3261 (23.8%) | 10305 (75.4%) |
|                        | 570 (1.4%)           | 11709 (28.5%) | 28746 (70.1%) |
|                        | 110 (0.8%)           | 3542 (25.9%) | 10023 (73.3%) |
|                        | 14 (0.6%)            | 500 (22.1%)  | 1746 (77.3%)  |
|                        | 82 (1.2%)            | 1878 (27.7%) | 4820 (71.1%)  |
|                        | 16 (0.7%)            | 571 (25.3%)  | 1673 (74.0%)  |
|                        | 104 (4.0%)           | 1013 (38.8%) | 1495 (57.2%)  |
|                        | 111 (1.4%)           | 2169 (27.7%) | 5556 (70.9%)  |
|                        | 26 (1.0%)            | 685 (26.2%)  | 1901 (72.8%)  |

| Exposure (vaccination) | Gestation at first vaccination within exposure period |
|------------------------|-----------------------------------------------------|
|                        | Preconception | 6126 (44.8%) | - | - | 828 (36.6%) | - | - | 1653 (63.3%) |
|                        | 2+0-5+6 weeks | 2975 (21.8%) | - | - | 486 (21.5%) | - | - | 691 (26.5%) |
|                        | 6+0-10+6 weeks| 1001 (7.3%)  | - | - | 166 (7.3%)  | - | - | 141 (5.4%)  |
|                        | 11+0-15+6 weeks| 1978 (14.5%) | - | - | 420 (18.6%) | - | - | 70 (2.7%)  |
|                        | 16+0-19+6 weeks| 1595 (11.7%) | - | - | 360 (15.9%) | - | - | 57 (2.2%)  |

| Number of vaccinations* | 1 | 10025 (73.3%) | - | - | 1615 (71.5%) | - | - | 2152 (82.4%) |
|                        | 2+ | 3650 (26.7%)  | - | - | 645 (28.5%)  | - | - | 460 (17.6%) |

| Dose number at first vaccination within exposure period | Dose 1 | 8181 (59.8%) | - | - | 1367 (60.5%) | - | - | 1394 (53.4%) |
|                                                      | Dose 2 | 4123 (30.1%) | - | - | 514 (22.7%)  | - | - | 1215 (46.5%) |
|                                                      | Dose 3 | 1371 (10%)   | - | - | 379 (16.8%)  | - | - | 3 (0.1%)  |

| Outcome (miscarriage) | Pregnancies ending in miscarriage up to 19+6 weeks | 1147 | 3804 | 1258 | 162 | 511 | 198 | 406 | 1152 | 389 |
|                        | Gestation at miscarriage | <=10+6 | 852 (74.3%) | 3467 (91.1%) | 867 (68.9%) | 127 (78.4%) | 468 (91.6%) | 133 (67.2%) | 322 (79.3%) | 1082 (93.9%) | 290 (74.6%) |
|                        |                        | 11+0-13+6 | 212 (18.5%) | 223 (5.9%) | 285 (22.7%) | 26 (16.0%) | 25 (4.9%) | 46 (23.2%) | 62 (15.3%) | 44 (3.8%) | 74 (19.0%) |
|                        |                        | >=14+0 | 83 (7.2%) | 114 (3.0%) | 106 (8.4%) | 9 (5.6%) | 18 (3.5%) | 19 (9.6%) | 22 (5.4%) | 26 (2.3%) | 25 (6.4%) |
| Imputed gestation for miscarriage | Yes | No – available from ANC booking | No – available from end of pregnancy record | Lag between first vaccination (or date of matching in unvaccinated) and miscarriage | <2 weeks | 2-5 weeks | 6-9 weeks | >=10 weeks |
|----------------------------------|-----|----------------------------------|-------------------------------------------|---------------------------------------------|--------|--------|--------|----------|
| Yes                             | 638 (55.6%) | 3108 (81.7%) | 619 (49.2%) | 103 (63.6%) | 426 (83.4%) | 87 (43.9%) | 233 (57.4%) | 967 (83.9%) | 207 (53.2%) |
| No – available from ANC booking | 394 (34.4%) | 224 (5.9%) | 484 (38.5%) | 50 (30.9%) | 29 (5.7%) | 87 (43.9%) | 132 (32.5%) | 52 (4.5%) | 138 (35.5%) |
| No – available from end of pregnancy record | 115 (10.0%) | 472 (12.4%) | 155 (12.3%) | 9 (5.6%) | 56 (11.0%) | 24 (12.1%) | 41 (10.1%) | 133 (11.5%) | 44 (11.3%) |
| Lag between first vaccination (or date of matching in unvaccinated) and miscarriage | 56 (4.9%) | 158 (4.2%) | 76 (6.0%) | 11 (6.8%) | 38 (7.4%) | 18 (9.1%) | 17 (4.2%) | 27 (2.3%) | 7 (1.8%) |
| <2 weeks | 166 (14.5%) | 483 (12.7%) | 180 (14.3%) | 33 (20.4%) | 72 (14.1%) | 33 (16.7%) | 59 (14.5%) | 101 (8.8%) | 48 (12.3%) |
| 2-5 weeks | 357 (31.1%) | 1299 (34.1%) | 391 (31.1%) | 48 (29.6%) | 180 (35.2%) | 58 (29.3%) | 130 (32.0%) | 408 (35.4%) | 132 (33.9%) |
| 6-9 weeks | 568 (49.5%) | 1864 (49.0%) | 611 (48.6%) | 70 (43.2%) | 221 (43.2%) | 89 (44.9%) | 200 (49.3%) | 616 (53.5%) | 202 (51.9%) |

