# Supplementary files

Table S1. Population characteristics description by COVID-19 outbreak wave.

Figure S1: SARS-CoV-2 positive test prevalence in each facility by number of healthcare staff working in that facility (n=119).

Table S2. Hazard ratio of COVID-19 positive test among healthcare professional by time period, bivariate cox models.

Table S3. Hazard ratio of COVID-19 positive test among healthcare professional by time period, multivariate cox models.

Figure S2. Hazard ratio of COVID-19 positive test among healthcare professional by time period, bivariate and multivariate cox models, complete case analysis.

Table S1. Population characteristics description by COVID-19 outbreak wave.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Wave 1** (n=12 505) | |  | **Wave 2** (n=12 156) | | **p-value**1 |
|  |  | **N** | **%** |  | **N** | **%** |  |
| **Gender** | |  |  |  |  |  | 0.5 |
|  | Female | 10 013 | **80.1** |  | 9 775 | **80.4** |  |
|  | Male | 2 492 | **19.9** |  | 2 381 | **19.6** |  |
| **Age** | |  |  |  |  |  | 0.5 |
|  | 30 and below | 2 287 | **18.3** |  | 2 276 | **18.7** |  |
|  | 31-40 | 2 757 | **22.0** |  | 2 697 | **22.2** |  |
|  | 41-50 | 2 844 | **22.7** |  | 2 806 | **23.1** |  |
|  | 51-60 | 3 344 | **26.7** |  | 3 213 | **26.4** |  |
|  | 61 and over | 1 273 | **10.2** |  | 1 164 | **9.6** |  |
| **Ethnic group** | |  |  |  |  |  | 0.3 |
|  | White - British | 10 594 | **84.7** |  | 10 403 | **85.6** |  |
|  | Other White minorities | 467 | **3.7** |  | 446 | **3.7** |  |
|  | Southern Asian | 616 | **4.9** |  | 579 | **4.8** |  |
|  | Other Asian background | 236 | **1.9** |  | 194 | **1.6** |  |
|  | Black | 221 | **1.8** |  | 205 | **1.7** |  |
|  | Mixed and other | 371 | **3.0** |  | 329 | **2.7** |  |
| **Staff group** | |  |  |  |  |  | 0.001 |
|  | Additional Clinical Services | 3 593 | **28.7** |  | 3 462 | **28.5** |  |
|  | Administrative and Clerical | 2 687 | **21.5** |  | 2 655 | **21.8** |  |
|  | Allied Health Professionals | 2 696 | **21.6** |  | 2 753 | **22.6** |  |
|  | Estates and Ancillary | 1 059 | **8.5** |  | 1 037 | **8.5** |  |
|  | Medical and Dental | 1 142 | **9.1** |  | 921 | **7.6** |  |
|  | Nursing and Midwifery Registered | 723 | **5.8** |  | 731 | **6.0** |  |
|  | Scientists, Prof Scientific and Technic | 605 | **4.8** |  | 597 | **4.9** |  |
| **Pay Grade** | |  |  |  |  |  | 0.056 |
|  | NHS Body Band 1, 2 and 3 | 4 587 | **36.7** |  | 4 554 | **37.5** |  |
|  | NHS Body Band 4 and 5 | 3 107 | **24.8** |  | 3 056 | **25.1** |  |
|  | NHS Body Band 6 and 7 | 2 973 | **23.8** |  | 2 905 | **23.9** |  |
|  | NHS Body Band 8, 9 and others2 | 1 838 | **14.7** |  | 1 641 | **13.5** |  |
| **Contract type** | |  |  |  |  |  | 0.7 |
|  | Part-time | 5 544 | **44.3** |  | 5 358 | **44.1** |  |
|  | Full-time | 6 961 | **55.7** |  | 6 798 | **55.9** |  |
| **Index of Multiple Deprivation** | |  |  |  |  |  | >0.9 |
|  | lower decile (1-4) | 4 093 | **32.7** |  | 3 988 | **32.8** |  |
|  | middle decile (5-7) | 4 139 | **33.1** |  | 4 016 | **33.0** |  |
|  | upper decile (8-10) | 4 273 | **34.2** |  | 4 152 | **34.2** |  |
| **Urban-rural classification** | |  |  |  |  |  | 0.5 |
|  | Urban | 7 512 | **60.1** |  | 7 244 | **59.6** |  |
|  | Rural | 4 993 | **39.9** |  | 4 912 | **40.4** |  |
| **Number of Non-COVID Diseases**3 | |  |  |  |  |  | <0.001 |
|  | 0 | 6 579 | **52.6** |  | 7 547 | **62.1** |  |
|  | 1 | 3 565 | **28.5** |  | 3 274 | **26.9** |  |
|  | 2 | 1 566 | **12.5** |  | 996 | **8.2** |  |
|  | 3+ | 795 | **6.4** |  | 339 | **2.8** |  |
| **Number of Isolation Days**3 | |  |  |  |  |  | <0.001 |
|  | 0 | 9 853 | **78.8** |  | 9 497 | **78.1** |  |
|  | [1-14] | 1 916 | **15.3** |  | 2 077 | **17.1** |  |
|  | >14 | 736 | **5.9** |  | 582 | **4.8** |  |
| **Other leaving absence Days**3 | |  |  |  |  |  | <0.001 |
|  | 0 | 10 808 | **86.4** |  | 10 920 | **89.8** |  |
|  | [1-7] | 1 070 | **8.6** |  | 754 | **6.2** |  |
|  | >7 | 627 | **5.0** |  | 482 | **4.0** |  |
| **Tested positive for COVID-19**3 | |  |  |  |  |  | <0.001 |
|  | Yes | 397 | **3.2** |  | 861 | **7.1** |  |
|  | No | 12 108 | **96.8** |  | 11 295 | **92.9** |  |

