***Epidemiology and Infection***

**Prediction of SARS-CoV-2 infection cases based on the meta-SEIRS model**

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***Supplementary Material***

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# Information extraction form

The inclusion criteria were: (1) Conformed to research questions, i.e., studies that estimated the reinfection rate of SARS-CoV-2 or we could calculate it based on the data provided in the paper; (2) The study design included cohort study, case-control study, and descriptive study; (3) The research had defined the reinfection of SARS-CoV-2.When estimating the time-varying reinfection rate, we took into account that it may not be possible to accurately determine whether the patients were reinfected or reinfected within a short time, so SARS-CoV-2 reinfection was defined by sequential positive PCR or LFD SARS-CoV-2 tests with a minimum interval of 90 days. (4) Original research. The exclusion criteria were: (1) The sample size was less than 20; (2) Belonged to one of the following types of studies: editorial, case report, case series study, systematic review, meta-analysis, animal experiment, news report; (3) Secondary reporting or articles on repeated studies of the same population; (4) Grey literature, including a range of documents not controlled by commercial publishing organizations*.*

Table S1 Information extraction form

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First author | Study period | Country | Study population | Number | Study design | Time-differentiated reinfected strains | Time between two positive tests (days) | Age | Reinfection rate | Number of reinfections |
| Benjamin Bowe[1] | NA | America | general population | 5819264 | case-control study | delta and omicron | Median (IQR) :191(127-330) days | All ages | 0.007036 | 40947 |
| Anna Jeffery-Smith[2] | May 2020 to October 2020 | United Kingdom | general population | 88 | cohort study | wild type (dominates); alpha | NA | All ages | 0.011 | 1 |
| Josè Vitale[3] | February 2020 to February 28, 2021 | Italy | general population | 1579 | case-control study | wild type; alpha | Mean (SD): 230 (90) days | All ages | 0.031 | 5 |
| Mark S Graham[4] | September 28 to December 27, 2020 | United Kingdom | general population | 36509 | cohort study | alpha | ≥90天 | All ages |  | 249 |
| Luis Pampa-Espinoza[5] | April 2020 to May 2021 | Peru | general population | 1695 | cohort study | lambda (dominates), gamma | ≥6 months | All ages | 0.0177 | 30 |
| Sumit Malhotra[6] | February 1, 2022 to February 25, 2022 | India | Health-care workers | 3545 | cohort study | omicron | NA | All ages | 0.284 | 1007 |
| Philippe Brouqui[7] | January 27, 2020 to January 12, 2021 | France | general population | 6771 | cohort study | wild type; alpha; beta; | Mean: 172 (90-308) days | All ages | 0.0067 | 46 |
| Godwin E Akpan[8] | March 2020 to July 2021 | Liberia | general population | 5459 | cohort study | wild type; alpha; beta; delta | Median (IQR) :200 (99-415) days | 21-74 | 0.0024 | 13 |
| Fariba Zare[9] | March 20, 2020 to November 20, 2020 | Iran | general population | 4039 | cohort study | wild type; beta | 134.4±64.5 days | All ages | 0.0025 | 10 |
| Naila A Shaheen[10] | March 2020 to August 2021 | Saudi Arabia | general population | 35288 | cohort study | wild type; alpha; beta; delta | Median (IQR) :222 (90-462) days | All ages | 0.0037 | 132 |
| Anna A Mensah[11] | January 2020 to early May 2021 | United Kingdom | general population | 3860054 | case-control study | wild type; alpha; delta | NA | All ages | 0.0036 | 13960 |
| Hiam Chemaitelly[12] | February 28, 2020 to June 5, 2022 | Dubai | general population | 301943 | cohort study | wild type; alpha; beta; gamma; delta; omicron | Median (IQR) :154 (65-224) days | All ages | 0.006 | 1806 |
| Annalisa Quattrocchi[13] | June to August 2021 | the Republic of Cyprus | general population | 44227 | case-control study | delta | NA | >=18 | 0.002 | 93 |