SIMD=Scottish Index of Multiple Deprivation

*Between 6 weeks pre-conception and the earliest of either: end of pregnancy or 19+6 weeks gestation

All groups exclude women with confirmed SARS-CoV-2 infection between 6 weeks preconception and the earliest of either: end of pregnancy or the end of the exposure period at 2+6 weeks gestation
**Supplementary Table 2: Key characteristics of vaccinated and control groups included in the vaccination and ectopic pregnancy analyses**

| Key characteristics                  | Vaccinated cohort | Unvaccinated historical controls | Unvaccinated contemporary controls |
|--------------------------------------|-------------------|----------------------------------|-----------------------------------|
| Number of pregnancies                | 10,570            | 31,710                           | 31,710                            |
| Median age (min-max)                 | 31 (15-51)        | 31 (14-52)                       | 31 (12-54)                        |
| Deprivation (SIMD quintile)          |                   |                                  |                                   |
| 1 (most deprived)                    | 2,147 (20.3%)     | 7,034 (22.2%)                   | 7,351 (23.2%)                    |
| 2                                    | 2,101 (19.9%)     | 6,378 (20.1%)                   | 6,520 (20.6%)                    |
| 3                                    | 1,941 (18.4%)     | 5,606 (17.7%)                   | 5,763 (18.2%)                    |
| 4                                    | 2,286 (21.6%)     | 6,448 (20.3%)                   | 6,359 (20.1%)                    |
| S (least deprived)                   | 2,000 (18.9%)     | 5,860 (18.5%)                   | 5,477 (17.3%)                    |
| Unknown                              | 95 (0.9%)         | 384 (1.2%)                      | 240 (0.8%)                       |
| Ethnicity                            |                   |                                  |                                   |
| White                                | 8,873 (83.9%)     | 20,243 (63.8%)                  | 26,465 (83.5%)                   |
| South Asian                          | 367 (3.5%)        | 735 (2.3%)                      | 1,071 (3.4%)                     |
| Black/Caribbean /African             | 121 (1.1%)        | 345 (1.1%)                      | 572 (1.8%)                       |
| Other/mixed ethnicity                | 298 (2.8%)        | 776 (2.4%)                      | 1,125 (3.5%)                     |
| Unknown                              | 911 (8.6%)        | 9,611 (30.3%)                   | 2,477 (7.8%)                     |
| Urban/rural status                   |                   |                                  |                                   |
| Large urban areas                    | 3,769 (35.7%)     | 12,124 (38.2%)                  | 11,894 (37.5%)                   |
| Other urban areas                    | 3,452 (32.7%)     | 11,151 (35.2%)                  | 11,144 (35.1%)                   |
| Accessible small towns               | 773 (7.3%)        | 2,508 (7.9%)                    | 2,345 (7.4%)                     |
| Remote small towns                   | 323 (3.1%)        | 936 (3.0%)                      | 925 (2.9%)                       |
| Accessible rural areas               | 1,046 (9.9%)      | 3,159 (10.0%)                   | 3,371 (10.6%)                    |
| Remote rural areas                   | 444 (4.2%)        | 1,396 (4.4%)                    | 1,331 (4.2%)                     |
| Unknown                              | 763 (7.2%)        | 436 (1.4%)                      | 700 (2.2%)                       |
| Clinical vulnerability               |                   |                                  |                                   |
| Extremely vulnerable                 | 120 (1.1%)        | 465 (1.5%)                      | 275 (0.9%)                       |
| Vulnerable                           | 2,760 (26.1%)     | 8,959 (28.3%)                   | 8,231 (26.0%)                    |
| Not vulnerable                       | 7,690 (72.8%)     | 22,286 (70.3%)                  | 23,204 (73.2%)                   |
| Exposure (vaccination)               |                   |                                  |                                   |
| Gestation at first vaccination       |                   |                                  |                                   |
| Preconception                        | 9,291 (87.9%)     | -                                | -                                 |
| 2 weeks (2+0 to 2+6)                 | 1,279 (12.1%)     | -                                | -                                 |
| Number of vaccinations*              |                   |                                  |                                   |
| 1                                    | 10,539 (99.7%)    | -                                | -                                 |
| 2+                                   | 31 (0.3%)         | -                                | -                                 |
| Dose number at first vaccination     |                   |                                  |                                   |
| Dose 1                                | 5,719 (54.1%)     | -                                | -                                 |
| Dose 2                                | 4,832 (45.7%)     | -                                | -                                 |
| Dose 3                                | 19 (0.2%)         | -                                | -                                 |
| Type of vaccination** | 7,340 (69.4%) | - | - |
|----------------------|---------------|---|---|
| mRNA-1273            | 1,040 (9.4%)  | - | - |
| ChAdOx1-S/nCoV-19    | 1,954 (18.5%) | - | - |
| 1+ different type    | 236 (2.2%)    | - | - |