1 global two-sided p-values (i.e. both rows and columns comparison for each characteristics) were computed using chi-square test of independence

2 Other pay grades encompass mainly specialty registrar and consultant

3 Measured during the wave period

**![Chart, scatter chart

Description automatically generated]()**

**Figure S1: SARS-CoV-2 positive test prevalence in each facility by number of healthcare staff working in that facility (n=119).**

Note: point have been jittered by 0.5 to allow the visualisation of superposed points.

**Table S2. Hazard ratio of COVID-19 positive test among healthcare professional by time period, bivariate cox models.**

|  |  | | | **Wave 1 (n=12 546)**  **Jan-Aug 2020** | | | **Wave 2 (n=12 198)**  **Sep 2020-Feb 2021** | | | **All period (n=13 410)**  **Jan 2020-Feb 2021** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | **HR** | **CI95%** | **p-value** | **HR** | **CI95%** | **p-value** | **HR** | **CI95%** | **p-value** |
| **Sex** *(Ref. Female)* |  | | |  |  | 0.041 |  |  | <0.001 |  |  | <0.001 |
|  | Male | | | 0.82 | [0.67-0.99] |  | 0.75 | [0.68-0.83] |  | 0.79 | [0.72-0.86] |  |
| **Age** *(Ref. 30 and below)* |  | | |  |  | 0.327 |  |  | <0.001 |  |  | <0.001 |
|  | 31-40 | | | 1.12 | [0.82-1.52] |  | 0.81 | [0.68-0.97] |  | 0.83 | [0.69-0.99] |  |
|  | 41-50 | | | 1.13 | [0.77-1.66] |  | 0.80 | [0.70-0.92] |  | 0.82 | [0.69-0.97] |  |
|  | 51-60 | | | 4.00 | [0.73-1.36] |  | 0.71 | [0.60-0.83] |  | 0.71 | [0.57-0.89] |  |
|  | 61 and over | | | 0.81 | [0.55-1.20] |  | 0.49 | [0.36-0.67] |  | 0.52 | [0.43-0.65] |  |
| **Ethnic group** *(Ref.White - British)* | | | |  |  | 0.006 |  |  | <0.001 |  |  | <0.001 |
|  | Other White minorities | | | 1.44 | [0.97-2.15] |  | 0.94 | [0.78-1.14] |  | 1.11 | [0.88-1.39] |  |
|  | Southern Asian | | | 1.69 | [1.07-2.66] |  | 1.46 | [1.24-1.71] |  | 1.63 | [1.31-2.02] |  |
|  | Other Asian background | | | 1.30 | [0.86-1.97] |  | 1.14 | [0.79-1.65] |  | 1.26 | [0.95-1.66] |  |
|  | Black | | | 1.58 | [0.91-2.75] |  | 2.09 | [1.57-2.76] |  | 2.10 | [1.50-2.94] |  |
|  | Mixed and other | | | 0.83 | [0.45-1.54] |  | 1.15 | [0.97-1.38] |  | 1.12 | [0.92-1.36] |  |
| **Staff group** *(Ref. Nursing and Midwifery Registered)* |  | | |  |  | <0.001 |  |  | <0.001 |  |  | <0.001 |
| Additional Clinical Services | | | 1.43 | [1.12-1.83] |  | 1.09 | [0.91-1.31] |  | 1.20 | [1.03-1.40] |  |
|  | Administrative and Clerical | | | 0.32 | [0.22-0.47] |  | 0.32 | [0.22-0.44] |  | 0.32 | [0.26-0.39] |  |