| Nickolas Lewis[14] | March 1, 2020 to January 2022 | America | general population | 100517;  According to the strain: wild type period: 100517;  Alpha period: 100517;  Delta period: 100517 | cohort study | delta; omicron | Median (IQR): 7.9(4.8-10.7) months | >=12 | 0.0204642; According to the strain:wild type period: 0.00851597;  Alpha period: 0.00329298;  Delta period: 0.00865525 | 2057;  According to the strain: wild type period: 856;  Alpha period: 331;  Delta period: 870 |
| Ariel Hammerman[15] | August 23, 2020 to November 26, 2021 | Israel | Health-care workers | 149032 | cohort study | alpha; delta | NA | All ages | 0.01692254 | 2522 |
| Oriol Yuguero[16] | March 1 to November 30, 2020 | Spain | general population | 27758 | cohort study | wild type (dominates); alpha | NA | All ages | 0.0005 | 14 |
| Sara Carazo[17] | December 26, 2021 to March 12, 2022 | Canada | general population | 696439 | case-control study | omicron | Median (IQR) :407 (354-480) days | >=12 | 0.042 | 9505 |
| A. de Arriba Fernández[18] | June 1, 2021 to February 28, 2022 | Spain | general population | 110726 | cohort study | alpha; delta | NA | >=12 | 0.0031 | 340 |
| İrem Ceren Erbaş[19] | March 2020 to July 2021 | Türkiye | general population | 8840 | cohort study | wild type; alpha; beta; delta | Median (IQR) :196 (92-483) days | <18 | 0.0012 | 11 |
| Valentina Pecoraro[20] | January 1, 2021 to June 30, 2021 | Italy | general population | 0-14 year:4926；15-29year: 6347；30-49 year: 10166；50-69 year: 9488；>70 year: 4765 | cross-sectional study | alpha; gamma; delta; omicron | Mean: 313 days | All ages | 0-14 year:0.0042；15-29 year:0.0040；30-49 year:0.0040；50-69 year:0.0026；>70 year:0.0029 | 0-14 year:208；15-29 year:252；30-49 year:414；50-69 year:246；>70 year:138 |
| Jonathan Bastard[21] | January 1, 2021 to February 20, 2022 | France | general population | 18661139 | cross-sectional study | omicron | Mean: 244 days; Median (IQR): 267 (166-314) days | All ages | 0.031 | 584129 |
| J. Richards[22] | March 1, 2020 to January 10, 2021 | America | general population | 2625 | cohort study | wild type; alpha | Median(IQR) :126.50 (105.50，171.00) days | All ages | 0.059 | 156 |
| S. Medic[23] | March 6, 2020 to the end of July 2022 | Serbia | general population | 32524 | cohort study | alpha; beta; delta | Mean (SD): 240(117) days | <18 | 0.029 | 964 |
| Ferhat Arslan[24] | March 2020 to May 2021 | Istanbul | general population | 32607 | cohort study | wild type; alpha; beta; delta | NA | 17-71 | 0.0008 | 27 |
| Sharon M. Casey[25] | January 1, 2020 to February 28, 2021 | America | general population | 2431 | cohort study | alpha; gamma | Mean (SD): 191(65) days | All ages | 0.027 | 65 |
| B. L. Hønge[26] | February 2020 to August 2021 | Denmark | general population | 3806 | cohort study | wild type; alpha; delta | NA | 17-69 | 0.006 | 21 |
| Daniela Michlmayr[27] | February 1, 2020 to June 30, 2021 | Denmark | general population | 198817 | cohort study | alpha; delta; omicron | NA | >=2 | 0.1252 | 720 |
| Carlota Dobaño[28] | March 2020 to April 2021 | Spain | general population | 173 | cohort study | wild type; alpha | Mean: 4.25 months | All ages | 0.023121 | 4 |
| Michael B Rothberg[29] | March 9, 2020 to March 1, 2022 | America | general population | 635341 | cohort study | omicron | 398.7± 124.8 days | All ages |  | 1467 |
| Joanne Lacy[30] | March 1, 2020 to December 31, 2020 | United Kingdom | general population | 517870 | cohort study | wild type; alpha | NA | >=10 | 0.005435727 | 2815 |
| Jeff Slezak[31] | March 1, 2020 to October 31, 2020 | America | general population | 75149 | cohort study | wild type | ≤270 days | All ages | 0.0042 | 315 |
| M E Flacco[32] | March 3, 2020 to May 21, 2021 | Italy | general population | 7173 | cohort study | wild type; alpha; gamma | Mean (SD): 201(61) days | All ages | 0.0033 | 34 |
| Isabel Cristina Hurtado[33] | March 9, 2020 to June 30, 2021 | Colombia | general population | 327886 | cross-sectional study | wild type; alpha; gamma | Median: 182 (IC 95%: 90-154) days | All ages | 0.011 | 3249 |
| Carlos A Prete Jr[34] | April 1, 2020 to 2021 | Brazil | general population | 238 | cohort study | gamma | NA | All ages | 0.1008 | 24 |
| Yusuf Arslan[35] | March 11, 2020 to August 31, 2021 | Türkiye | general population | 58811 | cohort study | wild type; alpha; beta; delta | Median: 290.5±105.3 days | All ages | 0.007 | 421 |