| Outcome (ectopic pregnancy) | 126 | 379 | 336 |
|-----------------------------|-----|-----|-----|
| Pregnancies ending in ectopic pregnancy up to 19+6 weeks | - | - | - |
| Gestation at ectopic pregnancy | - | - | - |
| <=10+6                      | 125 (99.2%) | 376 (99.2%) | 324 (96.4%) |
| 11+0-13+6                   | 1 (0.8%) | 2 (0.5%) | 8 (2.4%) |
| >=14+0                      | 0 | 1 (0.3%) | 4 (1.2%) |

| Imputed gestation for ectopic pregnancy | - | - | - |
|----------------------------------------|---|---|---|
| Yes                                    | 106 (84.1%) | 334 (88.1%) | 270 (80.4%) |
| No – available from ANC booking        | 7 (5.6%) | 3 (0.8%) | 32 (9.5%) |
| No – available from end of pregnancy record | 13 (10.3%) | 42 (11.1%) | 34 (10.1%) |

| Lag between first vaccination (or gestational week of matching in unvaccinated) and ectopic pregnancy | - | - | - |
|-----------------------------------------------------------------------------------------------|---|---|---|
| <=5 weeks                                      | 2 (1.6%) | 9 (2.4%) | 14 (4.2%) |
| 6-9 weeks                                      | 65 (51.6%) | 219 (57.8%) | 182 (54.2%) |
| >=10 weeks                                     | 59 (46.8%) | 151 (39.8%) | 140 (41.7%) |

SIMD=Scottish Index of Multiple Deprivation

*Between 6 weeks preconception and the earliest of either: end of pregnancy or 2+6 weeks gestation

All groups exclude women with confirmed SARS-CoV-2 infection between 6 weeks preconception and the earliest of either: end of pregnancy or the end of the exposure period at 2+6 weeks gestation
**Supplementary Table 3: Key characteristics of vaccinated and control groups included in the vaccination and ectopic pregnancy subgroup analyses**