|  | Estates and Ancillary | | | 0.66 | [0.29-1.49] |  | 0.63 | [0.38-1.04] |  | 0.64 | [0.51-0.80] |  |
|  | Allied Health Professionals | | | 0.87 | [0.62-1.22] |  | 0.72 | [0.55-0.94] |  | 0.78 | [0.60-1.00] |  |
|  | Medical and Dental | | | 0.88 | [0.43-1.80] |  | 0.81 | [0.48-1.38] |  | 0.93 | [0.55-1.57] |  |
|  | Scientists, Prof Scientific and Technic | | | 0.49 | [0.21-1.13] |  | 0.41 | [0.29-0.58] |  | 0.44 | [0.29-0.67] |  |
| **Contract type** *(Ref. Full-time)* | |  | |  |  | 0.397 |  |  | 0.043 |  |  | 0.007 |
|  | Part-time | | | 0.93 | [0.78-1.10] |  | 0.85 | [0.73-1.00] |  | 0.85 | [0.76-0.96] |  |
| **Pay grade** *(Ref. NHS Body Band 1,2 and 3)* |  | | |  |  | 0.165 |  |  | <0.001 |  |  | 0.040 |
| NHS Body Band 4 and 5 | | | 0.82 | [0.64-1.06] |  | 1.14 | [1.00-1.29] |  | 1.04 | [0.93-1.16] |  |
|  | NHS Body Band 6 and 7 | | | 0.80 | [0.62-1.02] |  | 0.78 | [0.51-1.17] |  | 0.78 | [0.57-1.05] |  |
|  | NHS Body Band 8,9 and others | | | 0.67 | [0.39-1.16] |  | 0.75 | [0.41-1.35] |  | 0.76 | [0.45-1.30] |  |
| **IMD decile** *(Ref. Lower decile (1-4))* | | | |  |  | 0.065 |  |  | 0.001 |  |  | 0.075 |
|  | Middle decile (5-7) | | | 0.91 | [0.64-1.30] |  | 1.09 | [0.94-1.25] |  | 1.03 | [0.88-1.19] |  |
|  | Upper decile (8-10) | | | 0.71 | [0.52-0.97] |  | 0.89 | [0.66-1.20] |  | 0.82 | [0.64-1.06] |  |
| **Residence area** *(Ref. Urban)* |  | | |  |  | 0.839 |  |  | 0.229 |  |  | 0.321 |
|  | Rural | | | 0.97 | [0.75-1.27] |  | 0.93 | [0.83-1.05] |  | 0.93 | [0.82-1.07] |  |
| **Number of non-COVID diseases** *(Ref. 0)* | | | |  |  | <0.001 |  |  | <0.001 |  |  | <0.001 |
|  | 1 | | | 1.27 | [1.12-1.44] |  | 1.36 | [1.18-1.58] |  | 1.25 | [1.08-1.45] |  |
|  | 2 | | | 1.71 | [1.30-2.26] |  | 1.32 | [1.07-1.62] |  | 1.49 | [1.27-1.74] |  |
|  | >2 | | | 1.22 | [0.74-2.02] |  | 1.39 | [1.10-1.76] |  | 1.90 | [1.49-2.42] |  |
| **Number of Isolation days** *(Ref. 0)* | | |  |  |  | <0.001 |  |  | <0.001 |  |  | <0.001 |
|  | 1-14 | | | 2.95 | [1.68-5.15] |  | 3.65 | [3.16-4.21] |  | 2.66 | [2.23-3.17] |  |
|  | >14 | | | 1.00 | [0.55-1.82] |  | 0.70 | [0.47-1.04] |  | 1.17 | [1.01-1.35] |  |
| **Other leaving absence days** *(Ref. 0)* | | | |  |  | 0.026 |  |  | <0.001 |  |  | 0.050 |
|  | 1-7 | | | 1.05 | [0.65-1.68] |  | 0.77 | [0.56-1.07] |  | 0.88 | [0.69-1.11] |  |
|  | >7 | | | 0.50 | [0.30-0.83] |  | 0.41 | [0.33-0.50] |  | 0.76 | [0.61-0.96] |  |

IMD: Index of Multiple Deprivation

Note: two-sided p-values were computed using Wald-test adjusted for clustering.