| Ana Rubia Guedes[36] | March 10, 2020 to March 10, 2022 | Brazil | Health-care workers | 5865 | cohort study | omicron | Mean: 429(122-674) days | All ages | 0.05 | 284 |
| megan M[37] | March 12, 2020 to August 30, 2020 | America | general population | 150325 | cohort study | wild type | 138.9 ± 46.3 days | All ages | 0.049 | 63 |
| Anna Jeffery-Smith[38] | April 10, 2020 to January 31, 2021 | United Kingdom | general population | 1377 | cohort study | wild type; alpha | Mean: 133(86-161) days | 20-99 | 0.007262164 | 10 |
| Adnan I Qureshi[39] | December 1, 2019 to November 13, 2020 | America | general population | 9119 | cohort study | wild type | Mean(±SD): 116±21 days | All ages | 0.007 | 63 |
| Lara J Akinbami[40] | May 2020 to August 2020 | America | Health-care workers | 1572 | cohort study | wild type; alpha | Mean: 216.0(95% CI, 198.8-233.1) days | All ages | 0.025 | 40 |
| Masoud Alebouyeh[41] | March 2020 to March 2021 | Iran | Health-care workers | 490 | cohort study | wild type; alpha; beta; gamma; delta | 74-360 days | All ages | 0.137 | 18 |
| Mahdi Barzegar[42] | January 1, 2020 to August 22, 2021 | Iran | general population | 6240 | case-control study | wild type; alpha; beta; delta | NA | All ages | NA | NA |
| Antonio Leidi[43] | April 2020 to January 2021 | Switzerland | general population | 498 | cohort study | wild type | NA | >=12 | 0.01 | 5 |
| Anna A Mensah[44] | January 2020 to July 2021 | United Kingdom | general population | 688418 | cohort study | wild type; alpha; delta | NA | <16 | 0.0068 | 2343 |
| Osman Özüdoğru[45] | April 22, 2021 to January 26, 2022 | Türkiye | general population | 27487;  According to the strain: Alpha(5554)；Delta(17941)；Omicron(3992) | cross-sectional study | alpha; delta; omicron | 361.2±131.6 days | All ages | 0.027;  According to the strain: Alpha(0.46%)；Delta(1.16%)；Omicron(13.0%) | 755;  According to the strain:Alpha(24)；Delta(209)；Omicron(520) |
| Sumit Malhotra[46] | March 3, 2020 to June 18, 2021 | India | Health-care workers | 4953 | cohort study | wild type; alpha; delta | Median (IQR): 233(175-321) days | All ages | 0.025 | 124 |
| John T. Wilkins[47] | May 26 to January 8, 2021 | America | Health-care workers | 4947 | cohort study | delta; omicron | NA | >=18 | 0 | 8 |
| Mary K Good[48] | January to November 2021 | America | general population | 1378 | cohort study | wild type; alpha; gamma; delta | Mean：197.5(95-301) days | 18-27 | 0.008 | 11 |
| David J Bean[49] | March 12, 2020 to January 21, 2021 | America | general population | 1669 | cohort study | wild type; alpha | Median: 139(91-298) days | All ages | 0.045 | 75 |
| Eric Ochoa-Hein[50] | March 2020 to February 2022 | Mexico | general population | 1388 | cohort study | omicron | Median: 487(99-664) days | All ages | 0.056 | 73 |
| Wataru Ando[51] | January 1, 2020 to August 27, 2021 | America | general population | 165320 | cohort study | wild type; alpha; gamma; delta | Median: 167(122-230) days | All ages | 0.037 | 6133 |
| Alexander Lawandi[52] | June 1, 2020 to February 28, 2021 | America | general population | 51484 | cohort study | wild type; alpha | NA | All ages | 0.1 | 253 |
| S. Gazit[53] | March 1, 2020 to December 13, 2021 | Israel | general population | 107413 | cohort study | alpha; delta (dominates) | NA | >=16 | 0.013 | 1374 |
| Étienne Racine[54] | August 21, 2020 to March 1, 2022 | Canada | Health-care workers | 569 | cohort study | wild type; gamma; delta; omicron | Mean: 196.33 days | 18-75 | 0.0105 | 6 |
| Maria Francesca Piazza[55] | September 2021 to May 2022 | Italy | general population | 335117 | cohort study | delta\omicron (dominates) | NA | All ages | 0.05 | 15795 |

1. **The AIC of model**

Table S2. AIC of meta-regression of time-varying reinfection rate.

|  |  |
| --- | --- |
| Model type | AIC |
| ~ bs(day, df = 3) + variant | 388.6690 |
| ~ bs(day, df = 4) + variant | 382.6962 |
| ~ bs(day, df = 5) + variant | 379.8534 |
| ~ bs(day, df = 6) + variant | 379.0613 |
| ~ bs(day, df = 7) + variant | 377.4777 |
| ~ bs(day, df = 8) + variant | 370.1893 |
| ~ bs(day, df = 9) + variant | 372.5500 |
| ~ bs(day, df = 8) + variant + country + studytype | misconvergence |

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