| Key characteristics | BNT162b2 sub-group analysis | mRNA-1273 sub-group analysis | ChAdOx1-S/nCoV-19 subgroup analysis |
|---------------------|-----------------------------|-------------------------------|------------------------------------|
|                     | Vaccinated cohort | Unvaccinated historical controls | Unvaccinated contemporary controls | Vaccinated cohort | Unvaccinated historical controls | Unvaccinated contemporary controls |
| Number of pregnancies | 7340 | 22020 | 22020 | 1040 | 3120 | 3120 | 1954 | 5862 | 5862 |
| Median age (min-max) | 30 (15-49) | 30 (14-50) | 30 (12-53) | 30 (18-51) | 30 (17-52) | 30 (14-48) | 32 (18-50) | 32 (17-51) | 32 (14-54) |
| Deprivation (SIMD quintile) | 1 (most deprived) | 1379 (18.8%) | 4950 (22.5%) | 5140 (23.3%) | 250 (24.0%) | 729 (23.4%) | 769 (24.6%) | 492 (25.2%) | 1244 (21.2%) | 1293 (22.1%) |
| 2 | 1458 (19.9%) | 4461 (20.3%) | 4597 (20.9%) | 208 (20.0%) | 631 (20.2%) | 621 (19.9%) | 404 (20.7%) | 1156 (19.7%) | 1167 (19.9%) |
| 3 | 1402 (19.1%) | 3889 (17.7%) | 4000 (18.2%) | 138 (13.3%) | 521 (16.7%) | 576 (18.5%) | 350 (17.9%) | 1068 (18.2%) | 1040 (17.7%) |
| 4 | 1664 (22.7%) | 4442 (20.2%) | 4395 (20.0%) | 201 (19.3%) | 641 (20.5%) | 625 (20.0%) | 363 (18.6%) | 1196 (20.4%) | 1210 (20.6%) |
| 5 (least deprived) | 1374 (18.7%) | 4016 (18.2%) | 4000 (18.2%) | 200 (20.0%) | 729 (25.2%) | 752 (24.6%) | 404 (20.7%) | 1156 (19.7%) | 1167 (19.9%) |
| Unknown | 63 (0.9%) | 262 (1.2%) | 160 (0.7%) | 9 (0.9%) | 30 (1.0%) | 22 (0.7%) | 22 (1.1%) | 81 (1.4%) | 49 (0.8%) |
| Ethnicity | White | 6189 (84.3%) | 14097 (64.0%) | 18468 (83.9%) | 750 (72.1%) | 2078 (66.6%) | 2627 (84.2%) | 1730 (88.5%) | 3618 (61.7%) | 4812 (82.1%) |
| South Asian | 239 (3.3%) | 509 (2.3%) | 728 (3.3%) | 63 (6.1%) | 66 (2.1%) | 94 (3.0%) | 53 (2.7%) | 139 (2.4%) | 216 (3.7%) |
| Black/Caribbean /African | 64 (0.9%) | 217 (1.0%) | 375 (1.7%) | 29 (2.8%) | 34 (1.1%) | 58 (1.9%) | 28 (1.4%) | 73 (1.2%) | 116 (2.0%) |
| Other/mixed ethnicity | 187 (2.5%) | 521 (2.4%) | 748 (3.4%) | 56 (5.4%) | 83 (2.7%) | 104 (3.3%) | 47 (2.4%) | 152 (2.6%) | 239 (4.1%) |
| Unknown | 661 (9.0%) | 6676 (30.3%) | 1701 (7.7%) | 142 (13.7%) | 859 (27.5%) | 237 (7.6%) | 96 (4.9%) | 1880 (32.1%) | 479 (8.2%) |
| Urban/rural status | Large urban areas | 2238 (30.5%) | 8346 (37.9%) | 8198 (37.2%) | 713 (68.6%) | 1194 (38.3%) | 1151 (36.9%) | 679 (34.7%) | 2310 (39.4%) | 2245 (38.3%) |
| Other urban areas | 2574 (35.1%) | 7788 (35.4%) | 7816 (35.5%) | 135 (13.0%) | 1149 (36.8%) | 1079 (34.6%) | 710 (36.3%) | 1997 (34.1%) | 2009 (34.3%) |
| Accessible small towns | 555 (7.6%) | 1739 (7.9%) | 1623 (7.4%) | 40 (3.8%) | 255 (8.2%) | 254 (8.1%) | 167 (8.5%) | 464 (7.9%) | 429 (7.3%) |
| Remote small towns | 249 (3.4%) | 683 (3.1%) | 657 (3.0%) | 6 (0.6%) | 78 (2.5%) | 98 (3.1%) | 65 (3.3%) | 157 (2.7%) | 152 (2.6%) |
| Accessible rural areas | 788 (10.7%) | 2179 (9.9%) | 2332 (10.6%) | 49 (4.7%) | 285 (9.1%) | 337 (10.8%) | 191 (9.8%) | 599 (10.2%) | 640 (10.9%) |
| Remote rural areas | 357 (4.9%) | 983 (4.5%) | 922 (4.2%) | 3 (0.3%) | 125 (4.0%) | 82 (4.2%) | 248 (4.2%) | 244 (4.2%) |
|-------------------|-------------|-------------|-------------|---------|------------|--------|----------|----------|
| Unknown           | 579 (7.9%)  | 302 (1.4%)  | 472 (2.1%)  | 94 (0.9%)| 34 (1.1%)  | 70 (2.2%)| 60 (3.1%)| 87 (1.5%) |
| Clinical vulnerability |         |             |             |         |            |        |          |          |
| Extremely vulnerable | 48 (0.7%)  | 317 (1.4%)  | 193 (0.9%)  | 0 (0.0%)| 42 (1.3%)  | 25 (0.8%)| 72 (3.7%)| 94 (1.6%) |
| Vulnerable        | 1754 (23.9%)| 6165 (28.0%)| 5675 (25.8%)| 207 (19.9%)| 914 (29.3%)| 832 (26.7%)| 751 (38.4%)| 1676 (28.6%)| 1539 (26.3%)|
| Not vulnerable    | 5538 (75.4%)| 15538 (70.6%)| 16152 (73.4%)| 833 (80.1%)| 2164 (69.4%)| 2263 (72.5%)| 1131 (57.9%)| 4092 (69.8%)| 4272 (72.9%)|