**Table S3. Hazard ratio of COVID-19 positive test among healthcare professional by time period, multivariate cox models.**

|  |  | | | **Wave 1 (n=12 546)**  **Jan-Aug 2020** | | | **Wave 2 (n=12 198)**  **Sep 2020-Feb 2021** | | | **All period (n=13 410)**  **Jan 2020-Feb 2021** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Var1** | **term** | | | **aHR** | **CI95%** | **p-value** | **aHR** | **CI95%** | **p-value** | | **aHR** | **CI95%** | **p-value** | |
| **Sex** *(Ref. Female)* |  | | |  |  | 0.354 |  |  | 0.001 | |  |  | 0.009 | |
|  | Male | | | 0.85 | [0.61-1.20] |  | 0.76 | [0.65-0.88] |  | | 0.79 | [0.66-0.94] |  | |
| **Age** *(Ref. 30 and below)* |  | | |  |  | 0.638 |  |  | 0.016 | |  |  | 0.013 | |
|  | 31-40 | | | 1.25 | [0.89-1.75] |  | 1.00 | [0.82-1.21] |  | | 0.98 | [0.80-1.20] |  | |
|  | 41-50 | | | 1.27 | [0.87-1.86] |  | 1.01 | [0.89-1.14] |  | | 0.97 | [0.83-1.15] |  | |
|  | 51-60 | | | 1.25 | [0.93-1.69] |  | 0.97 | [0.87-1.09] |  | | 0.93 | [0.78-1.11] |  | |
|  | 61 and over | | | 1.08 | [0.72-1.62] |  | 0.74 | [0.57-0.97] |  | | 0.74 | [0.61-0.90] |  | |
| **Ethnic group** *(Ref.White - British)* |  | | |  |  | <0.001 |  |  | <0.001 | |  |  | <0.001 | |
| Other White minorities | | | 1.20 | [0.88-1.64] |  | 0.84 | [0.70-1.02] |  | | 0.95 | [0.79-1.15] |  | |
|  | Southern Asian | | | 1.96 | [1.26-3.03] |  | 1.52 | [1.09-2.11] |  | | 1.66 | [1.29-2.13] |  | |
|  | Other Asian background | | | 1.20 | [0.75-1.91] |  | 0.97 | [0.57-1.67] |  | | 1.02 | [0.66-1.56] |  | |
|  | Black | | | 1.76 | [1.06-2.92] |  | 2.12 | [1.68-2.68] |  | | 2.16 | [1.56-2.99] |  | |
|  | Mixed and other | | | 0.86 | [0.51-1.46] |  | 1.05 | [0.86-1.29] |  | | 1.05 | [0.88-1.25] |  | |
| **Staff group** *(Ref. Nursing and Midwifery Registered)* |  | | |  |  | <0.001 |  |  | <0.001 | |  |  | <0.001 | |
| Additional Clinical Services | | | 0.79 | [0.53-1.17] |  | 0.59 | [0.46-0.76] |  | | 0.66 | [0.53-0.83] |  | |
|  | Administrative and Clerical | | | 0.23 | [0.15-0.37] |  | 0.24 | [0.14-0.40] |  | | 0.24 | [0.17-0.34] |  | |
|  | Estates and Ancillary | | | 0.38 | [0.11-1.33] |  | 0.39 | [0.28-0.54] |  | | 0.41 | [0.29-0.57] |  | |
|  | Allied Health Professionals | | | 0.91 | [0.64-1.30] |  | 0.88 | [0.68-1.14] |  | | 0.90 | [0.71-1.14] |  | |
|  | Medical and Dental | | | 1.10 | [0.40-3.03] |  | 1.28 | [0.64-2.59] |  | | 1.35 | [0.67-2.72] |  | |
|  | Scientists, Prof Scientific and Technic | | | 0.53 | [0.25-1.11] |  | 0.51 | [0.34-0.75] |  | | 0.52 | [0.34-0.80] |  | |
| **Contract type** *(Ref. Full-time)* | |  | |  |  | 0.033 |  |  | <0.001 | |  |  | <0.001 | |
|  | Part-time | | | 0.85 | [0.72-0.99] |  | 0.80 | [0.73-0.89] |  | | 0.78 | [0.71-0.87] |  | |
| **Pay grade** *(Ref. NHS Body Band 1,2 and 3)* |  | | |  |  | 0.005 |  |  | <0.001 | |  |  | <0.001 | |
| NHS Body Band 4 and 5 | | | 0.55 | [0.34-0.90] |  | 0.61 | [0.44-0.84] |  | | 0.60 | [0.45-0.80] |  | |
|  | NHS Body Band 6 and 7 | | | 0.49 | [0.27-0.87] |  | 0.39 | [0.23-0.66] |  | | 0.42 | [0.27-0.66] |  | |
|  | NHS Body Band 8,9 and others | | | 0.34 | [0.18-0.66] |  | 0.31 | [0.18-0.52] |  | | 0.32 | [0.22-0.48] |  | |
| **IMD decile** *(Ref. Lower decile (1-4))* |  | | |  |  | 0.201 |  |  | 0.002 | |  |  | 0.209 | |
| Middle decile (5-7) | | | 0.96 | [0.66-1.38] |  | 1.13 | [1.01-1.27] |  | | 1.06 | [0.91-1.24] |  | |
|  | Upper decile (8-10) | | | 0.78 | [0.57-1.07] |  | 0.98 | [0.77-1.26] |  | | 0.91 | [0.73-1.13] |  | |
| **Residence area** *(Ref. Urban)* | |  | |  |  | 0.569 |  |  | 0.718 | |  |  | 0.596 | |
|  | Rural | | | 1.07 | [0.84-1.36] |  | 1.03 | [0.86-1.24] |  | | 1.04 | [0.89-1.22] |  | |
| **Number of non-COVID diseases** *(Ref. 0)* |  | | |  |  | 0.004 |  |  | 0.101 | |  |  | 0.009 | |
| 1 | | | 1.09 | [0.96-1.25] |  | 1.11 | [1.02-1.20] |  | | 1.08 | [0.97-1.21] |  | |
|  | 2 | | | 1.37 | [1.06-1.78] |  | 0.93 | [0.70-1.23] |  | | 1.14 | [1.01-1.28] |  | |
|  | >2 | | | 0.87 | [0.55-1.39] |  | 0.77 | [0.53-1.13] |  | | 1.28 | [1.09-1.51] |  | |
| **Number of Isolation days** *(Ref. 0)* | | |  |  |  | <0.001 |  |  | <0.001 | |  |  | <0.001 | |
|  | 1-14 | | | 2.48 | [1.37-4.49] |  | 3.01 | [2.71-3.37] |  | | 2.16 | [1.80-2.60] |  | |
|  | >14 | | | 0.91 | [0.50-1.64] |  | 0.60 | [0.42-0.86] |  | | 0.97 | [0.82-1.15] |  | |
| **Other leaving absence days** *(Ref. 0)* |  | | |  |  | 0.065 |  |  | <0.001 | |  |  | 0.003 | |
| 1-7 | | | 0.92 | [0.59-1.44] |  | 0.69 | [0.50-0.96] |  | | 0.76 | [0.59-0.98] |  | |
|  | >7 | | | 0.52 | [0.31-0.90] |  | 0.45 | [0.36-0.56] |  | | 0.72 | [0.59-0.89] |  | |

IMD: Index of Multiple Deprivation

Note: two-sided p-values were computed using Wald-test adjusted for clustering.

**Chart

Description automatically generated with medium confidence**

**Figure S2. Hazard ratio of COVID-19 positive test among healthcare professional by time period, bivariate and multivariate cox models, complete case analysis.**

IMD: Index of Multiple Deprivation

Note1: two-sided p-values were computed using Wald-test adjusted for clustering.

Note2: NHS body band 1 is corresponding to the lower salary grade while NHS body band 9 is corresponding to the higher pay grade

Note3: logarithmic scale has been used for the hazard ratio axis