### Exposure (vaccination)

**Gestation at first vaccination within exposure period**

| Preconception | 6434 (87.7%) | - | - | 891 (85.7%) | - | - | 1741 (89.1%) | - | - |
|---------------|--------------|---|---|------------|---|---|-------------|---|---|
| 2 weeks (2+0 to 2+6) | 906 (12.3%) | - | - | 149 (14.3%) | - | - | 213 (10.9%) | - | - |

**Number of vaccinations***

| 1 | 7314 (99.6%) | - | - | 1039 (99.9%) | - | - | 1950 (99.8%) | - | - |
| 2+ | 26 (0.4%) | - | - | 1 (0.1%) | - | - | 4 (0.2%) | - | - |

**Dose number at first vaccination within exposure period**

| Dose 1 | 4064 (55.4%) | - | - | 626 (60.2%) | - | - | 1002 (51.3%) | - | - |
| Dose 2 | 3258 (44.4%) | - | - | 414 (39.8%) | - | - | 951 (48.7%) | - | - |
| Dose 3 | 18 (0.2%) | - | - | 0 | - | - | 1 (0.1%) | - | - |

**Outcome (ectopic pregnancy)**

| Pregnancies ending in ectopic pregnancy up to 19+6 weeks | 87 | 271 | 238 | 13 | 22 | 26 | 26 | 76 | 63 |
|----------------------------------------------------------|---|----|----|---|---|----|----|----|----|
| Gestation at ectopic pregnancy                           | <=10+6 | 86 (98.9%) | 268 (98.9%) | 228 (95.8%) | 13 (100%) | 22 (100%) | 25 (96.2%) | 26 (100%) | 76 (100%) | 62 (98.4%) |
|                                                        | 11+0-13+6 | 1 (1.1%) | 2 (0.7%) | 7 (2.9%) | 0 | 0 | 0 | 0 | 0 | 1 (1.6%) |
| Lag between first vaccination (or gestational week of matching in unvaccinated) and ectopic pregnancy | >=10 weeks | 6-9 weeks | <=5 weeks | | --- | --- | --- | --- | --- |
| SIMD=Scottish Index of Multiple Deprivation | 40 (46.0%) | 166 (61.3%) | 2 (2.3%) | 0 | 1 (4.5%) | 11 (4.6%) | 0 | 2 (2.6%) | 2 (3.2%) | 4 (1.1%) | 166 (61.3%) | 10 (76.9%) | 10 (45.5%) | 1 (0.4%) | 10 (45.5%) | 10 (45.5%) | 10 (45.5%) | 10 (38.5%) | 11 (50.0%) | 10 (38.5%) | 11 (50.0%) | 36 (40.0%) | 36 (47.4%) | 36 (40.0%) | 36 (47.4%) |
| **Between 6 weeks preconception and the earliest of either: end of pregnancy or 2+6 weeks gestation** | All groups exclude women with confirmed SARS-CoV-2 infection between 6 weeks preconception and the earliest of either: end of pregnancy or the end of the exposure period at 2+6 weeks gestation | |
## Supplementary Table 4: Key characteristics of infected and control groups included in the infection and miscarriage analyses

| Key characteristics                          | Infected cohort | Uninfected historical controls | Uninfected contemporary controls |
|----------------------------------------------|-----------------|-------------------------------|---------------------------------|
| **Number of pregnancies**                    | 3,025           | 9,075                         | 9,075                           |
| **Median age (min-max)**                     | 28 (14-48)      | 28 (14-48)                    | 28 (13-51)                      |
| **Deprivation (SIMD quintile)**              |                 |                               |                                 |
| 1 (most deprived)                            | 938 (31.0%)     | 2,195 (24.2%)                 | 2,425 (26.7%)                   |
| 2                                            | 742 (24.5%)     | 1,907 (21.0%)                 | 1,940 (21.4%)                   |
| 3                                            | 487 (16.1%)     | 1,690 (18.6%)                 | 1,625 (17.9%)                   |
| 4                                            | 481 (15.9%)     | 1,691 (18.6%)                 | 1,692 (18.6%)                   |
| 5 (least deprived)                           | 363 (12.0%)     | 1,526 (16.8%)                 | 1,347 (14.8%)                   |
| **Ethnicity**                                |                 |                               |                                 |
| White                                        | 2,679 (88.6%)   | 6,314 (69.6%)                 | 7,642 (84.2%)                   |
| South Asian                                  | 100 (3.3%)      | 222 (2.4%)                    | 270 (3.0%)                      |
| Black/Caribbean /African                     | 40 (1.3%)       | 97 (1.1%)                     | 145 (1.6%)                      |
| Other/mixed ethnicity                        | 78 (2.6%)       | 214 (2.4%)                    | 330 (3.6%)                      |
| Unknown                                      | 128 (4.2%)      | 2,228 (24.6%)                 | 688 (7.6%)                      |
| **Urban/rural status**                       |                 |                               |                                 |
| Large urban areas                            | 1,247 (41.2%)   | 3,270 (36.0%)                 | 3,255 (35.9%)                   |
| Other urban areas                            | 1,077 (35.6%)   | 3,481 (38.4%)                 | 3,429 (37.8%)                   |
| Accessible small towns                       | 196 (6.5%)      | 722 (8.0%)                    | 659 (7.3%)                      |
| Remote small towns                           | 53 (1.8%)       | 283 (3.1%)                    | 277 (3.1%)                      |
| Accessible rural areas                       | 214 (7.1%)      | 859 (9.5%)                    | 941 (10.4%)                     |
| Remote rural areas                           | 75 (2.5%)       | 385 (4.2%)                    | 359 (4.0%)                      |
| Unknown                                      | 163 (5.4%)      | 75 (0.8%)                     | 155 (1.7%)                      |
| **Clinical vulnerability**                   |                 |                               |                                 |
| Extremely vulnerable                         | 18 (0.6%)       | 114 (1.3%)                    | 70 (0.8%)                       |
| Vulnerable                                   | 812 (26.8%)     | 2,543 (28.0%)                 | 2,393 (26.4%)                   |
| Not vulnerable                               | 2,195 (72.6%)   | 6,418 (70.7%)                 | 6,612 (72.9%)                   |
| **Exposure (SARS-CoV-2 infection)**          |                 |                               |                                 |
| Gestation at first infection within exposure period |     |                               |                                 |
| Pre-conception                               | 645 (21.3%)     | -                             | -                               |
| 2+0-5+6 weeks                                | 552 (18.2%)     | -                             | -                               |
| 6+0-10+6 weeks                               | 589 (19.5%)     | -                             | -                               |
| 11+0-15+6 weeks                              | 566 (18.7%)     | -                             | -                               |
| 16+0-19+6 weeks                              | 673 (22.2%)     | -                             | -                               |
| **Number of infections**                     |                 |                               |                                 |
| 1                                            | 3,014 (99.6%)   | -                             | -                               |
| 2+                                           | 11 (0.4%)       | -                             | -                               |
| **Outcome (miscarriage)**                    |                 |                               |                                 |
| Pregnancies ending in miscarriage up to 19+6 weeks | 204            | 600                           | 584                             |
| Gestation at miscarriage | <=10+6 | 11+0-13+6 | >=14+0 |
|-------------------------|--------|-----------|--------|
|                         | 135 (66.2%) | 536 (89.3%) | 377 (64.6%) |
| Imputed gestation for miscarriage |        |           |        |
| Yes                     | 103 (50.5%) | 488 (81.3%) | 265 (45.4%) |
| No – available from ANC booking | 74 (36.3%) | 29 (4.8%) | 249 (42.6%) |
| No – available from end of pregnancy record | 27 (13.2%) | 83 (13.8%) | 70 (12.0%) |
| Lag between first infection (or gestational week of matching in uninfected) and miscarriage |        |           |        |
| <2 weeks                | 21 (10.3%) | 81 (13.5%) | 90 (15.4%) |
| 2-5 weeks               | 66 (32.4%) | 159 (26.5%) | 166 (28.4%) |
| 6-9 weeks               | 53 (26%) | 176 (29.3%) | 162 (27.7%) |
| >=10 weeks              | 64 (31.4%) | 184 (30.7%) | 166 (28.4%) |

SIMD=Scottish Index of Multiple Deprivation

*Between 6 weeks pre-conception and the earliest of either: end of pregnancy or 19+6 weeks gestation*

All groups exclude women who received COVID-19 vaccination between 6 weeks pre-conception and the earliest of either: end of pregnancy or the end of the exposure period at 19+6 weeks gestation.
## Supplementary Table 5: Key characteristics of infected and control groups included in the infection and ectopic pregnancy analyses

| Key characteristics                        | Infected cohort | Uninfected historical controls | Uninfected contemporary controls |
|--------------------------------------------|----------------|-------------------------------|---------------------------------|
| **Number of pregnancies**                  | 915            | 2,745                         | 2,745                           |
| **Median age (min-max)**                   | 28 (13-45)     | 28 (14-45)                    | 28 (13-46)                      |
| **Deprivation (SIMD quintile)**            |                |                               |                                 |
| 1 (most deprived)                          | 294 (32.1%)    | 718 (26.2%)                   | 768 (28.0%)                     |
| 2                                          | 223 (24.4%)    | 572 (20.8%)                   | 607 (22.1%)                     |
| 3                                          | 147 (16.1%)    | 481 (17.5%)                   | 460 (16.8%)                     |
| 4                                          | 148 (16.2%)    | 525 (19.1%)                   | 527 (19.2%)                     |
| 5 (least deprived)                         | 91 (9.9%)      | 414 (15.1%)                   | 362 (13.2%)                     |
| Unknown                                    | 12 (1.3%)      | 35 (1.3%)                     | 21 (0.8%)                       |
| **Ethnicity**                              |                |                               |                                 |
| White                                      | 774 (84.6%)    | 1,765 (64.3%)                 | 2,328 (84.8%)                   |
| South Asian                                | 26 (2.8%)      | 47 (1.7%)                     | 72 (2.6%)                       |
| Black/Caribbean /African                   | 9 (1.0%)       | 28 (1.0%)                     | 39 (1.4%)                       |
| Other/mixed ethnicity                      | 23 (2.5%)      | 49 (1.8%)                     | 69 (2.5%)                       |
| Unknown                                    | 83 (9.1%)      | 856 (31.2%)                   | 237 (8.6%)                      |
| **Urban/rural status**                     |                |                               |                                 |
| Large urban areas                          | 374 (40.9%)    | 970 (35.3%)                   | 980 (35.7%)                     |
| Other urban areas                          | 341 (37.3%)    | 1,036 (37.7%)                 | 1,003 (36.5%)                   |
| Accessible small towns                     | 59 (6.4%)      | 231 (8.4%)                    | 233 (8.5%)                      |
| Remote small towns                         | 15 (1.6%)      | 88 (3.2%)                     | 85 (3.1%)                       |
| Accessible rural areas                     | 49 (5.4%)      | 273 (9.9%)                    | 285 (10.4%)                     |
| Remote rural areas                         | 17 (1.9%)      | 107 (3.9%)                    | 111 (4.0%)                      |
| Unknown                                    | 60 (6.6%)      | 40 (1.5%)                     | 48 (1.7%)                       |
| **Clinical vulnerability**                 |                |                               |                                 |
| Extremely vulnerable                       | 5 (0.5%)       | 30 (1.1%)                     | 26 (0.9%)                       |
| Vulnerable                                 | 244 (26.7%)    | 762 (27.8%)                   | 728 (26.5%)                     |
| Not vulnerable                             | 666 (72.8%)    | 1,953 (71.1%)                 | 1,991 (72.5%)                   |
| **Exposure (SARS-CoV-2 infection)**        |                |                               |                                 |
| Gestation at infection within exposure period* |            |                               |                                 |
| Preconception                              | 769 (84.0%)    | -                             | -                               |
| 2 weeks (2+0 to 2+6)                       | 146 (16.0%)    | -                             | -                               |
| **Outcome (ectopic pregnancy)**            |                |                               |                                 |
| Pregnancies ending in ectopic pregnancy up to 19+6 weeks | 8 | 33 | 32 |
| Gestation at ectopic pregnancy             |                |                               |                                 |
| <=10+6                                     | 8 (100%)       | 33 (100%)                     | 32 (100%)                       |
| Imputed gestation for ectopic pregnancy    |                |                               |                                 |
| Yes                                        | 8 (100%)       | 30 (90.9%)                    | 29 (90.6%)                      |
| No – available from ANC booking            | 0              | 0                             | 3 (9.4%)                        |
No – available from end of pregnancy record | 0 | 3 (9.1%) | 0

| Lag between infection (or gestational week of matching in uninfected) and ectopic pregnancy | <=5 weeks | 0 | 1 (3.0%) | 0 |
| 6-9 weeks | 5 (62.5%) | 18 (54.5%) | 19 (59.4%) |
| >=10 weeks | 3 (37.5%) | 14 (42.4%) | 13 (40.6%) |

SIMD=Scottish Index of Multiple Deprivation

*It was only possible to have one infection in the exposure period (i.e. between 6 weeks pre-conception and 2+6 weeks gestation)

**Between 6 weeks pre-conception and the earliest of either: end of pregnancy or 2+6 weeks gestation

All groups exclude women who received COVID-19 vaccination between 6 weeks pre-conception and the earliest of either: end of pregnancy or the end of the exposure period at 2+6 weeks gestation
**Supplementary Table 6: Additional information on potential confounders included in analyses**

| Variable | Categorisation | Notes |
|----------|----------------|-------|
| **Deprivation: Scottish Index of Multiple Deprivation (SIMD)** | Quintile from 1 (most deprived) to 5 (least deprived) Unknown | SIMD is a relative measure of deprivation calculated for each of 6,976 areas across Scotland. It draws on data on income, employment, education, health, access to services, crime and housing.\(^1\,^2\) |
| **Ethnicity** | White South Asian Black/Caribbean/African Other/mixed ethnicity Unknown | This classification is based on standard categories used in the Scottish decennial population census.\(^3\) |
| **Rural urban status** | Large urban areas Other urban areas Accessible small towns Remote small towns Accessible rural areas Remote rural areas Unknown | We have grouped this according to the standard Scottish Government urban-rural categorisation.\(^4\) Where possible rural urban information was derived from postcode as identified from: general acute hospital discharge records (Scottish Morbidity Record (SMR) 01); maternity hospital discharge records (SMR 02); statutory termination of pregnancy notifications; the National Records of Scotland (NRS) statutory live birth registrations and the NRS statutory stillbirth registrations; where postcode was not available from these data sources it was taken from GP records (if available). As we rely on data from women’s maternity records and other sources capturing the end of pregnancy, we have higher levels of missing for this covariate among ongoing pregnancies in the COPS dataset. |
| **Clinical vulnerability** | Clinically extremely vulnerable (on highest risk list) Clinically vulnerable (but excluding diabetes) Not clinically vulnerable | Individuals considered clinically extremely vulnerable to SARS-CoV-2 infection were identified from the national highest risk/shielding list maintained by Public Health Scotland,\(^5\) with data kept up-to-date at the time the COPS cohort dataset was created for this study (26 April, 2022). Individuals considered clinically vulnerable were those not on the highest risk list whose primary care/GP record included a diagnostic code indicating they were in any Q-COVID risk group (excluding diabetes) or had hypertension.\(^6\) These data are based on what was reported to GPs, with cross-sectional data available in June 2020 and January 2021. The data available in June 2020 was used to assign pregnancies between January 2015 and December 2020 to clinical vulnerability categories, with all
later pregnancies assigned to categories based on the more recent cross section of data. We intended to include diabetes as a separate confounder variable, based on information recorded in women’s maternity records, however this was not feasible as information was missing for a high proportion of women with early pregnancy loss.

1Scottish Government. Scottish Index of Multiple Deprivation 2020 (Accessed 16 June 2022 at: https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/)
2Public Health Scotland. GPD Support: Deprivation (Accessed 16 June 2022 at: https://www.isdscotland.org/Products-and-Services/GPD-Support/Deprivation/SIMD/)
3IDS Scotland. Data Dictionary A-Z: Ethnic Group (Accessed 16 June 2022 at: https://www.ndc.scot.nhs.uk/Dictionary-A-Z/Definitions/index.asp?Search=E&ID=243&Title=Ethnic%20Group)
4Scottish Government. Scottish Government Urban Rural Classification 2016. (Accessed 16 June 2022 at: https://www.gov.scot/publications/scottish-government-urban-rural-classification-2016/)
5Public Health Scotland. COVID-19 – Search criteria for highest risk patients for inclusion to the shielding list (Accessed 22nd September 2022 at: https://hpsubsrepo.blob.core.windows.net/hps-website/nss/3008/documents/1_covid-19-search-criteria-highest-risk-patients.pdf)
6Oxford University. QCovid® risk calculation (Accessed 16 June 2022 at: https://www.qcovid.org/)
Supplementary Figure 1: Timeline of the COVID-19 vaccination programme in Scotland as relevant to pregnant women

Summary of population cohorts invited for COVID-19 vaccination over time in Scotland from the start of the vaccination program on 8 December 2020 (left) and policy changes relevant to vaccination in pregnant women (right).
Supplementary Figure 2. Selection of vaccinated and unvaccinated pregnancy cohorts for ectopic outcome analysis

Flow diagram showing the selection of pregnancies for the analysis of the association between COVID-19 vaccination and risk of ectopic pregnancy. *For ectopic analysis, vaccination needs to be given between six weeks preconception and up to the earliest of: (1) end of pregnancy or (2) two weeks and six days gestation.
Supplementary Figure 3. Selection of infected and uninfected pregnancy cohorts for miscarriage outcome analysis

Flow diagram showing the selection of pregnancies for the analysis of the association between SARS-CoV-2 infection and risk of miscarriage. *For miscarriage analysis, SARS-CoV-2 infection needs to be recorded between six weeks pre-conception and up to the earliest of: (1) end of pregnancy or (2) 19 weeks and six days gestation.
Supplementary Figure 4. Selection of infected and uninfected pregnancy cohorts for ectopic pregnancy outcome analysis

Flow diagram showing the selection of pregnancies for the analysis of the association between SARS-CoV-2 infection and risk of ectopic pregnancy. *For ectopic pregnancy analysis, SARS-CoV-2 infection needs to be recorded between six weeks pre-conception and up to the earliest of: (1) end of pregnancy or (2) 2 weeks 6 days gestation.